"Last-place Aversion": Evidence and Redistributive Implications*

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Abstract

We present evidence from laboratory experiments showing that individuals are "last-place averse." Participants choose gambles with the potential to move them out of last place that they reject when randomly placed in other parts of the distribution. In money-transfer games, those randomly placed in second-to-last place are the least likely to costlessly give money to the player one rank below. Last-place aversion suggests that low-income individuals might oppose redistribution because it could differentially help the group just beneath them. Using survey data, we show that individuals making just above the minimum wage are the most likely to oppose its increase.

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1 Introduction

A large literature in economics argues that utility is related not only to absolute consumption or wealth but also to an individual's relative rank along these dimensions within a given reference group.[1] Less attention, however, has been paid to the *shape* of the relationship between utility and rank.[2] In this paper we explore whether rank matters differently to individuals depending on their position in the distribution. In particular, we hypothesize that individuals exhibit a particular aversion to being in "last place," such that a potential drop in rank creates the greatest disutility for those who are already near the bottom of the distribution.

Our second objective is to explore how "last-place aversion" might predict individuals' actual redistributive preferences outside the laboratory. Many scholars have asked why low-income individuals often oppose redistributive policies that would seem to be in their economic interest. For example, Benabou and Ok (2001) suggest that a belief in upward mobility means the poor may reject redistributive taxation today so as to protect their future, richer selves tomorrow. Our account for this opposition, in contrast, focuses not on individuals' hope of rising to the top of the distribution, but rather on their fear of falling to the bottom. Last-place aversion suggests that low-income individuals might oppose redistribution because they fear it might differentially help a "last-place" group to whom they can currently feel superior.

We begin by testing for last-place aversion (LPA) in laboratory experiments. The two sets of experiments explore LPA in very different contexts. In the first set of experiments, subjects are randomly given distinct dollar amounts and then shown the resulting "wealth" distribution. Each player is then given the choice between receiving a payment with probability one and playing a two-outcome lottery of equivalent expected value, where the "winning" outcome of the lottery will typically offer the player the possibility of moving up in rank. We find that the probability of choosing the lottery is uniform across the distribution except for the last-place player, who chooses the lottery significantly more often. In another version of the game, where we try to prime individuals to think more strategically about their play,

[1]This work largely began with Duesenberry (1949), with Easterlin (1974) presenting a classic, early application.

[2]To the extent that non-linearities in the effect of relative position on utility have been explored in existing research, they have generally been modeled as allowing the effect of the underlying *absolute* index to vary with relative position, as in Clark and Oswald (1998). For example, Card *et al.* (forthcoming) find that the difference between own pay and median pay in a sample of University of California employees has a larger effect for those below the median than those above. In contrast, Luttmer (2005) finds that the effect of neighbors' income is the same for individuals who are above and below the median income in their MSA. Our model of utility in Section 2 focuses directly on rank and not deviations in the underlying absolute index from a given reference point.

both the last and second-to-last-place players opt for the lottery more often, consistent with the last-place player trying to escape last place and the second-to-last place player trying to defend against him. These results contrast sharply with the standard prediction that absolute risk aversion diminishes with wealth, which would predict that those in the bottom of the distribution would be the *least* likely to choose a risky over a risk-free payoff.

While risk and uncertainty play a large role in the first set of experiments, in the second set of experiments players play money-transfer games in settings with little uncertainty. Individuals are randomly assigned a unique dollar amount, with each player separated by a single dollar, and then shown the resulting distribution. They are then given an additional $2, which they must give to either the person directly above or below them in the distribution. Giving the $2 to the person below means that the individual herself will fall in rank, as ranks are separated by $1. Nonetheless, players almost always choose to give the money to the person below them, as apparently giving it to someone who already has more than they do is even less appealing than falling in rank. However, the second-to-last-place person is the most likely to give the extra two dollars to the person above her instead of the person below her—choosing to give the money to someone who already has more money than she does between one-half and one-fourth of the time—consistent with LPA's prediction that concern about relative status will be greatest for individuals who are at risk of falling into last place. In both the lottery and money-transfer experiments, we can show that merely being in the bottom half of the distribution does not explain the results—players must actually be close to last place—and can reject inequality aversion as an alternative hypothesis.

We then turn to whether these results might relate to how individuals actually form redistributive policy preferences. Of course, in the "real world," the concept of "last-place" is far less well-defined than in the two experimental environments described above. Applying literally our last-place model cannot explain why, say, politicians might be able to divide low-income voters and prevent them from uniting in support of redistributive taxes and transfers. Such voters could always think of the literally millions, if not billions, of poor people in developing countries who are far worse off, as well as neighbors or acquaintances who happen to be worse off along a particular dimension, and thus should not fear that a domestic redistributive policy would help those slightly worse off than they and land them in "last place." If, instead, individuals create reference groups specific to whatever policy question they are considering, then LPA has more hope of explaining policy preferences.

The final part of the paper explores whether low-income individuals appear to evaluate actual redistributive policies in a manner consistent with LPA, focusing on the minimum wage. LPA predicts that those making just above the current minimum wage might actually oppose an increase—whereas they might see a small raise, they would now have the last-place wage themselves and would no longer have a group of worse-off workers from whom they could readily distinguish themselves. We could not find existing survey data that includes both respondents' actual wages (as opposed to family income) and their opinion regarding minimum wage increases, so we conducted our own survey of low-wage workers. Consistent with almost all past surveys on the minimum wage, support for an increase is generally over 80 percent. However, consistent with LPA, support for an increase among those making between \$7.26 and \$8.25 (that is, within a dollar of the current minimum wage of \$7.25) is significantly lower. We find roughly consistent patterns using surveys on the minimum wage published by the Pew Research Center that report respondents' household income (as opposed to wages).

The evidence from the money-transfer games as well as the minimum wage surveys highlights why it might be surprisingly difficult to create a coalition in support of redistribution (or, equivalently, surprisingly easy to divide low-income voters). Groups close to the bottom of the distribution may only support policies that are rank-preserving, but such policies may generate little enthusiasm among the lowest group. The minimum-wage results suggest that even in cases where ranks are not reversed but merely condensed, redistribution may find little support among those who could previously think of themselves as distinctly above last place.

The remainder of the paper is organized as follows. Section 2 presents a simple utility function that allows for last-place aversion. Sections 3 and 4 describe, respectively, the lottery experiment and the money-transfer experiments, and derive and test predictions from the model in Section 2. Section 5 presents the results from our minimum wage survey. Section 6 discusses the potential implications of last-place aversion for behaviors beyond those we study in this paper and offers concluding thoughts.

