Appendix 1

Welcome!

Thanks for completing the pre-play survey.

Please turn off all electronic devices and place them in your bags or under your desk. Please do not talk during the experiment. If you have any questions, raise your hand and the experimenter will come to personally assist you.

Today's experiment involves several tasks. All participants will receive a payment of $5 for showing up on time and completing all of the tasks. Participants can win a bonus based on performance in the games we will play, up to ≈ $30 more. At the end of the study, you will be paid privately in cash.

1. Overview

For today's session, you will be randomly assigned to a team (either Red or Blue) with three other participants. This team will play 8 games with an opposing team. The teams will be fixed for the whole session today.

Each game consists of three terms, and each term includes both an election and four years of policy-making (see Figure 1).

For each game, each team will have one player assigned as the leader. The leader will be responsible for making policy decisions during each of the 3 terms per game. Everyone will have 2 opportunities to be the leader throughout the course of the session, once in the first half and once in the second half, in an order that is randomly assigned.

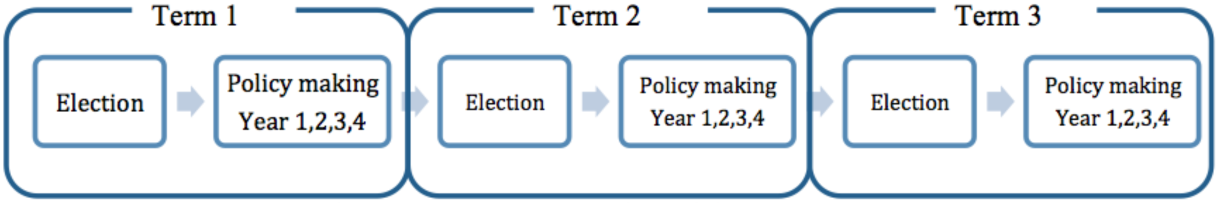


Figure 1. One game consists of three terms.

To determine your bonus, we will pick one of the games you played at random, and pay you for that game only. So do your best in every game!

2. Instructions for each game

a. Endowments and payoffs. You will start each term with an endowment of $10. Your payoff at the end of the term will be: the resources you started with **minus** any resources you used up in the election **plus** any resources you won from policy payoffs.

b. Rules for each electoral contest. There are three 'battlefields' in the electoral contest. Whoever wins the most battles wins control of the office for the term. Whoever commits the most resources to a battlefield wins the battle. Ties are settled by a coin toss.

Any resources you commit in the election get used up, whether you win or lose. You will have 40 seconds to make your commitments final. At the halfway point (i.e. 20 seconds in, with 20 seconds to go), you will see a snapshot of your opponent's choice so far, and they will see a snapshot of your choice. This gives you 20 more seconds to react.

c. Rules for policy-making

(For requiring turn-taking versions)

Whoever wins the election will be 'in' for the first and third years of the term, but roles will be reversed for the second and fourth years.

(For not requiring turn-taking versions)

Whoever wins the election will be 'in' for all four years of the term.

(For requiring consensus versions)

The 'in' leader proposes policy payoffs for the year to the 'out' leader. The 'out' leader can either accept or reject the offer. If the 'out' leader rejects the offer, neither side receives a policy payoff for the year. If the 'out' leader accepts the offer, both sides receive the agreed-upon policy payoffs.

(For no requiring consensus versions)

The 'in' leader chooses policy payoffs for the year.

(For all versions)

The possible policy payoffs are:

Payoff for own side ('Ins')	Payoff for other side ('Outs')
$5	$0
$4	$2
$3	$4
$2	$6
$1	$8
$0	$10

Suppose the second policy is chosen for the year. Then each member of the 'in' team, including the leader, would get $4 and each member of the 'out' team would get $2 for that year.

3. Payment

Your payoff at the end of each game will be the **average of your payoffs for each term.**

Remember, we will pick one of the games you play at random, and pay you for that game only. So do your best in every game!

