Role Switching in Multiple Round Dictator Game Experiments

Abstract: Two types of Dictator Game experiments involving repetition of play, role switching and outside options are studied. When players switch roles during the game, a significantly larger portion of the available surplus is claimed by Dictators and results conform more closely to predictions of self-interested subgame perfection than in previous Dictator Game studies. Outside options are frequently rejected and found not to have consistent significant effects on Dictator play following entry.

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Among experimental studies in economics, one of the seemingly simplest games for experimental participants to play is the Dictator Game. Dictators are provided a fixed endowment and asked to make an allocation decision of how to divide the surplus between one or more other participants in the experiment. Then the game is over.

There has been a multitude of studies comparing subject behavior in Dictator game experiments to the subgame-perfect prediction that Dictators should always claim any available surplus for themselves. As the results produced in numerous Dictator experiments have not conformed to this prediction (with participants leaving roughly 25 percent of the available pie to Recipients on average, and sometimes as much as half the pie), attention has turned to providing explanations for such seemingly (at least to game theorists) anomalous behavior. Camerer (2003) reviews emergent explanations in the literature that have focused on varieties of *social preferences,* including preferences for attaining payoffs similar to those of one's peers (difference aversion), acts of retribution or generosity in response to behavior of fellow players (reciprocity), attempts to model what constitutes a 'fair' allocation of the available surplus and various explanations that fall under the rubric of altruism.

The goal of this paper is to study the influences on Dictator behavior of several structural changes to the standard Dictator Game experimental environment, including repetition of the Dictator Game for more than two rounds, randomization of roles between players over time and the availability of outside options to Dictators. In discussing the results of these experiments, attempts to attribute certain patterns of behavior to motivations arising from social preferences will be made, but an initial caveat is that these data are subject to several of the confounds that have been identified in critiques of previous attempts to characterize experimental outcomes using the framework of social preferences.[1]

The experiments studied in this paper were conducted between October 2001 and October 2002 using subjects from the undergraduate population at the University of Wisconsin-Madison.[2] Two types of Dictator game treatments were implemented. One set of data allowed for role switching between players who repeatedly play the Dictator game against anonymous opponents. For comparison, we consider two sets of data in which subjects again played the Dictator Game,

[1] See Charness and Rabin (2002) for a discussion of such issues.

[2] Participants were drawn from a variety of undergraduate economics classes. Participation was always voluntary and not a required part of any class.

but remain either in the role of Dictator or Recipient for the entire game.

These data are unique relative to previous Dictator Game experiments along several dimensions. First, the repetition of play for more than two rounds is relatively rare among previous studies. This feature does result in lower stakes in each individual round than in other studies, but the overall stakes available are comparable. Second, the use of a computerized interface for players to make Dictator choices is also uncommon in previous Dictator studies. Most previous studies distribute envelopes of currency to participants who then make tactile decisions of how to allocate the available money. The possible influence of these differences, along with the presence of the group of Recipients and the experimenter in the same room with the Dictators, should be noted when considering the results presented here relative to previous studies.

From this experimental environment of multiple-round Dictator Games with outside options, several clear patterns of behavior emerge. We find that when players randomly switch roles over the course of the experiment, a significantly larger fraction of the available surplus is claimed by Dictators relative to treatments in which players maintain constant roles over the entire game. This result may be attributable to Dictators in the role-switching game raising their demands in response to observing other Dictators taking a large share of the surplus. Additionally, the relatively higher number of rounds played during the role-switching games could lead to convergence toward the subgame-perfect outcome. We also find that Dictators generally reject available outside options (in accord with Pareto efficiency), but that the level of an available outside option does not appear to systematically influence Dictators' choices following rejection of the option.

The remainder of the paper is organized as follows. Section 1 reviews prior results from prior experiments studying Dictator games. The exact rules for play and environment present during our Dictator Game experiments are specified in Section 2, along with predictions for play based on the unique characteristics of our two treatments. A summary of Dictator choices made in the three experiments and a comparison to results of previous Dictator Game experimental studies are presented in Section 3. Possible interpretations of the data from our two treatments are considered in Section 4. Preferences that allow for certain forms of social comparison in the role-switching game are formulated based on regularities observed in the data. Finally, a summary of results and potential interpretations and possibilities for further experimental studies in this area conclude the paper in Section 5.

1 Discussion of Previous Studies of Dictator Games

The methodologies employed for studying the behavior of Dictators in experiments have been relatively similar over the previous 10 years of research. Dictators are usually organized in a separate room from the Recipients and given an envelope. The majority of these envelopes contain 10 $1 bills as well as 10 blank sheets of paper, while a small number of envelopes contain 20 blank sheets of paper and no currency to ensure anonymity of the dictators.[3] The Dictator then removes the desired amount of currency they wish to keep along with enough sheets of paper so that a total of ten items remain in the envelope. These envelopes are then submitted to the experimenter (or a randomly chosen monitor) and distributed randomly to the Recipients. It is important to note the possibly significant differences in the structure of the experiments discussed in this paper relative to other studies when comparing results. These differences include the availability of an outside option to Dictators, the repetition of play, the use of computers to record Dictator choices, and the presence of the Recipients as well as the experimenter in the room when Dictators make their choices.

One of the initial DG studies that employed such an experimental environment is discussed in Forsythe *et. al.* (1994). They find results (when actually paying participants) similar to many of the studies that have followed their early work on this experiment. Dictators take about three-quarters of the available surplus and demand the entire surplus about one-third of the time.

Hoffman *et. al.* (1994) study the effects of the presence of an experimenter (as opposed to a randomly chosen participant) running the DG experiment and find that Dictators are most generous when experimenters have the least involvement in the experiment. Hoffman *et. al.* (1996) followed up their earlier study by replicating the results of Forsythe *et. al.* and comparing them to double blind treatments in which the 'social distance' of Dictators from the experimenter is varied. Their results for the greatest social distance are very similar to our results in the role-switching experiment with two-thirds of observations having Dictators demand the entire surplus.

Bolton, Katok and Zwick (1998) provide experimental results for Dictators making decisions over periods of varying length and with various choice spaces, but two results are of specific interest for comparison. In one treatment, Dictators make demands from a set of 6 possible choices over 10

[3] Without these envelopes filled with blanks, Recipients or the experimenter could know that all Dictators took the entire surplus.

rounds. These choices range uniformly from taking half of the surplus to the entire surplus of $1 in each round. On average, Dictators in this game demanded 87 percent of the available surplus and demanded the entire surplus in 58 percent of the observations, but the truncation from below on possible demands should be noted when considering these results. In another treatment with a length of ten rounds, Dictators made demands from a choice set of only either half or the entire surplus. In this case, the entire surplus was chosen in 72 percent of observations and on average Dictators claimed 86 percent of the available surplus.

One of the few studies involving DG experiments in which subjects possibly play in multiple roles over two rounds is presented in Cason and Mui (1999). They present the game to subjects as a pricing game in which the Dictator chooses a price at which the Recipient must buy. Following an initial round in which all players choose a price they would charge if Dictator, players either learn relevant information involving prices chosen by another player or the irrelevant information of another player's date of birth. Players then choose a second round price and payoffs are assigned based on either the first or second round prices chosen by two members of groups of four that are formed among the players. Overall, Dictators claim roughly 75 percent of the available surplus in the second round and the sharing of irrelevant information leads to more self-regarding demands by Dictators in the second round relative to the first, while the sharing of relevant information does not have a significant impact on changes in Dictator behavior between rounds.

While these studies (and others) provide results for comparisons made in Section 3, the unique features of the experiments studied here, including repetition, role switching, outside options and the collection of Dictator data via computers, constrain the efficacy of such comparisons.

2 Description of Experiment and Predictions for Play

The implementation of the Dictator Game (DG) considered in this paper differs from previous studies in at least two possibly relevant features. First, prior to making a decision for dividing the available surplus, Dictators are presented with the opportunity to accept an outside option. If this option is accepted, the round ends and the Dictator receives the value of the outside option and the Recipient receives a payoff of zero. Available outside options are specified such that their acceptance is never Pareto optimal. Second, both the constant-role and role-switching games are

repeated for multiple rounds. The exact instructions that were provided to players prior to play of the games are available on the author's website.[4] Data from the experiments studied in this paper were collected during three separate events.

