Ruling the Roost:
The Vicious Circle and the Emergence of Pecking Order

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Abstract

This paper constructs a new game—the "rule-the-roost game"—where players compete repeatedly for power ("chickens") and wealth ("eggs") in the laboratory. We consider two treatments: a "patronage" treatment, where players can buy others' support to win power, and a "no-patronage" treatment where such payments are not possible. We find that a vicious circle develops in the patronage treatment, where the powerful accumulate more power and wealth over time, leading to substantial inequality. The vicious circle is attenuated, however, by a countervailing force: the powerless take actions to oppose the powerful. No vicious circle arises in the no-patronage treatment and inequality is markedly lower. While gender differences in outcomes are small in the no-patronage treatment, they are large in the patronage treatment. We provide evidence that the vicious circle, by amplifying minor style-of-play differences, plays a critical role.

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Keywords: power, inequality, hierarchy, gender differences

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1 Introduction

According to Acemoglu and Robinson, political systems are susceptible to "vicious circles," where power and wealth, once accumulated, can be leveraged to acquire even more, leading to a concentration of control in the hands of a few. History is replete with examples of this cycle. In the city-states of medieval Italy, for instance, the signoria was frequently dominated by wealthy families like the Medici, who acquired control and used it to advance their own commercial interests. These dynamics are not limited to the political sphere; similar cycles can be observed in organizations and firms, where those who hold influence or resources may use them to consolidate further power, shaping internal hierarchies and limiting access to opportunities for others. Today, such concerns remain prominent, as seen in practices like the widespread gerrymandering following the Republican Party's success in the 2010 midterm elections, which was aimed at securing long-term control over key statehouses and congressional seats.[1]

However, counterforces can inhibit vicious circles. The cultural anthropologist Christopher Boehm suggests that followers may actively oppose and constrain leaders who attempt to amass excessive power and wealth, a phenomenon he terms "reverse dominance hierarchy" (see Boehm (1993, 1999)). A classic example is the assassination of Julius Caesar, whose refusal to disband his army after conquering Gaul spurred fears in the Roman Senate that he would crown himself king, prompting them to act against him.

To study these forces systematically, we construct a new game (the "rule-the-roost game") and examine how subjects play it in the laboratory. This game allows us to look under the microscope at the forces shaping the distribution of power and wealth. In the game, participants compete for (finitely-lived) chickens, which correspond to (finitely-tenured) positions of power; the eggs laid by chickens are the game's currency. In each round of the game, a chicken is born and an election takes place to determine its owner; subjects choose whether to run or vote in the election.

[1] See, for instance, Mayer, Jane, "State Legislatures Are Torching Democracy," *The New Yorker,* 6 August, 2022, Retrieved from `https://www.newyorker.com`.

We consider two versions of the game. In the "patronage" version, candidates can pledge their freshly-laid eggs to voters in return for their votes. This feature captures the idea that politicians can, in many instances, use their offices to engage in patronage (i.e., bestow favors to acquire support). In the "no-patronage" version of the game, candidates cannot pledge eggs to voters.

We characterize the equilibria of the game under some stark assumptions: in particular, that players are risk-neutral egg maximizers. These outcomes serve as a benchmark against which to compare our results, and also suggest some mechanisms that may lead to unequal outcomes in the game. We show that, in the patronage version of the game, a vicious circle arises. Intuitively, the ability to pledge eggs gives an electoral advantage to candidates who are already chicken-rich. This vicious circle leads to an extreme pecking order, with one player capturing all of the chickens and all of the eggs. In the no-patronage version of the game, there is no vicious circle and inequality is lower in expectation.

In the laboratory, we had some subjects play the patronage version of the game and others play the no-patronage version. We find, in line with the model, that patronage contributes substantially to inequality. In the patronage treatment, the top-ranked player (out of six) wins on average almost half of the chickens, while the bottom-ranked player wins just two percent. This gap narrows dramatically in the no-patronage treatment, with the top-ranked player winning 20 percent on average versus 13 percent for the bottom-ranked player.

We also test—and confirm—our hypothesis that patronage generates a vicious circle. Exploiting two sources of randomness—election ties and lack-of-history in the first election—we find that winning a chicken today increases the likelihood of winning subsequent elections by between 9.5 and 15.4 percent. In the no-patronage treatment, there is no vicious circle and, in fact, winning a chicken today *decreases* the likelihood of winning chickens in the future.

While these results are consistent with the benchmark model, we also find that inequality is less extreme in the patronage treatment than predicted. To investigate the reasons why inequality is less extreme, we look in greater detail at the patronage treatment and examine whether dominant players emerge who hold onto power (as the benchmark model predicts).

In particular, we focus on "lords": players who own at least 80 percent of the living chickens in a given round.

We find that lords are common in the patronage treatment—they arise in 40 percent of rounds—but they do not arise in every round, as the benchmark model predicts. Moreover, the average tenure of lords is only 40 percent of what the model predicts; lords are opposed in elections more often than expected: 87.7 percent of the time rather than zero; and lords pledge more of their eggs than expected: 35 percent rather than zero.

These findings regarding lords suggest two potential explanations for why inequality is less extreme than the model predicts. One possibility is that lords are *generous*: they voluntarily give away eggs and choose to end their tenures. An alternative is that the deviations reflect, along the lines of Boehm, *opposition to lords*: lord tenures may end because other subjects oppose them; and lords may give away eggs as a means of holding onto power. We show that our findings are more in line with the opposition story. For instance, in 69.9 percent of cases where a lord tenure ends, it is because there is an opposing candidate whom voters favor even though they pledged *less* than the lord. It therefore appears that opposition plays an important role in mitigating inequality.

The vicious circle has the potential to amplify the effect of small individual differences in style of play. By "style of play," we mean characteristics of a player's strategy (e.g. their propensity to run in elections). For example, suppose player 1's style of play gives them a marginal edge over player 2 in round 1. In round 2, they are likely to have slightly more power (i.e. chickens) than player 2, providing an additional advantage. Over time, this power advantage compounds, leading to an ever-increasing edge and potentially substantial inequality.

To test this idea, we compare outcomes of women and men. Subjects do not observe each others' genders; thus, any gender differences in outcomes must be due to style-of-play differences. We find that there are, in fact, large gender differences in final outcomes in the patronage treatment. Women obtain only 84.7 percent as many eggs and win elections only 70.4 percent as often. Differences in the tail of the distribution are especially striking: women are only 56.3 percent as likely as men to have the most eggs and they are lords only 31.9 percent as often. By contrast, difference in the no-patronage treatment are insignificant.

To examine whether the vicious circle amplifies gender differences in the patronage treatment—and helps explain while they are so large—we look at whether differences become more severe over the course of the game. This is indeed what we find. In the first five rounds, women have only slightly lower win rates than men: 2.2 percentage points (which is statistically insignificant). However, in the last four rounds, women have a win rate that is 8.8 percentage points lower. Put another way, the win-rate gap widens at a rate of 0.22 percentage points per round.

Our paper relates most closely to Acemoglu and Robinson's work on political institutions and their concept of vicious circles (see, for instance, Acemoglu and Robinson, 2005, 2012). Vicious circles have also been explored by Zingales (2017) in the context of rent-seeking by large firms; and Glaeser et al. (2003) have pointed out that subversion of institutions by the wealthy—specifically, the courts—can exacerbate inequality. Our paper also fits into a broader literature on institutions as a driver of growth and a determinant of inequality (see, for instance, Glaeser and Shleifer (2002), Rodrik et al. (2004), La Porta et al. (2008), and Acemoglu et al. (2005)).[2]

The literature on clientelism and patronage is also concerned with vote buying by politicians (see Dixit and Londregan 1996; Wantchekon 2003; Stokes 2005, 2009; Finan and Schechter 2012; Robinson and Verdier 2013; Szwarcberg 2015; and Kramon and Posner 2016). Issues that have been studied include: whether politicians buy votes from marginal or core supporters, the policy consequences of clientelism, the reliance of clientelism on social and ethnic networks, and why clientelism is associated with poverty and inequality. Our experiment contributes to this literature by showing how clientelism can, over time, lead to concentration of power.

Our paper fits into an experimental literature on elections (see Palfrey, 2006 for a review).

[2] In our experiment, we allow certain institutions to evolve (i.e., who holds power) but we take others as fixed. In particular, we impose democratic elections. In so doing, we suppress a force that Acemoglu and Robinson highlight as exacerbating vicious circles: democratic institutions tend to erode when power and wealth are concentrated. Even absent this force, we observe vicious circles—an outcome that Acemoglu and Robinson (2008) refer to as "captured democracy."

Topics studied include voter turnout, strategic voting, and candidate competition.

Finally, our paper shows how small initial differences between individuals or groups—such as gender differences in style of play—can lead to large outcomes differences. In this sense, our work relates to Cunha and Heckman (2007), who show that small differences in early childhood education can lead to large disparities in later life, as well as Frank and Cook (2010), who argue that winner-take-all markets can magnify differences between stars and other market competitors.

The remainder of the paper is organized as follows. Section 2 describes the rule-the-roost game. Section 3 characterizes the equilibria of the game under some stark assumptions; these equilibria serve as a natural benchmark against which to compare our experimental results. Section 4 details our experimental design. Section 5 reports our results on inequality and the vicious circle. Section 6 examines the ways in which our results deviate from benchmark and discusses possible mechanisms. Section 7 considers gender inequality and gender dynamics in the game. Section 8 concludes.

2 The Rule-the-Roost Game

Here, we propose a new game—the "rule-the-roost game"—that captures important elements of political competition. It is also simple enough that it can be played by subjects in a laboratory setting. In the game, players compete for chickens in elections. Chickens correspond to positions of power and the eggs they lay are the game's currency.

We begin by outlining the game's basic structure. Next, we describe the elections that are held in every round, including their timing and information structure.

Basic Structure of the Game

The game has $N \geq 2$ players and $R \geq 2$ rounds. In each round, except the very last, an election takes place. The election winner receives a newborn chicken at the start of the next round. Chickens live for T rounds (or until the game ends). While alive, they lay E eggs per round for their owners. In the final round of the game, no election takes place and players simply collect the eggs laid by their chickens. In our experiment (Section 4), we set $N = 6$, $R = 30$, $T = 5$, and $E = 2$.

Eggs are the currency of the game; the objective of the game for self-interested players is to maximize the total number of eggs acquired. (In our experiment, subjects exchange their eggs for money at the end of the session). Players can keep the eggs laid by their own chickens; they can also (potentially) transfer them to other players during elections. The game is zero-sum, with a fixed surplus of eggs. As such, the principal outcome of interest will be the division of eggs between players.

Notice that the number of living chickens grows at the start of the game—from zero in Round 1 to T in Round $T+1$—as more chickens are born. From Round $T+1$ onward, however, the number of living chickens is fixed at T, since each chicken birth is offset by a retirement.

Elections

We will consider two versions of the rule-the-roost game, whose election procedures differ in one respect. In the first version, election candidates can engage in patronage; in the second version, they cannot. These versions correspond, respectively, to our "patronage" and "no patronage" experimental treatments.

Patronage Version

In each election, a randomly-selected deciding voter determines the election winner. Elections proceed as follows:

1. Subjects simultaneously choose whether to be candidates or voters.[3] The list of candidates is then publicly announced. In the event that there are no candidates—or no voters—an election winner is randomly selected.

2. Candidates simultaneously choose how many eggs to pledge to the deciding voter. Candidates can only pledge freshly-laid eggs (i.e., eggs laid by their chickens in the current round). Candidates' pledges are then publicly announced.

[3]This feature of our game is in line with citizen-candidate models such as Osborne and Slivinski (1996) and Besley and Coate (1997).

3. Each voter simultaneously chooses a candidate from the list; and one voter is then randomly selected to serve as the deciding voter.[4] The deciding voter's choice determines the election winner. The election winner is announced; votes are made public; and it is also made public which voter served as the deciding voter.

4. Finally, the election winner transfers the pledged amount to the deciding voter. Subjects keep the eggs that they do not transfer and accumulate them over the course of the game.

Notice that all choices by all subjects are made public, so there is no hidden information in this game.[5]

No-Patronage Version

The version of the game without patronage differs in only one respect: candidates cannot make pledges to voters. Hence, there are no egg transfers between players.

Discussion

Means of patronage. In the patronage game we consider, candidates can only pledge freshly-laid eggs to voters. This modeling choice reflects situations where people can use their current power (corresponding to chickens in our game) to bestow favors.[6] A version of the game where candidates can pledge "stale eggs" as well better reflects situations where wealth as well as power can be used to conduct patronage. It would be a natural next step to study this variant of the game.

"Gifts" versus pledges. Political patronage in real-world settings often involves relational contracts rather than explicit ones. The patron, rather than explicitly trading benefits for support, will offer a "gift" to a client—a gift that comes with the expectation of support if it is accepted. In the patronage game we study, for the sake of simplicity, we have made

[4] If there is only one candidate, all voters must choose that candidate, which ensures the candidate wins.

[5] In particular, each subject can track the history of chickens won and eggs earned by every other subject. In fact, in our experimental interface, each subject can see every other subject's chickens on-screen.

[6] There are reasons to think power might be a more effective means of patronage than wealth: for instance, it might be easy for a polity to ban explicit vote buying but hard to outlaw the granting of political favors.

contracts explicit, with candidates pledging eggs to voters in exchange for votes. A version of that game that might be worth considering is one where patronage is less contractual and less precisely targeted—for instance, taking the form of unconditional transfers.[7]

Voting rule. In the versions of the game we study, election outcomes are determined by a deciding voter—rather than by a plurality vote, which might seem more natural. In addition, the deciding voter receives the entirety of the election winner's pledge. We chose this election procedure because it reduces strategic complexity. Under our procedure, voters only need to condition on being pivotal in their calculations. By contrast, if the election winner's pledge were divided between the winner's supporters, voters would need to take into account the likely split of the pledge. If, additionally, there were plurality voting, voters would need to factor in each candidate's chance of winning. A natural step for future work would be to consider alternative voting procedures.[8]

3 Theoretical Benchmark

Here, we characterize the equilibria of the game under some stark assumptions. These assumptions, while strong, serve as a natural benchmark. We show that, under these assumptions, outcomes are markedly different in the two versions of the game. A vicious circle arises in the patronage version, leading to an extreme pecking order where one player wins all of the chickens and all of the eggs. In the no-patronage version, there is no vicious circle and inequality is considerably lower.

Assumptions

For the purposes of our benchmarking exercise, we assume that players are self-interested and risk-neutral: they are motivated to maximize their own expected aggregate egg earnings. In

[7]A version that might be of particular interest is one where gifts cannot be targeted at all: candidates can only give gifts to voters as a block, with the hope that this generates goodwill.

[8]Notice that, in our version of the game, the election winner targets their patronage on a single, deciding voter—rather than distributing it among the set of voters who support them. Concentrating patronage rather than distributing it could potentially have an effect on outcomes.

addition, we focus on equilibria where strategies have the following properties.

Property I. Markov-perfection (Maskin and Tirole (2001)): players' strategies condition only on decision-relevant state variables (the chickens owned by players, the current-round candidates, and the current-round pledges).[9]

Property II. Index invariance: suppose each player is assigned an index $i \in \{1, \dots, n\}$. Then each player's index does not affect how they play or how they are treated by other players (see the Appendix for a more formal definition).

Property III. Even-handedness in voting: in any voting round, if a voter is indifferent between two candidates, they vote for each candidate with equal probability.

Equilibrium

Proposition 1 characterizes equilibria under these assumptions (for a formal proof, see the Appendix).

Proposition 1. *Suppose players are self-interested and risk neutral. If the number of players N is sufficiently large and chickens lay more than two eggs per round ($E > 2$), all equilibria with strategies satisfying I-III have the following form:*

1. *Patronage game:*
   - (a) *In the first round, all players run for election and one player wins at random.*
   - (b) *In subsequent rounds, only the first-round winner runs for election and no eggs are pledged to voters.*
   - (c) *Consequently, the first-round winner wins all of the elections and all of the eggs.*
2. *No-patronage game: in every round, all players run for election and one player wins at random.*

[9] Notice that players' past egg winnings are not decision-relevant state variables given that they have no effect on the continuation game.

Equilibria of the type described in Proposition 1 also exist when chickens lay two eggs per round ($E = 2$); moreover, they are unique if we additionally assume that candidates pledge eggs if otherwise indifferent.

Intuition. In the patronage game, voters succumb to the short-run logic of voting for the candidate who pledges the most. Consequently, a player who has won all past elections can, at minimal cost, continue to win elections: pledging one egg if they ever face a challenger. It follows that the first-round winner will win all subsequent elections. Moreover, since it does not pay to challenge, the first-round winner will run unopposed and win all of the eggs.

It would, of course, be in voters' collective interest to be more future-minded: sometimes voting for a chicken-poor candidate over a chicken-rich candidate who pledges more in order to generate electoral competition. However, it is difficult for voters to behave in this fashion if there is a severe free-rider problem (which is the case when N is large) or if they have trouble coordinating on a challenger to a chicken-rich candidate (which Properties I-III ensure).[10]

In the no-patronage version of the game, by contrast, voters do not have the opportunity to benefit from candidates' patronage (in the form of pledged eggs). At the same time, Properties I-III ensure that voters never favor one candidate over another, so any player that runs has an equal non-zero chance of winning a chicken. Consequently, it is a dominant strategy to run rather than vote.

Why our experimental results might differ from benchmark.

The outcomes described by Proposition 1 serve as a useful point of comparison for our experimental results. That said, there are important reasons why our experimental results might differ. We might expect chicken-rich subjects to be more *generous* than the proposition predicts; and we might expect chicken-poor subjects to engage in more *opposition* to the chicken-rich.

Concern with fairness. Players might be inequity averse or otherwise concerned with fairness. Such concerns might reduce inequality for two reasons. First, it might make chicken-rich

[10]They cannot use the past history to coordinate because of Properties I and III or players indexes because of Property II.

players more *generous*. In both versions of the game, chicken-rich players might run less often so as to give other players a chance to win. In the patronage version, chicken-rich players might also pledge more eggs.

