Journal of Behavioral Economics for Policy, Vol. 8, Issue 2, 11-26, 2024

Preferences for and Productivity Consequences of Different Fairness Paradigms of Income Distribution: An Experimental Investigation into Productive Effort and Income Distribution

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Abstract
This study aims to investigate preferences for equity and the efficiency implications of various income distribution strategies. We employ a multi-period, three-player ultimatum/dictator game combined with a real-effort task. Our findings reveal that when both roles and funds are earned through effort, equal income distribution results in the lowest productivity, while tournament style distribution achieves the highest. However, both approaches are frequently rejected, indicating perceptions of unfairness. In contrast, effort-proportional pay generates the highest total income when accounting for losses due to rejections. These results suggest that in this experimental context, the optimality of neoclassical income distribution stems from its perceived fairness.

JEL Classification: C92, D63, J24, J31, J51, M12

Keywords
laboratory experiment — fair division — labor productivity — wage inequality — tournament theory

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Introduction

The allocation of resources is a key aspect of economics, both at the macroeconomic and microeconomic levels. At the macroeconomic level, income inequality has been rising across the OECD for approximately 50 years (Hoeller et al., 2014; Piketty & Saez, 2003). At the microeconomic level, this is shown in the significant growth of the gap between CEOs and average workers. CEO compensation relative to the average worker increased from 21 times higher in 1965 to 320 times higher in 2019 (Mishel & Kandra, 2020). However, these large disparities in pay are not limited to the private sector since the highest-paid leaders of charities in the U.S. earned 35 times more than their average workers (Charity Watch, 2021).

While macroeconomic inequality can result from impersonal forces, inequality within an organization is necessarily the result of individual distributional choices. The expanding gap between the pay of a CEO and a typical worker results from specific decisions made by the organization's leadership. While CEOs have an incentive to increase their relative pay, this incentive is tempered by their preferences for fairness and by the impact of compensational choices on the worker effort, as CEOs or other workers. In addition, many businesses rely heavily on workers with significant bargaining power who are difficult to replace. These workers may engage in counterproductive work behaviors (CWBs), sometimes causing damage, as a response to compensation they perceive as unfair or unsatisfactory. Examples of CWBs identified in management literature include theft, sabotage, destruction of property, slander, withholding of effort and/or information, consuming firm resources for private benefit, and refusing to cooperate (Hunter & Penney, 2014; Kim et al., 2015; Palmer et al., 2020; Park et al., 2019; Penney & Spector, 2005).

Therefore, this work focuses on the variable nature of fairness. There is a great deal of research showing that people identify fairness as equal distribution of resources in hypothetical settings (Fisman et al., 2021; Isaksson & Lindskog, 2009; Müller & Renes, 2021) as well as in experimental environments in which funds are unearned (Alexopoulos et al., 2013; Güth et al., 2007). However, the operational definition of fairness shifts from equal distribution to rewarding individuals based on their contributions when funds are earned (Childs & Siebert, 2019; Fischbacher et al., 2009; Franco-Watkins et al., 2013; Gächter & Riedl, 2005; Konow, 1996; Oxoby & Spraggon, 2008). The acceptability of a distribution of income may significantly differ between those viewing it as an abstract notion and those who labor within said distribution.

This shift in distributive preference has important implications for both corporate and public policy. Inequality within an organization may be the result of differential contributions rather than the simple exercise of bargaining power. Attempts to alter the distribution to be consistent with the preferences

of external observers may result in lower productivity, and can potentially incentivize workers to withdraw their labor from an otherwise productive endeavor.

However, studying distributional choices and worker responses in real-world settings is challenging due to limitations in control and the lack of counterfactuals. To address this, we designed our study using a three-player dictator/ultimatum game, as implemented by Guth et al. (2007) paired using a real effort task (Benndorf et al., 2019). This experiment allows us to directly observe effort, proposed distributions of resources, and the response of workers to different distributions.

We present the results of this laboratory experiment to examine three fundamental questions. How does the operational definition of fairness change in response to demonstrations of effort? And conversely, how does effort change in response to distributions of available resources? Finally, which sorts of distributions are most likely to see workers withdraw their labor?

The remainder of the paper is organized as follows. Section 2 includes the experimental design and the behavioral hypotheses. Section 3 presents the core analysis and results. Section 4 reports the conclusions.

Experimental Design and behavioral hypotheses

Experimental design

The experiment was conducted at the Social Science Research Laboratory at the University of Saskatchewan (Canada), using zTree software (Fischbacher, 2007). A total of 114 participants were recruited from the university's general student population to engage in a computer-mediated, between-subjects experimental design. Each experimental session lasted approximately 60 minutes.

Upon arriving at the laboratory, participants were randomly and anonymously assigned to a group of three. Each participant took part in ten rounds of the experiment. Each round began with a decoding effort task in which participants had 100 seconds to substitute three-digit codes for letters (Benndorf et al., 2019). Then, participants engaged in a three-player ultimatum/dictator game. In this game, one participant (the proposer) proposes a distribution of funds, a second (the responder) either agrees or rejects the distribution, and the third player is entirely passive (the passive receiver) (Güth et al., 2007). As in a standard ultimatum game, a rejected proposal leads to all players getting no payoff that round. At the beginning of the sixth round, groups were re-formed and roles were redetermined. At the end of the 10th round, participants completed a short demographic survey.

Comprehensive details about the experiment, including instructions for each treatment, and the full survey text are available in Appendices A and B, respectively.

Hence, we implemented a 2-by-2 factorial design with two treatment variables. The first treatment variable refers to the origin of the funds to be divided among group members, which were either earned through the effort task or endowed. The second treatment variable considers the assignment of roles in the ultimatum/dictator game, which were earned via relative effort task performance or random.

Proposers and responders were provided with complete information, including the performance of each group member, the total amount of funds available for division, and the proposed distribution. In contrast, receivers had no information.

The total number of observations to be analyzed is 1140, 10 for each subject. The breakdown by treatment is shown in Table 1 below.

Table 1.

	Description	N
Treatment 1 (T1)	Endowed Funds, Random Roles	300
Treatment 2 (T2)	Endowed Funds, Earned Roles	270
Treatment 3 (T3)	Earned Funds, Random Roles	270
Treatment 4 (T4)	Earned Funds, Earned Roles	300

In endowed funds treatments (T1 and T2), groups were endowed with 105 ECUs (experimental currency units) to divide. In earned funds treatments (T3 and T4), groups earned 5 ECUs for each code a member solved in the effort task. At the end of the experiment, 16.67 ECUs were converted to $1 CAD. Participants received an average of $25 CAD, including a show-up fee.