For example, suppose we randomly choose the sixth game to set your payoff at the end of the session today, and in that game you ended up with $25, $20, and $15 in terms 1, 2, and 3. Your payoff for the game is $20. So you would walk away with that $20 bonus plus the $5 payment for showing up.

To make sure you understand these instructions, we will give you a 1 minute comprehension quiz and let you play two practice terms. After that, the rest of the experiment will begin.

GOOD LUCK!

Appendix 2

This appendix discusses the process for deriving numerical solutions for the election game given the stakes of the policy-making games. The game featured in the design is a non-constant-sum or 'all-pay' Colonel Blotto game with three battlefields between two groups each of four players, using dollar unit bids. There a no known closed form solution for this game, or immediately adjacent variations. We have to reduce the number of players down to two and make the dollar bids continuous in order to reach a variant of the game with a closed form analytical solution (Szentes & Rosenthal 2003; Kovenock & Roberson 2012a). This is one step removed from the original constant-sum Colonel Blotto game. Here we explain incremental changes to the MSNE as it moves from (a) the original two-player three-battlefield Blotto game to (b) the non-constant sum version to (c) the two-player all dollar units version to (d) the eight-player version numerically to treat the variant we use in the lab.

The original Colonel Blotto game was constant-sum in that resources were 'use it or lose it': resources that are not allocated to one of the battles are lost. For a three battlefield Blotto game between two players, the unique symmetric MSNE is to randomly allocate all resources across all three battlefields using a uniform distribution.

The non-constant sum version resembles an all-pay auction or a Tullock lottery in that resources committed to winning have an opportunity cost; they could simply be retained. The 3-battlefield version of Colonel Blotto is isomorphic to what Szentes & Rosenthal (2003) call a simultaneous 'pure chopstick' auction, where chopsticks are suggestive of identical objects that are useless except in pairs. Winning one battlefield alone is worth nothing, winning two is worth the full value of the prize, and winning three is worth nothing incremental to two. Here the unique symmetric MSNE is for both sides to randomly choose a budget using the uniform distribution between 0 and the value of the prize, $v_{1st} - v_{2nd}$, and then to randomly allocate it across the three battlefields, subject to the constraint that the battlefield with the most resources has no more than the sum of the lesser two.

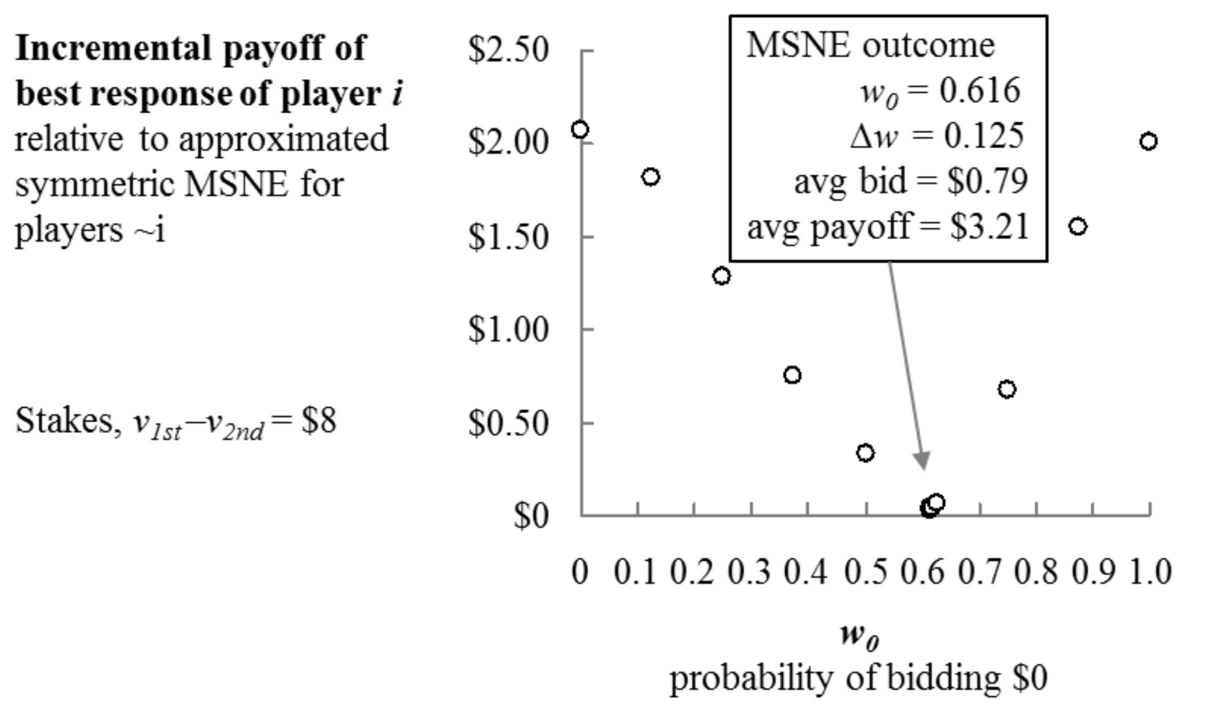
The intuition on the budget is that each seeks to make the other indifferent over the full range from 0 to the stakes of the prize. To make the expected value of all these bids equal, the benefit from the increased probability of winning must be equal to the loss from increasing one's bid. This means the uniform distribution. The intuition on the concentration is that this is the point at which the increased probability of dominating one battlefield is outweighed by the increased probabilities of losing the other two. Otherwise, one is spending more to win one particular battlefield (which alone is worth nothing) rather than on any particular two (which are needed to win the war).