2 A simple model of last-place aversion

In this section, we define a simple utility function that incorporates last-place aversion. The purpose of this section is merely to describe the properties of this function, and not to explain *why* individuals might be last-place averse. It might be an innate human trait, or it might be a conditioned response to seeing that individuals in last place are treated poorly. Sociologists and social psychologists often identify "shame" as the most powerful social emotion, which suggests to us that those at the very bottom of the distribution are likely to value an improvement in rank most highly, as there is likely little shame in being in the middle or higher parts of the distribution.[3] Indeed, being "picked last in gym class"

[3] See Goffman (1982) for an early treatment on the function of shame, who writes that "the emotion of embarrassment or anticipation of embarrassment plays a prominent role in every social encounter."

is so often described as a child's worst fear that it has become a cliché. Though we have not found work exploring this possibility, one could imagine evolutionary origins—the slowest member of a group would be caught first in an attack; or in a monogamous society with roughly balanced sex ratios, all but the "last place" individuals will find a partner. In any case, we take LPA as given and incorporate it into a simple utility function, which we will later use to generate predictions regarding how individuals will behave in different settings.

2.1 Individual utility under last-place aversion

Consider a finite number of individuals with wealth levels $y_1, y_2, ..., y_N$, and let y_L be the wealth of the poorest ("last-place") person. Let the utility of person i be defined by:

$$u(y_i) = (1-\alpha)f(y_i) + \alpha\mathbb{1}(y_i > y_L), \tag{1}$$

where $f' > 0$, $f'' < 0$, $\alpha \in [0, 1]$ and $\mathbb{1}(y_i > y_L)$ is an indicator function that takes the value of one if an individual is not in last place and zero if she is in last place. Essentially, utility is a weighted average of a typical concave utility function and a bonus payment to all but the last-place individual. As $\alpha \to 0$, the function approaches a standard, non-reference-dependent utility function, and as $\alpha \to 1$, the only factor that determines utility is whether one is in or out of last place. For convenience, we will sometimes call the first term the "standard term" of the utility function and the second term the "LPA term" of the utility function.

Now, consider a small δ-perturbation in wealth for individual i. If $y_i >> y_L$ or $y_i = y_L << y_{L+1}$, where y_{L+1} is the wealth of the second-to-last person, then the change in utility is merely $(1-\alpha)f'(y_i)\delta$. As such, LPA will typically not affect the decisions of an individual with wealth far above that of the last-place person or a last-place person so far behind the next person that he can never catch up.

In contrast, if $y_i - y_L < \delta$, then a loss of δ wealth—which would put individual i in last place—yields a utility loss of $(1-\alpha)f'(y_i)\delta + \alpha$. Similarly, if $y_i = y_L > y_{L+1} - \delta$, then a gain of δ, which would move i from last place, yields a utility gain of $(1-\alpha)f'(y_i)\delta + \alpha$. Therefore, as an individual approaches the last-place person from above or as the last-place person approaches the second-to-last-place person from below the change in the LPA term of the utility expression grows relative to that of the standard term.

The analysis above suggests that for individuals in or close to last place, standard results may no longer hold. For example, the last-place person should have a heightened tendency to accept gambles that provide a possibility of rank improvement, whereas absolute risk-aversion is generally believed to decrease with wealth (Arrow, 1971). Similarly, warm-glow models (Andreoni, 1990, Andreoni, 1989) predict that most people would choose to costlessly give money to a poorer individual, but LPA would diminish this tendency for individuals who are themselves close to last place.

2.2 Discussion

In equation (1), there is an increase in utility associated with moving out of last place, and then no further effect of relative position. An alternative utility function that captures the spirit of last-place aversion could incorporate a more continuous function of relative position:

$$u(y_i, r_i) = f(y_i) + g(r_i), \tag{2}$$

where r_i is individual i's relative position. Preferences similar to last-place aversion would be reflected in the shape of g—past work suggests that utility is increasing in relative position ($g' > 0$), but last-place aversion would suggest that $g(\cdot)$ is also *concave* and that its gradient is very large for small values of r (i.e., for individuals close to the bottom of the distribution) but then quickly flattens out.

Such a $g(\cdot)$ function would be difficult to distinguish empirically from last-place aversion, especially in settings without a large number of distinct ranks. In general, our empirical work will not focus on distinguishing last-place aversion from more general "low-rank" aversion that could be generated by certain $g(\cdot)$ functions, but will seek to show that last-place or low-rank aversion can be separately identified from a range of alternative hypotheses, such as reference-dependent models where the median acts as a reference point and inequality-aversion models.

The next two sections of the paper present evidence from laboratory experiments. We test predictions of last-place aversion in two separate contexts: individuals' choices among risk-free or risky assets and their decisions to transfer experimental earnings among fellow players in distribution games.

3 Experimental evidence of last-place aversion: making risky choices

In this section, we test whether individuals choose to bear risk in return for the possibility of moving out of last place that they forgo when placed in other parts of the distribution. Our guiding principle in this and the later experiments is to create an environment that biases us against finding LPA, so that any evidence we find in support of the model would not be an artifact of a particular aspect of our experimental design. First, as we speculate that shame or embarrassment may motivate individuals' desire to avoid last place, we take several steps to promote players' privacy during the game. Players never interact face-to-face, but instead through computers, and they generate their own screen names and are thus free to protect their identity. Each individual sits in a separate carrel, with large blinders placed around each carrel, which should further enhance privacy and anonymity. Players are not publicly paid at the end of the game and instead money is given to them while they are still sitting in their carrels. Second, all of the experiments involve an initial assignment to a rank, and we make clear to participants that this assignment is done randomly by a computer. We believe the emphasis on random assignment should diminish LPA by discouraging players from associating rank and merit.

Whether these decisions make the experiments more or less like the "real world" situations to which we seek to relate them is difficult to say. On the one hand, one's economics status is at least partially public and thus contrasts with the relatively strict anonymity the experiments provide. Moreover, relative position is hardly random, as it is in our experiments. On the other hand, when individuals make decisions on redistributive policies in a voting booth, anonymity is a critical feature of the experience.

3.1 Data and experimental design, main experiment

Participants ($N = 84$) sign up by registering online at the Harvard Business School Computer Lab for Experimental Research (CLER). See Appendix Table 1 for demographic summary statistics as well as more detailed information on eligibility requirements for registration and payment of participants.

We randomly divide participants into fourteen groups of six in order to play a multi-round game. At the beginning of the game, the computer randomly assigns each player in the group a rank, and endows them with an amount of money that corresponds to that rank. The monetary endowment decreases by 25 cents for each lower rank, such that the player in first place receives $3.00, the player in second place receives $2.75, down to the player in sixth place, who receives $1.75. Ranks and actual dollar amounts of all players are common knowledge and clearly displayed throughout the game.

Next, participants play a series of rounds. At the start of each round, the computer presents an identical two-option choice set to all players in the game:

In this round, which would you prefer?

(i) *Win $0.13 with 100 percent probability.*

(ii) *Win $0.50 with 75 percent probability and lose $1.00 with 25 percent probability.*

After players have submitted their choices, the computer makes independent draws from the common $P(win) = 3/4$ probability distribution for each player who chose the lottery and adds the risk-free amount to the balance of each player who did not choose the lottery. The new balances and ranks are then displayed. The players are then re-randomized to the same $\{\$1.75, ..., \$3\}$ distribution and the game repeats. Each game consists of nine rounds, but participants are not told how many rounds the game entails to avoid end effects.[4] Participants are told that one randomly selected player will be paid his balance from one randomly selected round.