Hypotheses

We propose three general hypotheses irrespective of the treatment:

> *H1: Distributions based on relative effort will be most often proposed.*

Previous research (Konow, 1996; Franco-Watkins, Edwards, & Acuff, 2013) has shown that participants in experiments strongly prefer to align rewards with effort. While we anticipate that equal distributions will be more prevalent when funds are endowed rather than earned, the presence of a real effort task is expected to influence proposers' decisions.

> *H2: Distributions based on relative effort will induce greater effort.*

Although we expect that participants will respond to incentives, it is important to distinguish between distributions based on relative effort in which each participant receives a share proportionate to their relative effort from those in which the participant with the greatest effort receives a share much larger than their relative effort. We identify proportionate distributions as "effort shares", and disproportionate distributions as "tournament shares".[1]

[1]The incentives for higher performers inherent in the tournament shares distributions are well established in the literature, starting with Lazear and Rosen (1981).

H3: Distributions of funds directly proportional to effort will seldom be rejected.

Hypothesis 3 is in keeping with the basic premise of earlier work (see, e.g., Güth, 1982; Charness and Rabin, 2002; Konow, 2003; Falk and Fischbacher, 2006) that finds the standard for fairness shifts in response to a common task that generates funds to be divided. However, it is unlikely that tournament style distributions will be seen as fair, and thus are likely to be rejected by responders.

H4: Distributions that maximize group effort may not be the most profitable for participants.

When a proposed distribution is rejected, the group forfeits any income for that period. This situation is similar to a scenario where essential workers in a firm, who are difficult to replace, engage in counterproductive work behaviors (CWBs) that significantly harm the firm's overall performance. If responders reject offers designed to maximize effort, the group may end up with a more equal but smaller distribution, ultimately reducing the potential payoff for all participants.

Data Analysis and Main Results

To inform with our results, in Table 2 we report some descriptive statistics on the mean choices and standard deviations across the four treatments.

Overall, and across all treatments, receivers solve fewer codes than both responders and proposers, a trend that persists even when roles are randomly assigned. As a result, the funds allocated to receivers are significantly lower compared to those assigned to the other roles.

Additionally, it is noteworthy that the rejection rate of proposed distributions is generally low, with a peak of 19 percent in Treatment 3. The lowest rejection rate occurred in Treatment 4, despite this treatment showing the largest disparity in the funds allocated to the proposer compared to the other roles.

Moving to a more detailed analysis, Figure 1 illustrates the distribution frequency of proposals across treatments, categorized into four groups. The first group is that of *Equal-shares*, where proposals distribute funds equally among all group members. The second group is the *Effort-shares*, in which funds are allocated in proportion to the effort each group member contributed to the effort task. In the third group of the *Tournament-shares*, funds are distributed based on relative effort. Still, the group member who contributes the most effort receives a disproportionately larger share, while the one who contributes the least gets a smaller portion. Finally, some distributions fit into none of these categories, lacking internal consistency. We put them into a fourth group, namely *Other*.[2]

In Figure 1, we observe that equal shares are proposed most often in Treatment 1, when the real effort task had no relationship to the assignment of roles nor the amount of funds to be distributed, accounting for just 17% of proposed distributions. Tournament shares are also most common in Treatment 1, accounting for 28% of distributions. Effort shares are least frequently proposed in Treatment 1, accounting for another 17% of proposals. So, even when equal shares are most often proposed, distributions based on relative effort are proposed twice as often (45% to 17%). In all other treatments, effort shares alone accounted for a greater proportion of distributions than equal shares. This is Result 1.[3]

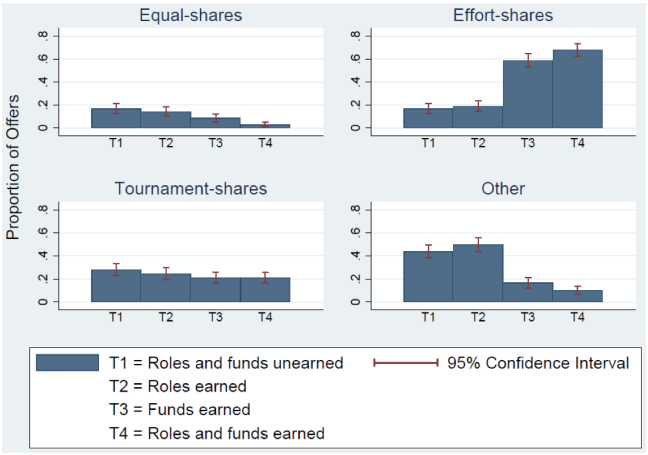

Figure 1. Relative Distribution Frequency by Treatment
This table reports the fraction of all distributions offered within each treatment corresponding to either tournament-shares, effort-shares, or equal-shares; as well as the fraction that does not correspond to any of these three categories.

> **Result 1:** Effort-based distributions (i.e., effort-shares and tournament-shares) are preferred to equal distributions when the effort is observable, even if it does not impact assigned roles or funds to be distributed.

Then, considering the impact of different distributions of funds on average effort, we notice that the output does not increase over time, regardless of the distribution of funds. The task is designed to limit the effects of learning while allowing participants to vary their output by varying the amount of effort. This is reported as result 2.[4]

> **Result 2:** No distribution of funds significantly impacts the evolution of effort over time in all treatments.

Moreover, the levels of effort do not differ significantly across distribution styles and treatments. Figure 2 presents the estimated impact of each distribution type on effort in the

[2] A detailed analysis of these "Other" group distributions can be found in Appendix C.

[3] Pairwise comparisons of each distribution type support this conclusion and are included in Appendix D as Tables D1, D2, and D3.

[4] Graphs showing the effort evolution by treatment and distribution are reported in Appendix E as Figure E1.

Table 2.

