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Productive and Unproductive Effort Choices in Groups and Sharing: An Experimental Study

Mürüvvet Büyükboyacı[1] | Emin Karagözoğlu[2] | Serkan Küçükşenel[1]

[1]Department of Economics, Middle East Technical University, Ankara, 06800, Turkey | [2]Department of Economics, Bilkent University, Ankara, 06800, Turkey

Correspondence: Serkan Küçükşenel (kuserkan@metu.edu.tr)

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ABSTRACT

Agents in collaborative relationships (e.g., business partnership and co-authorship) frequently need to decide on the allocation of limited resources (e.g., time and money) to productive activities that increase the size of the joint surplus and unproductive, promotional activities that do not affect the size of the surplus but increase their (individual) likelihood of capturing a greater control/share of the surplus. Using a laboratory experiment, we first analyze the effect of the opportunity cost of unproductive investment on subjects' resource allocation decisions in the first stage. Second, we study whether (i) the opportunity cost of unproductive investment and (ii) the identity of the decision-maker (human or computer) affect subjects' distributive decisions in the second stage. Three main insights emerge from our experiment: First, we find that subjects choose productive and unproductive investments equally likely both in low and high opportunity cost treatments. Second, subjects give less to their matched pairs if they choose unproductive investment in human treatment but not in computer treatment that suggests that subjects punish (by giving less) their matched pairs for allocating more resources to unproductive, promotional activities, a behavior that is not present when the allocation decision is made by a computer.

1 | Introduction

In most collaborative relationships, two distinct phases coexist: joint surplus production and distribution of surplus (see Karagözoğlu 2012 for a review). Individuals should expend resources on joint surplus production so that they can produce a value that they can later share. That said, it may also be in their best interest to expend resources on gaining recognition, power, or control over the jointly produced surplus to be able get as much share of it as possible. The first activity is collectively productive whereas the second is usually not, which creates a trade-off. To add to this trade-off, individuals are bounded by resource and/or time constraints in most situations. That is, expending more resources on one phase means fewer resources are available to be used for the other phase. Some examples are individuals involved in teamwork utilizing resources to contribute to a joint project or to gain visibility with acts of publicity so as to get the *lion's share* from the success; legislators working on a bill or spending resources to gain agenda control (see Cuellar 2022); elected politicians utilizing resources to do *real* service to their electorate or investing in advertising to gain popularity; coauthors working on a joint project or going around and talking about the project, making it more likely for others to associate the joint work with them; and partners spending time, effort, and money to improve the profitability of their company or lawyering up to shape the contract in order to have a full command of company assets in the case of a dissolving partnership. A characteristic aspect of all of these examples is the clash between collective rationality and individual rationality. Investments in recognition, control, or power are unproductive and as such they prevent individuals from reaching the maximum possible surplus value. This important trade-off is the main focus of the "guns vs. butter" literature on political economy, international relations, and political science (see, among others, Powell 1993; Skaperdas and Syropoulos 2001; Garfinkel and Skaperdas 2007).

In this paper, we focus on two questions in the framework described above. We first analyze whether and how individuals' resource allocation choices (in the first stage) are affected by the opportunity cost of unproductive investment. Second, we analyze whether and how the surplus sharing (in the second stage) is affected by the opportunity cost of the unproductive investment and who made the resource allocation decision in the first stage for the opponent, him/herself, or the computer on his/her behalf. Motivations for our questions come from existing studies on public good game experiments and human–computer interactions and theoretical work on competition for recognition in bargaining games. We provide further details on these studies in Section 2.

A brief description of our experimental design is in order here. Through a two-stage game, we capture production and distribution phases of a partnership in our laboratory. In the first stage (resource allocation stage), we allow our subjects to allocate their (fixed amount of) resources (a total of 150 tokens) between *productive* and *unproductive* accounts when the opportunity cost of unproductive investment is high or low. They have two options, one of which (Option A) places more resources in the productive account (Account 2) whereas the other (Option B) places more resources in the unproductive account (Account 1). This decision is simultaneously taken by all subjects. In the second stage (distribution stage), we ask them how they would distribute the resulting joint surplus if they were a dictator (i.e., using the strategy method) in four (2×2) treatments: (i) when the opportunity cost of unproductive investment is *high* or *low* (within-subject variation) and (ii) when the resource allocation decision in the first stage is made by a *human* or a *computer* (between-subject variation). All subjects make this decision, and the identity of the dictator is randomly determined afterwards using their investments for recognition. In *human* treatments, we also ask subject's expectation about the other subject's resource allocation decision in the first stage to gain insights about subjects' rationale behind their investment decisions.

We predict that as the opportunity cost of unproductive investment increases, subjects will allocate more resources to the productive account. We also predict that a subject who chooses to allocate more resources in the unproductive account (recognition choice) will give less to his matched pair in the second stage compared to a subject who chooses to allocate more resources in the productive account—as higher investment in recognition arguably reveals a preference for a more selfish stand. Depending on the fairness ideals a subject adopts, different sharing outcomes will prevail. We expect that subjects will give their matched pairs less on average in the second stage if their pairs choose to allocate more resources in the unproductive account (merit-based giving). Moreover, this share will be even lower when the choice is made by human (accountability heuristic).