Second, concern with fairness might stoke *opposition* to chicken-rich players, increasing chicken-poor players' willingness to run and vote against them. In both versions of the game, the chicken-rich might lose some elections as a result. Additionally, in the patronage version, chicken-rich players might pledge instrumentally as a means of fending off challenges.

Small number of players. It is in voters' collective interest to be future-minded: sometimes opposing chicken-rich candidates in order to generate electoral competition. However, when there are a large number of players, as Proposition 1 assumes, the free-rider problem is severe and players succumb to the short-run logic of voting for the candidate who pledges the most. By contrast, when there are only a small number of players, voters may be willing to *oppose* chicken-rich candidates.

Coordination. Effective opposition to a chicken-rich candidate requires that the other players successfully coordinate on a challenger; but Proposition 1 rules out various coordination mechanisms that might marshal opposition to the chicken-rich. The Markov-perfect assumption (Property I) rules out coordination on past history of play while index invariance (Property III) rules out the possibility of players' indexes being used as a coordination device. Our experimental subjects may, by coordinating more effectively than Proposition 1 assumes, generate more *opposition* to chicken-rich candidates.

4 Experimental Design

Subjects in our experiment were randomly allocated to groups of six ($N = 6$), and each group was assigned to play either the patronage or the no-patronage version of the rule-the-roost game. Every group played for 30 rounds ($R = 30$), with chickens living for 5 rounds ($T = 5$) and laying two eggs per round ($E = 2$).

To preserve anonymity, while maintaining publicly observable actions, subjects were identified by gender-neutral pseudonyms such as "Mushroom," "Spinach," and "Leek." Note that subjects had no information about each other's genders.

Subjects played the game using a graphical point-and-click interface programmed in zTree (Fischbacher, 2007). Screenshots of the interface are provided in Appendices D.2 and D.4. The interface included, on the left side of the screen, an illustrated dashboard where subjects could see the chickens each player had, how many eggs they had accumulated, and how many "fresh eggs" they had available to pledge.

At the start of the experiment, subjects received written instructions (see Appendices D.1 and D.3), which were also read aloud, and they played two non-incentivized practice rounds—one round as a voter and one round as a candidate. At the end of the experiment, subjects were asked to complete a non-incentivized survey about their motivations during the experiment.[11,12]

The experiment was conducted at Nanyang Technological University in Singapore between August 2018 and September 2019 and was programmed in zTree (Fischbacher, 2007). Subjects were recruited by email from the undergraduate population and were drawn from a wide variety of majors (see Table A.2). 456 subjects participated in the experiment over 21 sessions (see Table 1). In total, there were 76 groups of subjects.[13]

Subjects could see their earnings (in eggs) throughout the experiment. At the end of the experiment, the eggs they accumulated were converted to Singapore dollars at the rate of 5 eggs to $1 (at the time, one Singapore dollar translated to roughly 0.73 US dollars). Subjects

[11] In our first three patronage-treatment sessions, subjects received a different survey with more open-ended questions. The results we report in the paper come from the later version of the survey.

[12] Subjects appear to have understood the game well. Only 8% answered affirmatively to the question "Was there anything unclear about the instructions?"

[13] Budget constraints limited us to roughly 80 groups of 6 subjects each, with at least 24 rounds (Rounds 6–29) of play per group. Power calculations for a cluster-randomized design indicated that a larger share of the sample should be allocated to the patronage treatment, where we expected greater variance in outcomes. For instance, suppose we treat outcomes as standardized and assume variances of 1.5 and 0.5 in the patronage and no-patronage treatments, respectively. Then a medium effect of 0.5 standard deviations in group-round outcomes (clustered by group) can be detected with peak power of ≈ 0.87 when the patronage treatment is allocated 2.5 times as many observations as the no-patronage treatment—compared with ≈ 0.79 if sample sizes were equal across treatments.

Table 1: Treatment Descriptions

Treatment	Sessions	Sample size
Patronage	15	330
No Patronage	6	126
Total	21	456

Randomization into treatments took place at the session level. Each session contained at least three groups, with each group consisting of six participants.

also received a $5 show-up fee. The experiment lasted about 90 minutes and subjects earned an average of $14.20.

5 Experimental Results

This section proceeds in three steps. We first give some descriptive statistics on election outcomes. Next, we consider inequality in the game. We examine how patronage affects the level of inequality, and we compare the level of inequality in each treatment against the predictions of the benchmark model. Finally, we test whether patronage induces a vicious circle.

5.1 Descriptive Statistics on Elections

Table 2 reports some descriptive statistics on elections and compares against the predictions of the benchmark model. In the patronage treatment, the average number of candidates in the first round is 4.2, which is less than the benchmark model's prediction (that all players run in the first round). The benchmark also predicts that the first election winner will dominate all subsequent rounds: they will be the only subject who runs, and will win every chicken without pledging any eggs. Such dominance does not arise in our experiment: there are an average of 3.1 candidates in each round. From round 6 onward, the election winner only owns 2.3 of the five living chickens on average, and pledges 2.7 eggs.

In the no-patronage treatment, the average number of candidates (4.5 in the first round and

Table 2: Descriptive Statistics on Elections

	Patronage		No Patronage	
	Mean	Benchmark	Mean	Benchmark
Number of Candidates – Round 1	4.200	6	4.524	6
	(1.311)	(0)	(1.030)	(0)
Number of Candidates – Rounds 2–29	3.084	1	3.383	6
	(1.197)	(0)	(1.137)	(0)
Chickens Owned by Election Winner – Rounds 6–29	2.349	5	0.292	0.833
	(1.646)	(0)	(0.493)	(0.833)
Eggs Pledged by Election Winner – Rounds 6–29	2.715	0	–	–
	(1.730)	(0)		

Means with standard deviations in parentheses. Group-round level observations were used to compute averages over all rounds within the specified interval, with the exception of "Eggs Pledged" which was averaged over rounds where an election took place. Rounds where no election took place, because all or no group members chose to run, comprised 3.0% (2.6%) of all rounds in the patronage (no-patronage) treatment. In the no-patronage benchmark, notice that each of the five chickens is equally likely to be owned by each of the six candidates, so the number of chickens owned by the election winner is binomially distributed: $X \sim \text{Binomial}\left(n = 5, p = \frac{1}{6}\right)$. The mean is $\mathbb{E}[X] = np = 5 \times \frac{1}{6} = \frac{5}{6} = 0.833$ and the standard deviation is $\sqrt{\text{Var}(X)} = \sqrt{np(1-p)} = \frac{5}{6} = 0.833$.

3.4 in subsequent rounds) is less than the benchmark model's prediction that all players run in every round. The benchmark model predicts that, in rounds 6-29, every subject (including the election winner) owns an equal share of the five living chickens in expectation, or $\frac{5}{6} = 0.83$. By contrast, in our experiment, we find that the election winner only owns 0.29 chickens—less than the average subject.

In addition to Table 2, we report trends in running and pledge rates in Appendix B.

5.2 Inequality

Let us now examine the level of inequality among subjects. Figure 1 shows (in black) the amount of chicken and egg inequality that exists at the end of game in each treatment—allowing us to examine the impact of patronage on inequality. The black bars show the share of eggs—or chickens—captured by the players finishing 1st, 2nd, 3rd, and so forth.

Figure 1 also shows (in pink) the amount of chicken and egg inequality predicted by the benchmark model, allowing us to compare observed inequality against these predicted levels for each treatment. It is straightforward to calculate the benchmark model's predictions for the patronage treatment, since one player is predicted to capture all of the chickens and eggs. For the no-patronage treatment, we generated the benchmark shares for players finishing 1st, 2nd, and so forth, by simulating play for 10,000 groups, assuming (as in Proposition 1) that each round's winner is selected at random.[14]

Three findings emerge.

Inequality Finding 1: *There is substantial inequality in the patronage treatment and considerably less in the no-patronage treatment.*

Panels (a) and (b) of Figure 1 look at chicken inequality. They show that, in the patronage treatment, the top-ranked player wins 49.5 percent of the chickens on average, compared to just 20.2 percent in the no-patronage treatment. On the flip side, the bottom-ranked player wins only 2.1 percent of the chickens on average in the patronage treatment, compared to 12.8 percent in the no-patronage treatment. Panels (c) and (d) show similar results for egg inequality.[15] From these findings, we conclude that patronage contributes substantially to inequality.

Inequality Finding 2: *Inequality in both treatments is below the theoretical benchmark.*

As illustrated in Figure 1, inequality in both treatments is below the amount predicted by the benchmark model. The difference is particularly large in the patronage treatment, where the benchmark model predicts that one player will win all of the chickens and eggs.[16]

Inequality Finding 3: *In the patronage treatment, egg inequality is less pronounced than chicken inequality; nonetheless, egg wealth and chicken wealth are highly correlated.*

In the patronage treatment's benchmark, egg inequality and chicken inequality are equally extreme: a single player wins all the chickens and all the eggs. By contrast, egg inequality is less pronounced than chicken inequality in our experiment because chicken winners can (and

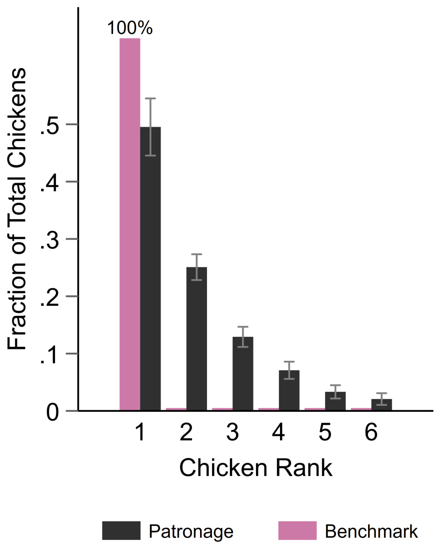
[14]In the no-patronage benchmark, each player receives the same amount in expectation; however, the random allocation of chickens tends to produce some inequality.

[15]Comparing panels (a) and (b), the performance of top-ranked players is significantly different ($p < 0.001$) and the performance of bottom-ranked players is significantly different ($p < 0.001$). The same is true comparing panels (c) and (d): $p < 0.001$ for both top- and bottom-ranked players.

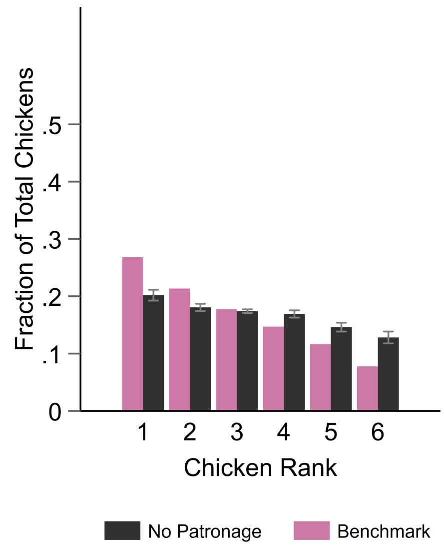
[16]In each panel, the performance of the top-ranked player is significantly different from benchmark and the performance of the bottom-ranked player is significantly different from benchmark ($p < 0.001$ in all cases).

Figure 1

Chicken Inequality

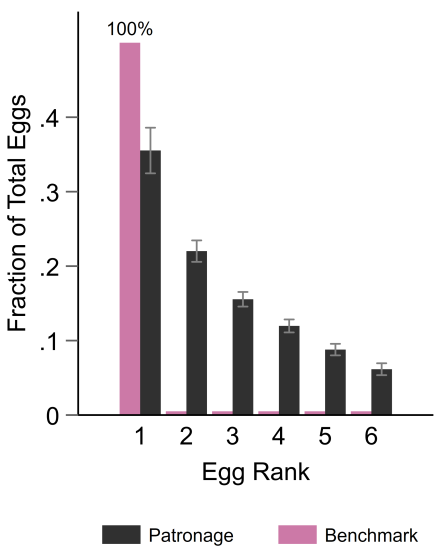


(a) Patronage Treatment

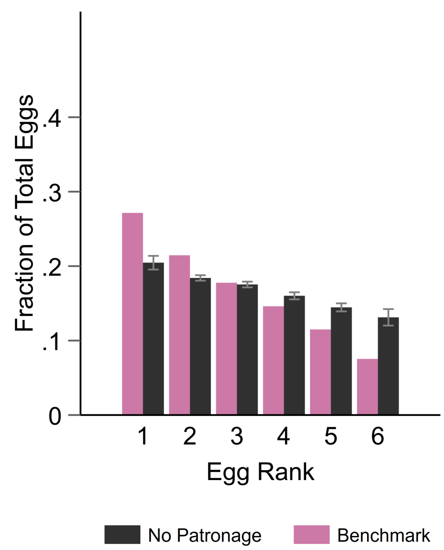


(b) No-Patronage Treatment

Egg Inequality



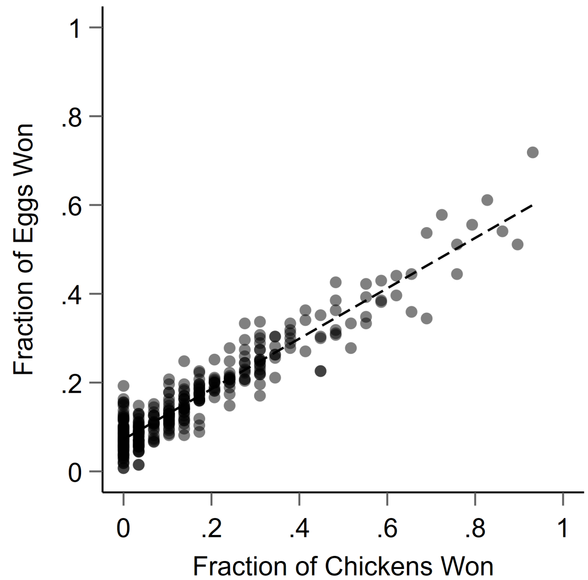
(c) Patronage Treatment



(d) No-Patronage Treatment

These figures are constructed by averaging, across groups, the fraction of chickens (eggs) won by the player of rank n at the end of the game. Error bars indicate 95% confidence intervals, with errors clustered at the group level. When multiple subjects in a group are tied, they are allocated to consecutive ranks.

Figure 2: Relationship between Eggs Won and Chickens Won



Each observation consists of the fractions of eggs and chickens won by a single subject at the end of the game.

do) give away eggs; see Figure 1.[17] For example, the top-ranked player in eggs wins on average 35.5 percent of the eggs, whereas the top-ranked player in chickens wins on average 49.5 percent of the chickens.[18] Nonetheless, players who win many chickens tend to accumulate many eggs. Figure 2 illustrates this relationship (the correlation between chicken and egg wealth is 95%).

In conclusion, we find that patronage contributes substantially to inequality—as the benchmark model predicts. In Section 5.3, we will provide evidence that the vicious circle underlies this finding. On the other hand, inequality is substantially below the levels predicted by the benchmark model. In Section 6, we will explore potential reasons why inequality is less extreme than predicted.

[17] In the no-patronage treatment, a player's chicken and egg earnings co-move mechanically because eggs cannot be given away.

[18] In the patronage treatment, the egg fraction won by the top-ranked player is significantly less than the chicken fraction won by the top-ranked player ($p < 0.001$). Conversely, the share of eggs won by the bottom-ranked player is significantly greater than the share of chickens won by the bottom-ranked player ($p < 0.001$).

5.3 Do we see vicious circles?

The high inequality in the patronage treatment and the low inequality in the no-patronage treatment is consistent with our hypothesis that a vicious circle arises only when patronage is present. To formally examine whether the patronage game gives rise to vicious circles—and the no-patronage game does not—we test whether winning a chicken in one round increases a subject's likelihood of winning chickens in future rounds. In particular, we estimate the following regression model:

$$WinRate_{ij(t+1,29)} = \beta_1 \mathbb{I}(Won_{ijt}) + \beta_2 \rho_i + \beta_3 X_i + \beta_4 \mu_{jt} + \epsilon_{ijt}$$

where $WinRate_{ij(t+1,29)}$ denotes the win rate of subject i in group j over rounds $t+1$ to 29, $\mathbb{I}(Won_{it})$ is a dummy variable for whether subject i won in round t, ρ_i are pseudonym fixed effects (i.e. they control for the pseudonym assigned to subject i), X_i are demographic controls, and μ_{jt} are Group-Round fixed effects.[19]

Notice that it is insufficient to look at the correlation between electoral success today and in the future, since such a correlation might be driven by subjects' unobservable characteristics. To formally test for vicious circles, we exploit two sources of randomness in election outcomes.

Our first test exploits the randomness in how the election winner is selected. We focus on "tied" elections where a candidate who lost received the same number of votes as the candidate who won. We compare the subsequent performance of the winner against these (equally popular) losers. Column 1 of Table 3 shows that, in the patronage treatment, tie winners are estimated to have a 9.5 percentage point greater likelihood of winning future elections than tie losers; this estimate is significant at the one-percent level. Note that this is the estimated impact averaged over *all* future elections—not just the subsequent election. This test thus provides strong evidence of a vicious circle in the patronage treatment.

Column 2 performs an analogous exercise for the no-patronage treatment. In this case, tie winners are estimated to have a 7.2 percentage point *lower* likelihood of winning future

[19] Any variables which do not vary within an election round are automatically excluded because of the group-round fixed effects.