Note that the payment players can receive with probability one is always equal to half the difference between ranks, rounded up to the nearest penny. That is, \$0.125 ($\$0.25 \div 2 = \$0.125$), rounded up to \$0.13. The "winning" payment of the lottery is always equal to the difference between a given individual and the person two ranks above him, that is, \$.50. And the losing outcome of the lottery is set to \$1, so that the lottery and the sure options are roughly equal in expected value ($0.75 * 0.50 - 0.25 * 1 = 0.125$), and in fact for ease of exposition in the text we will often describe the two options as having equal expected value. Note that even if the last-place player chooses the lottery and loses, he will still have \$0.75, so players can never "owe" money.

As readers may already have noticed, winning the lottery always gives a player the chance to move up a rank if the player directly above him either takes the sure option or plays the lottery and loses. Of course, it also entails a possibility of losing money. In contrast, playing the sure option offers no chance of moving up in rank if the player above either himself plays the sure option or plays the lottery and wins. Note that even if players (naively) hold all other players' balances constant when they make their decisions, the sure option still offers no way of moving up in rank whereas winning the lottery will result in leap-frogging the person directly above.

3.2 Predictions

In a standard expected-utility model, no one will choose the lottery so long as they are even slightly risk averse. The lottery and the sure option have the same expected value (the lottery actually is worth half a cent less in expectation, due to rounding), but the sure option is risk-free. Of course there might be some utility to playing the lottery (maybe it makes the experiment less boring). As risk aversion diminishes with greater levels of wealth—even, as past work has shown, experimental wealth—if anything we would expect those at the top

[4] In many experimental settings, subjects play differently when they know they are playing the final round of the game. See Rapoport and Dale (1966) for an early treatment of so-called "end effects."

of the distribution to decide to to play the lottery most often.[5] As we discuss below, the last-place aversion model in Section 2 predicts a very different pattern.

3.2.1 Last-place player

Consider the decision of the last-place player with balance $y = y_L$ and utility function as given by equation (1). Holding other players' balances constant, he chooses to gamble whenever:

$$(1-\alpha)(\tfrac{1}{4}f(y-\theta_{lose}) + \tfrac{3}{4}f(y+\theta_{win})) + \tfrac{3}{4}\alpha > (1-\alpha)f(y+\theta_{sure}),$$

or

$$\frac{3\alpha}{4(1-\alpha)} > f(y+\theta_{sure}) - (\tfrac{1}{4}f(y-\theta_{lose}) + \tfrac{3}{4}f(y+\theta_{win})). \quad (3)$$

As $\alpha \to 1$, and thus LPA increases, his propensity to gamble grows. As the θs are set such that two decisions have equal expected value, the right-hand side of equation (3) is merely the utility of a risk-free quantity minus the expected utility of a lottery with equal expected value and is thus always positive so long as individuals are risk averse. Therefore, as risk-aversion falls the right-hand-side goes to zero and the propensity to gamble also increases.

Of course, players may be more strategic and instead of holding their opponents' balances constant they might make their decision based on how they think certain opponents will play. In the Appendix, we solve for the Nash equilibrium of the game and we return shortly to those results. Here, we just note that for sufficiently large α, the last-place player will also play the lottery if they assume that the second-to-last-place player will take the sure option.

3.2.2 Second-to-last-place player

If he holds all other players' balances constant, the second-to-last-place player will never choose the lottery. In expectation, the lottery does not offer any gain in money over the sure option, but it does present the risk of falling into last place.

Similarly, if he assumes the last-place player will choose the sure option, then so will he. He gains nothing from the LPA term of the utility expression and any amount of risk-aversion should lead him to reject the gamble based on the standard term of the utility expression.

Now, suppose that the second-to-last-place player assumes the last-place player always

[5] See, for example, Levy (1994) for evidence of diminishing absolute risk aversion in laboratory settings.

gambles. Then, he will choose to gamble whenever:

$$\tfrac{3}{4}((1-\alpha)f(y+\theta_{win})+\alpha)+\tfrac{1}{4}(\tfrac{3}{4}(1-\alpha)f(y-\theta_{lose})+\tfrac{3}{4}((1-\alpha)(f(y-\theta_{lose})+\alpha) > (1-\alpha)f(y+\theta_{sure})+\tfrac{1}{4}\alpha$$

or, after some algebra,

$$\frac{9\alpha}{16(1-\alpha)} > f(y+\theta_{sure}) - (\tfrac{3}{4}f(y-\theta_{lose}) + \tfrac{1}{4}f(y+\theta_{win})). \quad (4)$$

Therefore, again, for α sufficiently large, the second-to-last player will always take the gamble if he believes the last-place player will as well.[6]

3.2.3 Other players

If players hold others' balances constant, then by the same logic as described for the second-to-last-place player, they will never choose the lottery. In contrast to the second-to-last-place players, Nash-equibrium play for these players is the same as the "naive" strategy of never choosing the lottery. By construction, θ_{win} allows the last-place player to attain the current earnings of the fourth-place player, so choosing the sure payment will always allow the fourth-place player to remain above at least the current last-place player and thus avoid last place herself. Thus, there is no reason for her to bear the risk of the lottery and she will take the sure payment. By the same logic, so will everyone above her.

3.2.4 Summary of predictions

If players hold others' balances constant, then only last-place players will ever choose the lottery. If instead the players play Nash equilibrium strategies, then, as demonstrated more rigorously in Appendix B, the last- and second-to-last-place players will play a mixed strategy between the lottery and the sure option. Players of higher rank will continue to play only the sure option. Of course, players likely have considerations beyond those modeled here—playing the lottery might be more enjoyable, as noted earlier, or players may care about rank beyond merely escaping last place and thus choose the lottery when in the middle or upper parts of the distribution in the hope of catching the person above them. However, LPA predicts players at the bottom of the distribution care *more* about rank than do other players, and thus choose the lottery at significantly higher rates.

[6] Whether, for the same α, he will more often gamble than the last-place player depends on how quickly absolute risk aversion diminishes—while the left-hand side of equation (3) is always greater than that of equation (4), the right-hand side of equation (4) is smaller than that of equation (3) so long as absolute risk aversion diminishes with wealth.

3.3 Results

3.3.1 Basic graphs

Figure 1 shows the share of individuals who choose the lottery, by their rank at the time they make the decision. The first series includes all rounds of play. Its most striking feature is the relatively flat relationship between rank and the propensity to choose the lottery for ranks one through five, contrasted with the elevated propensity for players in last place. Not only, as the regression analysis will show, is the last-place player significantly more likely than other players to choose the lottery, the p-values noted on the figure show that the pair-wise difference between the last-place player and *each* of the other ranks (except for the fourth, for which p=0.133) is statistically significant at conventional levels.[7]

The second series excludes observations from the first two rounds, as players may need time to understand how the game works even after hearing the instructions.[8] The pattern is very similar, though the player in third place appears to gamble at a slightly higher rate, though still below that of the last-place player. Neither series provides any evidence that the second-to-last-place player considers the need to "defend" against falling into last place if the last-place player wins the lottery. Instead, the evidence is highly consistent with the predictions from last-place aversion under the assumption that players hold others' balances constant.