2.1 Description of Role-Switching Game Environment

The first wave of data was collected in October 2001, with 24 UW-Madison undergraduates participating in 46 rounds of the 'role-switching' game via networked laptop computers located in a single classroom. Players were randomly assigned to a role each round with the restriction (known to the players) that each participant would play two rounds with every other player in the game, one round in each role. Players did not necessarily alternate roles between each round due to the random assignment of roles each round. An experimenter was present in the room during the game and was responsible for reading the instructions aloud prior to the beginning of the game.[5]

The surplus to divide in each round was equal to 100 tokens. This was represented on the computer screen with a bar of length 100. Dictators were presented as Red players while Recipients were Blue players in the instructions. Hence, the Red player was the only participant to make a decision each round. Following the assignment of roles for a given round, the Dictator was presented with an outside option that they could either accept or reject. These outside options were randomly chosen for each Dictator in each round from the set $\{0, 23, 46, 64, 82\}$. If the option was accepted, the round was finished with the Dictator receiving their outside option (in tokens) while the Recipient was not awarded any tokens. The amount of the outside option was indicated by the length of a red bar on the screen above a second bar of length 100 which had a "slider" located in the middle at a 50/50 split.[6] If the Dictator rejected the outside option, they were then free to move the slider anywhere along the bar with colors indicating the division of the surplus (so that the bar being all red indicated that 100 tokens would be awarded to the Dictator). The

[4] See http://www.ssc.wisc.edu/~tclassen/Research.html

[5] Hoffman *et. al.* (1996) find a significant decrease in generosity in the DG when the experimenter is not directly involved in the game. However, the generosity level elicited in the role-switching game discussed here is almost identical to their experiment using the lowest level of involvement of the experimenter. Participants in our games were assured in the instructions that, "No one in the room will be able to tie you to your decisions. Not even the people running the experiment."

[6] Even with this potentially influential visual cue, the 50/50 split was a rare occurrence during the role-switching game.

Recipient's only possible action was to click a button marked "Accept" and wait for the results of the Dictator's action.

Following the completion of each round, players were provided with a cumulative summary of tokens collected and at the conclusion of the experiment were paid 1.5 cents for each token collected during the 46 rounds. Hence, a most fortunate (and self interested) player could earn a maximum of $69 in the roughly 90 minute experiment. Players were not paid a fixed sum in addition to the payments for tokens collected. The frequency of outside options and summary statistics for the role-switching game are provided in Table 1 of Section 2 under column heading *Switching*. Players in the role-switching game earned $34.32 on average, with a maximum of $36.72 and a minimum of $28.61.

There are at least two important dimensions of uncertainty present in the role-switching game. First, players do not know how they will be treated by opposing Dictators in future rounds when they are in the role of Recipient. However, players can calculate exactly how many more rounds they will play in each role at any stage of the game and know that they will never face the same Dictator (or Recipient) more than once. Second, players do not know the results of the other 11 interactions (and resulting payoffs) occurring simultaneously each round. This may be relevant if players exhibit social preferences, such as difference aversion, as discussed in Section 4.

2.2 Description of Constant-Role Game Environment

Two sets of DG data were collected in which players did not change roles over the course of the game. The first 'constant-role' experiment took place in May 2002 with 24 UW-Madison undergraduates playing the DG over 12 rounds under conditions similar to that described for the role-switching game. The set of possible outside options was given by $\{0, 10, 23, 64, 82\}$. The frequency of each outside option, along with summary statistics for Dictator demands, are provided in Table 1 in Section 2 under heading *Constant1*. Individuals were randomly assigned into each role before play and the game was then played with the 12 Dictators maintaining the same role and outside option while playing one round with each of the 12 Recipients. Hence, Recipients were involved in games with varying outside options available to different Dictators, but had no

decisions to make during the experiment.[7] Note that following the assignment of participants into roles, the uncertainty for Dictators is reduced to not knowing how other Dictators (with whom they will never interact) are treating their Recipients. Players were paid a fixed sum of $5 for participating in the experiment along with 2 cents for each token collected. Thus, a participant assigned to the Dictator role who rejected the outside option and demanded all the available tokens each round could earn a maximum of $29 for this approximately one hour experiment. Including the $5 participation payment, the average payment to participants in the Constant1 treatment was $16.87 with players in the Dictator roles earning an average of $25.84 and players assigned to the Recipient role earning $7.89 on average. Other than the differences noted, the environment of the Constant1 experiment was identical to the Switching experiment discussed above.

The second set of constant-role data was collected in October 2002 with 24 UW-Madison undergraduates playing 12 rounds of the DG. The experimental environment was identical to the previous constant-role experiment, except in the set of available outside options. For this collection of data, denoted *Constant2* in Table 1, the set of available outside options was $\{0, 23, 46, 55, 74, 92\}$. Each of these outside options was assigned to two Dictators for the duration of the game, so that a total of 24 rounds with each outside option were generated. Payments to participants averaged $16.74 in the Constant2 treatment, with Dictators earning an average of $24 and Recipients earning $9.49 on average.

2.3 Predictions of Play in Repeated Dictator Games with Outside Options

Given the features of the experiments described in the previous subsections, hypotheses for how participants may behave will be made to provide a framework for discussing the results of these experiments.

While the presence of outside options in these DG experiments is a unique feature relative to previous DG studies, it is expected that the acceptance of these options should be infrequent and decline over time as Dictators realize the available payoff space generated after rejecting the outside option. Since rejection of the available option creates a surplus of 100 tokens and the outside option in all cases has value less than 100 tokens, acceptance of such options is clearly

[7] This lack of any available strategy for Recipients frustrated one participant in the constant role experiment of October 2002 to the extent that he refused any payment for his participation and tokens 'earned' in the game.

inefficient. If Dictators have preferences for social welfare, altruistic tendencies towards Recipients or simply realize that rejecting the outside option allows them to claim a larger payoff, we expect that the acceptance of outside options will be rare. If Dictators wish to punish Recipients by imposing a zero payoff on them, they can either claim the outside option or reject the option and demand the entire surplus of 100 tokens. The latter choice seems much more plausible if Dictators have increasing utility in their own payoffs.

Consistent with previous studies of outside options in experiments, we expect that Dictators who reject larger outside options will demand a larger fraction of the available surplus created by outside option rejection.[8] Binmore *et. al.* (1988) provide the initial study of experiments allowing for an outside option. They consider three levels of outside options available to one of the two players in a Rubinstein-type alternating offers bargaining game and find that players with higher outside options obtain a larger fraction of the available surplus in bargaining. Camerer and Knez (1995) allow for proposers and respondents to have differing outside options in an ultimatum game experiment and find that proposers make less generous proposals to respondents with lower outside options and that offers are rejected more frequently than in games without outside options. Binmore *et. al.* (1998) introduce outside options into a Nash Demand bargaining experiment and find that players with an outside option demand a larger share of the entire surplus when rejecting the option.[9] While the availability of outside options may have different implications in these studies than in our experiment, all of these studies find significant differences in behavior between players with different outside options. Dictators' claims to larger shares of the surplus following rejection of a larger outside option in our experiment may be attributed to preferences based on feelings of entitlement of Dictators who reject larger outside options. Hence, the first hypothesis is given by:

Hypothesis 1 (Frequent rejection of outside options, with Dictator de-

[8] We are assuming here that the initial bargaining point following outside option rejection by the Dictator is at (0,0). This means that a Dictator rejecting an outside option of 82 and then demanding 85 tokens has taken a larger fraction of the surplus (100 tokens) than a Dictator who rejects an outside option of 23 and then demands 75 tokens. Assuming the available surplus following rejection to be the difference between the rejected outside option and the total pie would lead to different predictions and results.

[9] As discussed in fn. 7, if we consider the surplus to be the entire pie minus the outside option, then players with larger outside options are actually demanding a smaller fraction of the surplus in this case.

mands increasing in forgone option value): *Dictators will reject available outside options to create a larger surplus to divide. Following this rejection, Dictators who gave up larger outside options will demand relatively larger shares of the surplus of 100 tokens created by their rejection.*

As discussed in the previous subsections, the nature of uncertainty varies significantly between the two treatments considered in this paper. In the constant-role game, following the assignment of roles at the beginning of the experiment, Dictators never face the prospect of playing as a Recipient and the only piece of information learned in each round is the Dictator's own surplus division (or outside option acceptance). For a player in the Dictator role in a given round of the role-switching game, there exists uncertainty over how other Dictators will play against them in future rounds when they are in the Recipient role (unless the game is near enough to the end that they know that only rounds in the role of Dictator remain for them). With this distinction, we posit that Dictators in the constant-role game exhibit preferences depending on the sum of their entire stream of payoffs over the 12 rounds of the experiment (rather than separable preferences for payoffs in individual rounds). While we allow that Recipient's payoffs may enter into Dictators' preferences in these games (presumably positively), without any information gained about the behavior of other players in the constant-role treatment, we expect that Dictators should treat different Recipients uniformly over the experiment. These two ideas combine to generate the prediction that demands by Dictators in the constant-role game will exhibit lower variance (within individuals, not necessarily across players) relative to the demands made by Dictators in the role-switching treatment. While it is possible that the information gleaned from each players' rounds in the role of Recipient in the role-switching game will serve to narrow the range of observed demands, the lack of any feedback from decisions made in the constant-role game and the certainty present in each round leads to this prediction:

Hypothesis 2 (Lower variance of Dictator demands in constant-role games relative to role-switching games): *Dictators maintaining the same role over the entire game will exhibit lower variance in their demands over time than players in the role-switching game who gain information about the levels of other Dictators' demands.*