Table 3: Testing for Vicious Circles

Dep Var: Future Win Rate	Tied Elections		First Elections	
	Patronage	No-Patronage	Patronage	No-Patronage
	(1)	(2)	(3)	(4)
Won	0.095***	-0.072***	0.154***	-0.006
	(0.022)	(0.016)	(0.042)	(0.009)
Constant	0.212***	0.206***	0.136***	0.166***
	(0.010)	(0.007)	(0.010)	(0.002)
Group–Round Fixed Effects	✓	✓	✓	✓
Pseudonym Fixed Effects	✓	✓	✓	✓
Year, Nationality, Course, Gender Fixed Effects	✓	✓	✓	✓
Observations	617	315	225	92

* 0.10 ** 0.05 *** 0.01. OLS regressions consisting of individual-round level observations. Standard errors (clustered at the group level) are in parentheses. Seven participants who did not disclose their gender are treated as a separate gender category in the fixed effects. Columns 1 and 2 consists of individual-round observations from the first 28 rounds where a candidate tied for the most votes. Some subjects appear several times because they are involved in multiple ties. In the patronage (no-patronage) treatment, there are 250 (130) two-candidate ties and 39 (19) three-candidate ties; 0 (2) singletons were dropped, yielding a total of 617 (315) observations. Columns 3 and 4 consist of observations of individuals who ran for election in round 1. In the patronage (no-patronage) treatment, there were 231 (95) such individuals; 6 (3) singletons were dropped, yielding a total of 225 (92) observations. In all columns, fixed effects are normalized to have zero mean. In a version of these regressions which pools the patronage and no-patronage treatments, the difference in the Won coefficient between the treatments is significant ($p < 0.001$ and $p = 0.001$ for tied elections and first elections respectively); see Table A.5.

elections than tie losers; this estimate is also significant at the one-percent level. Thus, it does not appear that there is a vicious circle in the no-patronage treatment; in fact, winning an election seems to *hurt*—rather than help—in subsequent rounds.

Our second test, which serves as a robustness check, exploits randomness arising out of the first election. In the first election, it is essentially random which subject wins among those who run given that all subjects look identical (there is no history of play and no subject owns chickens). Thus, we can test for a vicious circle by comparing the performance of first-round winners and first-round losers in future rounds. A potential concern is that certain pseudonyms might be systematically favored over others (e.g. voters might systematically favor "Mushroom" over "Spinach"). This might lead the first-round winner to perform well in subsequent rounds for reasons other than a vicious circle. However, we deal with this issue by including pseudonym fixed effects.

Column 3 of Table 3 shows that, in the patronage treatment, first-round winners are estimated to have a 15.4 percentage point greater likelihood of winning future elections than first-round losers; this estimate is significant at the one-percent level. This estimate is broadly in line with the first and lends further credence to the hypothesis that there is a vicious circle in the patronage treatment. Column 4 performs an analogous exercise for the no-patronage treatment. In this case, first-round winners have a 0.6 percentage point lower likelihood of winning future elections than first-round losers, although this effect is not statistically significant. Again, the estimate is broadly in line with the first and supports the conclusion that there is no vicious circle in the no-patronage treatment.

6 Checks on Inequality

The benchmark model predicts that the vicious circle will generate extreme inequality in the patronage treatment, with one player monopolizing all of the chickens and eggs. While we see considerable inequality in the patronage treatment, it is not as extreme as the benchmark model predicts. Even in the no-patronage treatment, inequality is less extreme than predicted. This begs the question: what are the forces that check inequality in the game?

To investigate this question, we focus on the patronage treatment. First, we examine whether dominant players—whom we call "lords"—emerge and we give some descriptive statistics about such players. We then use these descriptive statistics to form hypotheses about the forces keeping inequality in check. We suggest two potential mechanisms that might be playing a role. We then run some additional tests to examine the role these mechanisms play.

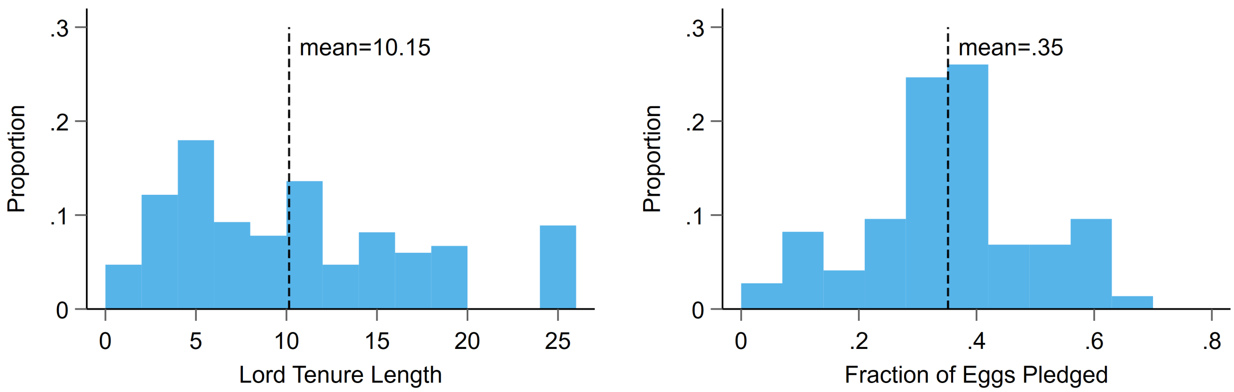
6.1 Lords

The benchmark model predicts that, in each round of the patronage game except the first, there will be a dominant player who owns all of the living chickens. Moreover, the model predicts that the dominant player will retain their dominant position throughout the game, run unopposed in every round, and give away no eggs. To understand the deviations from benchmark better, let us examine whether such players emerge and, if so, whether they retain their dominance throughout the game.

Recall that the number of living chickens grows in the first five rounds of the game; but

Figure 3

(a) Distribution of Lords' Tenures (b) Distribution of Lords' Pledges



Note: In panel (a), a tenure is defined as a continuous spell as a lord. Some subjects have multiple spells as a lord and appear more than once. Following the methodology of Clark and Summers (1979), the distribution is weighted by tenure length. In panel (b), the observations are the average fraction pledged by a subject over the rounds spent as a lord. Note that subjects are able to pledge in rounds where they run unopposed.

from round six onward, there are exactly five chickens since each birth is offset by a death. In analyzing our experimental findings, we will focus on rounds 6-30 and we will define a "lord" as follows.

Definition 1. *In round $r \geq 6$, we will say that subject i is a "lord" if they own at least four of the five chickens.*

Four main findings emerge concerning lords in the patronage treatment.

Lords Finding 1: *Lords arise often but they are less prevalent than in the benchmark model.*

Lords arise often in the patronage treatment: 87 percent of groups have a lord in at least one round, and across all groups, 40 percent of rounds have a lord. Lords do not arise in every round, however, so they are less prevalent than the benchmark model would predict.[20]

[20]In the no-patronage treatment, lords do not arise in any group in any round. The proportion of rounds with a lord is significantly different across treatments ($p < 0.001$), as is the proportion of groups with a lord in any round ($p < 0.001$).

Lords Finding 2: *Lords' tenures are shorter than in the benchmark model.*

The model predicts that there will be a lord in round 6 who retains power until the end of the game (a tenure of 25 rounds). Panel (a) of Figure 2 shows the distribution of lord tenures in the experiment. There are some 25-round tenures (4.5 percent). However, the average tenure is only 10.1 rounds. 24.9 percent of tenures are 4 rounds or less. Furthermore, power often changes hands. The first lord to emerge is toppled and replaced by another lord in 52.1 percent of groups where at least one lord emerges.

Lords Finding 3: *There are more opposing candidates than in the benchmark model.*

The benchmark model predicts that lords will run unopposed. In fact, we see a lot of opposition. When lords run, they are opposed 87.7 percent of the time. On average, there are 1.8 opposing candidates. This finding is in line with Table 2, which shows more generally that, in the patronage treatment, subjects run more frequently than the benchmark model would predict.

Lords Finding 4: *Lords pledge more eggs than in the benchmark model.*

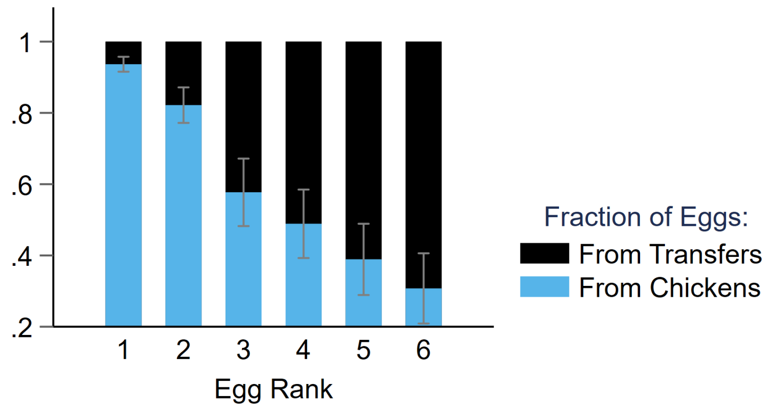
In the benchmark model, lords do not pledge any eggs to voters. Panel (b) of Figure 2 shows the distribution of lords' pledges in the experiment. In fact, we find that lords pledge a substantial amount. On average, they pledge 35 percent of their eggs. If we restrict attention to elections where lords run unopposed, we find that they still pledge 23.4 percent on average.[21] This finding is consistent with Table 2 as well, which shows more generally that subjects pledge more than the benchmark model would predict.

Recall that egg inequality in the patronage treatment is less pronounced than chicken inequality (Inequality Finding 3). The large pledges that lords make to voters help explain this finding. Egg inequality is less pronounced than chicken inequality because the chicken-rich transfer some of their eggs to the chicken-poor. Figure 3 shows that, within groups, egg-rich

[21] Relatedly, subjects often pledge more than is necessary to win. In elections where one candidate has more chickens than any other candidate, 51% percent of the time, that candidate pledges more than the amount needed to guarantee that their pledge is strictly largest.

subjects obtain most of their eggs from their own chickens whereas egg-poor subjects obtain most of their eggs from transfers.[22]

Figure 4: Sources of Eggs, by Rank within Group



This figure is constructed by averaging, across groups, the fraction of eggs won by the player of rank n at the end of the game. Error bars indicate 95% confidence intervals, with errors clustered at the group level. If multiple subjects in a group are tied, these subjects are allocated to consecutive ranks.

6.2 Potential Explanations

These findings regarding lords suggest two potential reasons why inequality is less extreme than the benchmark model would predict.

Generosity of Lords. One possibility is that lords are generous. Perhaps they voluntarily end their tenures, choosing not to run in order to give other subjects a chance to win chickens. Likewise, lords may pledge eggs out of generosity.

Opposition to Lords. Another possibility is that lords face opposition. Perhaps lord tenures end because other subjects are willing to run and vote against them. As noted in Section 3, opposition to lords could arise either because subjects are inequity averse (e.g. Fehr and

[22] Transfers are quite substantial. On average, they make up 41.3 percent of total egg earnings. A one unit decrease in rank is associated with a drop in the proportion earned from own chickens of 12.9 percentage points ($p < 0.001$).

Schmidt (1999)) or because they manage to coordinate. Under this story, lords might pledge eggs not out of a sense of generosity but out of a desire to cling to power.[23,24]

Evidence Concerning Mechanisms

It is difficult to fully tease apart the roles that generosity and opposition play in explaining the differences from benchmark. Nonetheless, we present some suggestive evidence.

Table 4: How Lord Tenures End

The lord fails to run	15.7%
The lord runs and makes the strictly largest pledge	69.9%
The lord runs and ties for the largest pledge	8.4%
The lord runs and is strictly out-pledged	4.8%
Every group member runs (randomly-selected election winner)	1.2%

Observations are at the round level and consist of rounds where a lord's tenure ends.

Table 4 examines how lord tenures end. Under the generosity story, we would expect a large share of tenures to end with the lord choosing not to run. In fact, only 15.7 percent of tenures end with a lord choosing not to run. Under the opposition story, by contrast, tenures end because other subjects run and vote against the lord. Consistent with this story, we find that in the majority of cases (69.9 percent), tenures end with the lord running and pledging the strictly largest amount.[25]

Under the generosity story, subjects pledge eggs non-instrumentally—simply because they see it as fair. By contrast, under the opposition story, subjects pledge eggs to win support.

[23] While our results below suggest that opposition to lords plays a big role in dampening inequality, they do not disentangle the respective roles of inequity aversion and coordination.

[24] Note that the opposition story does not guarantee that subjects will run or vote against a lord—the lord might preempt such opposition by pledging a large number of eggs. However, if subjects do run or vote against a lord, this would be evidence of opposition.

[25] These non-instrumental motivations—generosity and opposition—may help to explain subjects running decisions more generally and the deviations we observe from the benchmark model. In the patronage treatment, a large fraction of subjects (30%) choose not to run in the first round, even though the benchmark model predicts that all of them should. Likewise, in no-patronage treatment, in each round, a large fraction of players choose not to run (43% on average), even though the benchmark model predicts that all of them should. This is true even in the final election round, where 33% of subjects choose not to run even though they have considerable experience with the game and voting produces zero income.

At the end of the experiment, we surveyed subjects regarding their motivations for pledging eggs (see Table A.1 in the Appendix). Subjects agreed to a large extent with the statement "I pledged eggs because I wanted to win elections." The average level of agreement with this statement was 7.4 on a 10-point Likert scale. Subjects agreed to a lesser extent with the statement "I pledged eggs because I was concerned with fairness." The average level of agreement with this statement was only 4.4.[26]

Under the opposition story, voters favor underdog candidates (i.e. candidates who are chicken-poor). To examine this, we estimate a voter–candidate-election–level conditional logit:

$$P(Vote_{ijt} = 1 | X_t) = \frac{exp(\beta X_{jt})}{\sum_{k \in C_t} exp(\beta X_{kt})},\ j \in C_t,\ i \in V_t$$

where $Vote_{ijt}$ equals 1 if voter i in election t selects candidate j, and 0 otherwise; V_t and C_t are respectively the sets of voters and candidates in election t; X_{jt} is the vector of candidate j's observed traits; and $X_t = \{X_{kt}\}_{k \in C_t}$ consists of the traits of all candidates in C_t.[27]

Table 5: Determinants of Candidate Vote Share

Dep Var: Voted for Candidate	(1)	(2)
Candidate's Number of Chickens	0.425***	-0.096***
	(0.024)	(0.036)
Candidate's Pledge		0.507***
		(0.043)
Candidate Made Largest Pledge		0.482***
		(0.094)
Observations	9464	9464

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Conditional logits, grouped at the voter-round level, with candidate-voter-round-level observations from Rounds 6 - 29. Standard errors (clustered at the group level) are in parentheses.

Table 5 shows the results of this estimation. Column (1) shows that chicken-rich candidates are more likely to receive votes than chicken-poor candidates if we do not include any controls.

[26] The difference in agreement of 3.0 points is significant in a paired t-test ($p < 0.001$). We also find a strong negative correlation between the number of chickens a candidate owns and the proportion of eggs pledged. Under the generosity story, one might expect a positive correlation.

[27] Because the conditional logit conditions on the choice set, factors that do not vary across the alternatives facing a voter (e.g., the voter's own attributes) are not separately identified.

However, Column (2) shows that chicken-rich candidates are less likely to receive votes when we control for the size of candidates' pledges. This result is suggestive that voters indeed favor underdogs. Table A.3 in the Appendix conducts the same exercise for the no-patronage treatment. In the no-patronage treatment, there is no pledging of eggs; we simply find that chicken-rich candidates are less likely to receive votes—suggestive of an underdog preference there as well.

In sum, while both mechanisms are likely at work, it appears that opposition to lords is particularly important for understanding the differences from benchmark.

7 Gender Differences

The vicious circle has the potential to amplify the effect of small individual differences in style of play. By "style of play," we mean characteristics of a player's strategy—such as their propensity to run for election. For instance, imagine that player 1's style of play gives them a slight edge over player 2. In round 1, this advantage makes player 1 marginally more likely to win. In round 2, player 1's advantage grows, as they now benefit not only from their play style but also from a power advantage (i.e. they have more chickens in expectation). With each subsequent round, the vicious circle compounds player 1's advantage, continually increasing their likelihood of winning compared to player 2.

To test this idea, we can compare outcomes of women and men. The experimental economic literature suggests that there are gender differences that may be relevant in our context—such as differences in competitiveness and risk aversion, as well as gender-specific norms related to taking on leadership roles.[28] Gender comparisons serve as a clean test of the vicious cir-

[28]See Niederle and Vesterlund, 2011 for a review of the literature on competitiveness and risk aversion. For instance, Niederle and Vesterlund (2007) show that women tend to be less competitive than men; a variety of studies suggest that women are less pushy about seeking out job promotions (see Babcock and Laschever, 2003, Small et al., 2007, Dittrich et al., 2014, Leibbrandt and List, 2014, Card et al., 2015, and Exley et al., 2020); and other studies have documented differences in risk aversion (e.g. Croson and Gneezy (2009)). For work on gender norms related to leadership, see Beaman et al. (2012), Kanthak and Woon (2015), and Erkal et al. (2022)). In laboratory experiments, Erkal et al. (2022) find that women are more likely to enter leadership contests under an opt-out system than an opt-in system, while Kanthak and Woon (2015) find that women are more likely to run when the winner is selected at random rather than elected by vote. Beaman et al. (2012) find that the presence of female leaders raises girls' aspirations and educational attainment.

cle's amplification effect since subjects do not know each others' genders; consequently, any differences in outcomes must be due to differences in style-of-play.

7.1 Gender Differences in Outcomes

Let us first look at gender differences in outcomes for each treatment (see Table 6). In the patronage treatment, there are large differences in outcomes. Women obtain only 84.7 percent as many eggs as men and win elections only 70.4 percent as often. The differences are particularly striking in the tail of the distribution. Women are only 56.3 percent as likely as men to win the most eggs; they are only 45.6 percent as likely to ever become lords; and they are lords only 31.9 percent as often. All differences are significant at the one-percent level. In the no-patronage treatment, by contrast, there are no significant differences in outcomes between the genders.