3.3.2 Regression results

Table 2 displays results from probit regressions.[9] Col. (1) essentially shows the regression analogue of Figure 1. Translating the probit coefficients into changes in probability, the results suggest that last-place players play the lottery 13 percentage points (or 22 percent, given a mean of those in ranks one through five of 0.569) more often than do other players. Cols. (2) and (3) show, respectively, that the result is robust to including round and game fixed effects or excluding the first two rounds.

Throughout the paper, we will test whether LPA can be separated from a more general dislike of being in the bottom half of the distribution. Col. (4) shows that adding an indicator for being below the median (i.e., in fourth, fifth or sixth place) barely changes the coefficient

[7]The p-values are based on OLS regressions with standard errors clustered by player. Specifically, the regression equation is $chose\,lottery_i = \sum_{k=1}^{5} \beta^k rank_i^k + \epsilon_i$, where $rank_i^k$ is an indicator variable for player i having rank k. The omitted group is players in last place (rank 6).

[8]See Carlsson (2010) for a discussion and review of literature on why preferences may be more stable as subjects gain experience, and Slonim and Roth (1998) for an example of learning throughout the rounds of the ultimatum game.

[9]All results in the paper are robust to using a linear-probability model instead. Results available upon request.

of interest from its value in col. (2).

In col. (5) we test whether the effects that we interpret as LPA can instead be explained by inequality aversion. Following Fehr and Schmidt (1999), we assume that for player i "disadvantageous" inequality is proportional to $\sum_{j\neq i}\max\{x_j - x_i, 0\}$ and "advantageous" inequality is proportional to $\sum_{j\neq i}\max\{x_i - x_j, 0\}$, and that the two types of inequality can have different effects on individual utility. We then calculate the expected value of the two terms under two scenarios: (1) player i plays the lottery and all other players' balances are held constant; (2) player i takes the safe option, and all other players' balances are held constant. For each player, we calculate the difference in disadvantageous (advantageous) inequality under these two scenarios, and use this difference as a proxy for the net effect of his decision on disadvantageous (advantageous) inequality. The results in col. (5) suggest that, if anything, adding these controls increases the propensity of the last-place player to play the lottery.[10]

In col. (6) we evaluate LPA versus a model where the effect of rank is linear. While the two effects are jointly significant ($p = 0.002$), neither is individually significant at conventional levels, though the "last place" dummy is far closer ($p = 0.108$ versus $p = 0.456$). Note that both the weakly positive coefficient on the rank variable and the more significantly positive coefficient on the last-place variable are in marked contrast to the standard diminishing-absolute-risk-aversion prediction that players with the lowest balances should choose the risky option the least often.

Appendix Table 2 shows that the main results in col. (2) of Table 1 are robust to adding background and demographic controls. Only two main effects are significant: blacks are less likely to play the lottery, while political liberals are more likely. Somewhat surprisingly, given the evidence in Charness and Gneezy (2007) and elsewhere on gender differences with respect to risk tolerance, men are no more likely to choose the lottery than are women. However, men are marginally more likely to play the lottery when in last place (p=0.083, results not shown). While not quite statistically significant, whites and political conservatives follow a similar pattern. Given that all these groups are underrepresented in our data relative to the general population, a more representative sample might well have shown even stronger LPA effects.

Finally, col. (3) shows that the results barely change when individual fixed effects are

[10]We experimented with many other specifications to explore the potential effects of inequality aversion, all of which are available upon request. We calculated the differences in the inequality-aversion terms under several other scenarios, including: (1) player i plays the lottery while all $j \neq i$ also plays the lottery; (2) that player i *wins* the lottery while all $j \neq i$ takes the sure payment; (3) that i wins while all j's are held constant. We also simply included the *level* of each player's advantageous and disadvantageous inequality at the start of each round. The results are robust to all of these specification choices.

included. We tend not to emphasize these results, as with only nine rounds there is still considerable between-player variation in the randomly assigned ranks that is useful to exploit.

3.4 Why no effect for the second-to-last player?

The Nash equilibrium of the game predicts that both the last- and second-to-last place player will choose the lottery over the sure option if they are sufficiently last-place averse, whereas the results so far show that only the last-place player has a heightened tendency to choose the lottery. As noted earlier, if players "naively" hold other players' balances constant when making their decisions, then LPA predicts exactly this pattern. Given past work showing that players often ignore others' strategies even in settings where rank is made salient, this result is perhaps not surprising.[11]

We now alter the game slightly in an effort to prime players to think more strategically. This version of the game begins just as the last one did, with players ($N = 72$) being divided into twelve six-person games. As before, in each game players are randomly assigned to a position in the six-player distribution $\{\$1.75, \$2, ..., \$3\}$. However, in this version of the game, balances accumulate from one round to the next. In the first round, for example, last-place players who choose the sure option of $0.13 would begin the next round with $1.88 or if they chose the lottery and lost they would begin with $0.75. As before, players are paid based on the outcome of one randomly chosen round. Our conjecture is that when balances accumulate, so that the ramifications of prior decisions are particularly salient, players will think more strategically about their play.

The "sure" and "lottery" options of the first round of this experiment are equivalent to that of the original experiment. However, unlike the first experiment, players' balances evolve after the first round and thus we change the values of the "sure" and "lottery" options accordingly. The payment players can receive with probability one is always equal to *half* the difference between the current balance of the last-place player and the second-to-last-place player. The "winning" payment of the lottery is always equal to the difference between the current balances of the last-place and the fourth-place player.[12] The payoffs are designed so that last-place players always have the opportunity to accept a gamble that offers the possibility of moving out of last place, holding all other players' balances constant, and, usually, even if the second-to-last-place player took the sure payment.[13] In contrast, taking

[11]See, e.g., Moore and Kim (2003), Moore *et al.* (2007), and Radzevick and Moore (2008).

[12]Let $\delta_6, \delta_5, \delta_4$ be the current balances of the sixth- (last-) place player, the fifth-place player, and the fourth-place player, respectively. We define the payment individuals can receive with probability one as $\theta_{sure} = \frac{\delta_5 - \delta_6}{2}$ and the payment individuals receive if they win the lottery as $\theta_{win} = \delta_4 - \delta_6$. As before, θ_{lose} is determined by setting the expected value of the lottery equal to the sure payment: $\frac{3}{4}\theta_{win} - \frac{1}{4}\theta_{lose} = \theta_{sure}$. Note that θ_{sure} need not be a whole number and in such cases we round up to the nearest penny.

[13]If x equals the balance the sixth-place player will have in the next round conditional on winning the

the sure payment never allows the last-place player to improve his rank, holding other player balances constant, and in fact only allows a rank improvement if the second-to-last player chooses the lottery and loses.

While every game begins with the initial winning prize of the gamble set at \$.50, in subsequent rounds the prize depends on the outcomes of past rounds and tends to grow over time as the differences between ranks grow in terms of absolute dollars. The median winning prize in the final (ninth) round is \$1.92.[14] Even though balances accumulate, the game generates considerable shuffling between ranks. For example, the median player experiences four distinct ranks throughout a game and the average round results in 57 percent of players having a different rank than they did the previous round (compared to five and 77 percent, respectively, in the original version of the game).