With the static nature of the constant-role game, we expect that Dictators in such games will

form an optimal total payoff they wish to accumulate over the 12 rounds of play as discussed in Hypothesis 2. Given the lack of information about other players' decisions gained by Dictators during the constant-role game relative to the role-switching game, we predict that, on average, decisions in the constant-role game will be similar to those of players in one-round Dictator Games with similar conditions (other than the repetition in the games studied here) in previous studies. Dictators in previous experiments demand roughly three-quarters of the available pie and claim the entire pie about one-third of the time. Thus, we expect that the results for the constant-role games will conform to these results from prior studies and provide a benchmark for comparison under the conditions imposed in these experiments (such as the presence of outside options, computerized decisions and repetition). This leads us to make the following hypothesis:

Hypothesis 3 (Conformity of constant-role results to previous DG studies): *Under conditions similar to those present in the constant-role experiments studied here (i.e., sufficiently diverse choice space, computer interface for decisions, presence of experimenter and Recipients), Dictator demands in the constant-role, multiple-round game will be similar to Dictator choices in previous one-round DG experiments.*

With the primary difference in structure between the two treatments being the collection of information on the behavior of other Dictators by future Dictators in the role-switching game, we expect that this distinction may lead to choices that appear to be consistent with predictions of social preferences including indirect negative reciprocal behavior (punishing other players for previous rounds of low payoffs while a Recipient), difference aversion (making demands similar to those previously observed as Recipient) or some notion of fairness on the part of players who all play Dictator for an equal number of rounds in the game.[10] While these are all possibly relevant interpretations of Dictator behavior, a simple example allowing for preferences for fairness among two types of players provides the motivation for our next hypothesis.

With some (possibly small) fraction of purely self-interested participants, say λ, players with preferences for fairness implying equal splits of any available surplus may be induced to take the entire pie for themselves if opposing Dictators have taken the entire pie while the 'fair' types were in the role of Recipient. To understand this prediction, consider a set of n players (allow n to be finite

[10] A more detailed discussion of these socially-based motivations for play is provided in Section 4.2.

and even, for convenience) so that initially there are λn self-interested players and $(1-\lambda)n$ fair players. The probability of any given fair player being assigned the role of Recipient and matched with a self-interested Dictator in the first round is given by $\frac{\lambda n}{2(n-1)}$, so that the proportion of players behaving as if self-interested in the second round is given by $\lambda+(1-\lambda)\left(\frac{\lambda n}{2(n-1)}\right) = \lambda\left[\frac{n(3-\lambda)-2}{2(n-1)}\right] > \lambda$. Fair players who were Recipients to self-interested Dictators in the first round will claim the entire surplus if assigned to be a Dictator in the second round in order for average payoffs over the course of the game to be equal between players. Thus, the proportion of players in the role-switching game behaving as if self-interested (i.e., taking the entire surplus when in the role of Dictator) can be shown to be increasing over rounds. This leads to the following hypothesis:

> **Hypothesis 4 (Convergence in role-switching decisions to large share taken by Dictator):** *Demands by Dictators in the role-switching game will converge toward one another and increase in response to zero offers from purely self-interested types. This will cause the outcomes from the role-switching game to converge to results predicted by the purely self-interested subgame perfect equilibrium for the Dictator game in which the Dictator takes the entire surplus in each round.*

The first two of these hypotheses will be addressed in the summary of results in the Sections 3.1 and 3.2, while the last two will be discussed in the interpretation of play in these games in Sections 3.3 and 3.4.

3 Summary of Results and Comparison of Treatments

With the experimental environment described in Section 2, we now consider hypotheses about Dictator demands by examining the quantitative results from the three sets of data. Summary statistics for Dictator demands under the two experimental treatments are presented in Table 1. From these results, it is evident that outside option acceptance was indeed rare during these experiments. Additionally, average Dictator demands varied little between outside options for the role-switching game and exhibited no consistent patterns in the two sets of constant-role data.

Dictators in the role-switching game were nearly 20 percent more likely to demand the entire surplus than their counterparts in the Constant1 experiment and nearly 30 percent more likely to do so than players in the Constant2 game. Finally, only five percent of the available surplus was

left on the table by Dictators in the role-switching game while Dictators in the Constant1 game provided Recipients with roughly 12.5 percent of the surplus and nearly 20 percent of the surplus was awarded to Recipients in the Constant2 experiment. The remainder of Section 3 provides analysis of the details of these results.

Switching

Outside Option	Frequency	# accepted	Following rejection of Outside Option, % taking 100	Average Demand
0	104	0	65.4%	94.6
23	107	0	69.2%	94.8
46	111	1	65.5%	94.1
64	105	3	59.8%	95.3
82	125	6	64.7%	96.1
Overall	552	10	64.9%	95.0

Constant1

Outside Option	Frequency	# accepted	Following rejection of Outside Option, % taking 100	Average Demand
0	36	0	55.6%	80.8
10	36	0	30.6%	93.2
23	24	0	58.3%	94.1
64	12	2	40.0%	72.9
82	36	5	45.2%	87.7
Overall	144	7	46.0%	87.4

Constant2

Outside Option	Frequency	# accepted	Following rejection of Outside Option, % taking 100	Average Demand
0	24	0	8.3%	63.3
23	24	1	43.5%	79.9
46	24	0	95.8%	99.9
55	24	3	61.9%	84.0
74	24	4	5.0%	91.8
92	24	0	0.0%	64.7
Overall	144	8	36.0%	80.2

Table 1 - Frequency of Outside Options and Summary of Dictator Demands

One caveat to note prior to this discussion is that there exists strong statistical evidence of differences in Dictator behavior between the two constant-role treatments. For this reason, the results discussed below will be presented with separate statistics for each of the constant-role treatments. While the results for the role-switching game are strongly statistically different from the constant-role results (whether the constant-role data are pooled or considered individually), this significant difference between the two constant-role treatments appears to be based on some unaccounted for factor given the nearly identical environments for the two experiments. The sole distinguishing feature (known to the author) between the two constant-role experiments is the set of available outside options and their relative frequency, but as we will discuss there appears to be

little consistent evidence of significant effects of varying outside options.

3.1 Possible Effects of Outside Options

The presence of an outside option available to Dictators is a distinguishing characteristic of the experiments studied in this paper relative to previous DG experiments. Since a rejection of the outside option by the Dictator constitutes a Pareto improvement (since the option is always less than 100 tokens), while still affording the Dictator full control over the outcome of the game, Hypothesis 1 states that such rejections should be frequent. One possible influence countering this intuition is the presence of wording in the instructions which characterizes outside option acceptance as "simple" while the decision to enter is more "complicated." This does not appear to have affected Dictator choices as the frequency of outside option acceptance for each treatment (provided in Table 1) was in fact quite low.

In all three experiments, the frequency of outside option acceptance is less than six percent overall and appears to involve several individuals accepting the outside option at the beginning of the experiment. In the role-switching data, only two of the ten occurrences of outside option acceptance occurred after the sixth round, with one individual accounting for 30 percent of the observed acceptances. In the Constant1 treatment, one individual accounts for over half of the acceptances, and all acceptances are in the first five rounds of play. Seven of the eight accepted outside option observations in the Constant2 treatment are accounted for by two participants. Thus, the presence of outside options does not appear to have had a significant influence on Dictators' ability to achieve efficient outcomes.

The second component of Hypothesis 1 claims that Dictators with higher outside options will, on average, take a larger share of the available pie of 100 tokens created by outside option rejection, perhaps due to a sense of entitlement from forgoing the option. Strong support for this part of the hypothesis is not provided by the role-switching data. Average Dictator demands following outside option rejection are provided in the right-most column of Table 1. For the role-switching data, average demands range from 94 tokens for players rejecting an outside option of 46 to 96 tokens for players rejecting the highest available outside option of 82. Pairwise two-sided t-tests for differences in mean Dictator demands between the five outside options in the role-switching

game all fail to reject the null hypothesis of no difference in means between the outside options.[11]

While these aggregate results indicate relatively similar average demands among role-switching players across outside options, controlling for the portion of Dictator behavior attributable to individual's idiosyncratic preferences, along with the impact of time trends, also reveals little difference in Dictator demands resulting from variations in outside options. In order to more carefully measure the statistical significance of differences in Dictator behavior in response to varying available outside options, we specify a simple linear model of Dictator demand depending on individual i's idiosyncratic demand, round number t of the game and the available outside option α as

$$D_{it}(\alpha) = \mu_i + \beta_t 1_{round=t} + \gamma_\alpha 1_{OO=\alpha} + \varepsilon_{it} \tag{1}$$

where 1_x is an indicator function equalling one when x is true and 0 otherwise. For this section, we are interested in the relative magnitude and statistical significance of γ_α measuring the incremental effect of different outside options. Hypothesis 2 indicates that γ_α should increase in magnitude as α increases.