Table 6: Gender Differences in Outcomes

	Patronage Treatment			No-Patronage Treatment		
	Female mean (sd)	Male mean (sd)	Difference (p-value)	Female mean (sd)	Male mean (sd)	Difference (p-value)
Total Eggs	41.467	48.971	-7.505***	44.333	45.549	-1.216
	(24.554)	(34.858)	(0.007)	(8.358)	(7.710)	(0.496)
Win Rate	0.138	0.196	-0.058***	0.162	0.170	-0.008
	(0.143)	(0.220)	(0.002)	(0.033)	(0.028)	(0.246)
Group member with the most eggs	0.120	0.213	-0.093**	0.167	0.169	-0.002
	(0.326)	(0.410)	(0.020)	(0.376)	(0.377)	(0.974)
Was ever a Lord	0.147	0.322	-0.175***	0.000	0.000	0.000
	(0.355)	(0.469)	(0.000)	(0.000)	(0.000)	(.)
Rounds as a Lord	0.793	2.483	-1.689***	0.000	0.000	0.000
	(2.400)	(5.085)	(0.000)	(0.000)	(0.000)	(.)
Observations	150	174		54	71	

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Individual-level observations. Standard errors (clustered at the group level) are in parentheses. In a related regression that pools across treatments (see Table A.6), we find that the difference-in-differences is significant for most variables: Win Rate, Was ever a Lord, and Rounds as a Lord are significant with $p = 0.037$, $p < 0.001$, and $p < 0.001$ respectively.

While only suggestive, these findings are consistent with the idea that the vicious circle—

which is present only in the patronage treatment—amplifies gender differences.

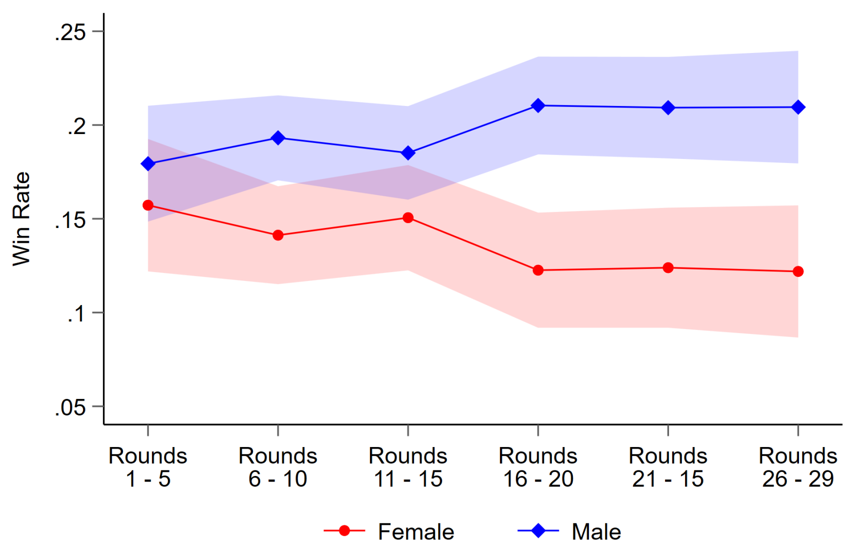
7.2 Win Rates by Round

To look at whether the vicious circle actually plays a role, let us look at how win rates for men and women compare round-by-round. We estimate a linear probability model of the following form:

$$P(Win_{ijt} = 1|Z, X) = \beta_0 + \beta_1 Z_t + \beta_2 \mathbb{I}(Female_i) Z_t + \beta_3 X_i + X_j, \quad (1)$$

where Win_{it} is a binary variable that equals one when subject i in group j wins in round t, Z_t are dummies for intervals of rounds (rounds 1-5, 6-10,..., 26-29), $\mathbb{I}(Female_i)$ is a dummy for whether subject i is female, X_i are demographic controls and X_j are group fixed effects.[29] These estimates are depicted in Figure 5.

Figure 5: Predicted Win Rates for each Gender over Blocks of 5 rounds



Win rates for each gender (for a given interval of rounds) are estimated using Equation (1). The estimates of male and female win rates correspond to β_1 and $\beta_1 + \beta_2$ respectively. Error bars indicate 95% confidence intervals, with errors clustered at the group level. For detailed estimation results, see Table A.4.

[29]Seven subjects chose not to disclose their gender (six subjects in the patronage treatment and one in the no patronage treatment). Our results on gender differences are based on the remaining 449 subjects who disclosed their gender.

Consistent with the idea that the vicious circle in the patronage treatment amplifies gender differences, we find that differences in win rates grow over the course of the game. In the first five rounds, women have only slightly lower win rates than men: 2.2 percentage points (which is statistically insignificant). By contrast, women have considerably lower win rates in the last four rounds: 8.8 percentage points (which is significant at the five-percent level). Put another way, we find that the win-rate gap widens at a rate of 0.22 percentage points per round.[30]

In the no-patronage treatment, where there is no vicious circle, we find that gender differences do not get worse over the course of the game. Moreover, gender differences are insignificant throughout.

7.3 Style-of-Play Differences

The differences in outcomes we observe must be driven by differences in style of play—rather than gender discrimination—since players do no know each other's genders.[31] It is natural to ask what these style of play differences look like. Tables 7 and 8 present our findings regarding style-of-play differences. It should be noted that we only observe players' actions—not strategies—so our findings are only suggestive of strategy differences.

Table 7 looks at run rates. In the patronage treatment, women are 16.3 percentage points less likely to run in the first round (a difference which is significant at the five-percent level). Across all rounds, women are 6.2 percentage points less likely to run (also significant at the five-percent level). While these run-rate differences are far from zero, they are not large if we compare them against Niederle and Vesterlund (2007), where women are half as likely as men to enter a tournament. In the no-patronage treatment, the difference in run rates is insignificant both in the first round and overall—however, we do not find that gender differences in run

[30]To see that the win-rate gap increases at this rate, observe that: $0.22 = \frac{8.8-2.2}{\frac{29+26}{2}-\frac{5+1}{2}}$.

[31]We cannot fully rule out an indirect form of discrimination, whereby a player P's style of play is used by other players to infer P's gender; however we suspect that such indirect discrimination plays a minimal role. First, it is unlikely that players have a good sense of how style of play differs by gender, which makes such inferences difficult. Second, even if they did have a sense, it would be hard to use this information to infer a given player's gender. For example, within-gender standard deviation in first-round run rates (0.484 for women and 0.429 for men) is extremely large compared the the cross-gender standard deviation (0.089)—making it extremely hard to use first-round run rates as a basis to discriminate.

rates across treatments are significantly different when we conduct a difference-in-differences test (see Table A.7).[32]

Table 7: Gender Differences in Style-of-Play: Running

Dep Var:	Patronage Treatment Run Rates in: First round	Patronage Treatment Run Rates in: Overall	No Patronage Treatment Run Rates in: First round	No Patronage Treatment Run Rates in: Overall
Female	-0.163***	-0.062**	0.023	-0.014
	(0.061)	(0.028)	(0.092)	(0.044)
Constant	0.780***	0.551***	0.752***	0.576***
	(0.028)	(0.013)	(0.040)	(0.019)
Group Fixed Effects	✓	✓	✓	✓
Year, Nationality, Course Fixed Effects	✓	✓	✓	✓
Observations	318	9396	122	3625

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. OLS Regressions with individual-round level observations. Standard errors (clustered at the group level) in parentheses. Columns 1 and 2 include observations from the first round only, while Columns 3 and 4 include observations from Rounds 1 to 29. Six subjects in the patronage treatment and one subject in the no-patronage treatment did not disclose their gender. Columns 1, 2, 3 and 4 exclude a total of 12, 174, 4, and 29 observations respectively because of non-disclosure of gender or singletons. In all columns, fixed effects are normalized to have zero mean. In a related regression that pools across treatments (see Table A.7), we find a marginally significant treatment difference in the Female coefficient for the first round ($p = 0.098$) but no significant treatment difference across all rounds ($p = 0.299$).

Table 8 looks at players' pledges in the patronage treatment. We find that women pledge slightly less than men. For instance, women with three chickens pledge 10.1 percentage points less and women with four chickens pledge 7.9 percentage points less (these differences are significant at the one-percent level and five-percent level respectively).

Taken together, the evidence points to a modest but persistent gender gap in power-seeking. Capturing chickens in our setting hinges on two moves—entering the race and staking pledges large enough to win votes—and men exhibit a slight advantage on each. The vicious circle compounds these twin edges, leaving women further and further behind in the scramble for office.

[32] If run-rate differences are present in the patronage treatment only, this might be explained by Kanthak and Woon (2015), who find that women are more likely to run when winners are selected randomly rather than by vote.

Table 8: Gender Differences in Style-of-Play: Pledges

Dep Var:	Proportion Pledged
2 Chickens	-0.067**
	(0.031)
3 Chickens	-0.249***
	(0.033)
4 Chickens	-0.477***
	(0.031)
5 Chickens	-0.612***
	(0.032)
1 Chicken × Female	-0.005
	(0.032)
2 Chickens × Female	-0.051
	(0.033)
3 Chickens × Female	-0.101***
	(0.034)
4 Chickens × Female	-0.079**
	(0.038)
5 Chickens × Female	-0.005
	(0.038)
Constant	0.898***
	(0.022)
Group Fixed Effects	✓
Year, Nationality, Course Fixed Effects	✓
Observations	2299

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. OLS regressions, consisting of individual-round level observations from Rounds 1-29 of the patronage treatment, in which the individual is a candidate with at least one chicken. Standard errors (clustered at the group level) are in parentheses. Six subjects (corresponding to 8 observations) did not disclose their gender and are excluded. In all columns, fixed effects are normalized to have zero mean.

8 Conclusion

In this paper, we construct a new game—the "rule-the-roost game"—to study the forces shaping the distribution of power and wealth. We find that, in the patronage game, there is a vicious circle and substantial inequality. At the same time, the powerless take actions to oppose the powerful. This meaningfully reduces the prevalence of "lords" and also induces the powerful to transfer some of their eggs.

We also test the hypothesis that the vicious circle progressively amplifies the effect of individual differences in characteristics. To do so, we focus on inequality between women and men. In line with this hypothesis, we find that in the patronage treatment, women perform worse over time compared to men, with the win-rate gap widening at a rate of 0.22 percentage points per round. In the no-patronage treatment, by contrast, the win rate of women is comparable to that of men throughout the game.

The forces that arise in our game are arguably relevant in a variety of contexts: electoral politics (of course), but also families and firms. Our game hints at the role that vicious circles play in generating pecking orders in these settings—in addition to differences in physical and human capital.

In future work, it would be interesting to explore the forces that affect opposition to lords, which in turn may affect the degree of inequality and who comes out on top. For instance, might subjects' backgrounds (e.g. gender or ethnic), if known, affect the amount of opposition they face? Or, might we see differences in opposition to lords across cultural contexts?

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A Tables

Table A.1: Survey Results

I. Patronage Treatment

	Mean Response (s.d.)
Pledging Strategies Ranked by Importance	
(1) I pledged eggs because I wanted to win elections.	7.409 (2.989)
(2) I pledged eggs because I was concerned with fairness.	4.424 (3.440)
Voting Strategies Ranked by Importance	
(1) I voted for the candidate who pledged the most eggs.	6.432 (2.873)
(2) I voted against the candidate with the most chickens because I thought more competition would increase pledges to voters.	5.652 (3.327)
(3) I voted against the candidate with the most chickens because it was the fair thing to do.	4.924 (3.211)
(4) I voted for candidates who pledged a large share of their eggs, even if they did not pledge the most.	4.811 (3.252)
(5) I voted for candidates who voted for me in the past.	4.436 (3.600)
(6) I was easily bored so I voted more or less randomly.	2.443 (2.976)
Running Strategies Ranked by Importance	
(1) I chose whether to be a candidate or voter depending on what I thought would get me the most eggs.	6.833 (2.791)
(2) I sometimes chose to vote because I wanted to support/oppose a particular candidate, even when I thought it would not get me the most eggs.	5.523 (3.514)
(3) I sometimes chose to be a candidate because I wanted to oppose someone I wanted to see lose, even when I thought it would not get me the most eggs.	4.674 (3.519)
(4) I sometimes chose to vote because I felt it was unfair to be a candidate too often or win too many chickens.	4.580 (3.719)
(5) I was easily bored so I chose whether to be a voter or a candidate more or less randomly.	2.466 (2.965)
Luck?	
To what extent do you think winning chickens was a matter of luck?	6.614 (2.826)

Responses are on a Likert scale from 0 to 10.

II. No-Patronage Treatment

	Mean Response (s.d.)
Voting Strategies Ranked by Importance	
(1) I voted against the candidate with the most chickens because it was the fair thing to do.	6.976 (3.525)
(2) I voted for candidates who voted for me in the past.	6.720 (3.340)
(3) I was easily bored so I voted more or less randomly.	1.632 (2.441)
Running Strategies Ranked by Importance	
(1) I sometimes chose to vote because I wanted to support/oppose a particular candidate.	6.432 (3.342)
(2) I chose whether to be a candidate or voter depending on what I thought would get me the most eggs.	6.256 (3.255)
(3) I sometimes chose to vote because I felt it was unfair to be a candidate too often or win too many chickens.	6.064 (3.512)
(4) I sometimes chose to be a candidate because I wanted to oppose someone I wanted to see lose	3.504 (3.585)
(5) I was easily bored so I chose whether to be a voter or a candidate more or less randomly.	1.336 (2.016)
Luck?	
To what extent do you think winning chickens was a matter of luck?	5.256 (2.932)

Responses are on a Likert scale from 0 to 10. One subject (out of 126) entered an incorrect ID number and was excluded.

Table A.2: Breakdown of Subject Demographics

	Patronage mean(s.d.)	No Patronage mean(s.d.)	Difference (p-value)
Gender			
Female	0.455	0.429	0.026
	(0.499)	(0.497)	(0.618)
Male	0.527	0.563	-0.036
	(0.500)	(0.498)	(0.489)
Other/Prefer not to say	0.018	0.008	0.010
	(0.134)	(0.089)	(0.345)
Major classification†			
Engineering and Computer Science	0.406	0.369	0.037
	(0.492)	(0.484)	(0.459)
Natural Sciences and Mathematics	0.161	0.162	-0.000
	(0.368)	(0.369)	(0.997)
Economics	0.078	0.115	-0.038
	(0.268)	(0.321)	(0.236)
Social Sciences (excluding Economics)	0.055	0.038	0.016
	(0.228)	(0.193)	(0.436)
Business and Accounting	0.182	0.262	-0.080*
	(0.386)	(0.441)	(0.070)
Arts and Humanities	0.086	0.054	0.033
	(0.281)	(0.227)	(0.193)
Other Technical and Professional Disciplines	0.032	0.000	0.032***
	(0.175)	(0.000)	(0.001)
Nationality			
Chinese	0.030	0.024	0.006
	(0.172)	(0.153)	(0.696)
Filipino	0.003	0.000	0.003
	(0.055)	(0.000)	(0.318)
Indian	0.033	0.040	-0.006
	(0.180)	(0.196)	(0.752)
Indonesian	0.058	0.079	-0.022
	(0.233)	(0.271)	(0.427)
Korean	0.000	0.008	-0.008
	(0.000)	(0.089)	(0.319)
Malaysian	0.121	0.111	0.010
	(0.327)	(0.316)	(0.762)
Myanmar	0.003	0.000	0.003
	(0.055)	(0.000)	(0.318)
Singapore PR	0.009	0.000	0.009*
	(0.095)	(0.000)	(0.083)
Singaporean	0.739	0.738	0.001
	(0.440)	(0.441)	(0.978)
Vietnamese	0.003	0.000	0.003
	(0.055)	(0.000)	(0.318)
Year of study	2.494	2.373	0.121
	(1.078)	(1.115)	(0.297)
Observations	330	126	456

* 0.05 ** 0.01 *** 0.001. †17 subjects in the patronage treatment and 4 subjects in the no-patronage treatment, whose double majors span two categories, are counted twice. Means for Gender, Major and Nationality reflect proportions in the population.

Table A.3: Determinants of Candidate Vote Share in the No-Patronage Treatment

Dep Var: Voted for Candidate	
Candidate's Number of Chickens	-1.598***
	(0.224)
Observations	3690

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Conditional logits (Rounds 6 - 29), grouped at the voter-election level, with candidate-voter-election-level observations. Standard errors (clustered at the group level) are in parentheses.

Table A.4: Evolution of Gender Differences in Winning

Dep Var: Win	Patronage	No Patronage
Rounds 6-10	0.014	0.014
	(0.014)	(0.013)
Rounds 11-15	0.006	-0.008
	(0.014)	(0.014)
Rounds 16-20	0.031*	0.003
	(0.018)	(0.015)
Rounds 21-25	0.030*	0.003
	(0.018)	(0.013)
Rounds 26-29	0.030	0.013
	(0.019)	(0.014)
Female × Rounds 1-5	-0.022	-0.003
	(0.034)	(0.027)
Female × Rounds 6-10	-0.052**	-0.032
	(0.025)	(0.020)
Female × Rounds 11-15	-0.035	0.016
	(0.027)	(0.016)
Female × Rounds 16-20	-0.088***	-0.010
	(0.029)	(0.024)
Female × Rounds 21-25	-0.085***	-0.010
	(0.030)	(0.014)
Female × Rounds 26-29	-0.088**	-0.035
	(0.033)	(0.028)
Constant	0.179***	0.168***
	(0.016)	(0.012)
Group Fixed Effects	✓	✓
Year, Nationality, Course Fixed Effects	✓	✓
Observations	9396	3625

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. OLS regressions consisting of individual-round level observations from Rounds 1-29. Standard errors (clustered at the group level) are in parentheses. We exclude six subjects (174 observations) in the patronage treatment and one subject (29 observations) in the no-patronage treatment who did not disclose their gender. In all columns, fixed effects are normalized to have zero mean.

Difference-in-Differences Tests

Table A.5: Testing for Vicious Circles (Diff-in-Diff)

Dep Var: Future Win Rate	Tied Elections	First Elections
	(1)	(2)
Won	0.106***	0.152***
	(0.022)	(0.041)
Won × No Patronage	-0.184***	-0.140***
	(0.031)	(0.042)
Constant	0.208***	0.144***
	(0.008)	(0.007)
Group–Round Fixed Effects	✓	✓
Pseudonym Fixed Effects	✓	✓
Year, Nationality, Course, Gender Fixed Effects	✓	✓
Observations	934	318

* 0.10 ** 0.05 *** 0.01. OLS regressions consisting of individual-round level observations. Standard errors (clustered at the group level) are in parentheses. Seven participants who did not disclose their gender are treated as a separate gender category in the fixed effects. Columns 1 and 2 consists of individual-round observations from the first 28 rounds where a candidate tied for the most votes. Some subjects appear several times because they are involved in multiple ties. In the patronage (no-patronage) treatment, there are 250 (130) two-candidate ties and 39 (19) three-candidate ties. This yields $(250+130)\times 2+(39+19)\times 3 = 934$ observations. Columns 2 consists of observations of individuals who ran for election in round 1. In the patronage (non-patronage) treatment, there were 231 (95) such individuals. 8 singletons were dropped, yielding 318 observations. In all columns, fixed effects are normalized to have zero mean.