Readers may have already noticed that this experimental design has an important drawback. The predictions in Appendix B refer to one-shot games, whereas in this version of the experiment players' balances accumulate. While players are not paid based on their final balances but on a randomly chosen round, they should still weigh both the immediate effect of their decision on the subsequent round (equivalent to the one-shot game) as well as the effect on later rounds. However, given the large body of evidence suggesting that players tend to maximize current-round payoffs even in multi-round games where the actual payoff is explicitly based on the final balance, we believe that players will generally think of their decisions as in one-shot games.[15] Our hope is that having balances accumulate primes players to think more strategically about what other players will decide, without making them explicitly focus beyond the one-shot game at hand.

3.4.1 Results when balances accumulate

Figure 2 plots the probability a player chooses the lottery option, separately by rank at the time of the decision. The most striking difference between Figures 1 and 2 is that in the

gamble, and y the balance of the fifth-place player if he takes the sure payment, then $x > y \Leftrightarrow \delta_4 > \delta_5 + \frac{\delta_5 - \delta_6}{2} \Leftrightarrow 2\delta_4 > 3\delta_5 - \delta_6 \Leftrightarrow 2(\delta_4 - \delta_5) > \delta_5 - \delta_6$. This condition holds in over 58 percent of the rounds.

[14] Note that after the first or second rounds, the algorithm for determining the θs based on the balances of the sixth-, fifth- and fourth-place players rarely produces round dollar amounts or even amounts that are multiples of five or ten cents. As a consequence, the math involved in any optimization becomes more difficult as the game progresses and is obviously more difficult than in the original version of the game.

[15] Benartzi and Thaler (1993) argue that due to myopia and mental accounting, individuals maximize current payoffs even in settings where the salient outcome is the final future payoff. Gneezy and Potters (1997) show that individuals tend to maximize over an "evaluation period." Since we inform all players of the new balances each round, each round is an evaluation period in our experiment and thus players would play each game as if it is one-shot. Camerer and Foundation (2003) use software that allows them to record the information players are viewing as they play a game. They conclude that even in a sequential game that is relatively simple to solve via backward induction, "subjects concentrated on the current round when making decisions."

former, only the last-place player chooses the lottery more than the others, whereas in the latter, both the second-to-last-place and last-place player do, roughly consistent with the Nash equilibrium of the (one-shot) game. The tendency of these two players to play the lottery more often than the others is robust to dropping early rounds and, as the p-values indicate, represents a statistically significant increase relative to each of the other ranks.[16]

Table 2 displays results from probit regression analysis. Col. (1) shows that the basic result from Figure 2 holds when round and game fixed effects are included. Players in fifth or last-place gamble at a significantly higher rate than more highly ranked players, and this effect remains after excluding the first two rounds (col. 2). Col. (3) shows the result is robust to using only the first round. While there may indeed be more noise in the first round as players are still learning the game, one reason to focus on it is that it is the only round where ranks are determined purely via random assignment and are not in part the consequence of past play.

Col. (4) includes all rounds, and shows that adding controls for players' current balance, as well as the "winning" and "losing" payments of the lottery and the "sure" payment does not change the coefficient of interest relative to its value in col (1). As noted, an important difference between the two versions of this experiment is that balances (and thus lottery and sure payments) tend to grow as balances accumulate, so for this and the remainder of regressions in the table we control for the size of payments.[17]

A potential confound in the game is that the winning amount of the lottery is equal to the difference between the fourth-place and last-place players' balances and thus is not set based on higher-ranked players' ability to move up in rank. We can test whether this confound is driving the heightened tendencies of the lowest-ranked players to gamble by focusing only on the first round, where the balance differences between players are all equal and thus the lottery provides all players outside of first place the same opportunity to move up in rank. As seen in col. (3), the coefficient of interest is actually larger in this sample.[18] We nonetheless

[16]As Figure 2 shows, the fifth-place player actually chooses the lottery more often than the sixth-place player, though this difference is not statistically significant and appears to be completely explained by players' aversion to having negative balances (unlike the original version of the game, players can have negative balances if they lose the lottery several times in a row). Even though players in this game were given a lump-sum payment so that they would never actually lose money in the experiment (see notes to Appendix Table 1, when a control for "losing the lottery will lead to a negative balance" is included, the difference between the fifth- and sixth-place players disappears.

[17]Note that current balances vary at the individual level, while the latter two variables vary at the round-game level. As such, unlike the original version of the experiment, all payments variables can be identified even though the regressions always include round fixed effects.

[18]Readers may wonder why we designed the game in such a way that this confound would exist. The alternative would be setting the lottery payoffs differently for each rank. However, doing so then introduces its own confound, that any differences across rank in the probability of choosing the lottery could be driven by the fact that the lottery and "sure" payments themselves are in fact different across ranks.

further probe this potential confound in col. (5) by explicitly controlling for whether a player could "catch" the next player: that is, for whether the winning amount is greater than the gap between him and the player above him.[19] Comparing cols. (4) and (5) shows that the coefficient of interest is unchanged—in fact, the slight decrease in col. (5) is entirely due to the different sample (running the col. 4 specification on the col. 5 sample yields a coefficient of 0.419).

Cols (6) through (8) test the result in col. (4) against, respectively, a below-the-median effect, inequality aversion, and a linear rank effect. As with the original version of the experiment, the data give little support to the first two alternative hypotheses, but when a linear rank term is added, the coefficient on the LPA term falls slightly and is now just below statistical significance. As we show in Appendix Table 2, however, when only the first round—which is based on pure random assignment— is included, the effect of being in the bottom two ranks is highly significant even when linear rank is included.

As shown in Appendix Table 1, a significantly smaller share of players in this version of the experiment answered the demographic questions after the experiment, so the demographic analysis for this experiment is more limited. Moreover, those who answer the questions play the lottery at significantly lower rates than those who do not (44 versus 55 percent of the time), suggesting differential selection into the sample who reported demographic information. Nonetheless, cols. (4) and (5) of Appendix Table 2 show that the coefficients of interest in the key Table 2 specifications are essentially unchanged after demographic controls are added; col. (6) shows the result is robust to adding player fixed effects.[20] The final three columns show that when only the first round is included (the only round where ranks are based purely on random assignment), LPA can be separately distinguished from not only a linear-rank effect, as noted in the previous paragraph, but also a below-the-median effect and inequality aversion.

3.5 Discussion

The evidence from both versions of the lottery experiment provide broad support for the predictions of the last-place-aversion model. Depending on whether players hold others' balances constant when they decide whether to choose the lottery or the "sure" payment, the model predicts that either the last-place or both the last- and second-to-last place player will choose the lottery significantly more often than other players. In the first experiment, only the last-place player chooses the lottery at a higher rate than other players. In the

[19] As this variable is only defined for those with a player above them, we exclude the first-place player.

[20] It is unclear whether player fixed effects are desirable, as only the initial assignment to rank in the first round is completely random, and player fixed effects would absorb this variation.

second experiment, which we believe likely encourages players to think more strategically, both the last- and second-to-last-place players choose the lottery at higher rates. In both cases, the results are robust to standard alternative hypotheses.