		Fixed Funds		Earned Funds	
	All Treatments	**Random Roles (Treatment 1)**	**Earned Roles (Treatment 2)**	**Random Roles (Treatment 3)**	**Earned Roles (Treatment 4)**
Code Solves Per Period					
All	7.42	7.19	7.32	7.31	7.84
	(1.59)	(1.55)	(1.47)	(1.78)	(1.49)
Proposer	8.05	7.81	7.99	7.36	8.98
	(1.37)	(1.13)	(1.07)	(1.53)	(1.19)
Responder	7.47	7.02	7.58	7.53	7.77
	(1.59)	(1.96)	(1.20)	(1.82)	(1.10)
Receiver	6.74	6.75	6.40	7.04	6.77
	(1.52)	(1.25)	(1.57)	(1.91)	(1.27)
ECU Pay Per Period					
All	31.54	30.1	28.39	31.13	36.20
	(15.56)	(13.68)	(16.01)	(16.79)	(14.77)
Proposer	36.00	32.88	32.18	34.48	43.95
	(16.54)	(14.19)	(16.51)	(17.39)	(15.34)
Responder	32.67	30.7	30.83	32.89	36.13
	(14.60)	(13.57)	(15.81)	(16.19)	(12.20)
Receiver	25.94	26.72	22.15	26.02	28.52
	(13.67)	(12.51)	(13.67)	(15.51)	(12.27)
Rejection rate	0.14	0.14	0.19	0.14	0.08
Age	25.64	25.63	26.55	24.88	25.5
	(6.57)	(6.89)	(7.28)	(5.29)	(6.54)
Male	0.33	0.17	0.40	0.48	0.30
Observations	1,140	300	270	270	300

Standard deviations are reported in brackets.

subsequent period, accounting for various factors such as the rejection of distribution in the previous period, participant age and sex, and the specific period under consideration.[5]

We observe that tournament style pay led to significantly higher firm output (total codes solved) in the most externally valid treatment (Treatment 4), whereas equal pay was associated with significantly lower productivity. This is the result 3.

> **Result 3:** Equal-share pay is associated with significantly lower productivity when both roles and funds are earned through effort.

However, the potential rejection of offers perceived as unfair can limit efficiency. For example, a distribution designed to maximize effort may backfire if it provokes significant labor disruptions due to perceived inequity. The benefits of an effort inducing distribution can be destroyed if workers withdraw their labor. Therefore, understanding the types of distributions that are rejected by responders is critical to addressing the relationship between fairness perceptions and firm productivity.

Remarkably, in Figure 3 we show that Equal-shares are rejected nearly one-third of the times it is proposed in Treatment 3. Tournament-shares, while also frequently rejected, reach their highest rejection rate in the same treatment. Although the difference is not statistically significant, it is interesting to note that tournament style distributions are rejected less often when roles are earned rather than randomly assigned. Despite this willingness to reject proposals, effort shares are never rejected, regardless of treatment. This is true even when

[5] See Appendix G for full regression output.

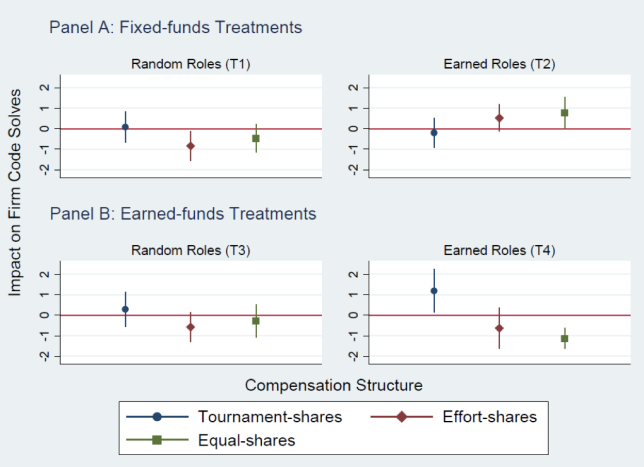

Figure 2. Compensation-structure and Firm Productivity
This figure reports the coefficient of primary interest, a lagged distribution dummy, in random effects regressions on a "firm's" total number of code-solves per period. The unit of observation is a "firm". Standard errors are clustered at the firm level. Confidence interval is at the 90% level. All regressions include controls for the period, rejection in the prior period, and the age and sex of the participants.

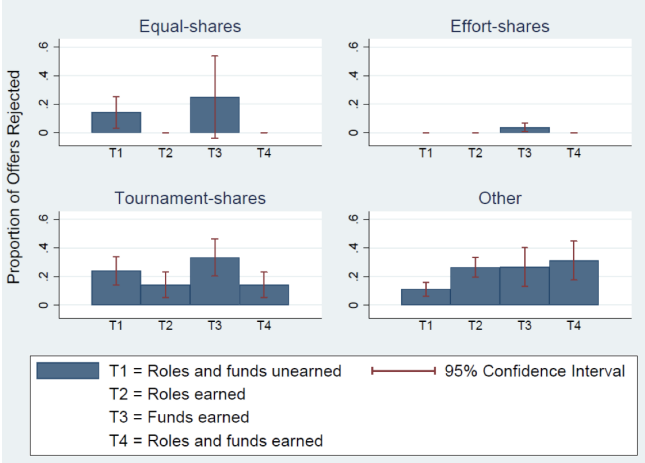

Figure 3. Relative Rejection Frequencies
This figure reports what fraction of the offers corresponding to each distribution type were rejected over all treatments, within fixed-funds and earned-funds treatments.

the effort task has no relationship to the assignment of roles nor the amount of funds to be divided. This is the foundation of result 4.

> **Result 4:** Proposals that distribute funds in direct proportion to relative effort are always seen as fair.

It should also be noted that in two treatments - T1 and T4 - a rejection made either tournament shares (T1) or effort shares (T4) more likely to be proposed in the following period.[6] Rejection was more likely to be followed by a proposal that distributed funds based on relative effort, reinforcing result 4.

Finally, we focus on revenue maximization at the firm level. In any environment where workers have sufficient bargaining power to withdraw their labor, CEOs have to consider the risk of CWBs, in response to a dispute over wages (relative or not). This dynamic can make payment structures that incentivize high effort counterproductive if they provoke labor disruptions. Figure 4 shows the regression results of total pay received by participants in a firm, based on distribution type.[7]

Although we saw that tournament pay in T4 elicited more effort, this is offset by rejections. The pursuit of the highest productivity structure has limits. It should be noted that, except T1, pay in direct proportion to effort offers the greatest returns. Thus, we offer result 5.

> **Result 5:** Distributions that make pay directly proportionate to each individual's effort offer the highest group returns.

[6] See Figure F1 in Appendix F.
[7] See Appendix G for full regression output.

Discussion and Conclusion

One of the principal responsibilities of leadership is determining the resource distribution within the organization. Choosing a pay structure means selecting a distribution of the organization's resources. To do so, leaders must necessarily contend with shifting definitions of fairness, the impact of incentives on the efforts of all workers, and the potential that a given pay structure leads to significant CWBs from essential, difficult-to-replace, employees. This is a complex act, that can be further complicated by external definitions of fairness. The extant literature (to which we want to contribute) shows that operative definitions of fairness differ between abstract/hypothetical cases and situations involving actual effort and production (see, e.g., Peng et al., 2020).