Table A.6: Gender Differences in Outcomes (Diff-in-Diff)

	Total Eggs	Win Rate	Group member with most eggs	Was ever a lord	Rounds as a lord
Female	-7.808**	-0.060***	-0.115**	-0.198***	-1.732***
	(3.344)	(0.021)	(0.051)	(0.051)	(0.381)
Female × No Patronage	5.860	0.049**	0.108	0.199***	1.468***
	(4.129)	(0.023)	(0.094)	(0.052)	(0.363)
Constant	48.032***	0.188***	0.207***	0.239***	1.779***
	(1.217)	(0.008)	(0.021)	(0.018)	(0.141)
Group Fixed Effects	✓	✓	✓	✓	✓
Year, Nationality, Course Fixed Effects	✓	✓	✓	✓	✓
Observations	440	440	440	440	440

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. OLS regressions consisting of individual-level observations. Standard errors (clustered at the group level) are in parentheses. Six subjects in the patronage treatment and one subject in the no-patronage treatment did not disclose their gender. Columns 1 to 4 each drop 16 observations due to non-disclosure of gender or singletons. In all columns, fixed effects are normalized to have zero mean.

Table A.7: Gender Differences in Style-of-Play: Running (Diff-in-Diff)

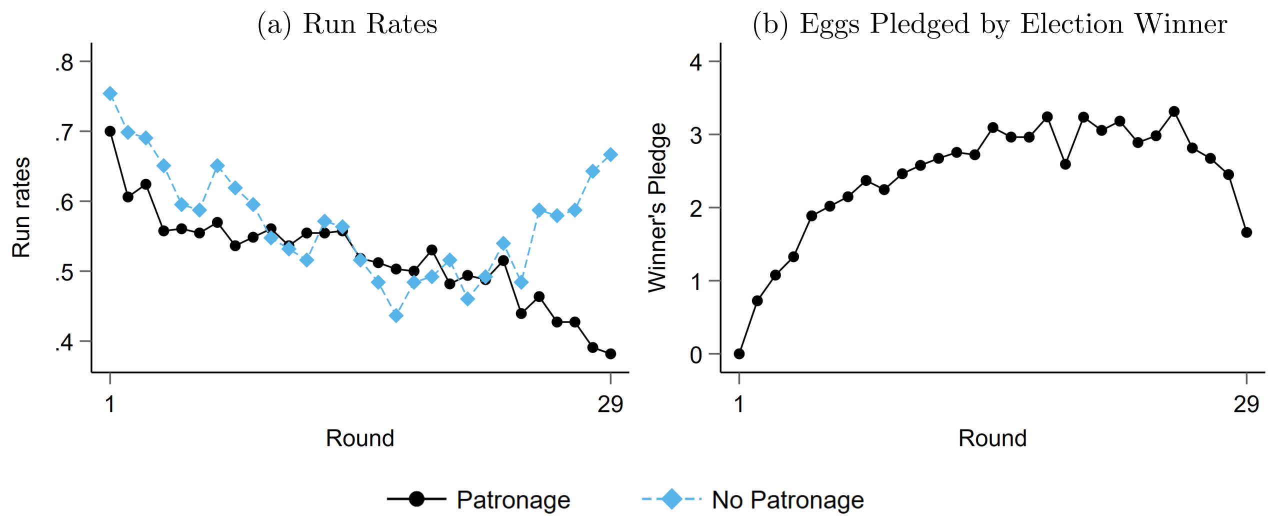
Dep Var:	Run Rates in:	
	First round	Overall
	(1)	(2)
Female	-0.151**	-0.064**
	(0.058)	(0.028)
Female × No Patronage	0.154*	0.046
	(0.092)	(0.044)
Constant	0.770***	0.559***
	(0.022)	(0.011)
Group Fixed Effects	✓	✓
Year, Nationality, Course Fixed Effects	✓	✓
Observations	440	13021

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. OLS regressions consisting of individual-round level observations. Standard errors (clustered at the group) level are in parentheses. Column 1 includes observations from the first round only while Columns 2 includes observations from Rounds 1 to 29. Six subjects in the patronage treatment and one subject in the no-patronage treatment did not disclose their gender. Column 1 (2) drops a total of 16 (203) observations because of non-disclosure of gender or singletons.

B Trends

Here, we examine trends in play over the course of the game. Panel (a) of Figure B.1 shows how run rates evolve. In the patronage treatment, run rates fall slowly over time. Our interpretation is that chicken-poor subjects learn that they are unlikely to win elections and they are better off voting and acquiring eggs through transfers.

Figure B.1 Run Rates and Pledges by Round



Run rates are calculated from individual-round level observed. Pledges are calculated from individual-round level observations where the individual was the winner of a valid election.

In the no-patronage treatment, run rates fall slowly until close to the end of the game, at which point they quickly rise. Our interpretation is that subjects develop a norm of taking turns at running. In line with this view, we find that there is a negative correlation between winning and running in the next round. At the end of the game, when the reneging temptation is large, this norm breaks down and subjects increase their run rates.

Panel (b) of Figure B.1 shows the number of eggs pledged by the election winner. In the first few rounds, when the number of living chickens is growing, the winning pledge grows. After that, it is relatively constant until the final few rounds of the game, at which point it drops. Our interpretation is that the chickens in the final rounds are less valuable, since they lay less than ten eggs; consequently, subjects pledge less.

C Theoretical Analysis

Definition of Index Invariance (Property II)

A history $h \in H$ is the sequence of realized events up to some node of the game tree; for example,

$$h_0 = \begin{cases} \text{all players choose to run} \\ \downarrow \\ (\dots) \\ \downarrow \\ i \text{ and } j \text{ choose to run, } k \text{ and } \ell \text{ choose to vote} \\ \downarrow \\ k \text{ votes for } j,\ \ell \text{ votes for } i \\ \downarrow \\ k \text{ is randomly chosen to be the deciding voter} \end{cases}$$

History h' is an extension of h (denoted $h' \sqsupset h$) if (i) h' is consistent with the events of h and (ii) h' ends at a later game node than h. Each strategy profile, by specifying the probabilities of action profiles being taken at every decision node, uniquely identifies the conditional probability $\Pr[h'|h]$ that history h' occurs given h, for all h and all $h' \sqsupset h$.

Notice that events contain references to player indices. Let π be a permutation of the set of players, and let $P_\pi(\cdot) : H \to H$ denote the transformation that acts on histories by permuting the indexes of players according to π. For instance, under the permutation

$$\pi(i) = j, \quad \pi(j) = k, \quad \pi(k) = \ell, \quad \pi(\ell) = i,$$

the history h_0 is transformed into

$$P_\pi(h_0) = \begin{cases} \text{all players choose to run} \\ \downarrow \\ (\dots) \\ \downarrow \\ j \text{ and } k \text{ choose to run, } \ell \text{ and } i \text{ choose to vote} \\ \downarrow \\ \ell \text{ votes for } k,\ i \text{ votes for } j \\ \downarrow \\ \ell \text{ is randomly chosen to be the deciding voter} \end{cases}$$

We say that a strategy profile is index invariant if $\Pr[h'|h] = \Pr[P_\pi(h')|P_\pi(h)]$ for all histories h and $h' \sqsupset h$, and all permutations π. In words, histories that are equivalent up to a re-labelling of the players are equally likely to occur. This notion of index invariance captures two notions of symmetry. First, each player treats other players identically regardless of their indexes. Second, players play identical strategies.

Proof of Proposition 1

Let us start with the patronage game. Consider the following sequence of statements indexed by the round number t.

> Statement $S(t)$: Suppose h is a history up to the start of round $t \geq 2$ in which a single player owns all of the living chickens in round t. In any equilibrium, on the continuation path of h, the same player wins all future rounds, as the sole candidate, and gives away no eggs.

We will show that $S(2)$ holds, from which our proposition follows. To do so, we will proceed by induction: we will show that for any round $2 \leq t < R-1$, if statement $S(t+1)$ holds, then the following four claims hold for round t—which will then imply that statement $S(t)$ holds as well. We then show that $S(R-1)$ holds, which completes the argument.

In the following discussion, suppose that $t < R-1$ and that $S(t+1)$ holds. Unless otherwise stated, the current round is t and the history prior to t is as described in the statement of $S(t)$.

Claim A: a chicken-less voter strictly prefers to vote for a candidate who makes the largest pledge. Let's calculate the continuation payoff for a chicken-less voter, starting with the current round t. (i) If the chicken-less voter is not the deciding voter, they receive zero eggs this round. Further, from round $t+1$ onward they receive some continuation payoff v which is independent of their voting choice in this round (by Property I, their non-deciding vote does not affect the distribution of continuation play). (ii) If they are the deciding voter, then they receive the eggs pledged by the election winner, denoted g, in the current round. What about their continuation payoff in subsequent rounds? By Properties I and II, they receive the same continuation payoff in equilibrium as all other chicken-less players, of which there are $N-1$. Given that there are no more than TE eggs laid per round in the remaining $R-t$ rounds, the continuation payoff in subsequent rounds is at most $TE(R-t)/(N-1)$, which is vanishingly small for large N (asymptotically, $o_{N\to\infty}(1)$).

Let the number of voters in this round be m, so that the chicken-less voter is the deciding voter with probability $1/m$. Averaging over cases (i) and (ii), the chicken-less voter's continuation payoff is $v\frac{m-1}{m} + (g + o_{N\to\infty}(1))/m$. For N sufficiently large (so that the $o(1)$ term is less than one), the chicken-less voter strictly prefers to vote for the candidate who pledges the most eggs g. Claim A thus holds.

Claim B: Suppose there is at least one voter and there are at least two candidates, one of which is the only player with chickens. Then the chicken-owning candidate will pledge one egg. Consider the pledging decision of the chicken-owning candidate. Suppose they pledge one or more eggs. No other candidate has any eggs to pledge. By Claim A, the chicken-owning candidate will win all votes, and thus will win the election. Given that $S(t+1)$ holds, they will also win all subsequent elections without pledging any eggs. It is thus strictly suboptimal for them to pledge more than one egg.

Suppose instead they pledge zero eggs. By our stated assumptions, all voters are chicken-less; by Property II, they pursue the same voting strategy. Let the probability under this strategy of voting for the chicken-owning candidate be p. Let us consider several potential values p could take.

Suppose $p = 1$, in which case the chicken-owning candidate always wins. Given that statement $S(t+1)$ holds, no voter will ever receive any chickens or eggs in subsequent rounds; thus each voter *weakly* prefers to vote for a candidate without chickens. Property III (even-handedness in voting) therefore requires that voters vote for chicken-less candidates with weakly greater probability than the chicken-owning candidate; but this contradicts the statement that $p = 1$.

Now suppose $0 \leq p < 1$. Either $p = 0$, or each voter must be indifferent between voting for the chicken-owning candidate and some other candidate. Given Property III, we must have $p \leq 1/2$, and thus the chicken-owning candidate wins with some probability less than 1/2. If the chicken-owning candidate pledges one egg and thus wins the round-t election, they receive all eggs laid in subsequent rounds; if they lose, they will lose out on at least E of these eggs – because then the round-t election winner can guarantee themselves at least E eggs by keeping all eggs laid by the round-t chicken in round $t+1$, and thus must receive at least E eggs in expectation. This leads to an expected loss of at least $E/2 > 1$ future eggs for the chicken-owning candidate if he pledges zero eggs instead of one. This loss outweighs the one round-t egg that the chicken-owning candidate gains if he pledges zero eggs instead of one. Thus the chicken-owning candidate will pledge one egg. (If $E = 2$, the chicken-owning candidate weakly prefers to pledge one egg and so will do so if candidates pledge when they are otherwise indifferent.)

In sum, there is no case where it is optimal for the chicken-owning candidate to pledge zero eggs; hence Claim B holds.

Claim C: In round t, the chicken-owning player always chooses to run. Consider the running decision of the chicken-owning player in round t. We claim that they are strictly better off running than voting. Let v be the probability that all other players run, and let w be the probability that no other players run. Observe that $v = p^{N-1}$ and $w = (1-p)^{N-1}$, where p is the probability that a given chicken-less player runs.

Suppose that the chicken-owning player chooses not to run. With probability w/N, the chicken-owning player wins because nobody else runs and the chicken-owning player is randomly selected as winner. Denote the chicken-owning player's continuation payoff under this outcome as y. With probability $1 - w/N$, some other player receives the chicken. Denote the chicken-owning player's continuation payoff under this outcome as x. Averaging over the two possible outcomes, the chicken-owning player's continuation payoff is $y - (1 - w/N)(y - x)$.

Note that $y \geq x + E$. If the chicken-owning player wins the chicken, then (given that $S(n+1)$ holds) they receive all eggs laid by chickens in the future. By losing the round-t chicken, the chicken-owning player loses at least E eggs in expectation to the round-t election winner. In what follows, we rely only on the weaker bound $y \geq x + 1$.

Suppose that the chicken-owning player chooses to run. With probability v, all other players run, and the chicken-owning player pledges no eggs; they are randomly selected to win the election (and receive y) with probability v/N and lose (and receive x) with probability $v(1 - 1/N)$. With probability w, no other players run, so the chicken-owning player wins and receives continuation payoff y. With probability $1 - v - w$, some players run and some players vote, so (by Claim B) the chicken-owning player pledges one egg, wins, and receives continuation payoff $y-1$. The chicken-owning player's continuation payoff from running is

$$\begin{aligned}(1-v-w)(y-1)+vy/N+vx(N-1)/N+wy\\ &= y-v(1-1/N)(y-x)-(1-v-w)\\ &\geq y-v(1-1/N)(y-x)-(1-v-w)(y-x)\\ &= y-(1-v/N-w)(y-x)\\ &> y-(1-w/N)(y-x),\end{aligned}$$

and thus is strictly larger than the continuation payoff from not running.

Claim D: In round t, each chicken-less player chooses to vote. Consider the running decision of a given chicken-less player (denoted CL) in round t. We seek to show that CL never runs. Suppose that CL runs with probability $0 < p \leq 1$. By Properties I and II, all other chicken-less players also run with probability p. By Claim C, the chicken-owning player will run. Thus, the probability v that all other players besides CL run is strictly positive: $v = p^{N-2} > 0$. We will compare CL's payoff from running versus voting.

Suppose CL runs. If all players run for office, so that there are no voters: with probability $1/N$, CL wins and their continuation payoff is bounded above by $TE(R-t)$ (there are at most TE eggs laid in each round, so $TE(R-t)$ is an upper bound for the total number of eggs remaining after round t). With complementary probability $1-1/N$, CL does not win, and (given that all chicken-less players receive the same continuation payoff) their payoff is bounded above by $TE(R-t)/N$. If not all players run, Claims A-C imply that CL never wins the election (the chicken-owning player wins) and so CL's continuation payoff is zero. Since all players run with probability v, CL's continuation payoff from running is bounded above by $v(TE(R-t)/N+(1-1/N)(TE(R-t)/N)) \leq 2vTE(R-t)/N$.

Suppose CL doesn't run. With probability v, all other players run for office. In this event, the chicken-owning player pledges one egg, and CL always votes for the chicken-owning player (Claim A). CL's continuation payoff is thus at least v, which exceeds $2vTE(R-t)/N$ for

$N > 2TE(R-t)$. That is, for large N, CL is strictly better off not running than running. This establishes claim D.

Notice that for any round $2 \leq t < R-1$, Claims A-D together with statement $S(t+1)$ jointly imply statement $S(t)$. It is also easy to establish that statement $S(R-1)$ holds. Consequently, $S(2)$ holds by induction: the player who wins the first-round chicken wins every subsequent election without facing any candidates and without pledging any eggs.

It remains to show that all players run in the first round of the patronage game. Given $S(2)$, on the equilibrium path, the player who wins in the first round will acquire all of the eggs in the game; whereas all other players will receive zero eggs. Each player thus seeks to maximize the probability of winning the first round. Given the lack of prior history, all candidates in the first round are indistinguishable; so, given Properties I and II, all candidates in the first round have an equal and strictly positive probability of winning (whereas the probability of winning as a voter is of course zero). It is thus strictly optimal for each player to run in the first round.

We now turn to the no-patronage version of the game. Notice that the game is memoryless, in the sense that at the start of each round, the continuation game does not depend on the past history of play. This observation leads to two implications. First, given Properties I and II, each voter is equally likely to vote for each candidate, and thus, each candidate has an equal (and strictly positive) chance of winning the election. Second, each player's choice of whether to run has no effect on their expected winnings in subsequent rounds. Given that, with certainty, each voter earns zero chickens in the current round, it is strictly optimal for each player to run rather than vote. The proposition follows. ■

D Instructions and Screenshots

D.1 Instructions (Patronage Treatment)

Ground Rules

Welcome to the experiment. Please read the instructions below carefully.

Communication between participants is not allowed. Also, please refrain from using any communication devices. If you have any questions at any time, please raise your hand and an experimenter will come over to see you.

If you need to write anything, please use the paper and pen provided. Please do not write anything on this instruction sheet.

Groups and Privacy

The computer will randomly assign you to a group of *six* participants. You will interact only with the participants in your group. The computer will randomly select an ID for you, such as “Cabbage” or “Potato.” You will keep the same ID throughout the experiment.

Your decisions in the experiment will be anonymous, and your anonymity will be strictly preserved. Participants will interact with each other using only their IDs. For example, you may learn that “Cabbage has voted for you”; but you will not be told the real name of “Cabbage.”

Chickens and Eggs

In this experiment, you may win *chickens* that lay *eggs* for you. You may give some of your eggs to other participants. At the end of the experiment, your eggs will be converted into dollars at the rate of 5 eggs to $1.