A few observations emerge from our experiment. *First of all*, our analyses show that subjects' resource allocation decisions are not affected by the opportunity cost of unproductive investment: They choose the two options with equal frequency in both (high and low opportunity cost) treatments. *Second*, subjects' giving behavior is influenced by their own resource allocation decisions in the first stage. *Third*, they give less (in the distribution stage) to their partners if their partners choose unproductive investment in human treatment, but not in computer treatment that suggests that subjects punished human partners for choosing unproductive account, whereas such a punishment strategy is not present if their matched pair's resource allocation decision was made by the computer. Therefore, we provide mixed support for our hypotheses.

Our study contributes to mainly two lines of research: (i) the experimental literature on collaborative relationships where both production and distribution decisions are endogenously determined and (ii) the experimental literature on human–computer interactions. In the first one, to the best of our knowledge, our study is the first one to analyze the production-recognition tradeoff. In the second one, again to the best of our knowledge, we are the first one to study differences between human–computer and human–human interactions in production-recognition framework. We present further details about existing studies in the next section.

The organization of the paper is as follows: In Section 2, we relate our work to relevant strands of the literature. In Section 3, we present the experimental design and hypotheses. Section 4 presents our results. Finally, Section 5 concludes.

2 | Related Literature

As we briefly mentioned in the introduction, our paper is related to three different literatures: (i) bargaining/distribution games with unproductive and/or productive efforts/investments, (ii) contest games with endogenous prizes and recognition, and (iii) human–computer interactions in strategic environments. In what follows, we describe the contributions of related studies and explain how our study adds to the existing knowledge.

Yildirim (2007, 2010) analyzed a multilateral, legislative bargaining game where players can invest a fixed amount (i.e., unproductive effort) to increase their recognition probability (of becoming a proposer). That is, the surplus is exogenously given and agents exert costly effort to be recognized as a proposer. Similar question was analyzed by Fong and Deng (2012) and Levy and Razin (2013) who studied a game where the right to become a proposer is sold through an all-pay auction. In the current paper, different than in Yildirim (2007) and follow-up studies of his work, we concentrate on a dictator game environment where before the game, agents allocate their limited resources to joint production (productive activity that increases the size of the surplus) and investment in recognition (unproductive activity that increases individual's chances of controlling the surplus in the distribution stage). Hence, both the size of the surplus and the player who decides on the distribution are determined endogenously. There are also studies in which team members involve in a joint production phase before sharing. In Ali (2015), before investing for recognition (unproductive investment), agents invest to generate surplus. However, in that paper the amount invested in surplus and recognition are chosen independently, whereas they depend on each other via a resource budget constraint in the current paper. The closest papers to ours are Anbarci, Skaperdas, and Syropoulos (2002) and Cuellar (2022). In both of these papers, there is a trade-off between productive and unproductive investments. In Anbarci, Skaperdas, and Syropoulos (2002), agents need to compromise from investing in their disagreement points, which would be a source of power in the case of conflict, if they invest in surplus production. In Cuellar (2022), agents sacrifice from their recognition probabilities in a bargaining game to increase the size of the surplus, in a dynamic bargaining environment. Both of these studies are theoretical. Here, we constructed a two-stage game (resource allocation in the first stage and distribution in the second stage) and experimentally studied subjects' resource allocation decisions under high and low opportunity costs (of unproductive investment) and their distributive decisions when resource allocation decisions are made by human or computers.

In the basic Tullock contest, each agent expends valuable resources to increase her probability of winning a prize (Tullock 1980). This implies negative externalities on other participants because each agent exerts costly, unproductive effort to increase the chance of winning. In some extended rent-seeking models, productive efforts and/or modified payoffs are also present (see Chung 1996; Matros and Armanios 2009; Chowdhury and Sheremeta 2011). For instance, Chung (1996) presented a model of rent-seeking contest in which the surplus (or prize) increases with aggregate efforts. This makes every agent's effort productive, and hence, positive externalities are introduced to the contest environment. Agents can expand resources to increase the size of the surplus, but at the same time, there can be underprovision of effort since an agent cannot always recoup full return of her investment. This extended contest model also generates socially wasteful outcome since the level of exerted aggregate efforts is greater than the socially optimal level. Matros and Armanios (2009) presented a contest model with winner/loser reimbursements which implicates endogenous payoff function. They analyze the impact of reimbursements on total spending (aggregate unproductive effort level) and net total spending. In Chowdhury and Sheremeta (2011), agents receive different prizes contingent on winning or losing and payoffs are endogenous. These authors characterized the unique symmetric equilibrium with generalized payoff function which is linear in prize, own effort, and the effort of the competitor. Unlike the related theoretical contest literature, there are two types of investments, and there is a trade-off between investment types in our experimental setup. If an agent invests more in the unproductive account, then fewer resources are left to invest in to increase the amount of surplus. Moreover, the winner does not directly take all prize in our environment. The winner becomes the dictator and determines how to split the prize. Several experiments have studied the basic rent-seeking contests as well. In previous experiments, rent-seeking expenditures were usually observed to be higher than equilibrium expenditures (see, e.g., Anderson and Stafford 2003; Fonseca 2009; Sheremeta 2013; Masiliunas 2023). As far as we know, our paper is the first experimental work that investigates investments in recognition and distribution of endogenously determined prize.