The ability of at least one group of workers to significantly hinder a firm's operations through CWBs acts as a check on unfair distributions of resources within a firm. We saw that distributions that rewarded top performers at the expense of weaker performers were the most often rejected, despite the productivity effects of such tournament style distributions.

The policy implications are profound. External impositions of fair distributions may not always be necessary. This finding implies serious limits to activist shareholders and governments alike. Moreover, attempts to impose an exogenously determined definition of fairness (typically abstract or hypothetical) can be counter to the operational definition of fairness used by those embedded in the situation. We have shown that it is possible for such distributions to lead to labor disruptions and lost productivity. As is often the case, those actually in the situation likely have more information than an external viewer. In terms of operational definitions: fair may not always be equal, equal may not always be fair, and it may be that neither is efficient (Lehmann, 2022). Finally, our

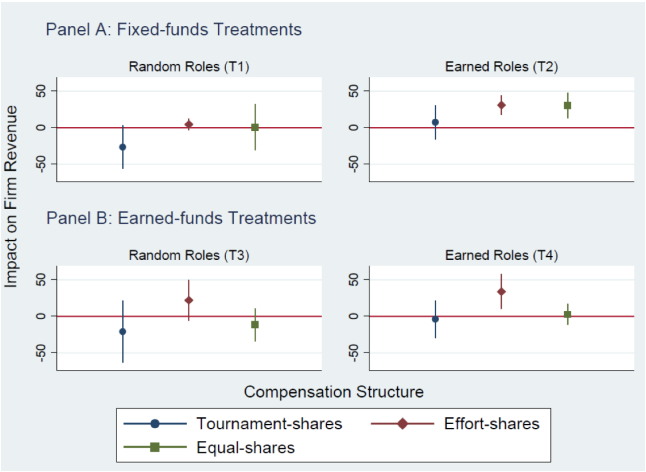

Figure 4. This figure reports the coefficient of primary interest, a lagged distribution dummy, in random effects regressions on a "firm's" revenue per period in fixed-funds treatments. The unit of observation is a firm. Standard errors are clustered at the firm level. Confidence interval is at the 90% level. All regressions include controls for the period and the age and sex of the participants.

study has important implications for broader organizational performance since some designs/incentives are likely to affect workers differently according to their operational definition of fairness (see, e.g., Espin et al., 2017). In principle, the same incentives can even have opposite effects on individuals with different perceptions about what is actually a "fair" incentive.

Funding

This experiment was funded by the University of Regina's Department of Economics.

Involvement of Funding Organization

The funding organization had no involvement in the experimental design, collection, analysis, or interpretation of data; writing of the study; or in the decision to submit this article for publication.

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Appendix A: Experiment Instructions

When the experiment begins on the computer, participants first complete three periods of the effort task to become familiar with it before the game officially begins. This is called the "trial stage". When the trial stage begins, the "trial stage information" appears. When the trial stage ends, the "post-trial information" appears.

A1. Trial Stage Information

General Instructions and Information:

1. Please don't speak with other participants during the game.
2. Please turn off your phone(s).
3. The experimental currency unit (ECU) to Canadian dollar (CAD) conversion rate is approximately 15 to 1.

The next screen will be a trial of the encryption task so you can familiarize yourself with it. You will be presented with three letters and three input boxes beneath the letters, as well as a randomly assorted alphabet with three numbers that correspond to each letter. Put the corresponding numbers into the boxes beneath the three letters at the top and click okay to solve the code. You will solve three codes in the trial stage.

A2. Post-trial Information: Treatment Instructions

A2.1 Earned roles and earned funds

After this screen the game will begin for real. This time, when you do the encryption task, you will have 100 seconds to solve as many codes as possible, where each correct solve generates 5 ECUs. Once the encryption task is complete, the program will then randomly match you with two other participants, combine your ECUs together, and assign you the role of Player 1, Player 2, or Player 3 based on your performance in the encryption task.

Player 1 has the right to split the ECUs between their group members as they see fit (they will be able to see and compare each group member's performance in the encryption task as they decide on a split). The group member who solves the most codes in the encryption task will earn this role.

Player 2 has the right to review Player 1's split and choose whether it will be enacted or rejected, where rejection results in all group members receiving zero payoff for the period (they will also be able to see each group member's performance in the encryption task as they make their decision). The group member who solves the second most codes in the encryption task will earn this role.

Player 3 is entirely passive. The group member who solves the fewest codes in the encryption task will earn this role.

After the first period, where roles are initially assigned, you will not have another opportunity to change your role until the 6th round. In addition, you will be randomly regrouped with different people on the 6th round (i.e., the people you play with for the first five rounds will be different from the people you play with in the last five rounds).

A2.2 Random roles and earned funds

After this screen the game will begin for real. This time, when you do the encryption task, you will have 100 seconds to solve as many codes as possible, where each correct solve generates 5 ECUs. Once the encryption task is complete, the program will then randomly match you with two other participants, combine your ECUs together, and randomly assign you the role of Player 1, Player 2, or Player 3.

Player 1 has the right to split the ECUs between their group members as they see fit (they will be able to see and compare each group member's performance in the encryption task as they decide on a split).

Player 2 has the right to review Player 1's split and choose whether it will be enacted or rejected, where rejection results in all group members receiving zero payoff for the period (they will also be able to see each group member's performance in the encryption task as they make their decision).

Player 3 is entirely passive.

After the first period, where roles are initially assigned, roles will not change until the 6th round, where they will be randomly reassigned by the program. In addition, you will be randomly regrouped with different people on the 6th round (i.e., the people you play with for the first five rounds will be different from the people you play with in the last five rounds).

A2.3 Earned roles and fixed funds

After this screen the game will begin for real. This time, when you do the encryption task, you will have 100 seconds to solve as many codes as possible. Once the encryption task is complete, the program will then randomly match you with two other participants, and assign you the role of Player 1, Player 2, or Player 3 based on your performance in the encryption task.

Player 1 has the right to split 105 ECUs between their group members as they see fit (they will be able to see and compare each group member's performance in the encryption task as they decide on a split). The group member who solves the most codes in the encryption task will earn this role.

Player 2 has the right to review Player 1's split and choose whether it will be enacted or rejected, where rejection results in all group members receiving zero payoff for the period (they will also be able to see each group member's performance in the encryption task as they make their decision). The group member who solves the second most codes in the encryption task will earn this role.