The results of a fixed effects regression of the role-switching Dictator demands on indicator variables for the various outside option values, along with dummy variables for round number, are provided in columns 2 and 3 of Table 2. The lone significant coefficient among the outside option variables occurs for γ_{82} and the magnitude of this coefficient is less than 3.[12] A regression using identical regressors, but allowing for random individual effects, generates nearly identical statistical significance and coefficient magnitudes while a random-effects Tobit specification[13] produces similar relative statistical significance.

[11] A one-sided test with an alternative hypothesis of $\mu_{OO=82} > \mu_{OO=46}$, where $\mu_{OO=x}$ represents the mean slider choice in games with an outside option equal to x, cannot reject the null hypothesis of no difference in means at the 5 percent significance level.

[12] Note that the indicator variable for an outside option of 64 is excluded from this regression to ensure non-singularity. Outside option 64 was excluded since the coefficient on this variable is the lowest among the specifications of similar fixed effects regressions using only one outside option indicator variable in each regression. Thus, the result presented here indicates that controlling for the included regressors and individual fixed effects, players made demands as Dictators with outside options of 82 that were 2.6 tokens higher on average than in rounds with outside options of 64.

[13] The Tobit specification is used to incorporate the clustering of demands that occur at 100 tokens. 352 of the 542 observations in the role-switching data have Dictator demands equal to 100.

Table 2 - Regressions of Influence of Outside Options on Dictator Demands in Role-Switching Game

Variable	Fixed Effect Coeff.	p-value	Random Effects Coeff.	p-value	RE Tobit Coeff.	p-value
$1_{OO=0}$	.68	.54	.62	.58	2.53	.33
$1_{OO=23}$	.21	.85	.16	.88	1.92	.46
$1_{OO=46}$	1.05	.35	1.01	.37	2.05	.42
$1_{OO=82}$	2.60	.02	2.49	.02	5.44	.03
Constant	78.18	0	78.08	0	80.88	0

note: All regressions include dummy variables for each of the 46 rounds of the game.

The relevance (or lack thereof) of outside options in explaining demands made in the constant-role games is much less obvious. In the Constant1 data, the two outside options that correspond to the highest average demands are 10 and 23. The average demands for the Constant2 data do not provide any additional insight into the influence of outside options on Dictator choices, and only further obscure the relationship. The outside option resulting in the highest average Dictator demand is 46, with average Dictator demands in games with the highest outside option of 92 less than 2 tokens higher than average demands in games with an outside option of 0. This is due to one individual with an outside option of 92 rejecting the option and then choosing an equal split of 50/50 in each round, while in 23 of the 24 rounds with Dictators having an outside option of 46 the two Dictators with this option chose a payoff of 100 (with a choice of 98 in the 24th round).

With only two individuals assigned to play Dictator for each outside option in the Constant2 experiment and at most three individuals assigned to an outside option in Constant1, fixed effects regressions to measure the influence of different outside options are not feasible. Instead, regressions allowing for random effects among individuals and controlling for time trends are estimated which indicate that rejection of larger outside options does not lead to larger demands of the surplus by constant-role Dictators. The results of such regressions for the two constant-role data sets are provided in Table 3.[14] For the Constant1 experiment, none of the outside options result in demands significantly different under this specification than demands for Dictators with an outside option of zero. For Constant2, demands for Dictators having outside options of 46 are significantly

[14]The indicator variable for the outside option of 0 is excluded in both regressions for simplicity of presentation. Thus, these coefficients measure the difference in Dictator demands attributable to outside options relative to an outside option of 0.

larger than for Dictator having an outside option of 0, but the hypothesis that an outside option of 92 will generate significantly larger demands than an outside option of zero is not supported.

Table 3 - Random Effects Regressions of Influence of Outside Options on Dictator Demands in Constant-Role Game

	Constant1	
Variable	Coefficient	p-value
$1_{OO=10}$	12.42	.34
$1_{OO=23}$	13.33	.36
$1_{OO=64}$	-6.95	.71
$1_{OO=82}$	7.71	.56
Constant	85.13	0
	Constant2	
Variable	Coefficient	p-value
$1_{OO=23}$	16.76	.25
$1_{OO=46}$	36.67	.01
$1_{OO=55}$	17.73	.223
$1_{OO=74}$	26.92	.07
$1_{OO=92}$	1.46	.92
Constant	61.24	0

note: All regressions include dummy variables for each of the 12 rounds of the game.

Thus, while play in these DG experiments is in agreement with predictions of players choosing Pareto optimal strategies (through rejection of outside options), the influence of outside options on Dictator demands is either generally insignificant (as in the role-switching data) or at odds with any sensible hypotheses we have considered.

3.2 Statistical Comparison of Dictator Demands Between Treatments

Given the evident lack of any consistent significant effects of outside options on players' demands across the treatments, for the remainder of the paper we will focus on results generated by

pooling the data in each experiment across outside options. Thus, the set of data we will study consists of the demands made by Dictators following the rejection of the available outside option pooled over outside options in each set of data. The most persistent and striking result from this set of data is the significantly larger fraction of the available surplus claimed by Dictators in the role-switching data relative to the constant-role games (and previous DG experiments).

To determine whether there exist significant differences between decisions made in the role-switching game and the two constant-role games, several statistical tests for differences in mean and distribution were performed.[15] The results of these tests are provided in Table 4. These tests were conducted pairwise between the role-switching data and the two constant-role treatments due to the significant difference between the two constant-role data sets mentioned previously (and demonstrated here).

Data Sets Compared	Sample Mean Slider Choices	Standard Errors of Slider Choices	p value for Differences in Means t-test	p value for Kolmogorov-Smirnov tests for Equality of Distributions	p value for Mann-Whitney rank sum test
(Switching, Constant1)	(95, 87.4)	(.44, 1.73)	<.001	<.001	<.001
(Switching, Constant2)	(95, 80.2)	(.44, 1.91)	<.001	<.001	<.001
(Constant1, Constant2)	(87.4, 80.2)	(1.73, 1.91)	0.003	0.008	0.008

Table 4 - Tests of Differences in Means and Distributions of Demands Between Treatments

[15] Note that these tests need to be adjusted to take into account the lack of independence among the data since each Dictator is making multiple demands over time.

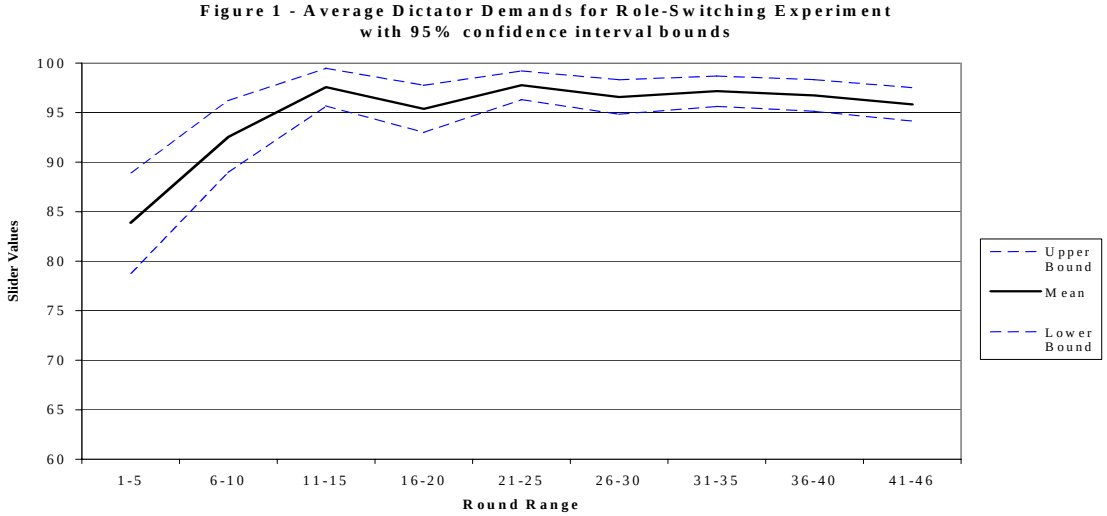
The tests for differences in means displayed in Table 4 indicate that across all three pairwise groupings of data there exist statistically significant differences in average demands. The average demand for the role-switching game is 18 percent larger than the average demand in the Constant2 treatment and 9 percent larger than the average demand made in Constant1. Between the two constant-role games, Dictators collected 7 more tokens on average in the Constant1 treatment than in Constant2 leading to a significant difference in mean demands for these games as well.

Two tests for differences in distribution are conducted and the results are consistent with significant differences between all three data sets.[16] Both the Kolmogorov-Smirnov test for equality of distributions and the Mann-Whitney two sample rank sum test indicate pairwise differences between all three distributions of Dictator demands. The significance levels for both tests in all three cases are easily large enough to reject the null hypothesis of no difference in distributions. Thus, it seems clear that allowing players to switch roles during the course of the multiple round DG had a significant effect of increasing demands relative to the constant-role treatments. The difference between the two constant-role treatments remains unexpected and without an obvious explanation. The remainder of this section will further explore these differences in treatments before moving on to possible interpretations of the differing outcomes between and within treatments in Section 4.