This solution is only incrementally different once we move from continuous to dollar units. When neither side is willing to pay the full value of the prize, and each seeks to make the other indifferent over the full range, from 0 to the stakes of the prize minus one dollar, the result is that the average bid should be \$0.50 less than it would be in the continuous environment.

The eight-player version introduces a wedge between the optimal budget for the group to bid and the optimal budget for the individual to bid. The optimal budget for the group is the same as it is in the two-player game, but the individual has incentives to free-ride on his fellow group members. To numerically derive the symmetric mixed strategy Nash equilibrium, we search for the probability weight assigned to playing zero, w_0, constrained by the fact that the incremental probability of committing each dollar unit up to the maximum bid, x_{max}, must be $1/v$, that makes player i indifferent over the same range. The maximum bid, x_{max}, is $\|\frac{1-w_0}{\Delta p}\|$, and every positive commitment less than x_{max} is played with probability Δw, and x_{max} itself is played with the probability $1 - w_0 - (x_{max} - 1) * (\Delta w)$.

The example when $v_{1st} - v_{2nd} = 8$ is displayed in Figure A1. The incremental payoff of the best response of player i relative to the symmetric strategy of players $\approx i$ is approximately zero when $w_0 = 0.616$, and therefore $w_1 = 0.125$, $w_2 = 0.125$, $w_3 = 0.125$, and $w_4 = 0.009$. The weighted average of these is $0.79. By contrast, the individual contribution that is optimal for the group would be to set w_0 to 0.128, implying an average contribution of $3.48. The overall process for determining optimal budget distributions is visualized below in Figure A2.

Figure A1: Mixed Strategy Nash Equilibrium Outcome



1 For a given budget, groups choose among all possible distributions across 3 battlefields *Example*

Probability of winning election for group 1
as a function of the distribution of resources across battlefields

$11 budget chosen by group 2 (rows); $10 budget chosen by group 1 (columns)