Player 3 is entirely passive. The group member who solves the fewest codes in the encryption task will earn this role.

After the first period, where roles are initially assigned, you will not have another opportunity to change your role until the 6th round. In addition, you will be randomly regrouped with different people on the 6th round (i.e., the people you play with for the first five rounds will be different from the people you play with in the last five rounds).

A2.4 Random roles and fixed funds

After this screen the game will begin for real. This time, when you do the encryption task, you will have 100 seconds to solve as many codes as possible. Once the encryption task is complete, the program will then randomly match you with two other participants, and randomly assign you the role of Player 1, Player 2, or Player 3.

Player 1 has the right to split 105 ECUs between their group members as they see fit (they will be able to see and compare each group member's performance in the encryption task as they decide on a split).

Player 2 has the right to review Player 1's split and choose whether it will be enacted or rejected, where rejection results in all group members receiving zero payoff for the period (they will also be able to see each group member's performance in the encryption task as they make their decision).

Player 3 is entirely passive.

After the first period, where roles are initially assigned, roles will not change until the 6th round, where they will be randomly reassigned by the program. In addition, you will be randomly regrouped with different people on the 6th round (i.e., the people you play with for the first five rounds will be different from the people you play with in the last five rounds).

Appendix B: End-of-experiment Survey Questions

1. What is your sex?
2. What is your age?
3. What is your declared major, if any?
4. What is your faculty and degree program?
5. What is your cumulative grade point average at the University of Regina? This is the average of all the grades you have received at the University of Regina. Please enter a number between 0 and 100 to indicate the percent. If you are unsure, then please enter your best estimate.
6. How important is your religion to you? [7-pt Likert scale]
7. On average, how many hours per week do you spend in religious observance? This includes any time in prayer, church, or other religious activities.
8. Are your parents divorced?

   (a) If your parents are divorced, about how old were you when they divorced?

9. Were you raised by a single parent?
10. Thinking of your family's financial status or socio-economic status while growing up, which of the five options below best describes it?
    (a) Low income
    (b) Lower-middle income
    (c) Middle income
    (d) Upper-middle income
    (e) High income
11. Do you have any student loans or any other debts?
    (a) If you have student loans or any other debts, what is the amount, or your best estimate of the amount, in dollars.
12. What culture do you identify yourself as?
13. Please indicate the degree to which you agree with the following statements: [5-pt Likert scale for each statement]
    (a) I am willing to be unethical if I believe it will help me succeed.
    (b) I am willing to sabotage the efforts of other people if they threaten my own goals.
    (c) I would cheat if there was a low chance of getting caught.
    (d) I enjoy being able to control the situation.
    (e) People are only motivated by personal gain.

Appendix C: Analysis of Non-categorized Distributions

To investigate the distributions classified as "Other", we use scatterplots comparing the proposers' relative compensation (relative to their productivity) to the relative compensation of the responder (left pane) and receiver (right pane). These scatterplots are shown in Figure C1 and Figure C2 below, where we illustrate the distribution of the "Other" category of proposed fund-distributions relative to Effort-shares in each round by treatment. An offer corresponding to exact effort-shares would be shown at coordinates (1,1). Locations above 1 on the horizontal axis represent the proposer receiving a greater share of funds than their share of group effort. Locations above 1 on the horizontal axis indicate one of the other participants was allocated a greater share of funds than their share of group effort. For example, locations in the upper right quadrant indicate that both the proposer and the participant indicated on the horizontal axis are both receiving a greater share of the funds available to be divided, relative to their effort, at the expense of the third participant. The figure in the left-hand panel shows the shares of the proposer and the responder. The figure in the right-hand panel shows the proposer and the receiver. Figure C1 shows the distribution of funds in fixed-funds treatments, Figure C2 shows the distributions in earned-funds treatments.

In Figure C1, distributions tend to favor, in roughly equal measure, the upper-left and lower-right quadrants. Offers in the upper-left quadrant indicate the proposer extracting rents; that they are taking a share of funds over their effort. Offers in the lower-right quadrant indicate that the proposer is being altruistic; they are taking a smaller share of funds than their share of effort, and giving extra funds to the subject indicated on the horizontal axis. The relatively even dispersion of extractive and altruistic offers between both the proposer and the responder and the proposer and the receiver, in both Panel A and Panel B, suggests that proposers may be confused as to how they ought to allocate funds in the fixed-funds setting. However, we investigate the possibility that the "other" distributions in fixed-funds treatments could be the result of proposers' imprecisely targeting equal-shares, effort-shares, or another distribution common in prior three-person ultimatum/dictator game studies.[8] To do this, we redefined the distributions to allow for a 10% margin of error. For example, if the proposer kept 36% of the funds, and gave 32% to both the responder and the receiver, then this counts as equal-shares under the more flexible definition. Recalculating the distribution frequencies with these more flexible definitions had almost no impact on the frequencies of any of the distributions or the size of the "other" category. Therefore, there is no clear pattern to the "other" distributions in the fixed-funds treatments.

Figure C2 shows significantly fewer offers than Figure C1, as there were fewer instances of offers classified as "other" in the earned-funds treatments was much less than in fixed-funds treatments (the frequencies of distribution types by treatment are illustrated in Figure 1 in Section 3). Of these "other" proposed distributions, Figure C2 shows a tendency of offers to cluster in the upper-left quadrant. This is true both when the proposers' shares are compared to the responders' and when their shares are compared to those of the receiver. This indicates that the proposer is taking a greater share of the funds than their share of contribution to the total effort, and they are taking this additional share at the expense of both players – not just the receiver. Therefore, the "other" distributions in earned-funds treatments appear to be typified by a distribution where the proposer extracts rents from both the responder and the receiver. This is distinct from tournament-shares where the proposer is only extracting rents from the receiver.

Overall, the scatterplots show that in fixed-funds treatments the "other" distribution types follow no clear pattern,

[8] In prior three-person ultimatum/dictator games the modal distribution is equal-shares, and the second most common distribution is the "power coalition", where the proposer keeps half of the funds, gives the receiver the smallest possible amount, and offers the residual to the responder.

which, given the large size of the "other" category in fixed-funds treatments, suggests that there is significant confusion among proposers when deciding what an appropriate distribution of income should look like in this setting. However, in earned-funds treatments, the scatterplots show that the "other" category is typified by a distribution where the proposer extracts rents from both the responder and the receiver (as opposed to just from the receiver under tournament-shares).