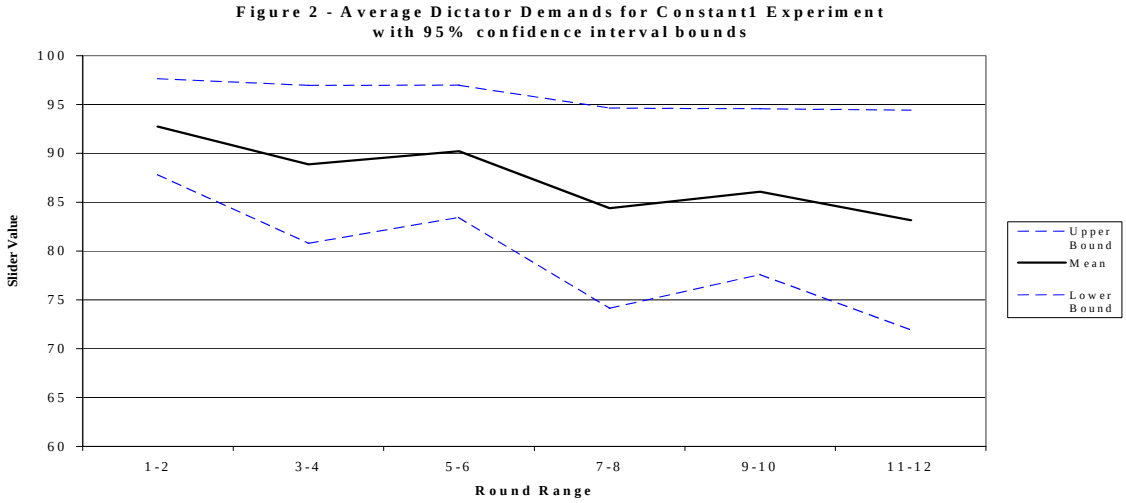
3.3 Graphical Comparison of Dictator Demands Between Treatments

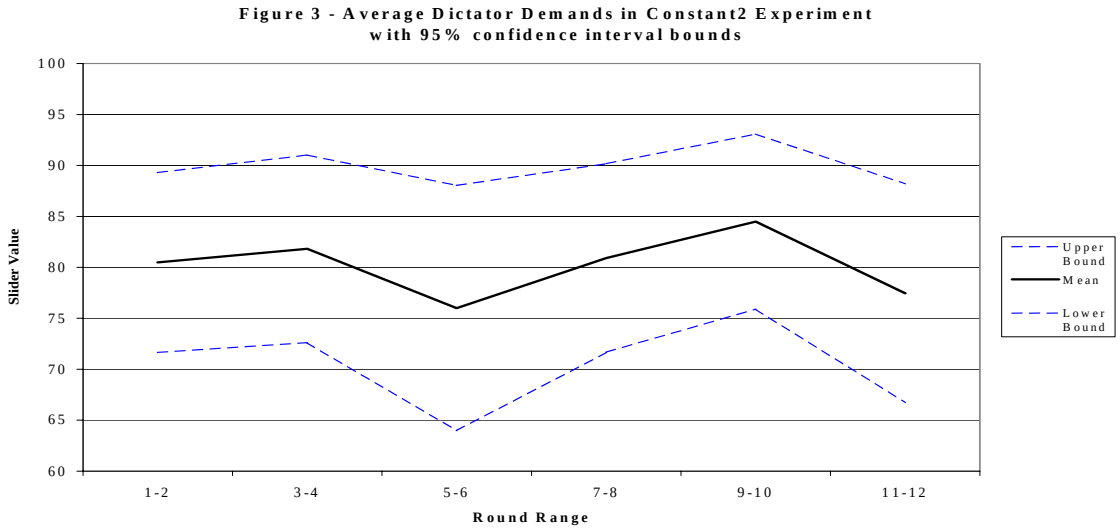
Figures 1-3 display average Dictator demands with 95% confidence interval bounds over round ranges for the three data sets. Figure 1 indicates fairly rapid convergence of average Dictator demands in the role-switching experiment to more than 95 percent of the available surplus after the first ten rounds. Given the theoretical prediction that 100 percent of the surplus will be claimed by self-interested Dictators in the subgame perfect equilibrium, this result for the role-switching game represents one of the few instances of DG experiments conforming closely to theory. Whether this result is due to self interest or socially-motivated factors will be considered in Section 4.

[16] The validity of these tests for differences in distribution may be called into question due to the clustering of demands at 100. While there exists what may be construed as censoring of demands at 100 (such participants might wish to choose whatever highest slider value is available regardless of pie size), separate tests are conducted later in this section indicating that Dictators in the role-switching game are significantly more likely to take the entire surplus of 100 tokens.

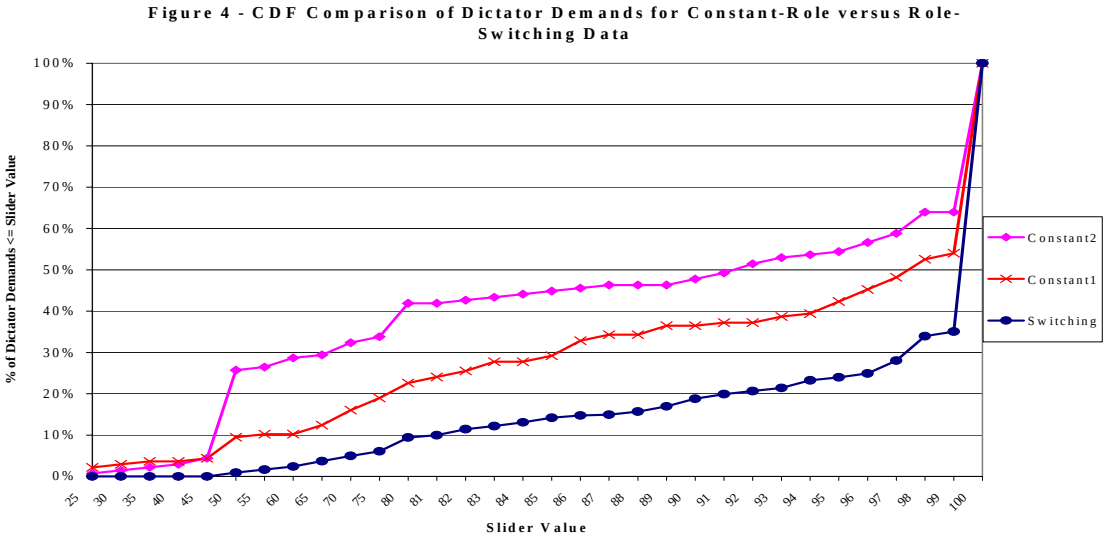


Figures 2 and 3 display the contrast between the two constant-role treatments, as well as the relatively lower average Dictator choices compared to the role-switching game. The 95% confidence interval bounds are also noticeably wider indicating larger dispersion in offers across Dictators.





Another comparison of these results is provided in Figure 4 where the cumulative distribution functions for each of the three treatments are displayed.[17] It should be noted that the two distribution functions for the constant-role treatments are similar except for a spike in the Constant2 cdf at a slider value of 50. This is due to two players in the Constant2 treatment who chose to split the surplus equally in 22 of their 24 total rounds as Dictator, accounting for over half of the total occurrences of this equal split of the pie in all three experiments combined.



[17] Note that the horizontal axis for this figure displaying slider values is not uniformly distributed between 0 and 100. This is done in order to better display differences in distributions at the higher end of the possible slider choices.