Rounds

The experiment will consist of 30 rounds.

In each round, except the final round, an election will take place. The winner of the election receives a chicken. Chickens lay eggs for five rounds, and then retire.

Your Coop and Your Basket

Your chickens live in your chicken *coop*. At the start of each round, each of your chickens lays two eggs in the coop. You may give some of these eggs to other participants.

At the end of the round, the eggs in your coop are transferred to your egg *basket*.

Details of Elections

In each round except the final round, there is an election to determine who will win a chicken. You will have a choice whether to 1) be a candidate in the election or 2) a voter in the election. One voter will be selected at random by the computer to be the *deciding voter*. The election outcome will be determined by the deciding voter's vote.

The election will proceed as follows:

Step 1: If you are a candidate, you may pledge to give some eggs from your coop to the deciding voter if he/she votes for you.

Step 2: If you are a voter, you will choose whom to vote for after observing the candidate's pledges. The computer will then randomly select the deciding voter.

Step 3: At the end of the election, the election winner's pledge will be transferred to the deciding voter's basket.

If nobody chooses to be a candidate or nobody chooses to be a voter, the computer randomly allocates the chicken to one participant.

Final Round

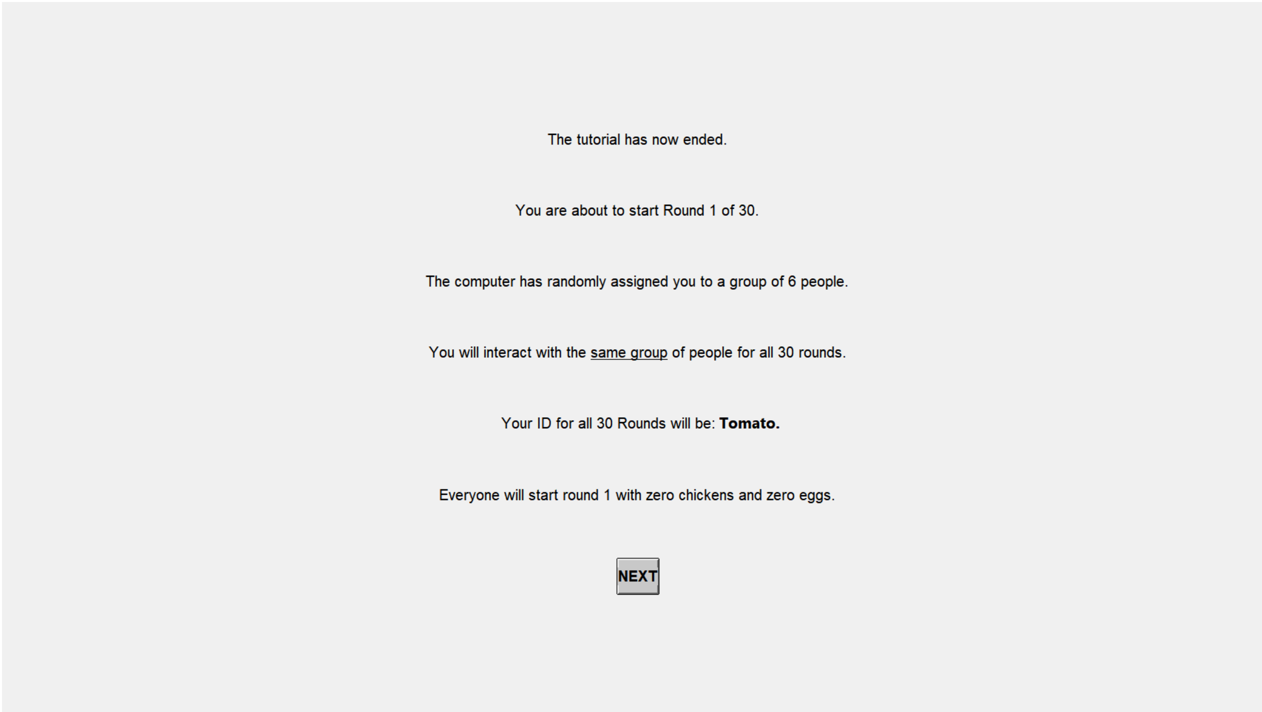
In the final round, there is no election. Each chicken's eggs are immediately placed in its owner's basket.

Payment

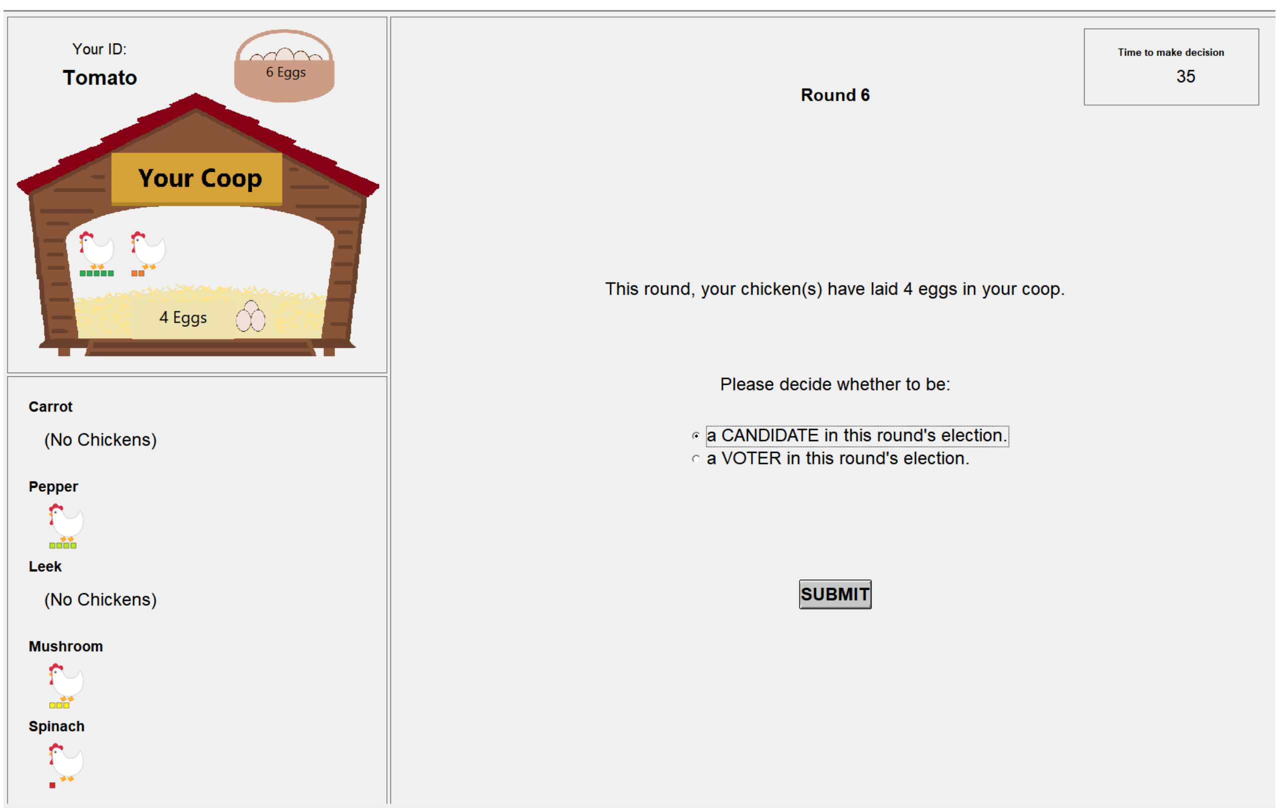
At the end of the experiment, the eggs in your basket will be converted into dollars at the rate of 5 eggs to $1. You will also receive a show-up fee of $5. You will be paid privately and confidentially.

You will be asked to fill in a short questionnaire before being paid.

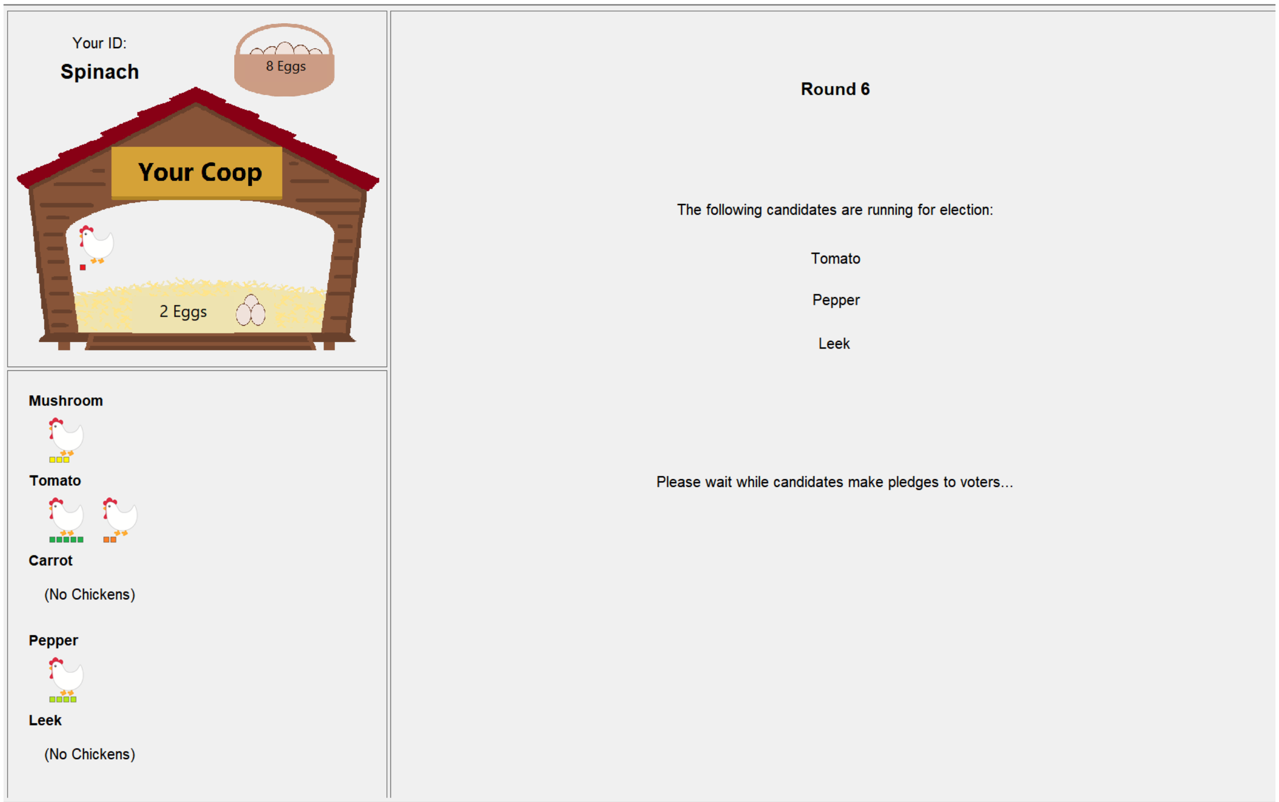
D.2 Screenshots (Patronage Treatment)