11	0	0	0.42	0.67	0.67	1.00	0.67	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	1.00
10	1	0	0.25	0.38	0.50	0.67	0.50	0.83	0.50	0.83	1.00	0.50	0.83	1.00	1.00	1.00
9	2	0	0.33	0.38	0.38	0.33	0.50	0.50	0.50	0.67	0.67	0.50	0.67	0.83	0.83	1.00
9	1	1	0.00	0.25	0.33	0.42	0.33	0.67	0.33	0.67	1.00	0.33	0.67	1.00	1.00	1.00
8	3	0	0.33	0.50	0.38	0.50	0.38	0.33	0.50	0.50	0.33	0.50	0.67	0.50	0.67	0.67
8	2	1	0.00	0.17	0.38	0.25	0.33	0.38	0.33	0.50	0.67	0.33	0.50	0.83	0.83	1.00
7	4	0	0.33	0.50	0.50	0.67	0.38	0.50	0.38	0.33	0.33	0.50	0.50	0.33	0.33	0.17
7	3	1	0.00	0.17	0.33	0.33	0.38	0.38	0.33	0.38	0.33	0.33	0.50	0.50	0.67	0.67
7	2	2	0.00	0.00	0.33	0.00	0.50	0.25	0.33	0.33	0.42	0.33	0.33	0.67	0.67	1.00
6	5	0	0.33	0.50	0.50	0.67	0.50	0.67	0.38	0.50	0.50	0.25	0.17	0.17	0.00	0.00
6	4	1	0.00	0.17	0.33	0.33	0.33	0.50	0.38	0.38	0.50	0.33	0.38	0.33	0.33	0.17
6	3	2	0.00	0.00	0.17	0.00	0.50	0.17	0.50	0.38	0.25	0.33	0.33	0.38	0.50	0.67
5	5	1	0.00	0.17	0.33	0.33	0.33	0.50	0.33	0.50	0.67	0.42	0.25	0.33	0.00	0.00
5	4	2	0.00	0.00	0.17	0.00	0.33	0.17	0.50	0.33	0.33	0.67	0.38	0.38	0.25	0.17
5	3	3	0.00	0.00	0.00	0.00	0.33	0.00	0.67	0.33	0.00	0.67	0.50	0.25	0.33	0.42
4	4	3	0.00	0.00	0.00	0.00	0.17	0.00	0.67	0.17	0.00	1.00	0.67	0.17	0.42	0.17
			10	9	8	8	7	7	6	6	6	5	5	5	4	4
			0	1	2	1	3	2	4	3	2	5	4	3	4	3
			0	0	0	1	0	1	0	1	2	0	1	2	2	3

2 Within those distributions, the "balanced" distributions (where resources on the largest are equal or less than the sum of those on the smaller two) dominate the "non-balanced"

Probability of winning election for group 1
as a function of balanced or non-balanced distribution

Group 2		Group 1: Non-balanced	Group 1: Balanced
	Non-balanced	0.43	0.69
	Balanced	0.12	0.38

3 While there is some randomness when groups' chosen budgets are near equal in size, the greater the difference the more likely the larger can win with certainty

Probability of winning election for group 1
as a function of budgets randomly chosen distributions across battlefields
constrained so that largest is not greater than sum of other two

Budget for group 2 (rows); Budget for group 1 (columns)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	0.50	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	0.25	0.50	0.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.00	0.17	0.50	0.75	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.00	0.00	0.25	0.50	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	0.00	0.00	0.04	0.13	0.50	0.71	0.91	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	0.00	0.00	0.00	0.00	0.29	0.50	0.81	0.96	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	0.00	0.00	0.00	0.00	0.09	0.19	0.50	0.74	0.88	0.96	0.99	1.00	1.00	1.00	1.00	1.00	1.00
7	0.00	0.00	0.00	0.00	0.02	0.04	0.26	0.50	0.76	0.91	0.97	0.99	1.00	1.00	1.00	1.00	1.00
8	0.00	0.00	0.00	0.00	0.01	0.01	0.12	0.24	0.50	0.69	0.87	0.93	0.97	0.99	1.00	1.00	1.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.09	0.31	0.50	0.78	0.88	0.94	0.99	0.99	1.00	1.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.13	0.22	0.50	0.62	0.78	0.89	0.94	0.97	0.98
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.12	0.38	0.50	0.71	0.87	0.92	0.97	0.98
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.22	0.29	0.50	0.69	0.81	0.88	0.93
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.11	0.13	0.31	0.50	0.67	0.78	0.88
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.08	0.19	0.33	0.50	0.62	0.77
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.12	0.22	0.38	0.50	0.71
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.07	0.12	0.23	0.29	0.50