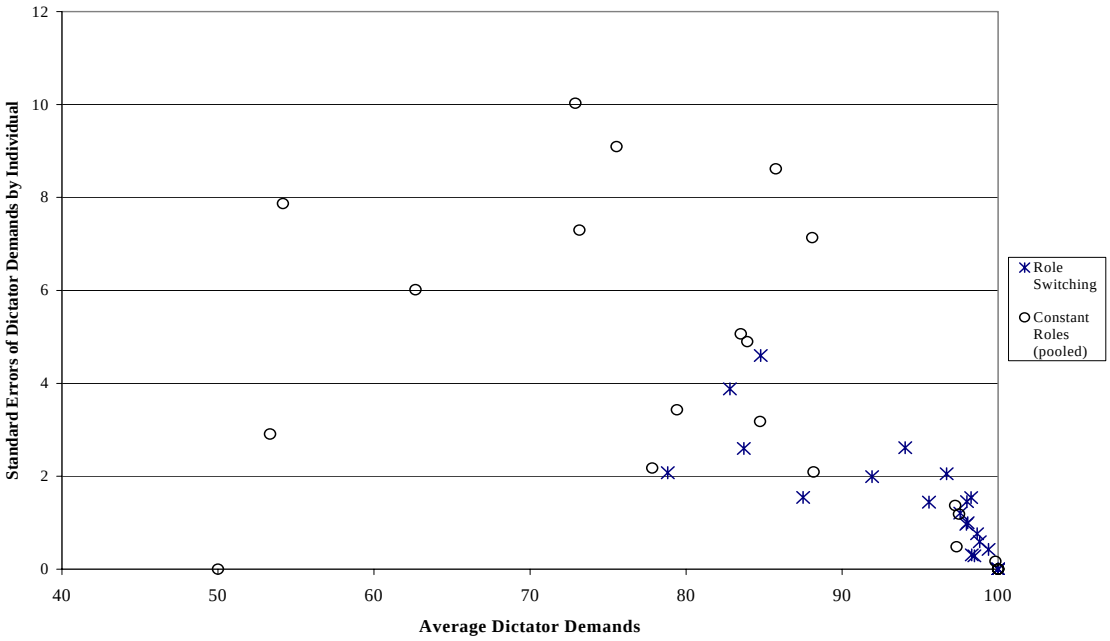
The significant difference across treatments in average Dictator demands is at least partially due to a substantial difference in the frequency of Dictators taking the entire surplus of 100 tokens for themselves. Five participants in the role-switching game took the full surplus in every round in which they rejected the outside option in the role of Dictator.[18] For the constant-role games, three participants in Constant1 made a slider choice of 100 tokens in every round following rejection of the outside option[19] while two players chose a slider value of 100 in each round as Dictator in Constant2. Overall, 65% of demands in the role-switching game were for 100 while only 46 % of the time in Constant1 and 36% of the time in Constant2 did Dictators give themselves the entire surplus, as can be seen from the cdfs in Figure 4. This result was not due to only a minority of players, as two-thirds of players in the role-switching game made Dictator demands of 100 more than half of the time following rejection of the outside option. This frequent occurrence of Dictators choosing the self-interested subgame perfect demand lends support to Hypothesis 4 which claims that role-switching demands will converge to a high level of surplus claimed by Dictators. However, the interpretation provided in Section 4 allows for the possibility that this result emanates from non-self-interested players with social preferences for fairness.

The final distinction between the role-switching and constant-role games that will be considered involves the prediction made in Hypothesis 2 that individuals' demands in the constant-role games will exhibit a lower variance than demands made in the role-switching game due to the static nature and lack of uncertainty present in the constant-role game, following role assignment. Figure 5 provides a graphical depiction of each individual's average demand during rounds as Dictator along with the standard error of these choices.

[18] One of these five players accepted an outside option of 82 in their first round as Dictator.

[19] Similar to the role-switching result, one of these three players accepted an outside option of 82 in their first round as Dictator.

Figure 5 - Comparison of Average and Standard Errors of Dictator Demands Across Treatments



These results clearly contradict Hypothesis 2 claiming that constant-role players would exhibit lower variance within their own offers and reveal that Dictators in the constant-role game make larger changes in their demands over the course of the game and give more of the available pie to Recipients. The lowest average demand for the constant treatments was 50 tokens while the lowest average demand in the role-switching games was 78. Note that this graph combines the constant treatments into one data series for ease of reading the figure. This higher variance of players' demands in the constant-role treatments can also be seen in the series of Figures 1-3 displaying 95% confidence intervals for average demands in each round. These results demonstrate that Dictators in constant-role games are more generous on average than their role-switching counterparts. Additionally, they exhibit more variance in their offers over time (within individuals) and across individuals, with the result of higher variance within individuals' Dictator demands in constant-role treatments being contrary to our expectations. Possible explanations for this outcome will be discussed in Section 4.

3.4 Quantitative Comparisons to Previous DG Results

For a measure of our results relative to previous studies, a table of average demands made by Dictators and the frequency of Dictators claiming the entire surplus in previous DG experiments is presented in Table 5.[20] On average, among the previous studies presented in the table, Dictators demand roughly 75 percent of the available surplus and in about one-third of the observations Dictators demand the entire surplus.

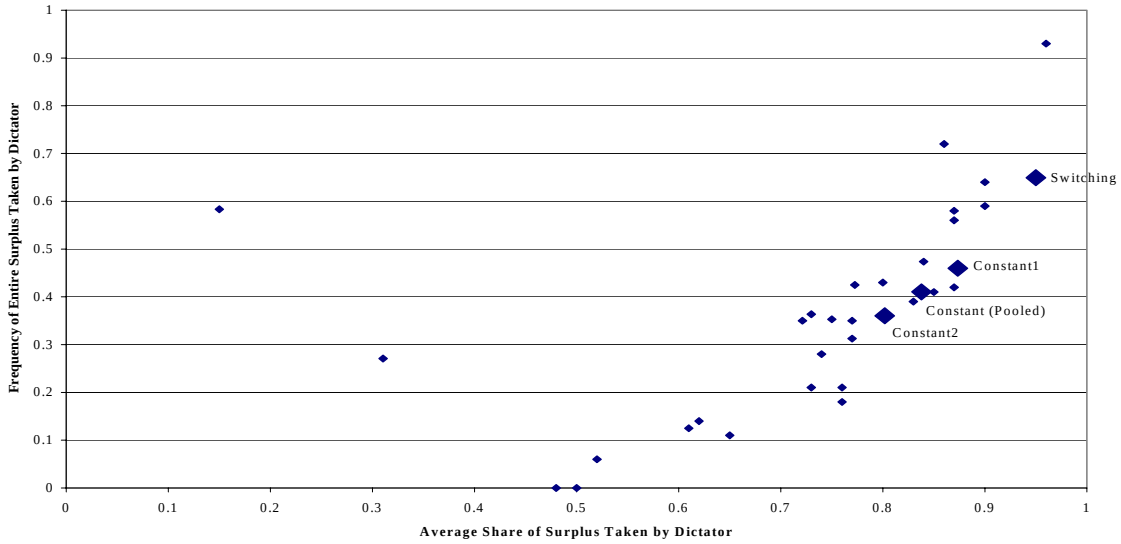
	Average Share Taken	Frequency of Entire Share Taken	Obs.	Participants	Stakes for each to allocate
Classen (2003)					
Constant Pooled	84%	41%	273	24	$1
Constant1	87%	46%	137	12	$1
Constant2	80%	36%	136	12	$1
Role Switching	95%	65%	542	24	$1
Bohnet & Frey (1999)					
anonymity, 93-94	74%	28%	39	39	$10
mutual ID, 93-94	50%	0%	28	28	$10
communication, 93-94	52%	6%	17	17	$10
one way ID, 95-96	65%	11%	18	18	$10
onw way ID + info, 95-96	48%	0%	25	25	$10
Bolton, Katok and Zwick (1998)					
1 Game 2 Card	96%	93%	28	28	$10
10 Game 6 Card	87%	58%	250	25	$1
10 Game 2 Card	86%	72%	250	25	$1
Anonymity	83%	39%	33	33	$10
1 Game 6 Card	87%	56%	27	27	$10
Cason and Mui (1998)					
Relevant Info	77.3%	43%	80	40	$40
Irrelevant Info	72.1%	35%	40	20	$40
Forsythe, Horowitz, Savin and Sefton (1994)					
with pay	76%	21%	24	24	$10
without pay	62%	14%	46	46	$5
with pay	77%	35%	45	45	$5
Frohlich and Oppenheimer (2001)					
Canada Two Room	73%	36%	22	22	$10
US Two Room	84%	47%	19	19	$10
US One Room	75%	35%	17	17	$10
Eckel and Grossman (1996)					
double blind 1	15%	58%	12	12	$10
Red Cross	31%	27%	48	48	$10
Hoffman et. al. (1994)					
Exchange labels	73%	21%	24	24	$10
Contest & Exchange		42%	24	24	$10
double blind 1	90%	64%	36	36	$10
double blind 2	90%	59%	41	41	$10
Hoffman et. al. (1996)					
FHSS-replication	76%	18%	28	28	$10
FHSS-variation	80%	43%	28	28	$10
single blind 1	85%	41%	37	37	$10
single blind 2	87%	42%	43	43	$10
Schotter, Weiss and Zapater (1996)					
one stage	61%	13%	16	16	$10
first of two stages	77%	31%	16	16	$10

Table 5 - Comparison of Results to Previous Dictator Game Experiments

[20] This table is a replication of Table 2.4 of Camerer (2003). Slight changes have been made where appropriate.

A scatterplot of the data in Table 5 is provided in Figure 6. Support for Hypothesis 3 that the constant-role results over multiple rounds of play will be relatively close to previous outcomes in single-round games is most evident in this graph. For the Constant2 data, Dictators demand 80 percent of the surplus and the entire surplus was taken by the Dictator 36 percent of the time. Dictators in the Constant1 data demanded 87 percent of the available surplus on average and demanded the entire surplus 46 percent of the time.