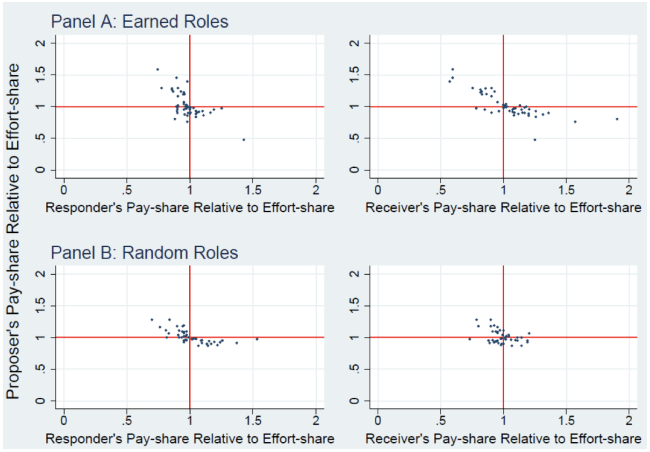

Figure C1. Relative Compensation by Role Pairs in Fixed-funds Treatments

Figure C2. Relative Compensation by Role Pairs in Earned-funds Treatments

Appendix D: Pairwise Comparisons of Offers by Treatment

Figure 1 in the main body of the paper shows the frequency of each distribution type by treatment. In raw frequency, equal-shares distributions are most frequent in Treatment 1 (fixed funds and random roles), occurring in 17% of opportunities. The frequency of falls to 14.4% in Treatment 2 (fixed funds and random roles). This frequency falls to 8.9% in Treatment 3 (earned funds and random roles). The lowest frequency of equal-shares distributions occurs in Treatment 4 (earned funds and earned roles), at just 3%. Table D1 shows the p-values for pairwise two-tailed t-tests between each of the treatments, which indicate that the drops in the frequency of equal-shares in earned funds treatments are statistically significant.

Table D1. P-values from Pairwise Two-tailed T-tests Comparing the Frequency of Equal-shares

	Treat. 1	**Treat. 2**	**Treat. 3**	**Treat. 4**
Treatment 1		0.4044	0.0042	0.0000
Treatment 2	0.4044		0.0444	0.0000
Treatment 3	0.0042	0.0444		0.0026
Treatment 4	0.0000	0.0000	0.0026	

For effort-shares, Figure 1 in the main paper shows that the lowest frequency of effort-shares occurs in Treatment 1, with just 17% of offers, increases slightly in Treatment 2 to 18.9%, and then rises dramatically in frequency in Treatments 3 and 4; accounting for 58.9% and 68% of all offers respectively. Table D2 shows the p-values from pairwise two-tailed t-tests between each of the treatments.

Table D2. P-values from Pairwise Two-tailed T-tests Comparing the Frequency of Effort-shares

	Treat. 1	**Treat. 2**	**Treat. 3**	**Treat. 4**
Treatment 1		0.5577	0.0000	0.0000
Treatment 2	0.5577		0.0000	0.0000
Treatment 3	0.0000	0.0000		0.0239
Treatment 4	0.0000	0.0000	0.0239	

For tournament shares, Figure 1 shows that such offers occur most often in Treatment 1 (28%) and least often in Treatment 4 (21%). However, there is little variation between the Treatments; with tournament-shares being offered 24.4% of the time in Treatment 2, and 21.1°% of the time in Treatment 3. Table D3 shows the p-value for pairwise two-tailed t-tests between the treatments.

Table D3. P-values from Pairwise Two-tailed T-tests Comparing the Frequency of Tourn-shares

	Treat. 1	**Treat. 2**	**Treat. 3**	**Treat. 4**
Treatment 1		0.3366	0.0572	0.0463
Treatment 2	0.3366		0.3567	0.3273
Treatment 3	0.0572	0.3567		0.9741
Treatment 4	0.0436	0.3273	0.9741	

The change in the frequency of tournament-shares is marginally significant between Treatments 1 and 2 and significant between Treatments 1 and 4. This suggests a limited role for the treatment variables on the likelihood of tournament-shares.

Appendix E: Evolution of Effort by Treatment and Offer Type

Figure E1 shows the evolution of group effort in each treatment by distribution of funds, using period 1 as a baseline.

For Treatment 1 (T1) we see that equal-shares are associated with the greatest increase in effort over time, while both effort-shares and tournament-shares see similar increases in effort until period three and then decline to their initial level.

For Treatment 2 (T2) equal-shares distributions see effort return to the initial level by period 5 whereas both effort-shares and tournaments shares are associated with a consistent increase in effort from period 1 to period 5. Thus, in fixed funds treatments, increases in effort over the first period coincide with all distributions of funds for the first 4 periods. When roles were randomly assigned, effort returned to initial levels under both effort and tournament-shares. When roles were earned, effort returned to its initial level under equal-shares distributions.

For Treatment 3 (T3) we see smaller increases in effort over time than in T1 or T2. Equal-shares are only associated with an increase in effort in the second period, then they are at or below initial effort in all other periods in which it was offered. Both effort-shares and tournament-shares show modest but sustained increases in effort from period 1 to period 5.

For Treatment 4 (T4), we again see only one period in which equal-shares show an increase in effort over initial levels (period 3). We again see modest and sustained increases in effort from period 1 to period 5 when funds are allocated according to effort- and tournament-shares, with the largest increase between periods 1 and 5 coming under tournament-shares.

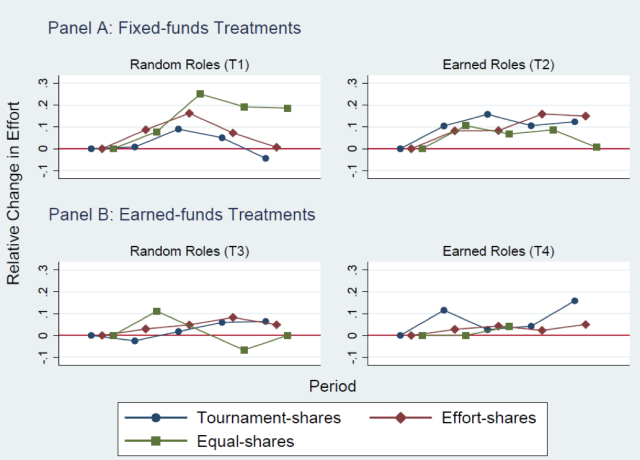

Figure E1. Evolution of Effort by Income Distribution

This figure shows the percentage change in firms' average total effort expenditure in the period following the offer of one of our three key distributions of interest (irrespective of whether the distribution was rejected). Both random- and earned-roles treatments are pooled together since some distributions are never offered in some periods in single treatments.