As noted earlier, the results in this section contrast with the standard result that absolute risk-aversion diminishes with wealth, and with experimental findings that individuals exhibit diminishing absolute risk aversion with respect to laboratory earnings. In our experiment, players in the bottom of the distribution—who thus have the least wealth—choose the risky option the most often. Our results thus suggest that the relationship between wealth and risk-aversion may depend on whether individuals view wealth in an absolute or relative sense, an interesting question for future work to investigate.

4 Experimental evidence of last-place aversion: preferences over redistribution

In this section, we test the predictions of last-place aversion in a very different context—subjects' decisions to redistribute experimental earnings among their fellow players. In this experiment, players play money-transfer games and face minimal uncertainty.

4.1 Experimental design

As in the lottery game, the game begins with players ($N = 42$, divided into seven six-player games) being randomly assigned dollar amounts, in this case \$1, \$2,...,\$6. As before, the ranks and current balances of all players are common knowledge throughout the game. Each player ranked two through five must choose between giving the player directly above or directly below them an additional \$2. As this choice is not well-defined for the first- and last-place players, we have the first-place player decide between the second- and third-place player, and the last-place player between the fourth- and fifth-place player. We always separately control for these two ranks as their choice sets are quite different than ranks two through five. The choice sets are summarized in Appendix Table 3. As the players are clearly instructed, the additional \$2 comes from a separate account and not from the player herself. Instructions and a typical screen shot from the game are found in Appendix C.

After players make their decisions, one player is randomly chosen and his choice determines the final payoffs of that round. As such, players should make their decisions as if they alone will determine the final distribution of the round. Players do not know which player is chosen each round or the outcome of the round. After the end of each round, players are re-randomized across the same \$1, \$2,...,\$6 distribution and the game repeats. They are paid their final balances for one randomly chosen round.[21]

[21] Note that in contrast to the lottery game, where all players' decisions were implemented simultaneously,

4.2 Predictions

A subject's choice set is limited to giving an extra $2 to one of two other players—he can keep none of it himself. As such, pure self-interest does not obviously push him toward one choice or the other, as his balance remains at its initial level regardless of the decision. Furthermore, because total surplus is held constant, players do not face an equity-efficiency trade-off, as in Engelmann and Strobel (2004).

Inequality aversion would predict that all players in ranks one through five give to the lower-ranked player. In fact, the game is constructed so that the net effect of giving to the lower-ranked person with respect to the standard Fehr-Schmidt inequality terms is constant for ranks one through five.[22] As such, any variation among these five ranks in the probability of giving to the lower-ranked player cannot be explained by standard inequality aversion.

By construction, giving to the lower-ranked player in their choice set causes all players except the first and last to drop one rank in the distribution. LPA predicts that dropping in rank would have the largest psychic cost for the second-to-last-place player, and thus we predict that individuals will be the least likely to give to the lower-ranked player when they themselves are in second-to-last place.

4.3 Initial results

Figure 3 shows how the probability a player gives the additional $2 to the lower-ranked player in his choice set varies by rank. Overall, players choose to give to the lower-ranked player in their choice set 75 percent of the time. This probability varies from over eighty percent in

after each round one player is randomly chosen to have his decision implemented, so a player need not take into account other players' decisions when making his own decision. We made this design choice largely to follow existing literature, where risk-taking in group settings is often investigated using game shows and other competitions (see, e.g., Gertner 1993 and Metrick 1995), but preferences over redistribution are often elicited using Dictator games, where players need not consider the actions of others (see Camerer *et al.* 1993 for a review of work using the Dictator game to elicit redistributive preferences).

[22] To see this, note that for ranks two through five, giving to the lower-ranked player increases disadvantageous inequality by one, whereas giving to the higher-ranked player increases it by two, so the net effect of giving to the lower- versus higher-ranked player is a decrease in disadvantageous inequality of one. For rank one, giving to the higher-ranked player in the choice set (rank two) increases disadvantageous inequality by one, whereas giving to the lower-ranked player (rank three) does not change it, so for the first-place player the net effect of giving to the lower-ranked player is to decrease disadvantageous inequality by one. For advantageous inequality, ranks two through five decrease this term by one if they give to the lower-ranked player and have no effect on it if they give to the higher-ranked player, so the net effect of giving to the lower-ranked player is a decrease of one. The first-place player decreases advantageous inequality by two if he gives to the lower-ranked player and by one if he gives to the higher-ranked player, so the net effect of giving to the lower-ranked player is a decrease of one. To summarize, for ranks one through five, the net effect of giving to the lower-ranked player is to decrease disadvantageous and advantageous inequality by one. As players are assumed to dislike both types of inequality, inequality-aversion would suggest that all these players always give to the lower-ranked player in their choice set.

the top half of the distribution, to less than sixty percent for the second-to-last place player. Players are the least likely to give to the last-place player when they are in second-to-last place and this difference is pairwise significant for the first-, third- and last-place players, and marginally significant ($p = 0.120$) for the second-place player. Those ranked fourth are nearly equally likely to deny the $2 to the lower-ranked player, though the difference grows somewhat when the first two rounds are eliminated.

The first- and last-place players are the most likely to give to the lower-ranked player in their choice set, consistent with their not facing an equality-rank trade-off. The first-place player is the most likely to give to the lower-ranked player—concerns over rank and inequality both push him toward giving money to the third- instead of the second-place player. The player in the bottom half of the distribution most likely to give to the lower-ranked player in his choice set is the last-place player, consistent with his being able to give money to the lower-ranked player without changing his rank, as he remains in last place regardless of his decision.

Table 3 presents probit regression results. In all cases, round and game fixed effects and separate dummy variables for the first- and last-place players are included, since these two players do not have parallel choice sets to those of other ranks. Col. (1) shows that adding round and game fixed-effects does not change the general patterns in Figure 3. The fifth-place player is less likely to give to the lower-ranked player in his choice set. However, col. (2) shows that, as in the figure, this effect is largely driven by players in the bottom half of the distribution (again, excluding the last-place player) being less likely to give to the lower-ranked player.

A key challenge in separating any last-place-aversion effect from competing hypotheses is that with only six ranks we have limited degrees of freedom. This problem is aggravated in the current game relative to the the earlier ones because only ranks two through five have comparable choice sets, whereas in the lottery game we could compare ranks one through six. Being able to compare only four ranks makes it nearly impossible to separate, say, a story in which individuals dislike being near last place versus one in which they want to be above the median. For this reason, we decided to re-run the experiment with eight players.

4.4 Results from the eight-player game

Beyond the number of players, the game is exactly parallel to the six-player game described in Section 4.1. Players ($N = 72$, divided into nine eight-player games) in ranks two through seven must decide between giving $2 to the person directly above them or below them, and the first-place player decides between the second- and third-place players while the last-place player decides between the sixth- and seventh-place players.