Figure A2: Deriving Optimal Budget Distributions

Appendix 3

Figure A3: Experimental results, focusing on trust

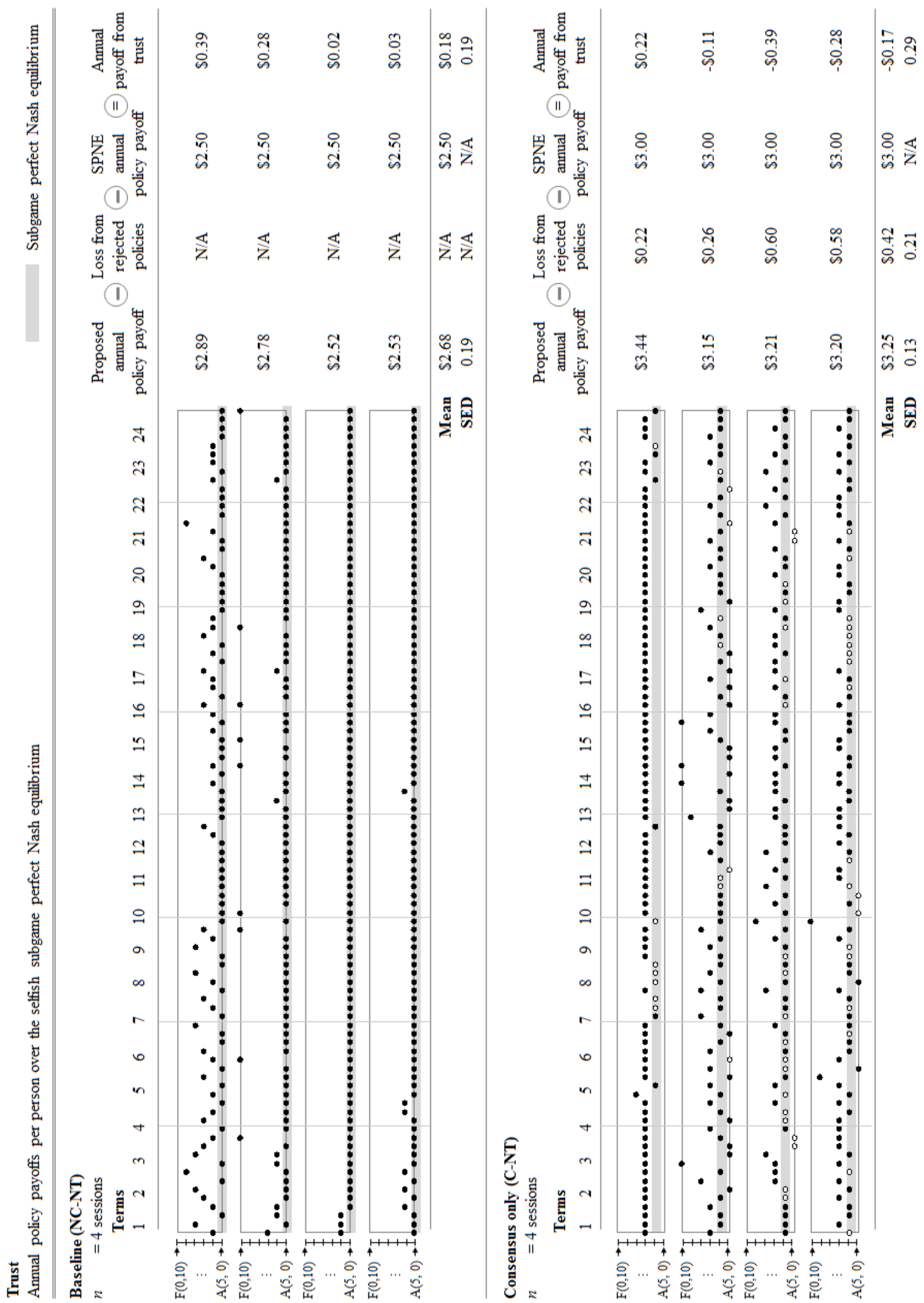


Figure A4: Experimental results, focusing on trust

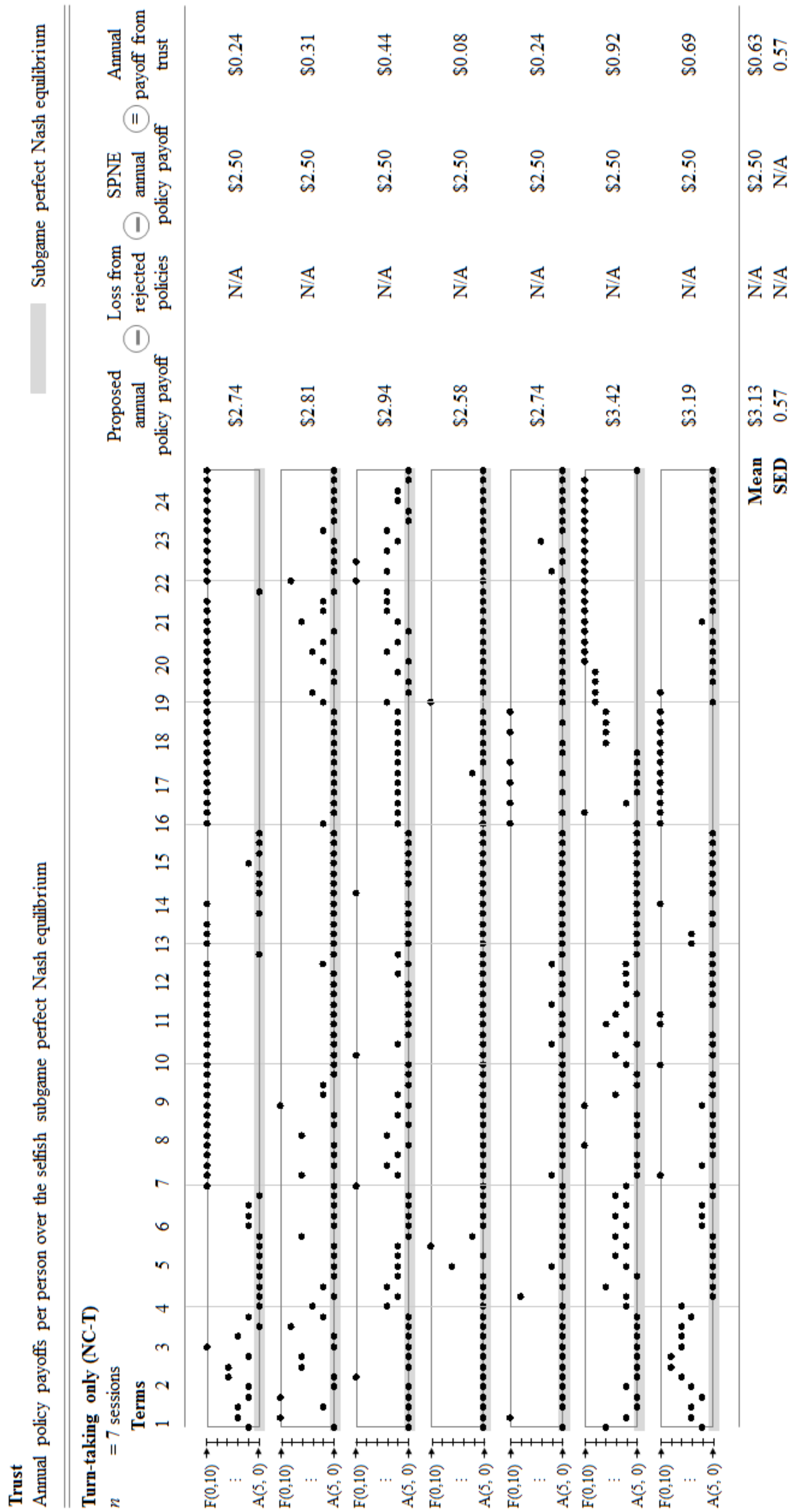