Appendix F: The Impact of Rejection on Offer Type

Figure F1 explores how proposers react to a rejected offer. Each point in Figure F1 reports the coefficient estimate of a lagged rejection dummy (equal to 1 in the current period if the proposer's offer was rejected in the prior period) from random-effects linear probability models run on indicator variables for each distribution and treatment combination. For example, in Treatment 1 (T1), offers based on tournament-shares dramatically increase in likelihood following a rejected offer in the previous period. We also see an increase in the likelihood of an effort-shares proposal following a rejection in Treatment 4 (T4). In none of the other treatments do we see a significant increase in the likelihood of a particular type of offer following a rejection.

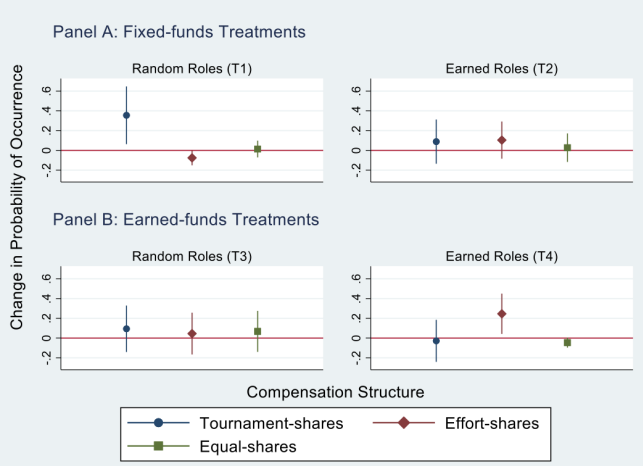

Figure F1. The Impact of Rejection on Compensation Structure

This figure reports the coefficient of primary interest, lagged rejection, in random effects linear probability models on a dummy for each of the distribution types. The unit of observation is a "firm". Standard errors are clustered at the firm level. Confidence interval is at the 90% level. All regressions include controls for the period, the firm's code solves for the period, and the age and sex of the participants. See Appendix H for full regression output.

Appendix G: Full Regression Output

Table G1. Compensation Structure and Productivity when Funds are Earned

	Random Roles			Earned Roles		
	(1)	(2)	(3)	(4)	(5)	(6)
L.TS	0.294			1.193*		
	(0.513)			(0.642)		
L.ES		-0.576			-0.632	
		(0.430)			(0.600)	
L.=S			-0.271			-1.124***
			(0.483)			(0.305)
L.Rejection	0.303	0.116	0.312	-1.535*	-1.810*	-1.479
	(0.252)	(0.322)	(0.270)	(0.895)	(0.992)	(1.004)
Period	0.326***	0.345***	0.338***	0.176	0.202*	0.182
	(0.119)	(0.119)	(0.122)	(0.107)	(0.116)	(0.118)
Male Proposer	-0.885	-1.168	-0.816	-1.082	-1.224	-0.838
	(1.796)	(1.785)	(1.790)	(0.982)	(1.130)	(0.990)
Male Responder	-2.294**	-2.308**	-2.352**	0.396	0.462	0.838
	(0.943)	(0.949)	(1.004)	(0.767)	(0.755)	(0.790)
Male Receiver	0.139	0.137	0.037	-0.690	-0.660	-0.730
	(1.239)	(1.161)	(1.200)	(0.927)	(0.916)	(1.000)
Proposer's Age	-0.008	0.014	-0.021	0.210***	0.212***	0.216***
	(0.158)	(0.157)	(0.159)	(0.072)	(0.077)	(0.073)
Responder's Age	-0.073	-0.068	-0.076	0.071	0.058	0.055
	(0.123)	(0.122)	(0.123)	(0.045)	(0.045)	(0.046)
Receiver's Age	-0.008	-0.003	-0.000	0.022	0.029	0.037
	(0.130)	(0.129)	(0.134)	(0.071)	(0.073)	(0.081)
Observations	72	72	72	80	80	80

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table G2. Compensation Structure and Productivity when Funds are Fixed

	Random Roles			**Earned Roles**		
	(1)	(2)	(3)	(4)	(5)	(6)
L.TS	0.087			-0.198		
	(0.450)			(0.433)		
L.ES		-0.840*			0.523	
		(0.442)			(0.396)	
L.=S			-0.465			0.763
			(0.420)			(0.476)
L.Rejection	-1.772***	-1.754***	-1.765***	0.715*	0.794**	0.903**
	(0.534)	(0.524)	(0.557)	(0.405)	(0.398)	(0.416)
Period	0.148*	0.154*	0.143*	0.283**	0.289**	0.289**
	(0.089)	(0.085)	(0.086)	(0.120)	(0.120)	(0.116)
Male Proposer	-0.900	-0.922	-1.030*	-1.597	-1.598	-1.668
	(0.604)	(0.591)	(0.600)	(1.140)	(1.124)	(1.151)
Male Responder	1.507	1.570	1.352	-2.435	-2.435	-2.440
	(1.139)	(1.160)	(1.135)	(1.614)	(1.568)	(1.537)
Male Receiver	2.283***	2.406***	2.309***	-0.721	-0.623	-0.492
	(0.881)	(0.870)	(0.882)	(1.528)	(1.554)	(1.537)
Proposer's Age	-0.381***	-0.386***	-0.399***	-0.163**	-0.164**	-0.155**
	(0.056)	(0.051)	(0.049)	(0.076)	(0.076)	(0.074)
Responder's Age	0.027	0.027	0.033	0.035	0.035	0.046
	(0.043)	(0.043)	(0.042)	(0.077)	(0.078)	(0.077)
Receiver's Age	-0.395***	-0.397***	-0.398***	-0.078	-0.080	-0.075
	(0.109)	(0.109)	(0.110)	(0.105)	(0.105)	(0.101)
Observations	80	80	80	72	72	72

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table G3. The Impact of Rejection on Compensation Structure when Funds are Earned