March (2021) classified usage of computer players in strategic interactions in economics into five different categories. Ours belongs to the exclusion of "social preferences as a driving force of behavior" among this classification following the studies of Houser and Kurzban (2002) and Johnson, Camerer, and Rymon (2002). Here, we include a *computer* treatment and test whether subjects' dictator game giving in the distribution stage is influenced by who (human or computer) made the resource allocation decision in the first stage.

TABLE 1 | Treatments and number of subjects.

	Low opportunity cost	High opportunity cost
Human	Treatment 1 (48 subjects)	Treatment 2 (48 subjects)
Computer	Treatment 3 (48 subjects)	Treatment 4 (48 subjects)

3 | Experimental Design

We conduct a 2×2 laboratory experiment with two stages (production and distribution). In one dimension, we vary whether (resource allocation) decision in the first stage is made by a computer or a human in a between-subject fashion. In the other dimension, we vary the opportunity cost of unproductive investment (one or three) in a within-subject fashion. To control possible order effects, we implemented both orders (i.e., first high opportunity cost then low opportunity cost and first low opportunity cost then high opportunity cost) with equal frequency in a between-subject fashion. All treatments are shown in Table 1.

Our experiment consists of two blocks, and there are two stages in each block. In the first stage of each block, subjects are shown Table 2. They are told that each subject has 150 tokens[1] and is asked to decide on the allocation of this resource between Accounts 1 and 2. They have two allocation options: Options A and B. Option A (B) places 50 tokens to Account 1 (Account 2) and 100 tokens in Account 2 (Account 1). In the *computer* treatment, the computer chooses Option A with 1/2 probability and Option B with 1/2 probability.

In the *high* (*low*) opportunity cost treatment, the amount placed in Account 2 is multiplied by three (one). Subjects are told that the number of tokens that accumulates in Account 2 determines the value of the joint surplus they will distribute in the second stage (i.e., Account 2 is the production account), and the number of tokens that accumulates in Account 1 together with their own allocation into Account 1 determines who would control the

TABLE 2 | Decision in the first stage.

	Account 1 (promotion account)	Account 2 (production account)
Option A (surplus oriented)	50	100
Option B (recognition oriented)	100	50

distribution of the joint surplus in the second stage (i.e., Account 1 is the promotion account). In particular, a subject in a pair becomes the dictator with probability equal to (tokens he placed in Account 1/total tokens placed in Account 1). That is, one invests resources in Account 1 to have a higher recognition, similar to winning probability in Tullock contests.

After subjects make their allocation decisions (or learnt what the computer chose for them in the computer treatment) in the first stage, we ask how much (of the jointly produced surplus) they would give to their matched pair if they had complete control over the distribution of the joint surplus, that is, if they were the dictator. We use the strategy method, that is, we ask them to make this decision in case their matched pair chose Option A and in case she/he chose Option B.

In the human treatment, there is an additional part where (i) subjects are told according to which block their and their matched pair's payments are realized and then (ii) we ask them their beliefs about the first-stage decision of the other subject in the pair. If they guess correctly, they earn extra 50 tokens. During the experiment, subjects do not receive any feedback regarding others' resource allocation or distribution decisions. At the end of the experiment, subjects are randomly paired with another subject in the session, and decisions in one of the blocks are realized to determine the payment. More precisely, one block is chosen randomly for payment, and then, one of the subjects in each pair is randomly chosen as the dictator using the recognition probabilities implied by their investments in Account 1 in that block; and that subjects distributive decision is realized as the final distribution of the jointly produced surplus.

We conducted eight sessions at METU-FEAS Behavioral and Experimental Laboratory (BEL) at the Middle East Technical University (METU), https://bel-feas.metu.edu.tr/. Subjects were recruited by e-mail using the BEL database, which consists of undergraduate students at METU. Overall, 96 subjects participated in the experiment. Each subject participated in only one session, and sessions lasted approximately 30 min. Average earning from the experiment was 36.15 TL including 10 TL show up fee.[2] The average age of the subjects was 21.28, and 48% of the subjects were male. All sessions were computerized using z-Tree (Fischbacher 2007). We read the instructions aloud at the beginning of each stage to make the rules common knowledge among subjects.[3]

3.1 | Hypotheses

The resource allocation choices in the experiment are named as *surplus oriented*, *S* (Option A), and *recognition oriented*, *R* (Option B), in the rows and columns of tables in Figure 1. If both agents choose *S*, the size of the surplus is 200 tokens and each agent can be a dictator with 1/2 probability. If one agent chooses *S* and the other chooses *R*, the size of the surplus is 150 tokens, and the agent who chooses *S* can be a dictator with 1/3 probability, whereas the agent who chooses *R* can be a dictator with 2/3 probability. If both agents choose *R*, the size of the surplus is 100 tokens, and each agent can be a dictator with 1/2 probability. The theoretical prediction under standard rationality and selfishness assumptions is that when an agent becomes a dictator, she/he keeps all surplus to her/himself. In this case, as it can be seen in the first table of Figure 1, all strategy profiles are pure strategy Nash equilibria. However, if agents expect the distribution in the second stage to be according to proportionality (using the initial contributions, as in the second table of Figure 1) or egalitarianism (as in the third table of Figure 1), choosing *S* becomes the dominant strategy for each player.