Figure 6 - Distribution of Average Dictator Demands and Frequency of 100% Dictator Demand



Additionally, the unique nature of the Dictator demands made in the role-switching game relative to previous studies is clear from Figure 6. The average demand is among the closest to the predictions of self-interested subgame perfection with 95 percent of the surplus being claimed by Dictators while the frequency of Dictators taking the entire surplus is near to the highest recorded.

4 Interpretation of Results and Discussion

Given the clear differences between the results of play in the constant-role and role-switching experiments detailed in Section 3.2, we now turn to some possible explanations for these results relative to previous studies discussed in Section 3.4. We first discuss some features and possible

interpretations of the results from the static, constant-role games where Dictators face little, if any, uncertainty. Next, possible interpretations of the role-switching results are discussed before proposing possibly socially-motivated preferences to explain behavior in the role-switching experiment. This is accompanied by details of econometric results to provide credence to the assumptions made in the preference specification.

4.1 Discussion of Results in Constant-Role Games

Contrary to the prediction that individual's decisions in the constant-role DG would exhibit relatively little variation over the course of play, we found high levels of variance both for individual's choices over time and across individuals in a given round. While the latter is perfectly admissible in any model allowing for varying degrees of fairness or altruism among players, the former is difficult to explain in any sort of coherent model of behavior. Players in the constant Dictator role gain no information directly during the course of the game other than their own decisions,[21] so social effects such as reciprocity and difference aversion have no clear impact.

Roughly half of the players in these constant-role settings appear to exhibit behavior that might reasonably be explained by standard preference assumptions.[22] Seemingly highly self-interested individuals who take almost (or actually) the entire pie in every round make up roughly one-third of players while another one-third of playes have relatively clear trends in their choices over time. However, a remaining one-third of players seem to defy the predictions of theory in terms of the smoothing of choices in environments lacking uncertainty.

Given the static nature of these constant-role games, it seems that a reasonable way to proceed with analysis would be to specify preferences in which players assigned to the Dictator role have preferences only over the sum of all payoffs collected over the duration of the experiment. This allows us to explain away the seemingly random demands made by certain Dictators in these constant-role games. While some players may wish to take the entire surplus each round and maximize payoffs to themselves, others exhibit some degree of altruism or 'warm glow' through their decisions to offer some fraction of the pie to Recipients. How these decisions to allocate

[21] One possible explanation for the seemingly random choices displayed in Figures 7 and 8 may be the presence of the Recipients in the room with Dictators. Physical signals such as expressions of annoyance (as discussed in fn. 6) or pleasure (from a generous split of the surplus) may influence the choices of Dictators over time.

[22] Plots of each subject's Dictator demands are available at http://www.ssc.wisc.edu/~tclassen/DictatorExperiment/ConstantPlots.pd

some fraction of surplus to Recipients are made over time appears to be beyond the scope of formal modeling techniques, so we remain agnostic beyond the claim that a fraction of Dictators have altruistic preferences to share the available surplus with Recipients. These players likely formulate some optimal level of fairness at the beginning of play (or adaptively during the course of play, even though no seemingly relevant outside information is gained during play) which is then realized over the course of their decisions (which is feasible since players were provided a summary of their total tokens collected after each round).

4.2 Discussion of Results in Role-Switching Games

Relative to the results in the two constant-role treatments, the behavior of players in the role-switching game conform much more closely to one another and converge within themselves over time, as would be expected under conditions of information exchange combined with possible social responses such as negative reciprocity. Roughly half of the subjects' Dictator demands exhibit little, if any, variance over time and a high level of surplus extracted by the Dictator from the beginning of the game. Approximately one-third of the demands in the role-switching game feature instances of players initially offering some fraction of surplus to Recipients, but then quickly moving to the outcome with the Dictator taking the entire surplus in nearly every round. Finally, there are four instances of players increasing demands over time, but not taking the entire surplus in most cases. Comments from the role-switching players obtained in surveys following the experiment and plots of each subject's demands by round are provided in an appendix on the author's website.[23]

The aggregate results for these data have been detailed extensively in Section 3 and combined with those results, the validity of Hypothesis 4, which predicts convergence to a high level of surplus claimed by Dictators in the role-switching game, appears evident. What remains is to interpret variations in the data as they converge to the maximum possible Dictator demand of 100 tokens.

One possibility to consider, as detailed in Section 2.3, is that there exists a fraction λ of entirely self-interested individuals who will always take the entire surplus regardless of what others do to them. There clearly exists a substantial fraction of these types in our data. Additionally, allow for a fraction of players, $1 - \lambda$, with some preferences for a 'fair' distribution of the surplus involving Dictators taking less than the entire surplus. Even allowing for relatively small values of λ, we will

[23] See http://www.ssc.wisc.edu/~tclassen/DictatorExperiment/RoleSwitchCommentsPlots.pdf

still have convergence to the outcome witnessed in the data due to these 'fair' players interacting with the self-interested types. In a given round in which a fair type is the Recipient and the Dictator is purely self-interested, the fair-minded Recipient will receive zero. In order to maintain what they consider a fair distribution over the course of the game, say at 50/50, the fair player will then have to mimic the self-interested demand in their next round as Dictator and take the entire surplus for himself. If a fair player happens to be the Recipient in such a round, then this pattern will continue to escalate demands toward the entire surplus of 100 being taken in each round.

Another possibility for the reasonably fast convergence to the high levels of demand seen in the role-switching data is that the presence of outside options may add noise to players' formation of beliefs over what they consider 'fair' divisions of the surplus. Again, assume that the fraction $1 - \lambda$ of fair types have preferences for an even split of any surplus presented to them, prior to learning that Dictators will be presented with an outside option. If the presence of an outside option leads a player who otherwise considers 50/50 a fair split to revise their preferred claim as Dictator upwards (possibly due to a sense of entitlement following the outside option rejection) while others maintain the 50/50 preference, the interactions between the fair types will make the convergence toward higher Dictator demands faster still. Without the noise created by the available option, fair players playing against one another in the DG would persist in making 50/50 claims until they were a Recipient in a round with a self-interested Dictator.

In addition to these possibilities for fairness ideals, there might also exist preferences which dictate retributive play following a round as Recipient with a self-interested Dictator (known as negative reciprocity) or a preference to have payoffs similar to one's peers (known as difference aversion). There has been a rapid increase in the past five years of attempts to provide specifications of preferences that conform to the ideals of economic theorists while also generating predictions in agreement with experimental results. Camerer (2003) provides a review of the recent developments in these models in Chapter 2 of his recent book. Some of these theories of preferences include Bolton and Ockenfels (2000) who develop a model of equity, reciprocity and competition (ERC) which implies that a player's utility depends on one's own payoff relative to the average payoffs of all other players. This would lead to players having a preference for demands equal to the average of what other Dictators are doing in this game. Fehr and Schmidt (1999) study a similar model of difference aversion in which players have feelings of envy (when payoffs are lower than others') and

guilt (when payoffs are relatively higher than others') that enter into utility. A model allowing for various forms of reciprocity is developed in Dufwenberg & Kirchsteiger (2003). The model we use to design the social preferences discussed in the next section is most closely related to that posited in Charness and Rabin (2002).

As mentioned previously, these possible interpretations of play are confounded in these particular data and are only suggestive of what may be happening among players in these experiments. The next subsection provides a formation of preferences allowing for social comparison which is in seeming agreement with the empirical regularities found in the role-switching data. These patterns of behavior in the role-switching experiment are detailed in the section that follows the presentation of the model.

4.2.1 Model of Social Preferences in Role-Switching Game

The predictions made by any model attempting to identify behavior consistent with one or more of the variety of social preferences identified above will obviously depend crucially on the specification of the utility functions $u_D(\cdot)$ and $u_R(\cdot)$ for Dictators and Recipients, respectively. In attempting to explain the behavior of Dictators in the role-switching game, we specify preferences in which utility while in the role of Dictator is dependent on the relative demands of the current Dictator in the last period that they were Dictator as well as the previous demand they were subjected to while a Recipient.[24]

A specification that seems desirable in light of the motivations discussed above includes weights on one's own and partner's payoffs that are functions of indicator variables for whether current payoffs are higher or lower than a partner's.[25] A utility function that could capture some of the patterns of responses contained in the multiple-round, role-switching data generated in our experiment is given by

$$u_D(S', 1_{\{S<P\}}, 1_{\{S\geq P\}}) = (\sigma 1_{\{S<P\}} + \gamma 1_{\{S\geq P\}})S' + (1 - \sigma 1_{\{S<P\}} - \gamma 1_{\{S\geq P\}})(100 - S')$$

[24] This specification is similar to the model discussed in Charness and Rabin (2002) in which utility is a weighted sum of each player's payoff and indicator functions for relative payoffs and previous play are utilized.

[25] It is possible that each utility function should contain one's current role as an argument as well if players have preferences over roles (i.e., they prefer to have awarded a Recipient a 50/50 split while Dictator rather than to have received such a split from a Dictator while in the role of Recipient). However, this adds unnecessary complication to an already challenging problem.