	Random Roles			**Earned Roles**		
	TS	ES	=S	TS	ES	=S
L.Rejection	0.094	0.045	0.068	-0.028	0.246**	-0.046
	(0.143)	(0.129)	(0.126)	(0.129)	(0.124)	(0.031)
Group Productivity	0.029	-0.040	-0.013	0.005	-0.054*	-0.011
	(0.028)	(0.026)	(0.016)	(0.024)	(0.029)	(0.007)
Period	-0.024	0.024	0.031**	-0.011	0.047*	-0.000
	(0.015)	(0.026)	(0.015)	(0.018)	(0.024)	(0.003)
Male Proposer	0.499***	-0.749***	-0.075	0.412***	-0.768***	-0.074
	(0.182)	(0.155)	(0.098)	(0.101)	(0.177)	(0.055)
Male Responder	0.006	-0.072	-0.060	0.223	-0.386**	0.039
	(0.154)	(0.173)	(0.069)	(0.144)	(0.195)	(0.038)
Male Receiver	-0.387***	0.158	0.102	-0.047	0.030	0.021
	(0.115)	(0.171)	(0.070)	(0.097)	(0.169)	(0.030)
Proposer's Age	-0.037**	0.052***	-0.010	0.002	0.015	0.006
	(0.017)	(0.020)	(0.009)	(0.009)	(0.010)	(0.007)
Responder's Age	-0.010	0.019	-0.006	-0.018**	0.017*	0.002
	(0.010)	(0.015)	(0.005)	(0.007)	(0.009)	(0.001)
Receiver's Age	0.028	-0.014	0.010**	0.008	-0.012	0.000
	(0.018)	(0.018)	(0.005)	(0.007)	(0.011)	(0.002)
Observations	72	72	72	80	80	80

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table G4. The Impact of Rejection on Compensation Structure when Funds are Fixed

	Random Roles			**Earned Roles**		
	TS	ES	=S	TS	ES	=S
L.Rejection	0.355**	-0.076*	0.013	0.088	0.104	0.027
	(0.178)	(0.046)	(0.052)	(0.136)	(0.114)	(0.088)
Group Productivity	0.059**	-0.030	-0.006	-0.031	0.000	0.012
	(0.023)	(0.018)	(0.031)	(0.033)	(0.021)	(0.021)
Period	0.017	0.016	-0.023*	0.045*	-0.010	-0.003
	(0.018)	(0.014)	(0.014)	(0.025)	(0.014)	(0.025)
Male Proposer	0.261**	0.097**	-0.233*	-0.100	-0.078	-0.008
	(0.128)	(0.041)	(0.119)	(0.163)	(0.137)	(0.150)
Male Responder	0.153**	0.311***	-0.268***	0.093	-0.036	-0.088
	(0.076)	(0.090)	(0.099)	(0.249)	(0.120)	(0.161)
Male Receiver	-0.155	0.054	-0.014	-0.155	-0.106	-0.199*
	(0.171)	(0.067)	(0.098)	(0.237)	(0.090)	(0.114)
Proposer's Age	-0.025	-0.009	-0.036	-0.007	-0.001	-0.009
	(0.016)	(0.011)	(0.028)	(0.016)	(0.008)	(0.009)
Responder's Age	0.003	-0.011**	0.005	-0.013	0.004	-0.008
	(0.006)	(0.005)	(0.006)	(0.009)	(0.010)	(0.010)
Receiver's Age	0.019	-0.005	0.001	-0.002	0.003	-0.004
	(0.017)	(0.008)	(0.016)	(0.021)	(0.008)	(0.008)
Observations	80	80	80	72	72	72

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table G5. Compensation Structure and Revenue when Funds are Earned

	Random Roles			**Earned Roles**		
	(1)	(2)	(3)	(4)	(5)	(6)
L.TS	-20.903			-3.899		
	(25.685)			(15.546)		
L.ES		21.846			33.685**	
		(16.842)			(14.413)	
L.=S			-11.816			2.670
			(13.338)			(8.755)
Period	0.424	0.187	0.652	4.378***	3.739***	4.309***
	(1.518)	(1.843)	(1.570)	(1.292)	(1.433)	(1.442)
Male Proposer	-1.714	4.991	-11.224	-3.577	24.976	-4.610
	(22.472)	(22.649)	(15.618)	(13.729)	(19.311)	(12.637)
Male Responder	-7.459	-6.134	-5.459	6.325	20.834*	4.924
	(10.616)	(12.746)	(14.292)	(11.972)	(11.433)	(9.587)
Male Receiver	17.737	20.698*	26.614***	1.508	-3.901	1.703
	(12.582)	(10.613)	(8.500)	(10.588)	(12.862)	(10.629)
Proposer's Age	-0.565	-0.975	0.099	0.213	-0.344	0.212
	(1.834)	(1.908)	(1.476)	(0.685)	(0.839)	(0.755)
Responder's Age	-0.321	-0.420	-0.150	0.154	0.001	0.209
	(0.983)	(1.006)	(0.851)	(0.497)	(0.479)	(0.536)
Receiver's Age	0.022	-0.305	-0.196	0.330	0.963	0.269
	(1.671)	(1.377)	(1.420)	(0.981)	(1.088)	(1.022)
Observations	72	72	72	80	80	80

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table G6. Compensation Structure and Revenue when Funds are Fixed

	Random Roles			**Earned Roles**		
	(1)	(2)	(3)	(4)	(5)	(6)
L.TS	-26.843			7.157		
	(17.972)			(13.960)		
L.ES		4.114			30.508***	
		(4.882)			(8.024)	
L.=S			0.375			30.405***
			(18.889)			(10.456)
Period	0.808	0.407	0.451	2.777	2.465	2.341
	(1.138)	(1.280)	(1.310)	(1.756)	(1.595)	(1.553)
Male Proposer	11.302	7.322	7.259	-19.407**	-16.353**	-19.179**
	(10.593)	(8.958)	(11.397)	(8.078)	(6.952)	(8.206)
Male Responder	27.764***	24.716***	25.102**	-7.853	-6.247	-6.933
	(9.740)	(9.559)	(12.377)	(9.969)	(9.573)	(11.193)
Male Receiver	0.558	-2.654	-2.099	-5.147	-3.479	0.781
	(8.660)	(8.788)	(8.792)	(12.516)	(12.171)	(13.588)
Proposer's Age	-2.898*	-1.909	-1.907	-0.937*	-1.213***	-0.811
	(1.501)	(1.264)	(1.459)	(0.558)	(0.458)	(0.515)
Responder's Age	-0.768	-1.117*	-1.130*	-1.216**	-1.409***	-0.908
	(0.600)	(0.650)	(0.685)	(0.602)	(0.452)	(0.697)
Receiver's Age	0.103	0.126	0.117	0.174	0.151	0.352
	(0.924)	(1.048)	(1.070)	(0.784)	(0.645)	(0.666)
Observations	80	80	80	72	72	72

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$