In the high opportunity cost treatment, all payoffs in the tables of Figure 1 are multiplied by three but the equilibrium predictions remain the same. In particular, all strategy profiles constitute Nash equilibria under selfish preferences, whereas only (*S*, *S*) constitutes a Nash equilibrium if players adopt proportional sharing or egalitarian sharing principles as dictators. These predictions lead to our null version of Hypothesis 1, which predicts that the opportunity cost of unproductive investment will not have an effect on subjects' allocation decisions.

Hypothesis 1. *Null (based on the equilibria in game tables in Figure 1): The frequency of* S *choice will be independent of the opportunity cost of unproductive investment.*

On the other hand, multiplying the amount invested in productive account can resemble varying MPCR in public good games (Isaac and Walker 1988; Goeree, Holt, and Laury 2002; Zelmer 2003; Carpenter 2007; Herrmann, Thöni, and Gächter 2008; Cartwright and Lovett 2014) or varying cooperation payoff in prisoner's dilemma games (Charness, Rigotti, and Rustichini 2016; Büyükboyacı and Gürdal 2022). Hence, one may expect more subjects to choose *S* in line with findings in public good game or prisoner's dilemma games literature, which leads to our alternative version of Hypothesis 1.

Hypothesis 2. *Alternative (based on experimental findings): As the opportunity cost of unproductive investment increases, subjects will choose* S *more often.*

Allocating more resources into Account 1 reflects investments for power/control. In other words, a higher investment in recognition than in surplus production reveals a stronger preference for control in the distribution stage than contribution to enlarge the surplus. Moreover, Hoffman and Spitzer (1985), Hoffman et al. (1994) among others showed that subjects who earn (by taking costly actions) the proposer role in the ultimatum game

Selfish Preferences

	S	R
S	100, 100	50, 100
R	100, 50	50, 50

Proportional sharing

	S	R
S	100, 100	100, 50
R	50, 100	50, 50

Egalitarian sharing

	S	R
S	100, 100	75, 75
R	75, 75	50, 50

FIGURE 1 | Dictator game tables depending on sharing expectations in Stage 2.

make more aggressive demands. Along these lines, we expect subjects who choose *R* to give less to their matched pairs. In the game tables in Figure 1, choosing *R* is an equilibrium strategy only under selfish preferences, where the equilibrium payoff structure provides a foundation for this hypothesis.

Hypothesis 3. *Subjects who choose* R *will give less to their pairs than those who choose* S.

Cappelen et al. (2007) studied three different fairness ideals based on output, talent, and effort components. The first fairness ideal, *egalitarianism*, claims that people are not responsible neither for their effort nor for their talent, and any jointly produced surplus should be shared equally. The second fairness ideal, *libertarianism*, claims that people are responsible for both their effort and talent. The third fairness ideal, *liberal egalitarianism* (*or liberalism*), claims that people are responsible for their effort (under their control) but not for their talent (not under their control). In our experiment, we only have allocation dimension for the output, and there is no room for talent because joint production is realized through resource allocation decisions not through some real effort task. Hence, we focus on egalitarianism and meritocracy here. The following hypothesis relates these fairness ideals to giving behavior (defined as the % of the total surplus) in the dictator game.

Hypothesis 4. *For a subject who embraces egalitarianism, his/her dictator game giving will not differ by the other's* R *choice. For a subject who embraces meritocracy, his/her dictator game giving will be lower when his/her matched pair choses* R. *Finally, for a selfish subject, his/her dictator game giving will not differ by the other's* R *choice (i.e., it will always be 0).*

Knoch et al. (2006) showed that subjects reject unfair offers in an ultimatum game more often if they know that the offer comes from a human than from a computer. McCabe et al. (2001) showed that (more trusting) subjects' behavior is different when they play with computer and human in trust game. Along these lines, we expect dictator game giving in the second stage to be affected by whether the resource allocation decision in the first stage is made by a human or computer. More precisely, we expect less giving (i.e., punishment of selfish and unproductive promotion) when *R* choice was made by a human.

Hypothesis 5. *When* R *is chosen by their matched pairs, subjects give more to their matched pairs in the* computer *treatment than in the* human *treatment.*

4 | Results

We analyze our results in two subsections: resource allocation choice and dictator game giving.

TABLE 3 | Recognition choice.

Treatment	*R* choice (frequency)
Low opportunity cost	0.54
High opportunity cost	0.46

4.1 | Resource Allocation Choices

Table 3 shows the frequency of resource allocation decision in the first stage in the low and high opportunity cost treatments. The frequency of resource allocation choices (i.e., *R* and *S*) neither in the low opportunity cost treatment nor in the high opportunity cost treatment is significantly different from 0.50 (p value = 0.56 in both). This is in line with the multiple equilibria prediction under the "selfish-rational individual" assumption (see the first table in Figure 1). Corresponding investment frequencies in the two treatments are not significantly different from each other either (signed-rank test, p value = 0.19). Hence, this result is in line with Hypothesis 1.