Figure 4 is the analogue of Figure 3 and presents the basic results from the eight-player game. As before, the second-to-last-place player is the least likely to give to the player below him, and this difference is often pair-wise significant from other ranks. Also as before, the third-to-last-place player is relatively unlikely to give to the player below him. Importantly, however, the player just below the median ($rank = 5$) shows no such tendency, and the pairwise difference with the second-to-last-place player is statistically significant. Put differently, comparing the six- and eight-player games suggests that there is nothing particularly salient about being, say, in fourth or fifth place, but instead behavior appears to depend on how close one is to last place: the fourth- and fifth-place players in the six-player game show strong evidence of LPA, while the fourth- and fifth-place players in the eight-player game do not.[23]

Cols. (3) through (10) of Table 3 present probit regression results from the eight-player game. Consistent with the figure, in col. (3) the second-to-last-place player is significantly less likely to give to the lower-ranked player than are other players (though, again, the first- and last-place players always have their own fixed effect, so their generally higher tendency to give to the lower-ranked player is not contributing to the coefficient), and this effect grows when early rounds are excluded (col. 4). In cols. (5) and (6), we gain precision (the standard error falls by one-fourth) by including those in third-to-last place as being affected by last-place aversion: if they give \$2 to the lower-ranked player, they would fall into second-to-last place. For the remainder of the table, we will focus on distinguishing this effect—the aversion to falling to the bottom two ranks of the distribution—from alternative hypotheses. For completeness, in Appendix Table 4 we include these same tests when only the second-to-last player is considered affected by LPA—while less precisely estimated, the point estimate of interest is very stable across these additional specifications.

Col. (7) explores the hypothesis that players are simply less likely to give to a lower-ranked player when they themselves are below the median, which we could not distinguish from last-place aversion in the six-player game. In contrast, the below-the-median indicator in col. (7) is small and insignificant and the estimated effect of being in the bottom of the distribution increases relative to the estimate in col. (5).

Col. (8) tests whether a modified form of inequality aversion can explain the reluctance of those close to last place to giving the \$2 to the lower-ranked player. As noted earlier, inequality aversion in the standard two-term Fehr-Shmidt parameterization cannot explain the results, as the decision of each player in ranks two through seven has, by construction,

[23]Interestingly, in both the six- and eight-player games, the second-place player is one of the least likely ranks to give to the player below him. We speculate that there may be some utility gained from remaining close to first place in rank, even though he would be further away in terms of absolute dollars, though this effect is not statistically significant and in fact considerably diminishes in later rounds.

the same net effect on the two terms. As such, we test whether players respond to how the Gini coefficient of the overall distribution changes when they give to the higher- versus lower-ranked of the two people in their choice set. The positive coefficient on this variable indicates that the greater this difference, the more players give to the lower-ranked player, suggesting that, all else equal, players wish to make the distribution more equal. However, this effect is not statistically significant, and including it only increases the estimated effect of being second or third from last.

Cols. (9) and (10) test whether including a linear rank term diminishes the estimated effect of avoiding the bottom of the distribution. Again, the coefficient on the indicator for being second or third from last increases. Although the p-value in col. (11) grows slightly, to 0.102, having only eight ranks from which to identify a linear effect of rank and three indicator variables (for being in last, for being in first, and for being in sixth- or seventh-place) likely limits the precision with which any single effect can be measured. When the first two rounds are excluded, the coefficient on the variable of interest regains its significance. Finally, cols. (11) and (12) present the baseline result when both the six- and eight-player games are pooled.

Appendix Table 4 shows that the main results are robust to adding demographic controls and including player fixed effects. In unreported results, self-identified religious and politically conservative people show stronger LPA effects. As with the lottery experiment, such individuals are significantly under-sampled relative to the general population, suggesting a more representative sample would display even larger LPA effects.

4.5 Discussion

The results using the eight-player design offer broad support for the hypothesis that players experience disutility from being in the bottom of the distribution. This effect can be separated from players' merely wanting to be above the median as well as from inequality aversion.

Both the six- and eight-player games suggest that players take steps to avoid falling not just to the very bottom rank, but to the second-lowest rank as well. Two possible explanations seem likely. First, players may have a similar distaste for being "near" last place in a distribution as they do for being in last place itself. In both experiments, this heightened concern over rank appears to diminish once players are safely near the middle of the distribution. Alternatively, they may care only about avoiding last place, but may have mistakenly played the game as strategic when, because only one randomly-chosen player's decision is implemented, it is actually non-strategic.[24] Especially in early rounds, the third-

[24] Our asking everyone to make their decisions and then randomly choosing a single player to be the decider is a variant of the "strategy method," which some studies have found confuse experimental subjects.

from-last player may have assumed that everyone else would give money to the last-place player, and thus (incorrectly) inferred that by allowing the second-to-last-place player to leapfrog him, he would run the risk of falling to last place himself. Either way, as we predicted, players behave in a manner consistent with their being less willing to sacrifice rank when it leads to falling to a rank that can be reasonably viewed as being in "the bottom" of the distribution.

It is worth emphasizing that those close to last place are willing to take measures that typically have high psychological cost in order to avoid falling closer to last place. As Tricomi *et al.* (2010) show, in both subjective ratings and fMRI data, the poorer member in a two-player game evaluates transfers to the richer member more negatively than the richer person evaluates transfers to the poorer person. Indeed, in the middle of the distribution the participants in our experiments generally make decisions consistent with this finding. However, between a quarter and a half of those in second-to-last place prefer to give the $2 to a person who already has more money than they do, suggesting that last-place aversion can outweigh the general aversion to giving money to a richer person found in other studies and in other parts of the distribution in our experiment.

The evidence supporting last-place aversion is especially striking given that our experiments offer players confidentiality and anonymity, as well as emphasize that rank is based on random assignment and not merit. While we believe that these conditions allow us to test for last-place aversion in a more rigorous manner, they may limit the experiments' connection to how individuals' support for redistributive public policies depends on their actual economic position, as economic position is typically not randomly assigned nor completely confidential. The remainder of the paper explores last-place aversion outside the laboratory, using survey data on minimum wage policy.

5 Last-place aversion and support for minimum wage increases

In choosing a "real-world" policy to test the predictions of last-place aversion, we select the minimum wage over other redistributive policies for several reasons. First, the minimum wage defines the "last-place" wage that can legally be paid in most labor markets, so it allows us to define "last place" more easily than in the context of other policies. Second, while the worst-off workers are not always those being paid the minimum wage (e.g., middle-class teenagers might take minimum-wage jobs during the summer), past work has found that policies that more explicitly target the poor such as Temporary Assistance for Needy Families could have potentially confounding racial associations.[25] While those racial associations are interesting

[25]See Gilens (1996) on the association white survey respondents make between welfare and African-Americans.

and, as we briefly discuss later, might well relate to last-place aversion, we leave them to future work. Third, through spillover effects to other low-wage workers, the minimum wage plays an important role in the compensation of low-income workers and thus analyzing the determinants of its political support has potentially important policy consequences.[26]

5.1 Predicting who would support a minimum wage increase

A minimum wage increase is a transfer to some low-wage workers from—depending on market characteristics—other low-wage workers who now face greater job rationing, employers with monopsony power in the labor market, or consumers who now pay higher prices.[27]

Assuming low-wage workers are not concerned with adverse employment effects—a hypothesis we directly test in the empirical work—they should generally exhibit the greatest support for an increase relative to other workers. First, they themselves might see a raise, depending on the difference between their current wage and the proposed new minimum and the strength of spillover effects to workers just above the proposed new minimum. Second, even for those who would not be directly affected, the policy could act as wage insurance and should increase their reservation wage. Finally, if low-wage workers are relatively substitutable, then those making just above the current minimum should welcome a minimum-wage increase as employers would then have less opportunity to replace them with lower-wage workers.