Figure A5: Experimental results, focusing on trust

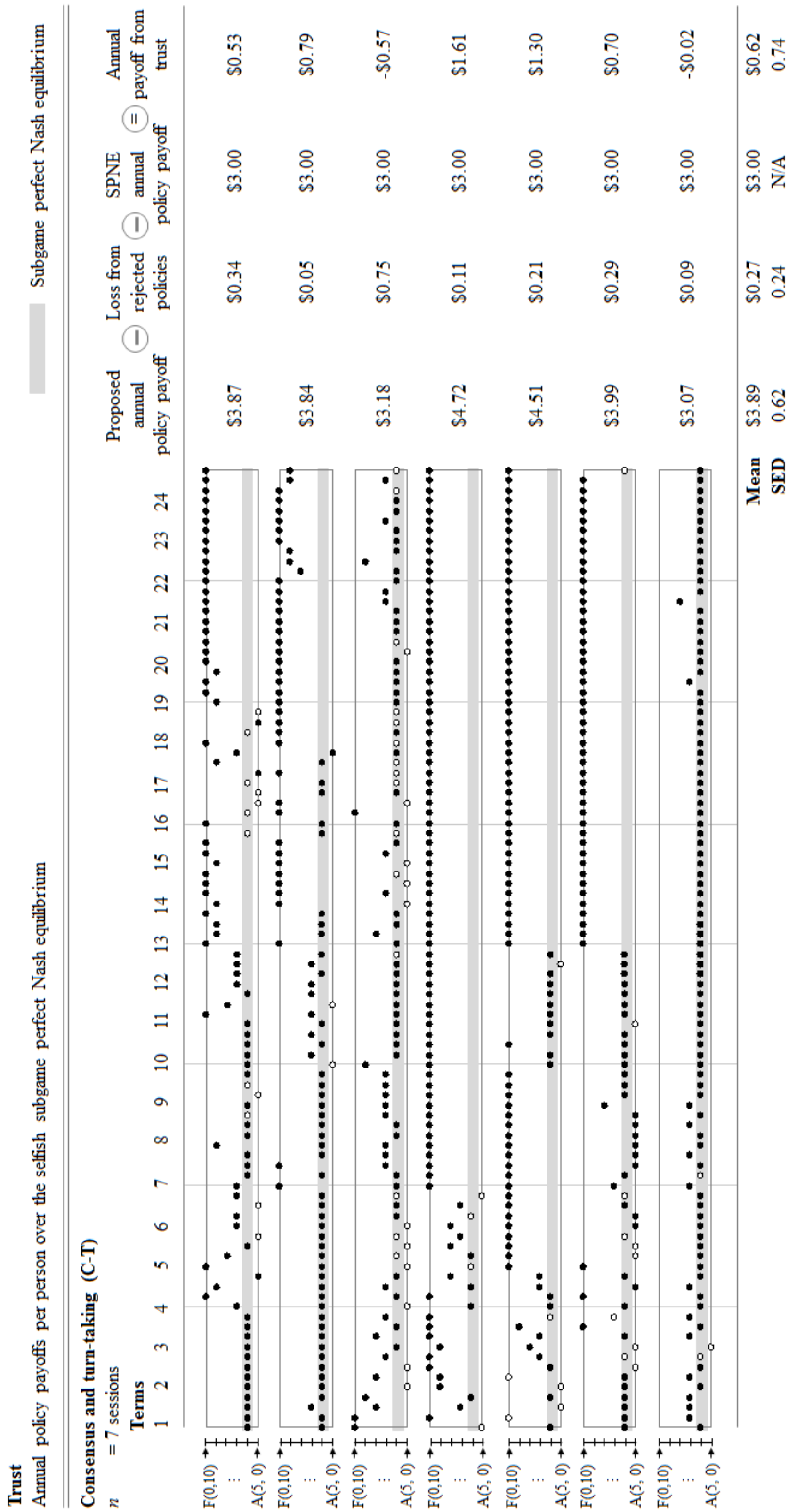


Figure A6: Experimental