In the models in Table 4, recognition (*R*) choice is the dependent variable. The main explanatory variable is *highoppcost* (i.e., high opportunity cost treatment), which takes the value 1 if data come from that treatment and 0 otherwise. *Order* takes the value 1 if high opportunity cost treatment is conducted first and 0 otherwise. The control variables, *gender*, *age*, and *economics* (takes the value 1 if the subject is an economics student), are included in Model 1 and not included in Model 2. According to the probit regressions in Table 4, none of these variables have a significant effect on the recognition choice in either model.[4] In particular, the insignificant coefficient for *highoppcost* confirms the statistical test results above.

4.2 | Giving Behavior in the Distribution Stage

In Appendix A, Tables A1 and A2 show how giving (%-wise) differs by subjects' own choices and their matched pairs' choices in all treatments. In low-cost human treatment, giving is affected by both own choices and others' choices. Subjects who choose *R* give lower shares to their matched pairs than subjects who choose *S*. In the rest of the treatments, subjects' own choices do not affect their giving behavior.[5] Based on statistical tests that do not consider control variables, Hypothesis 3 holds only in low-cost human treatment.

Fairness ideals described in the hypotheses section (i.e., egalitarianism and liberal sharing) would lead us to predict either (i) a lower dictator giving (%-wise) in response to an *R* choice of the matched pair (if the dictator is meritocratic) or (ii) no difference between dictator giving for *S* and *R* choices of the matched pair and a positive giving (if the dictator is egalitarian) or (iii)

TABLE 4 | Recognition choice—Probit regression results.

	(1)	(2)
Highoppcost	−0.22 (0.20)	−0.21 (0.20)
Order	−0.15 (0.31)	−0.11 (0.31)
Constant	1.29 (1.61)	0.16 (0.24)
Controls	Yes	No
N	192	192
#Clusters	48	48
Pseudo-R^2	0.0038	0.0063

Note: Standard errors in parentheses.

no difference between dictator giving for S and R choices of the matched pair and 0 giving (if the dictator is selfish). Based on their dictator game giving, we categorized our subjects into four groups: (1) selfish: subjects who give 0 to their matched pairs independent of allocation choices they made; (2) egalitarian: subjects who give equal positive share if their matched pair chooses R or S; (3) meritocratic (or merit based): subjects who give less (%-wise) when their matched pair chooses R compared to the situation when their matched pair chooses S; and (4) unclassified: if a subject does not belong to three groups listed above. According to Table 5, the largest share among these groups belong to merit-based group. A word of precaution is in order here as it can be seen in Table A1 in Appendix A, at least some of the subjects seem to be behaving in a way that combines selfishness with meritocracy or applying meritocracy in a self-centered fashion (e.g., on average subjects who choose R still take majority share of the surplus for themselves).

Table 6 reports the results from two OLS regression specifications to explain dictator game giving (in % terms). Specification (1) uses control variables whereas Specification (2) does not. In both specifications, the dependent variable is the giving percentage. Explanatory variables are the following: *Own R choice* takes the value 1 if the subject chooses recognition (R) oriented strategy in the first stage, *other's R choice* takes the value 1 if the subject's matched pair chooses recognition (R) oriented strategy in the first stage, *computer* takes the value 1 if data come from treatments in which computer makes the first-stage decisions, interaction of *other's R choice* and *computer,* and *order* take value 1 if high opportunity cost treatment comes as first and low opportunity cost treatment comes as second. Control variables are *gender*, *age*, and *economics*.

Although the sign of *own R choice* is negative as expected (i.e., average giving percentage is negatively correlated with subjects' own R choices), the coefficient is not significant. Hence, Hypothesis 3 is not confirmed (see Appendix A for average giving in all treatments). Consistent with the categorization of subjects presented in Table 5, giving percentage is negatively correlated with the other subject's R choice. Hence, the subjects behave according to meritocracy in human treatments, partially consistent with Hypothesis 4. The sum of coefficients on *other's R choice* and *other's R choice×computer* is not significantly different than zero ($p=0.874$ in Specification (1) and $p=0.874$ in Specification (2)), indicating that giving behavior does not differ in computer treatment by the matched pair's allocation choices. The sum of coefficients on *computer* and *other's R choice×computer* is significantly different than zero ($p=0.06$ in Specification (1) and $p=0.08$ in Specification (2)), indicating that giving shares differ by computer treatment when the other person chooses R. This finding confirms Hypothesis 5. In particular, when R choice in the first stage is made by a computer instead of a human, subjects give to their matched pair more. This suggests that giving less when R is chosen in the first stage carries a punishment flavor, and when it is not the matched pair's decision, punishment disappears because there is no responsibility. Notice that the coefficient for *computer* is not significant but the coefficient for the interaction variable between other's R choice and computer is, which suggests that subjects differentiate humans from a computer only when R is chosen by/for the other subject in the first stage.

5 | Conclusion

Individuals, organizations, and governments invest to improve their bargaining powers (recognition) in negotiations at a cost of productive activities which can enlarge the surplus. Here, we analyze such an environment experimentally. First, we look at whether subjects' binary allocation decisions on productive and unproductive accounts differ by opportunity cost of unproductive investment. We find no effect of higher opportunity cost on unproductive investment decisions of subjects. Second, we analyze how giving behavior in the distribution stage is affected

TABLE 6 | OLS regression for dictator game giving (in % terms).