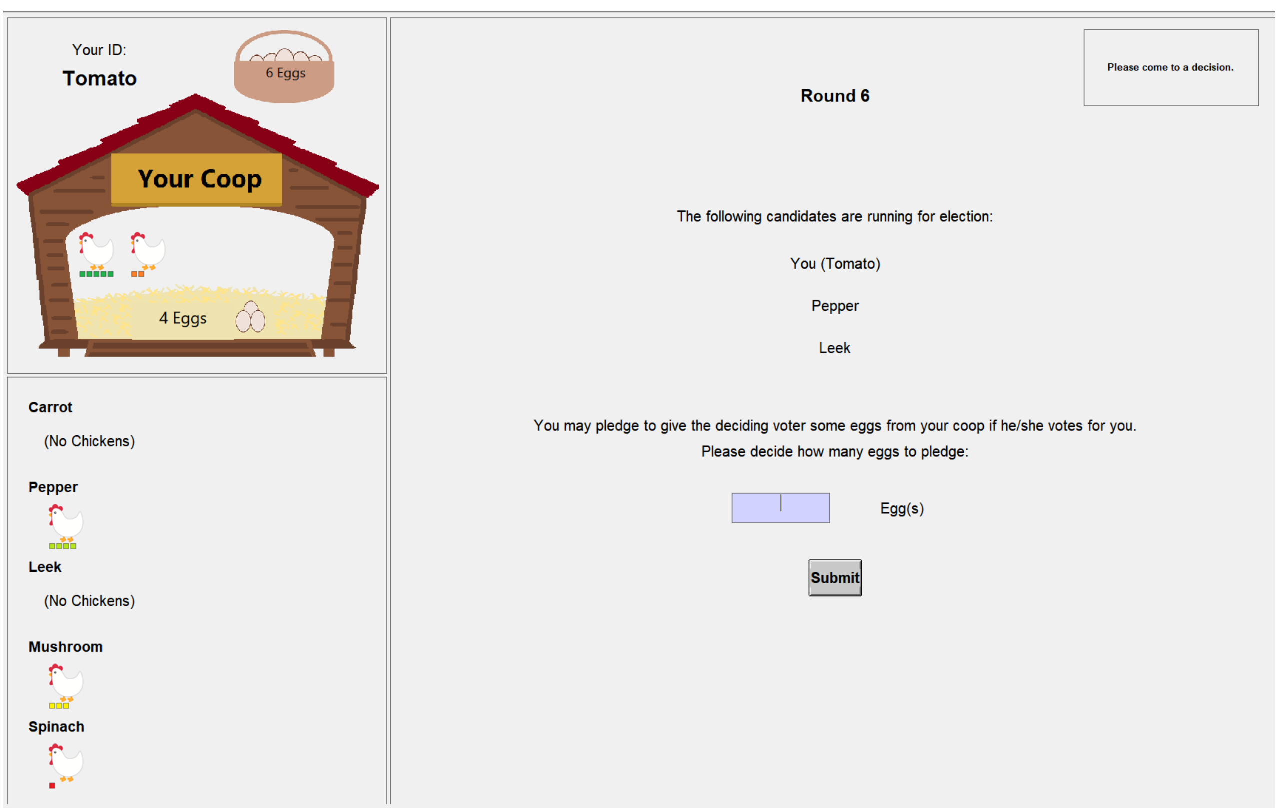
Start Screen



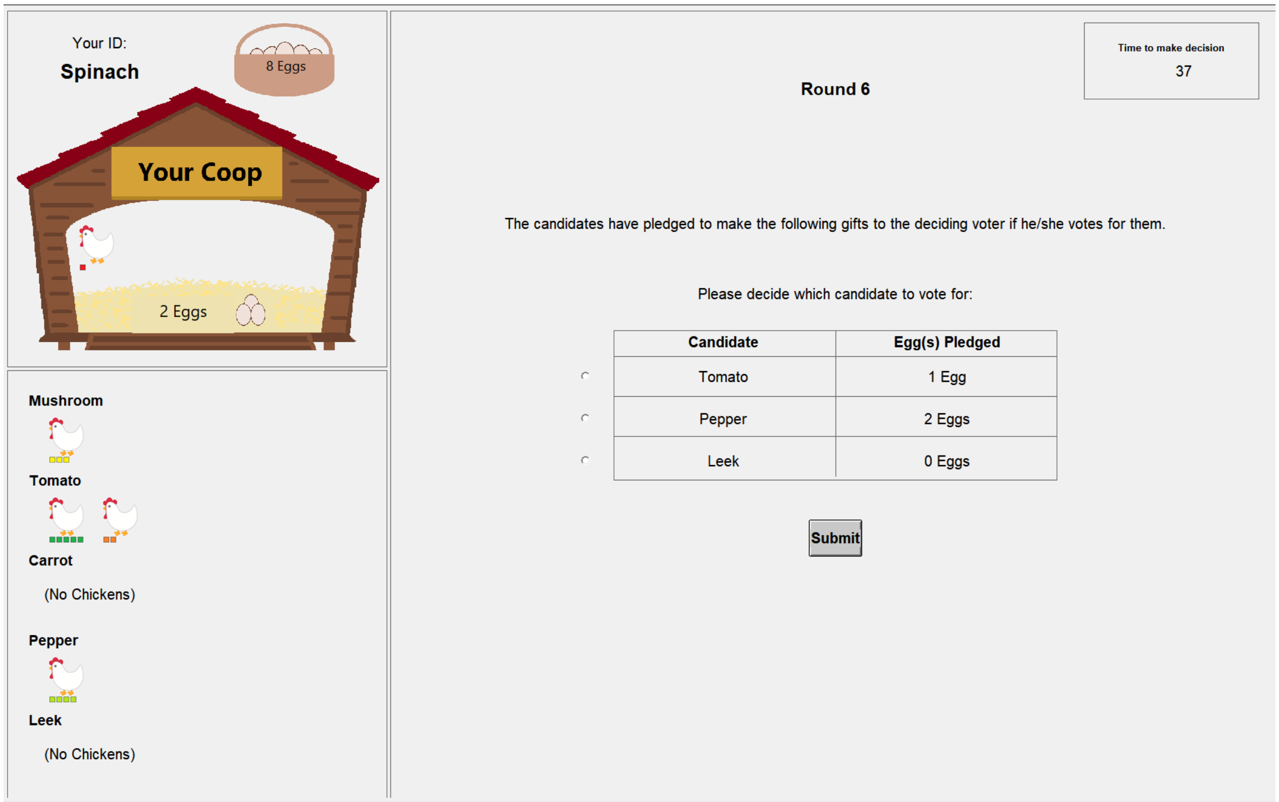
Screen 1



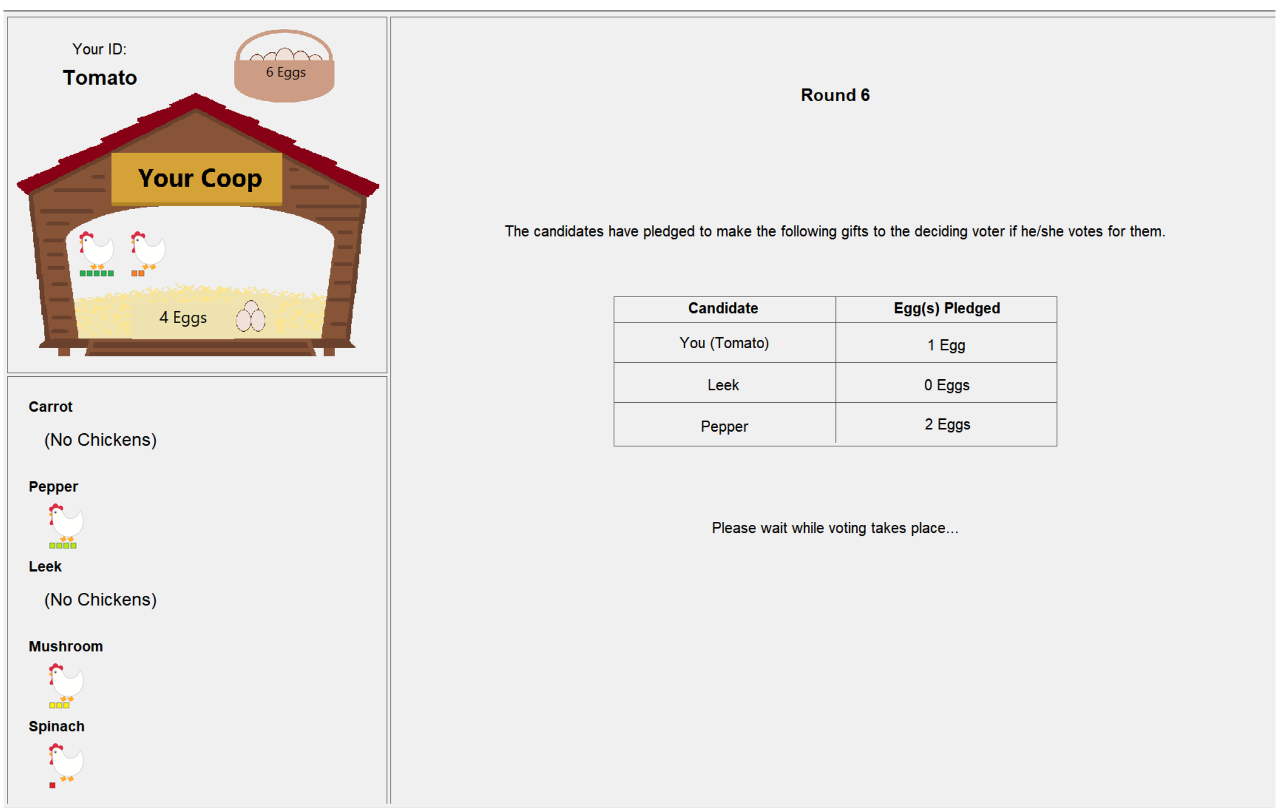
Screen 2 (Voter)



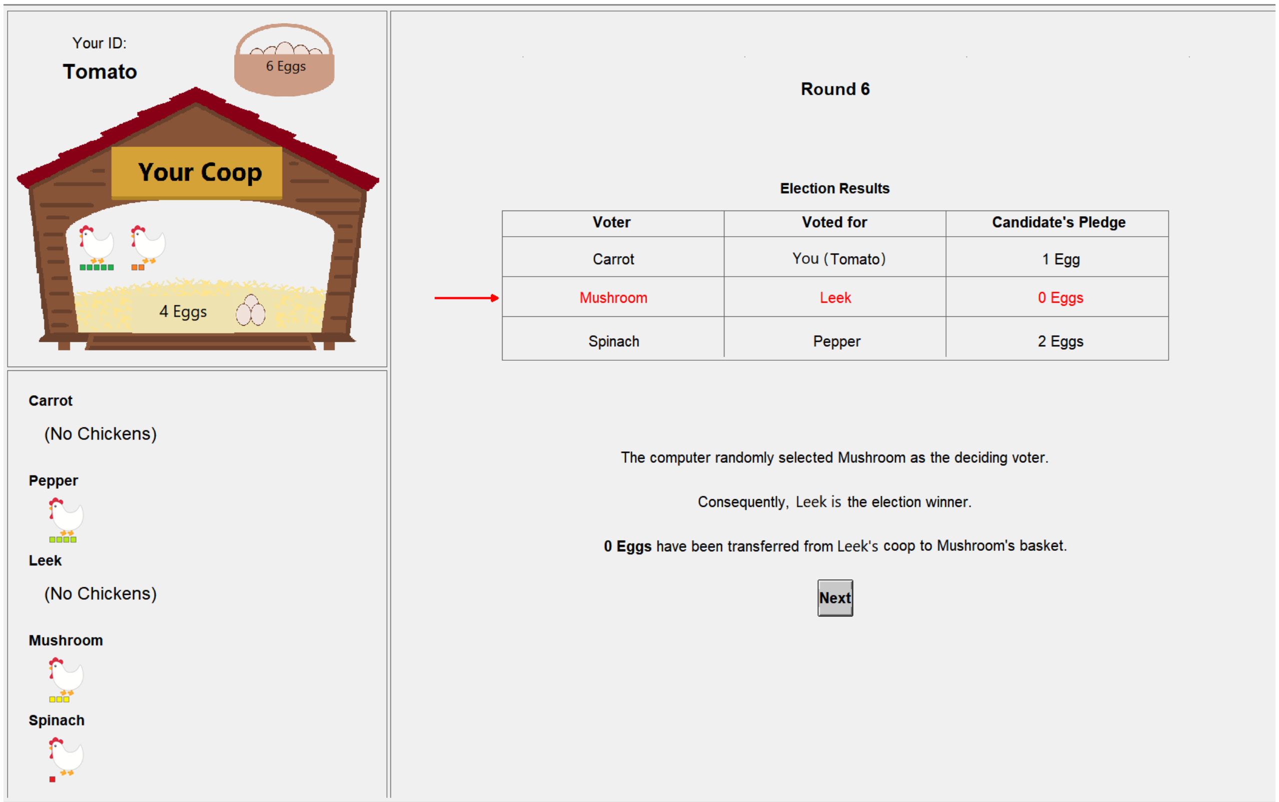
Screen 2 (Candidate)



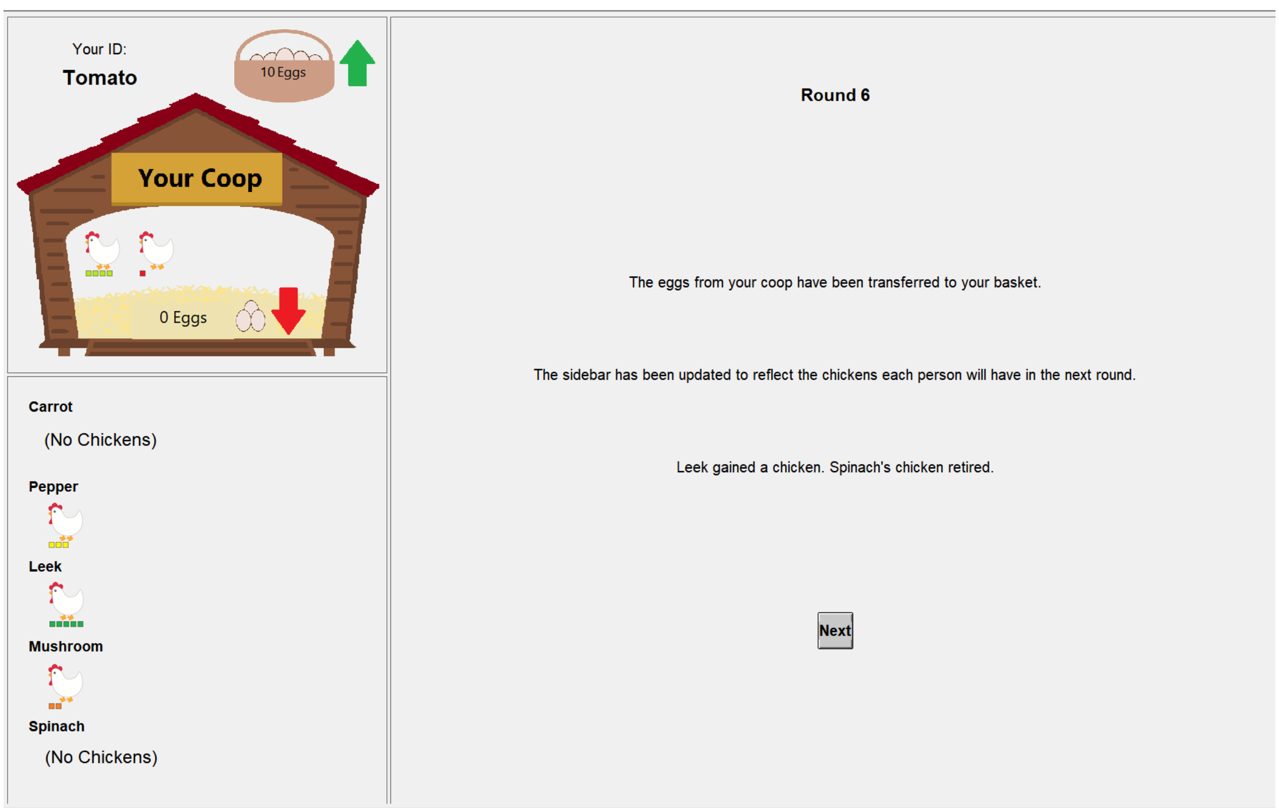
Screen 3 (Voter)



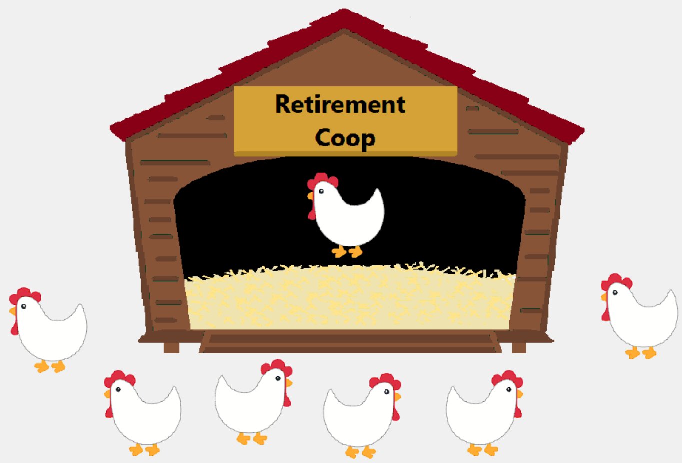
Screen 3 (Candidate)



Screen 4



Screen 5



The experiment is now over.

No chickens were harmed in the making of this experiment.

Next

End Screen 1

Final Egg Totals

	Amount in Basket
You (Tomato)	130.00 Eggs
Mushroom	20.00 Eggs
Carrot	26.00 Eggs
Leek	30.00 Eggs
Pepper	30.00 Eggs
Spinach	34.00 Eggs

Your eggs will be converted into dollars at the rate of 5 eggs to 1 dollar.

Next

End Screen 2

D.3 Instructions (No-Patronage Treatment)

Ground Rules

Welcome to the experiment. Please read the instructions below carefully.

Communication between participants is not allowed. Also, please refrain from using any communication devices. If you have any questions at any time, please raise your hand and an experimenter will come over to see you.

If you need to write anything, please use the paper and pen provided. Please do not write anything on this instruction sheet.

Groups and Privacy

The computer will randomly assign you to a group of *six* participants. You will interact only with the participants in your group. The computer will randomly select an ID for you, such as "Cabbage" or "Potato." You will keep the same ID throughout the experiment.

Your decisions in the experiment will be anonymous, and your anonymity will be strictly preserved. Participants will interact with each other using only their IDs. For example, you may learn that "Cabbage has voted for you"; but you will not be told the real name of "Cabbage."

Chickens and Eggs

In this experiment, you may win *chickens* that lay *eggs* for you. At the end of the experiment, your eggs will be converted into dollars at the rate of 5 eggs to $1.

Rounds

The experiment will consist of 30 rounds.

In each round, except the final round, an election will take place. The winner of the election receives a chicken. Chickens lay eggs for five rounds, and then retire.

Your Coop and Your Basket

Your chickens live in your chicken *coop*.

At the start of each round, each of your chickens lays two eggs. These eggs are put in your *basket*.

Details of Elections

In each round except the final round, there is an election to determine who will win a chicken. You will have a choice whether to 1) be a candidate in the election or 2) a voter in the election.

If you choose to be a voter, you will cast a vote for one of the candidates. The computer will then randomly select a *deciding voter*. The election outcome will be determined by the deciding voter's vote.

If nobody chooses to be a candidate or nobody chooses to be a voter, the computer randomly allocates the chicken to one participant.

Final Round

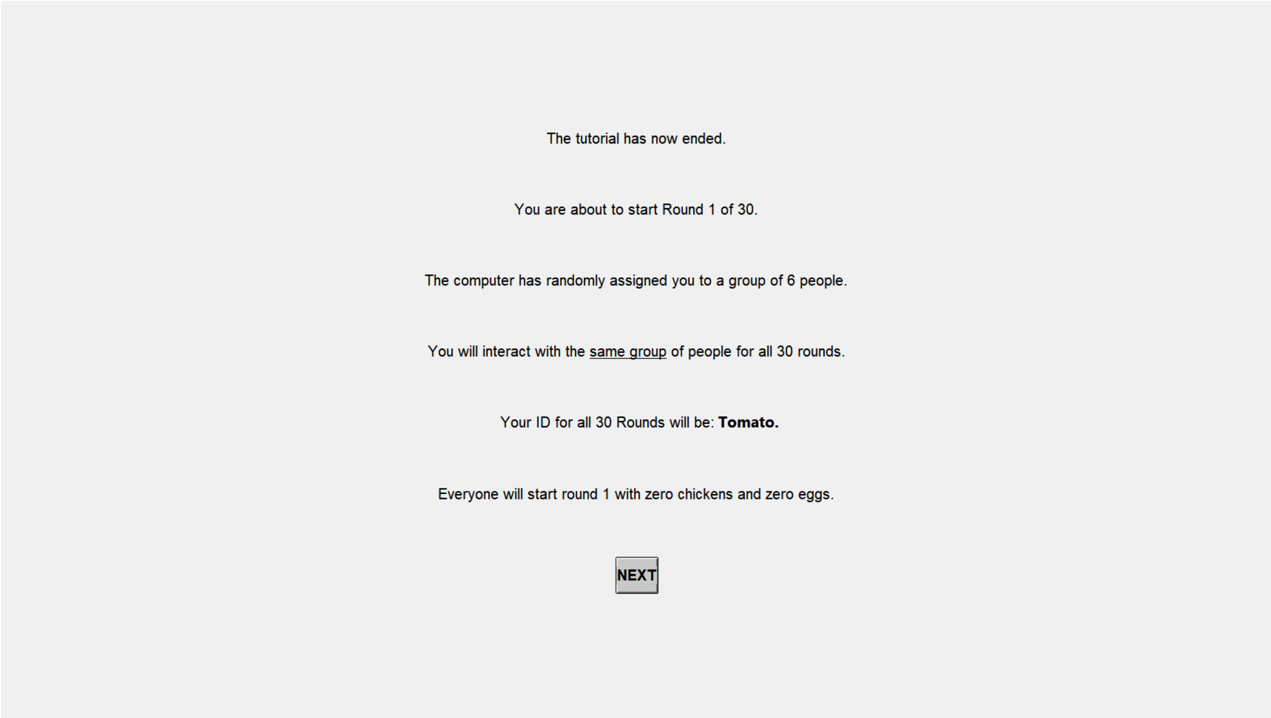
In the final round, there is no election. You will simply receive the eggs laid by your chickens.

Payment

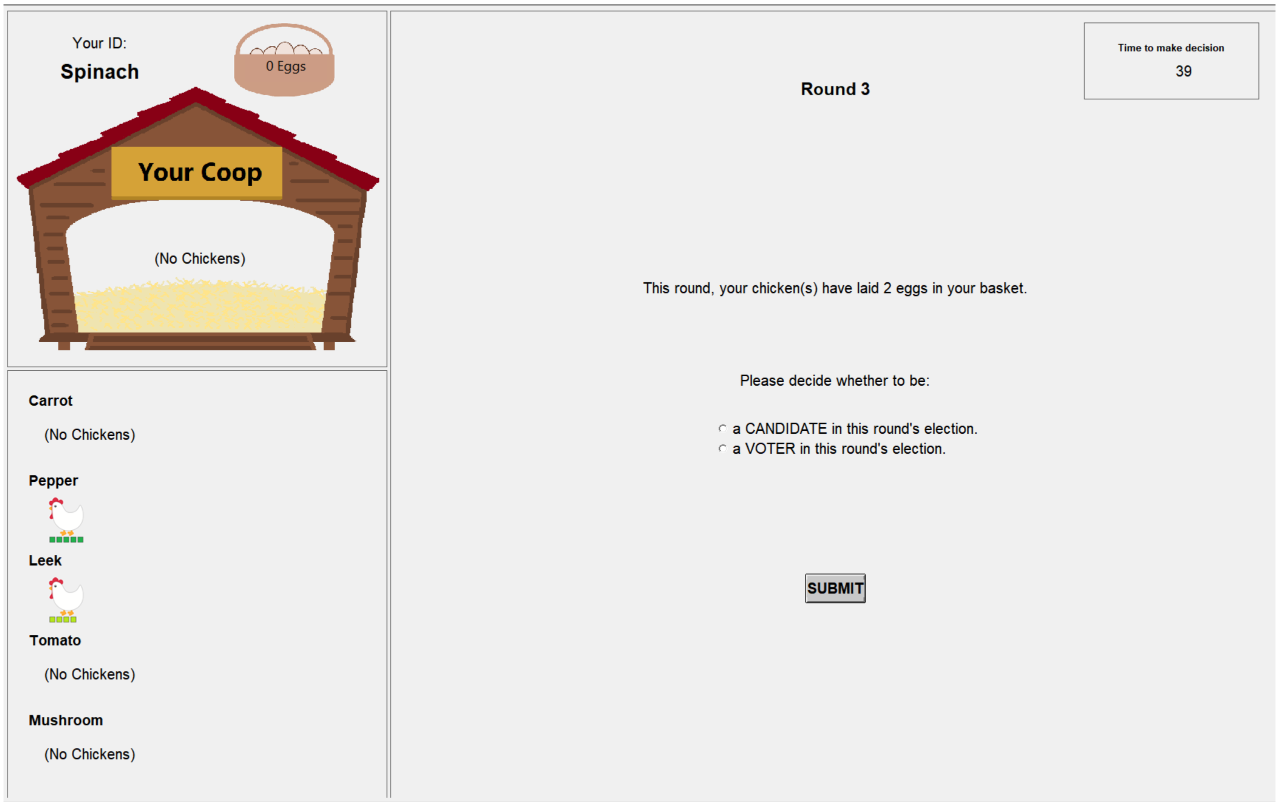
At the end of the experiment, the eggs in your basket will be converted into dollars at the rate of 5 eggs to $1. You will also receive a show-up fee of $5. You will be paid privately and confidentially.