results, focusing on adaptability

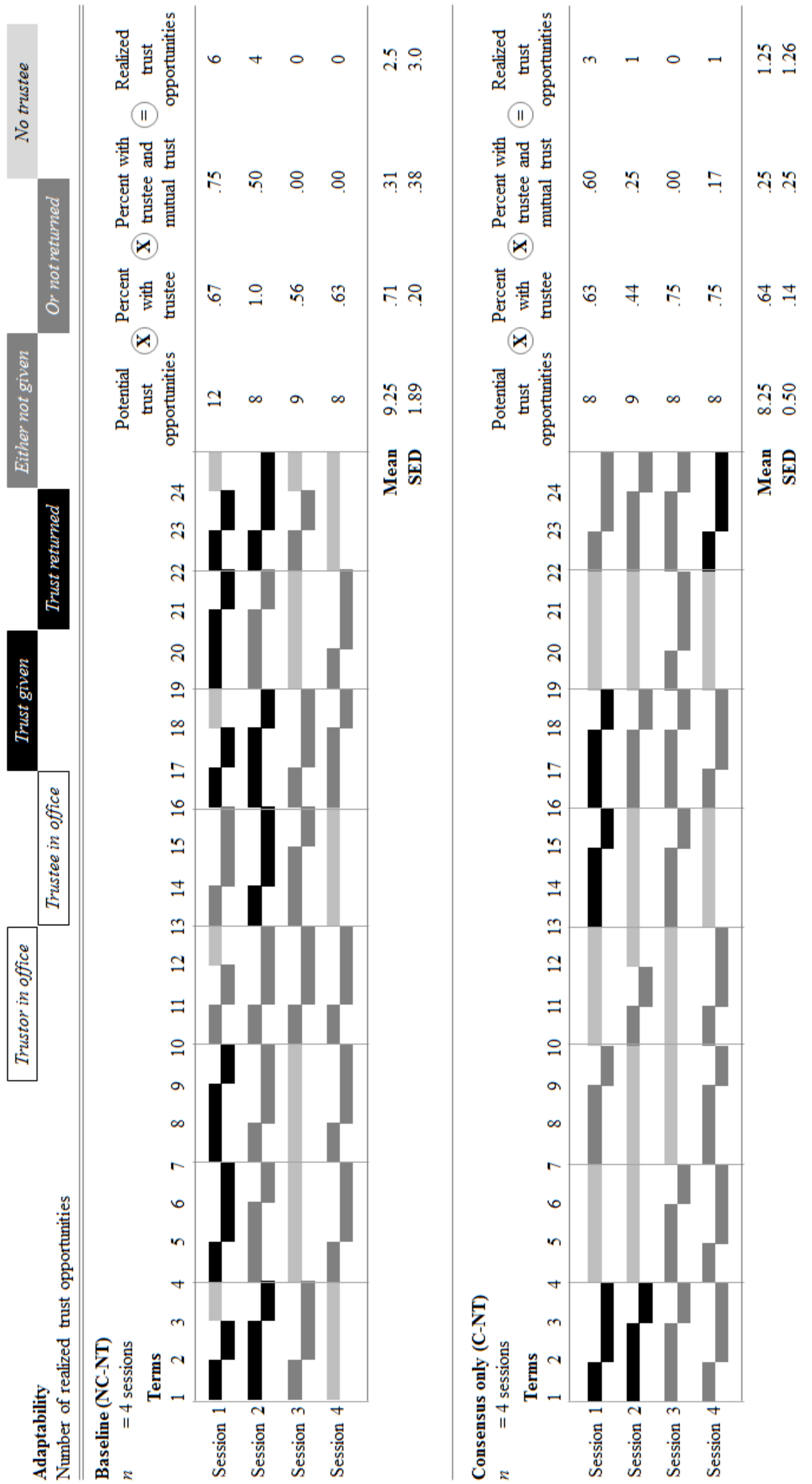


Figure A7: Experimental results, focusing on adaptability