	(1)	(2)
Own R choice	−0.02 (0.02)	−0.02 (0.02)
Other's R choice	−0.05 (0.02)**	−0.05 (0.02)**
Computer	0.02 (0.03)	0.01 (0.03)
Other's R choice×computer	0.05 (0.03)*	0.05 (0.03)*
High cost	0.02 (0.01)	0.02 (0.01)
Order	−0.04 (0.03)	−0.03 (0.03)
Constant	0.49 (0.17)***	0.32 (0.03)***
Control variables	Yes	No
N	384	384
#Clusters	96	96
Pseudo-R^2	0.04	0.03

Note: Standard errors clustered by subjects are in parentheses.
*$p<0.05$.
**$p<0.01$.
***$p<0.001$.

TABLE 5 | Percentage of subjects by second-stage decisions.

Second-stage decisions	Low opportunity cost computer	Low opportunity cost human	High opportunity cost computer	High opportunity cost human
Selfish	3/48	6/48	1/48	3/48
Egalitarian	6/48	8/48	11/48	12/48
Merit based	21/48	26/48	26/48	19/48
Unclassified	18/48	8/48	10/48	14/48

by subject's and his/her matched pair's resource allocation decisions, opportunity cost of unproductive investment, and whether the resource allocation decision is made by a computer or human (in that case, the matched pair him/herself). We find that although subject's own resource allocation decision does not affect his relative giving, his/her matched pair's allocation decision is correlated with the percentage of the jointly produced surplus she/he gives to the other. Furthermore, if more resources were allocated to unproductive, promotion activities (i.e., *R* choice), then the share of the jointly produced surplus that subjects give to their matched pair is affected by whether a human or a computer made the resource allocation decision. In particular, while subjects give less to the subjects who chose unproductive investment, this share increases if the decision is made by a computer.

A few takeaway messages from our results are as follows: (i) Although individuals make their allocation choices according to selfish prediction when they get the power, they do not use it much. This may be due to the strategy method we used. Due to the strategy method, subjects may make more empathy regarding the division and hence increase their giving shares even though they compete for power. Second reason for this may be due to beliefs, that is, subjects may invest on recognition not for gaining power per se but for not losing it to the other person (Neri and Rommeswinkel 2017). However, we cannot say it directly because we did not elicit beliefs for expected sharing before the allocation choices (to avoid possible priming of subjects). (ii) Other's recognition choice affects giving shares, but dictators do not distribute the surplus based solely on contribution; they also used their power, that is, divisions are away from proportional giving.[6] (iii) Finally, the identity of the decision-maker (i.e., computer or human) for the allocation choice affects distribution behavior in the dictator game. Considering we are in artificial intelligence era, understanding how fairness perceptions towards machine and human differ is important to study (see, among others, Chugunova and Luhan 2024 for more on this).

As future work, one can study how norms or the presence of an audience (through the social image concern channel) affect distribution behavior when there is a trade-off between recognition and surplus production. For beliefs, as in the case of norms, one can experimentally study third party beliefs on players' allocation choices and distribution behavior by incentivizing them based on correct predictions. Finally, future work may investigate human preferences over pairing with computer or another human decision-maker in a teamwork environment that involves recognition and production.

As our experimental design is inspired by various real-life situations that involve teamwork or collaboration, our results have some managerial/organization implications. First, we observe that, overall, our subjects' productive investment frequency did not respond to an increase in the opportunity cost of unproductive investment. On the other hand, some of them responded to the change in the opportunity cost. This suggests that some individuals may have types (e.g., always collaborative and collaborative under sufficient incentives). It would be good for the designer, authority, or manager to know about team members' types and adjust/set incentives accordingly. Second, we observe that our subjects' giving/sharing behavior does not depend much on their own investment choices but rather depend on their matched pair's investment choices. In particular, they give less to human pairs who invested more in unproductive account but still take a larger share of the surplus when they are the ones who made such an investment. This can be interpreted as another evidence for a self-centered application of fairness ideals. Similarly, a manager who is interested in efficiency and equity should take these self-serving biases into account when allocating tasks, designing the form of relationships in the team or distributing the outcome of joint work. Third, we observe that human subjects treat selfish choices coming from a computer differently from those coming from a human counterpart. In particular, they more severely punish when the selfish choice is made by a human. In an era where human–machine interaction in teamwork is plausible, these different attitudes may provide useful guidance for managers. For the type of task the computer is doing, people avoid punishment of the machine. This implies that managers can delegate machines for decisions related to the allocation of surplus (e.g., salary negotiations). Finally, our experiment highlights various possible channels (e.g., expectations, beliefs, identity of the matched pair, one's desire to have more power/control over the surplus, or one's fear from an opponent who may abuse power) that can influence both individual investment and sharing behavior. Thus, it is also practically important for a manager to know which particular channel is influential to be able to sustain high levels of surplus.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

[1] Five tokens correspond to 1 TL.

[2] By the time we ran the experiment, the hourly minimum wage was 18.90 TL.

[3] Instructions of each treatment can be seen in Appendix C.