This gives the utility for the current Dictator when making demand S'. In this utility function, $1_{\{S<P\}}$ is an indicator function equalling one when the previous demand made by the current Dictator was less than the most recent demand observed while the current Dictator was a Recipient.

In the case of our Dictator game where after rejection of the outside option, total payoffs will be Pareto efficient and sum to 100 this function simplifies to

$$u_D(S', 1_{\{S<P\}}, 1_{\{S\geq P\}}) = \left[2(\sigma 1_{\{S<P\}} + \gamma 1_{\{S\geq P\}}) - 1\right] S' + (1 - \sigma 1_{S<P} - \gamma 1_{S\geq P})100 \qquad (2)$$

Similarly, a Recipient whose previously demanded S when a Dictator has utility when subjected to a Dictator's demand of P (or, equivalently, when the Dictator offers the Recipient $100 - P$) described by

$$u_R(P, 1_{\{S<P\}}, 1_{\{S\geq P\}}) = (\sigma 1_{\{S<P\}} + \gamma 1_{\{S\geq P\}})(100 - P) + (1 - \sigma 1_{\{S<P\}} - \gamma 1_{\{S\geq P\}})P$$

which simplifies to

$$u_R(P, 1_{\{S<P\}}, 1_{\{S\geq P\}}) = \left[1 - 2(\sigma 1_{\{S<P\}} + \gamma 1_{\{S\geq P\}})\right] P + (\sigma 1_{\{S<P\}} + \gamma 1_{\{S\geq P\}})100 \qquad (3)$$

Determining the relative magnitudes (and possibly the absolute magnitudes) of σ and γ based on the data collected in the role-switching experiment would provide insight into the types of social preferences exhibited by players in our experiment. A dynamic model is available on the author's website that may allow for identification of these parameters.[26] One implication of such a model is that in the case of players motivated solely by self interest, we will have $\sigma = \gamma = 1$ so that no weight is placed on the utility of the Recipient in the Dictator's utility function and conversely that no weight is placed on the Dictator's payoff in the Recipient's utility function. Similarly, when $\sigma = \gamma = \frac{1}{2}$, a player is indifferent between all distributions of the available surplus in either role.

The next subsection provides results from the role-switching data that offer support for the specification of utility provided here.

4.2.2 Empirical Justification for Social Preferences

As stated above, the focus of the preferences specified in (2) and (3) is on the relative magnitudes of a Dictator's previous demands and the demand the Dictator was subjected to in their

[26] See http://www.ssc.wisc.edu/~tclassen/DictatorExperiment/DynamicDictatorModel.pdf

previous round in the role of Recipient. In studying the data from the 46 rounds of Dictator demands made in the role-switching game, a strong pattern emerged for this relationship being influential in predicting slider increases and decreases in the data.

This relationship is indicated in Table 6 where regression results for fixed- and random effects logit models are displayed. The two dependent variables are indicator functions equal to 1 when Dictators increased (decreased) their demands relative to the choice in their previous round as dictator. Explanatory variables include outside options (which fail to enter significantly in almost every regression specification related to these data), dichotomous variables for round number, and an additional dichotomous variable indicating the relationship between one's own previous Dictator choices and that of one's partners. The *avgindicator* variable considers the average of all of one's own previous demands relative to the average of all demands learned while in the role of Recipient. It equals one when the average of one's own previous demands is strictly less than the average of demands observed while a Recipient, and zero otherwise. Similarly, the *prvindicator* variable considers one's own most recent demand relative to the most recent demand learned while in the role of Recipient.

Slider Increases

Dependent variable is indicator variable=1 if current slider choice>previous own slider choice for Dictator

avgindicator is indicator variable = 1 if the average of all of one's own previous slider choices is strictly less than the average of all slider choices seen while in role of Recipient

prvindicator is indicator variable = 1 if one's own previous round slider choice is strictly less than the previous slider choices seen while in role of Recipient

Fixed Effects Logit Regressions			Random Effects Logit Regressions		
	Coefficient	p-value		Coefficient	p-value
outside option	0.003	0.615	outside option	0.002	0.738
avgindicator	1.089	0.040	avgindicator	1.525	0.000
	Coefficient	p-value		Coefficient	p-value
outside option	0.011	0.091	outside option	0.010	0.116
prvindicator	3.661	0.000	prvindicator	3.828	0.000

Slider Decreases

Dependent variable is indicator variable=1 if current slider choice<previous own slider choice for Slider Decrease
Explanatory variables are same as above

Fixed Effects Logit Regressions			Random Effects Logit Regressions		
	Coefficient	p-value		Coefficient	p-value
outside option	0.002	0.718	outside option	0.002	0.674
avgindicator	-0.360	0.493	avgindicator	-0.096	0.825
	Coefficient	p-value		Coefficient	p-value
outside option	0.001	0.874	outside option	0.001	0.797
prvindicator	-1.110	0.010	prvindicator	-1.036	0.013

Note: All regressions include individual round dummy variables in addition to those shown here.

Table 6 - Results of Logit Regressions for Slider Increases and Decreases

The results from these logit regressions using the role-switching data indicate that the previous slider choice indicator variable has relatively better explanatory power in predicting demand fluctuations of Dictators relative to their own most recent slider decision. A positive coefficient on *prvindicator* in the slider increase logit regressions (top half of Table 6) indicates that players are more likely to increase their demand relative to their most recent demand when their most recent demand was less than the most recent demand observed while in the role of Recipient. This result has many possible interpretations in terms of the social preference literature including a preference for difference aversion, negative reciprocity or fairness. Easily delineating these confounding effects does not seem possible given the structure of the current experiment.

The results for slider decreases are also in line with what we would expect given the definition of the explanatory variable *prvindicator.* This result indicates that Dictators are more likely to lower their demand relative to their most recent demand when their most recent demand was greater than or equal to the most recent demand learned while a Recipient (i.e., *prvindicator=0).*

5 Conclusions

This paper studies the results of two different treatments proposed for multiple-round Dictator Games with outside options available to Dictators. As expected, the results indicate no consistent significant role for outside options in influencing the demands of Dictators. Outside options are nearly always rejected to create a larger available surplus, and demands made following rejection do not indicate any clear pattern of the influence of such options.

The more interesting features of our experimental environment that appear to have significant influence over behavior are the repetition of the game, and more specifically, repetition of the game in which participants switch roles randomly between rounds of play. Relative to the constant-role treatments studied, Dictator demands in the role-switching game are consistently higher with a lower variance between and within players than in the constant-role game. This seems to indicate a significant influence of alternating roles over the course of the experiment on Dictator demands.

Relative to previous studies of DG experiments, the constant-role results are quite similar, which is in line with our interpretation of the constant-role games as static multiple-round games with certainty that should generate outcomes similar to one-round Dictator Games. The role-switching outcomes exhibit a significantly higher level of surplus claimed by Dictators relative to previous studies. These role-switching data converge to choices relatively close to those predicted in the subgame perfect equilibrium of this game played by strictly self-interested participants. These results for the role-switching game do *not* lead us to conclude that all participants are highly self interested and ignorant of certain social preferences. Instead, an interpretation of these results is provided that allows for some fraction of players to have fairness ideals of surplus divisions other than the Dictator taking the entire surplus. However, if even a small fraction of players behave in a self-interested fashion, these interactions with other 'fair' players leads to the outcomes observed of most choices near demands of the entire surplus.

Testing for the presence of social preferences such as negative reciprocity and difference aversion seems to fall victim to the confound problems identified in studies such as Charness and Rabin (2002). Preferences are considered in which one's relative decision in a previous round is compared to the most recent decision observed while in the role of Recipient to determine how one's own and one's partner's current payoffs enter the utility function. While more work is needed to generate concise predictions from such a model (particularly taking a stand on belief formation and possibly

eliminating indicator functions from the objective function to ensure existence of a solution), the current model reflects a particularly strong feature of the data.

Results from logit regressions indicate that Dictators are significantly more likely to increase their demand relative to their own previous demand when their previous demand was lower than the choice observed while in the Recipient role most recently. Conversely, Dictators are significantly more likely to lower their demand relative to their previous choice when their previous demand is higher than that most recently observed as a Recipient. While these results are consistent with the predictions of (indirect) reciprocity proposed in the literature (as well as our intuition), attributing such outcomes to a single explanation among possible social preferences seems dubious.

In order to better delineate the various social preference explanations for Dictator behavior in multiple-round experiments, a future experiment that could be designed for comparison to these results is a constant-role game in which Dictators learn the demands of one or more of the other Dictators after each round. Thus, the effect of difference aversion could be studied separately from the effects of negative reciprocity. Another experimental design that could be used to judge the effect of interactions between different types of players is a role-switching experiment in which Dictators indicating some preference for fairness early in the game could be matched with one another to determine whether such preferences for fairness will persist. This could also be useful for determining whether positive reciprocity could develop in games with Dictators having similar preferences.

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