You will be asked to fill in a short questionnaire before being paid.

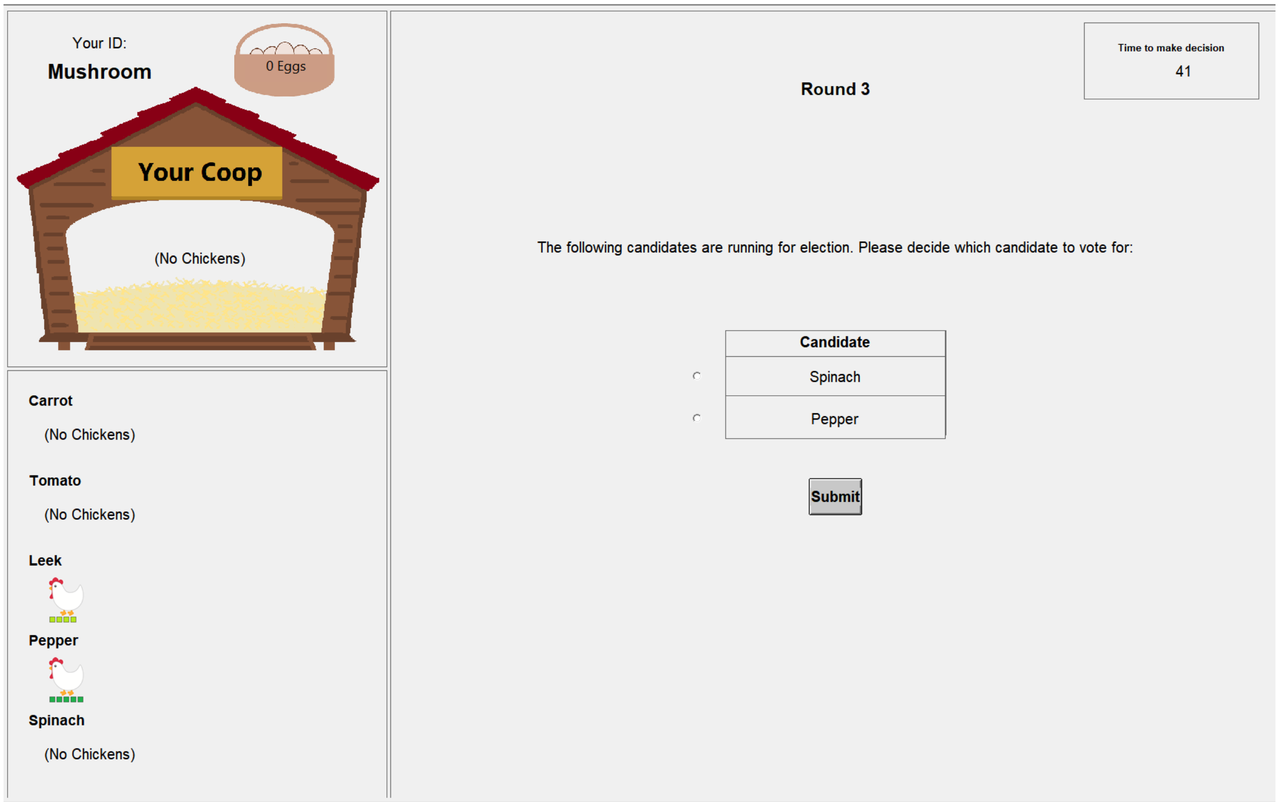
D.4 Screenshots (No-Patronage Treatment)



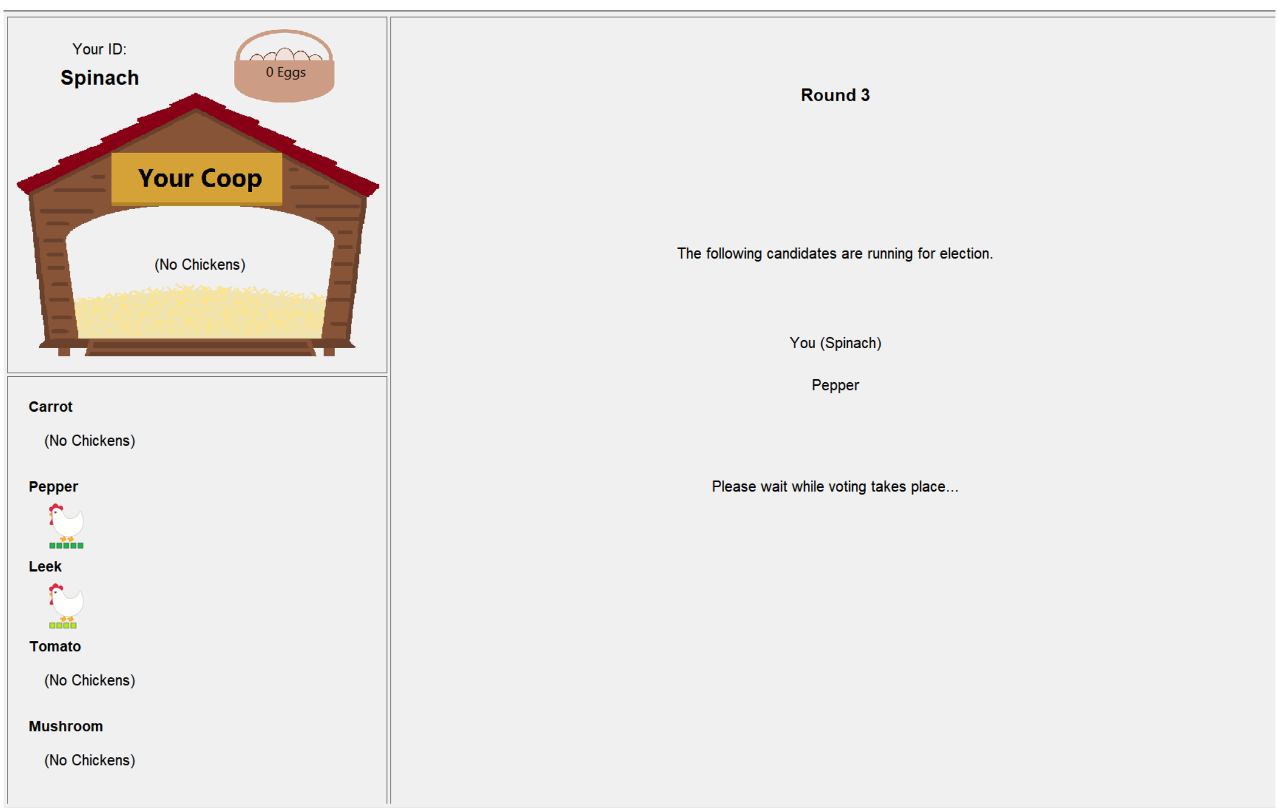
Start Screen



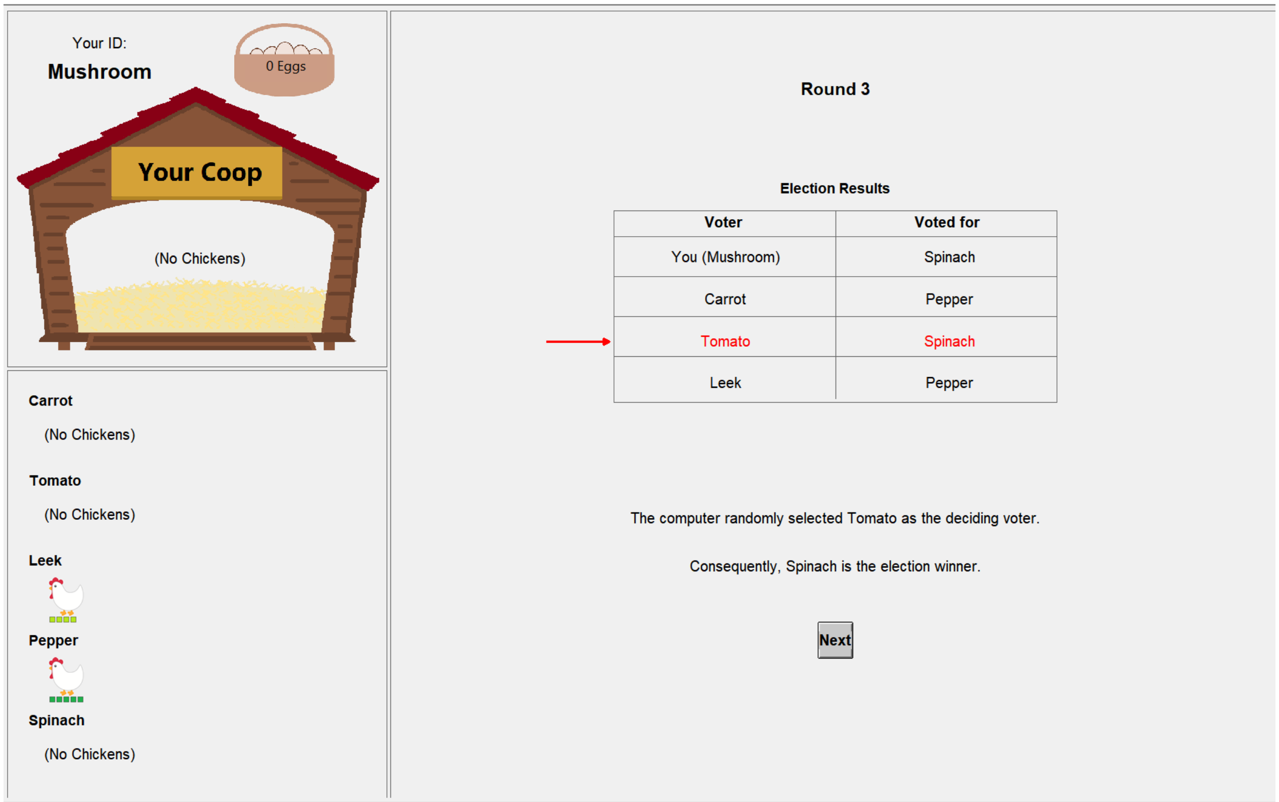
Screen 1



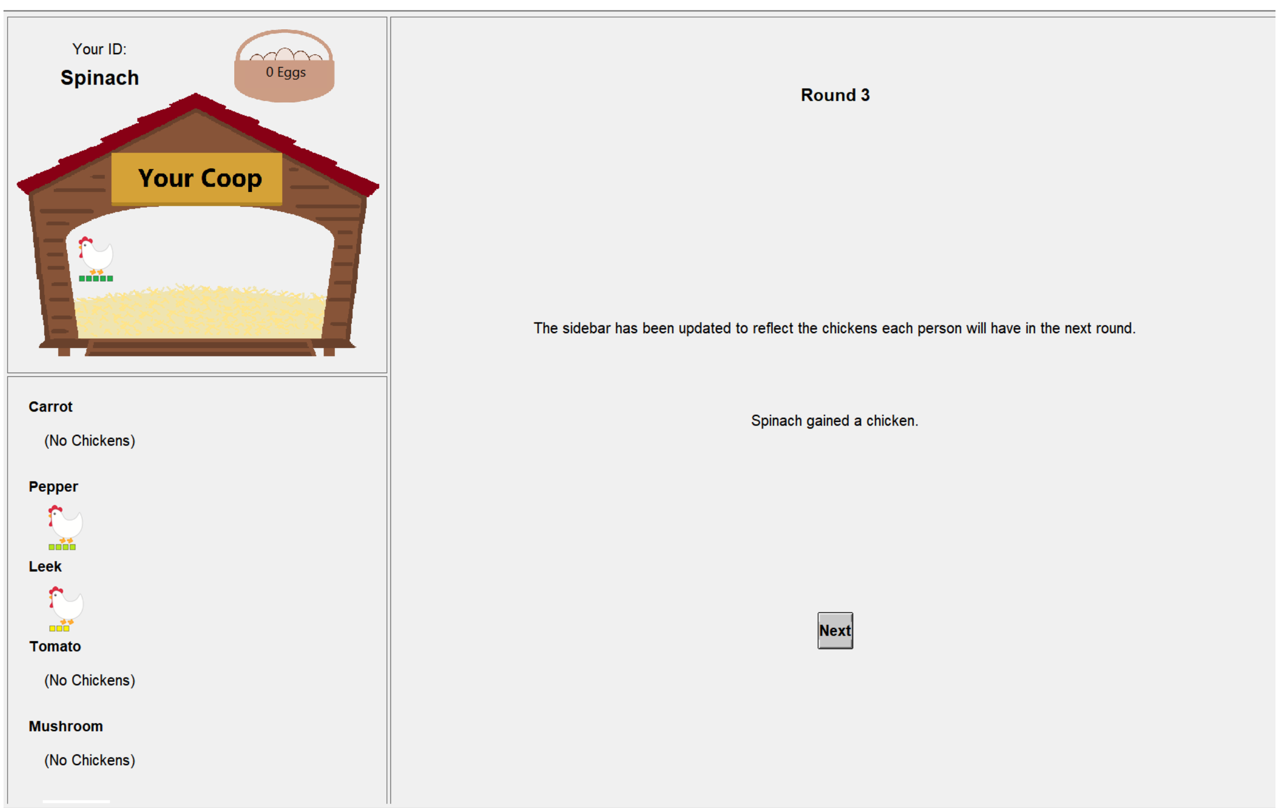
Screen 2 (Voter)



Screen 2 (Candidate)



Screen 3



Screen 4

D.5 Post-Experiment Survey Questions

Demographic questions

What is your age? *(If you would prefer not to answer, please leave it blank.)*
What is your year of study? [1st Year, 2nd Year, 3rd Year, 4th Year, Postgraduate]
What is your nationality?
What is your course of study?
What is your gender? [Male, Female, I'd prefer not to answer, Other (Please describe if you wish)]

Voting behaviour*

How well do the following statements describe the strategies you followed as a voter? *Note: if you never voted, please indicate how you think you would have voted.* [0: Not well at all— 10: Extremely well]

- I voted for the candidate who pledged the most eggs.†
- I voted for candidates who pledged a large share of their eggs, even if they did not pledge the most.†
- I voted against the candidate with the most chickens because I thought more competition would increase pledges to voters.†
- I voted against the candidate with the most chickens because it was the fair thing to do.
- I voted for candidates who voted for me in the past.
- I was easily bored so I voted more or less randomly.

Are there other strategies you followed? If so, please describe below.

Pledging behaviour*

How well do the following statements describe your reasons for pledging eggs when you were a candidate? *Note: if you were never a candidate, please indicate how you think you would have pledged.* [0: Not well at all - 10: Extremely well]

- I pledged eggs because I was concerned with fairness.†
- I pledged eggs because I wanted to win elections†.
- Are there other reasons you pledged eggs? If so, please describe below.†

Running behaviour*

How well do the following statements describe your reasons for choosing whether to be a candidate or a voter in each round? [0: Not well at all - 10: Extremely well]

- I chose whether to be a candidate or voter depending on what I thought would get me the most eggs.
- I sometimes chose to vote because I felt it was unfair to be a candidate too often or win too many chickens.
- I sometimes chose to vote because I wanted to support/oppose a particular candidate.‡
- I sometimes chose to vote because I wanted to support/oppose a particular candidate, even when I thought it would not get me the most eggs.†
- I sometimes chose to be a candidate because I wanted to oppose someone I wanted to see lose.‡
- I sometimes chose to be a candidate because I wanted to oppose someone I wanted to see lose, even when I thought it would not get me the most eggs.†
- I was easily bored so I chose whether to be a voter or a candidate more or less randomly.

Are there other reasons why you chose to be a candidate or voter? If so, please describe below.

Miscellaneous questions
To what extent do you think winning chickens was a matter of luck? [0: Not Luck - 10: Mostly Luck]
Was there anything unclear about the instructions?

Authority Preference
How much do you value having authority over other people? [0: Not at all - 10: A lot]

Disadvantageous inequity aversion
In each row below, you will have to choose between hypothetical allocations of experimental Coins between yourself and another. Please select, for each row, which option you prefer.

(1)	Option A: You: 12.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(2)	Option A: You: 11.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(3)	Option A: You: 10.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(4)	Option A: You: 9.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(5)	Option A: You: 8.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(6)	Option A: You: 7.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(7)	Option A: You: 6.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(8)	Option A: You: 5.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(9)	Option A: You: 4.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins
(10)	Option A: You: 3.5 Coins, Other: 15 Coins	Option B: You: 10 Coins, Other: 26 Coins

Advantageous inequity aversion

In each row below, you will have to choose between hypothetical allocations of experimental Coins between yourself and another. Please select, for each row, which option you prefer.

(1)	Option A: You: 18.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(2)	Option A: You: 17.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(3)	Option A: You: 16.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(4)	Option A: You: 15.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(5)	Option A: You: 14.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(6)	Option A: You: 13.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(7)	Option A: You: 12.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(8)	Option A: You: 11.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(9)	Option A: You: 10.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins
(10)	Option A: You: 9.5 Coins, Other: 9 Coins	Option B: You: 17 Coins, Other: 5 Coins

*Order of questions was randomised within section.
†Only included in patronage treatment survey.
‡Only included in no-patronage treatment survey.