[4] Because we elicit beliefs either only for low opportunity cost or high opportunity cost, it is not appropriate to have belief variable in the regression for Table 4. In Appendix B, we also look at how subjects' beliefs about others' action choices are affected from their own choices. Neither in high opportunity cost treatment nor in low opportunity cost treatment, their beliefs are affected from their own choices.

[5] Because many pairwise comparisons are possible across the tables, we look at the role of treatment by regression analysis.

[6] Except when own choice is surplus based but other's choice is recognition based. According to Table A2 in Appendix A, in these cases, proportional giving leads 0.33, and giving shares are close to 0.33.

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Appendix A

Giving (% Terms)

TABLE A1 | Average giving in the human treatment.

	Low cost		
	Other's choice		Signed-rank test
Own choice	*R*	*S*	*p*
R	0.18	0.23	0.07
S	0.30	0.38	0.01
Rank-sum test	0.02	0.005	
	High cost		
	Other's choice		**Signed-rank test**
Own choice	***R***	***S***	***p***
R	0.33	0.30	0.22
S	0.23	0.31	0.01
Rank-sum test	0.09	0.59	

TABLE A2 | Average giving in the computer treatment.

Low cost			
	Other's choice		Signed-rank test
Own choice	***R***	***S***	***p***
R	0.34	0.30	0.32
S	0.27	0.30	0.36
Rank-sum test	0.11	0.97	
High cost			
	Other's choice		Signed-rank test
Own choice	***R***	***S***	***p***
R	0.30	0.35	0.002
S	0.33	0.32	0.38
Rank-sum test	0.68	0.53	

Appendix B

Beliefs by Subject's Own Choice in Human Treatment

Low cost		
	Own choice	
Belief	***R***	***S***
R	8	5
S	8	7
Chi2 test = 0.66		
High cost		
	Own choice	
Belief	***R***	***S***
R	3	2
S	4	11
Chi2 test = 0.18		

Appendix C

Experimental Instructions

Below is the instruction for the control treatment.

Instructions of the Experiment.

Welcome to our experiment; thank you for your participation.

We are asking you not to talk with someone during the experiment.

C.1 | Introduction

The purpose of the experiment is to analyze the process of economic decision-making. You can earn money with the decisions you make during the experiment. How much you earn depends on your decision, other participants' decisions, and the chance. You will take 10 TL for your participation, regardless of the decisions you make during the experiment.

From now on, we ask you not to talk with others. If you have a question, please raise your hand. We will come to your desk and answer the questions.

The experiment you participate in is a one-stage experiment. The revenues will be in terms of the token during the experiment. Five tokens equal to 1 Turkish Lira in the experiment.

There will be two similar blocks in the experiment. We will inform you about each block before it starts. Your earnings will depend on your decisions in a randomly chosen block, others' decisions, and the chances.

Your earnings from the experiment will be based on a randomly chosen block and your and your pair's decisions in that block.

C.1.1 | Block 1

There will be two parts in each block.

C.1.1.1 | The First Part. In this part, you will be paired with a person randomly. You and your pair will have 150 tokens. You and your pair can allocate this money into Accounts 1 and 2 as follows.

[**In Control:** *The computer will randomly choose options A or B for you and your pair. That means the computer can choose A or B by 1/2 probability.*]

	Account 1	Account 2
A	50	100
B	100	50

[**In Control:** *The computer randomly chooses A or B for you and your pair.*] The amount put by you and your pair in Account 2 will determine **the total amount** you will share with your pair.

The amounts put by you and your pair in Account 1 [**In Control:** *the amounts in Account 1*] will show how you and your pair share the total amount as follows:

- With $\frac{\textit{Your amount of token in Account 1}}{\textit{The total amount in Account 1}}$ probability, you will determine how to share the amount in Account 2.
- With $\frac{\textit{Your pair's amount of token in Account 1}}{\textit{The total amount in Account 1}}$ probability, your pair will determine how to share the amount in Account 2.

For example, suppose [**In Control:** *the computer chooses A for you and B for your pair*] while you chose Option A, you pair chose Option B in the first part. That means you put 50 tokens in Account 1 and 100 tokens in Account 2, whereas your pair put 100 tokens in Account 1 and 50 tokens in Account 2.

- The sum in Account 2, the amount to be shared, will be 150 tokens: 100 from you (A) and 50 from your pair (B).
- According to amounts in Account 1, with $\frac{50}{50+100}$ probability you will determine how you share, with $\frac{100}{50+100}$ probability your pair will determine how you share.

In this part, you need to make a choice between A and B. You can make this choice over computer. [**In Control:** *We do not have this paragraph in Control.*]

C.1.1.2 | The Second Part. After you and you pair make decisions [**In Control:** *the computer makes a decision for you and your pair*] in the first part, [**In Control:** *you will see the decision for you (A or B). However,*] you will not know the decision for your pair.

You will inform us **how you would share if you were the one who determines how to share between you and your pair** depending on the decision made by you and potential decisions by your pair [**In Control:** *the computer makes for you and its "potential decisions" for your pair*]. For instance, suppose you [**In Control:** *the computer*] chose **A** [**In Control:** *for you*] in the first part; you are expected to make decisions about these cases in the second part:

- If your pair chooses A [**In Control:** *the computer chooses A for your pair*], the sum in Account 2 will be 200 tokens. In this case, how much of 200 tokens would you give your pair?
- If your pair [**In Control:** *the computer chooses B for your pair*], the sum in Account 2 will be 150 tokens. In this case, how much of 150 tokens would you give your pair?

The determination of payments in Block 1:

The total amount you and your pair will share and the probabilities of who makes sharing decision will be determined **according to the choices made by you and your pair** [**In Control:** *of the computer*] **in the first part.** Then, these probabilities will be realized and according to your or your pair's decisions, the sharing will occur.

For instance, suppose you [**In Control:** *the computer*] chose A [**In Control:** *for you*] and your pair chose B [**In Control:** *for your pair*], then the total amount shared (in Account 2) was 150 tokens.

- According to the decisions in the second part (in case [**In Control:** *the computer chooses A for you and B for your pair*] you chose A and your pair chose B in the first part), you shared the total amount as 100 tokens for yourself and 50 tokens for your pair.
- According to the decisions in the second part (in case [**In Control:** *the computer chooses A for you and B for your pair*] you chose A and your pair chose B in the first part), your pair shared the total amount as 125 tokens for herself or himself and 25 tokens for you in the second part.

According to [**In Control:** *the computer's choices for you and your pair*] choices you and your pair made in the first part (according to the amounts you and your pair have in Account 1), with 1/3 probability that your sharing decision will be considered, while 2/3 probability that your pair's sharing decision will be considered.

C.1.2 | Block 2

This block will be similar to Block 1.

C.1.2.1 | The First Part.

In this part, you will be paired with a person randomly. You and your pair will have 150 tokens. You and your pair can allocate this money into Account 1 and Account 2 as follows. [**In Control:** *The computer will randomly choose options A or B for you and your pair. That means the computer can choose A or B by 1/2 probability.*]

	Account 1	Account 2
A	50	100
B	100	50

[**In Control:** *After the computer randomly chooses A or B for you and your pair,*] The sum in Account 2 will be multiplied by 3 and determine **the total amount** you will share with your pair.

The amount put in Account 1 by you and your pair [**In Control:** *the amounts in Account 1*] will show how you and your pair share the total amount as follows:

- With $\frac{\textit{Your amount of token in Account 1}}{\textit{The total amount in Account 1}}$ probability, you will determine how to share the amount in Account 2.
- With $\frac{\textit{Your pair's amount of token in Account 1}}{\textit{The total amount in Account 1}}$ probability, your pair will determine how to share the amount in Account 2.

For example, suppose while you chose Option A, you pair chose Option B [**In Control:** *the computer chooses A for you and B for your pair*] in the first part. That means you put 50 tokens in Account 1 and 100 tokens in Account 2, whereas your pair put 100 tokens in Account 1 and 50 tokens in Account 2.

- The sum in Account 2, the amount to be shared, will be 450 tokens: 300 from you (A) and 150 from your pair (B).
- According to amounts in Account 1, with $\frac{50}{50+100}$ probability you will determine how you share, with $\frac{100}{50+100}$ probability your pair will determine how you share.

In this part, you need to make a choice between A and B. You can make this choice over computer. [**In Control:** *We do not have this paragraph in Control.*]

C.1.2.2 | The Second Part.

After you and you pair make decisions [**In Control:** *the computer makes a decision for you and your pair*] in the first part, [**In Control:** *you will see the decision for you (A or B). However,*] you will not know the decision for your pair.

You will inform us **how you would share if you were the one who determines how to share between you and your pair** depending on the decision made by you and potential decisions by your pair [**In Control:** *the computer makes for you and its "potential decisions" for your pair*]. For instance, suppose you [**In Control:** *the computer*] chose **A** [**In Control:** *for you*] in the first part; you are expected to make decisions about these cases in the second part:

- If your pair chooses A [**In Control:** *the computer chooses A for your pair*], the sum in Account 2 will be 600 tokens. In this case, how much of 600 tokens would you give your pair?
- If your pair [**In Control:** *the computer chooses B for your pair*], the sum in Account 2 will be 450 tokens. In this case, how much of 450 tokens would you give your pair?

The determination of payments in Block 1:

The total amount you and your pair will share and the probabilities of who makes sharing decision will be determined **according to the choices made by you and your pair** [**In Control:** *of the computer*] **in the first part.** Then, these probabilities will be realized and according to your or your pair's decisions, the sharing will occur.

For instance, suppose you [**In Control:** *the computer*] chose A [**In Control:** *for you*] and your pair chose B [**In Control:** *for your pair*], then the total amount shared (in Account 2) was 450 tokens.

- According to the decisions in the second part (in case [**In Control:** *the computer chooses A for you and B for your pair*] you chose A and your pair chose B in the first part), you shared the total amount as 300 tokens for yourself and 150 tokens for your pair.
- According to the decisions in the second part (in case you chose A and your pair chose B in the first part [**In Control:** *the computer chooses A for you and B for your pair*]), your pair shared the total amount as 350 tokens for herself or himself and 100 tokens for you in the second part.

According to [**In Control:** *the computer's choices for you and your pair*] choices you and your pair made in the first part (according to the amounts you and your pair have in Account 1), with 1/3 probability that your sharing decision will be considered, while 2/3 probability that your pair's sharing decision will be considered.