Last-place aversion, in contrast, predicts that individuals making just above the current minimum would have limited enthusiasm for seeing it increased. The minimum wage essentially defines the "last-place" wage a worker in most labor markets can legally be paid. A worker making just above the current minimum might see a wage increase from the policy, but could now herself be "tied" with many other workers for last place.

5.2 Evidence from online survey data

5.2.1 Data collection and summary statistics

Questions regarding the minimum wage have often appeared in opinion surveys, but to the best of our knowledge none have also asked respondents to report their own wages (as opposed to household income). We thus designed our own survey, which was administered

[26]In fact, Lee (1999) estimates that the majority of the growth in the wage gap between the tenth and fiftieth percentiles during the 1980s was due to the erosion of the federal minimum wage during the decade.

[27]There is a large literature on the effect of the minimum wage on employment levels, which we do not review here. The monopsony argument was first made by Stigler (1946), and Aaronson (2001) provides evidence of price pass-through in the restaurant industry.

in the fall of 2010.[28] Subjects were randomly selected from a nationwide pool and invited to complete the online survey in exchange for five dollars. Enrollment in the study was limited to employed individuals between the ages of 23 and 64, so as to target prime-age workers. We also over-sampled low-wage and hourly workers.

The survey stated the current federal minimum wage ($7.25) and then asked respondents whether it should be increased, decreased or left unchanged. The survey asked those who identified themselves as hourly-wage workers: "What is your current hourly wage? If you have more than one job, please enter the wage for your main job." For those who did not specifically identify themselves as hourly workers, the survey asked: "If you are currently paid by the hour for the main job you hold, what is your hourly wage? (Even if you are not actually paid by the hour, please calculate your estimated hourly wage. You can do this by dividing your paycheck by how many hours you typically work in a pay period.)"

We make the following sampling restrictions in generating our regression sample. First, we drop the 74 people who completed the survey in less than two minutes (even though we wrote the survey, it took us an average of three minutes to complete). We also drop from this sample twelve individuals who report being unemployed but somehow slipped through the survey's filter. We also drop 63 observations with missing or unusable wage data (e.g., "I work on commission," "Depends"). These exclusions leave a regression sample of 489 observations, with a median wage of $13.80.

The first column of Appendix Table 5 displays summary statistics from the online survey data. Given the explicit oversampling of certain groups and the fact that online surveys by their nature are not likely to appeal to the entire population equally, we do not expect the data to resemble a random sample of the U.S. population. Indeed, compared to the sample from the Pew Research Center that we use later in this section, there is over-representation of women and college graduates, and under-representation of minorities and married people.

5.2.2 Graphical results

Figure 5 shows how support for increasing the minimum wage varies across wage groups in our survey. As found in past surveys, increasing the minimum wage is a popular policy—roughly eighty percent of our sample appears to support the idea. The striking exception, however, is the relative lack of support among those making just above the current minimum. They are, in fact, the group least likely to support it, and the difference between them and other groups in the figure is often statistically significant.[29] With the exception of this group, support for

[28]The survey was administered by C&T Marketing Group, `http://www.ctmarketinggroup.com`.

[29]In one version of the survey, we asked questions specifically designed to illicit information regarding people who report making *less* than the minimum wage. About a third worked for tips. More than half

increasing the minimum wage appears to decrease roughly linearly with individuals' wages.

5.2.3 Regression results

Table 4 presents probit regression results. Without any controls, the effect of being "just above" the current minimum wage (i.e., making more than $7.25 but no more than $8.25 an hour) is negative but not significant, as shown in col. (1). Note that this specification is fairly demanding because we do not include any other controls for wage (even though Figure 5 shows a negative effect of wages on support) or limit the sample to those with relatively low wages. As such, those making just above the minimum wage are largely being compared to those making substantially more than they do. When in col. (2) we limit the sample to those below the median wage and include a linear control for wage, the effect of being just above the current minimum is highly significant without any additional controls, not surprising given the striking pattern in Figure 5.

For the sake of being conservative and parsimonious, we choose the more demanding specification in col. (1) and in the remainder of the table explore its robustness. In col. (3), adding basic demographic controls substantially increases the effect of being just above the minimum wage. This result is not surprising—the types of workers who normally support a minimum wage increase (women, minorities, young workers) are over-represented among those making just above $7.25. Adding controls for Census division, the state-level minimum wage and an indicator for whether it is above $7.25 marginally increases the coefficient of interest (col. 4). Similarly, controlling in col. (5) for education and marital status also marginally increases the magnitude of the effect, as does controlling for party affiliation, union status and approval rating of President Obama (col. 6). With a small sample like ours, the coefficient estimate might be attributable to randomly having sampled, say, a very politically conservative group who happen to make within a dollar of the current minimum. In fact, however, workers making between $7.25 and $8.25 give Obama the highest approval rating of any of the wage groups depicted in Figure 5.

An important concern regarding the results reported so far is that they may be driven by worries regarding the effect of the minimum wage on the demand for low-wage labor and not last-place aversion. For this reason, we also asked participants: "Do you worry that if the minimum wage is set too high, it might make employers reduce hiring and possibly cause you to lose your job?" We control for the answer to this question in col. (7). Not surprisingly, those who report that a minimum wage increase might threaten their job are far less likely to support the policy, but controlling for this variable does not affect the coefficient on the variable of interest. In fact, of the four lowest-wage groups in Figure 5, those making between

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reported that they thought their own wage would rise if the minimum wage increased.

$7.25 and $8.25 report the lowest concern about employment effects (not shown), and yet they exhibit the greatest opposition to a minimum wage increase.

5.3 Pew Research Center data

Workers in our survey making just above the minimum wage exhibit limited support relative to other workers for seeing it raised, a result that might be seen as surprising but is consistent with last-place aversion. We now seek confirming evidence in a more nationally representative sample. As noted earlier, results from existing national surveys are at best just suggestive, as only income and not wage data are available. Our approach in this section is to present the data with as little analysis as possible and merely try to gauge whether the income patterns appear roughly consistent with the wage patterns in our online survey.

5.3.1 The data

We selected every Pew Research Center survey over the past ten years that both asked respondents if they approved or disapproved of a minimum wage increase and asked for their income and employment status.[30] Three surveys (from June 2001, December 2004, and March 2006) met these criteria. During this period, the federal minimum wage was $5.15 per hour, and respondents were asked about increasing it to $6.45, except that the March 2006 survey randomly assigned half the sample to consider an increase to $6.45 and the other half to $7.15.

To match the online survey, we sample employed individuals between the ages of 23 and 64. Summary statistics appear in the last two columns of Appendix Table 5.

5.3.2 Results

Appendix Figure 1 shows how support for increasing the minimum wage from $5.15 to $6.45 varies across the income groups in the Pew survey. The raw data show a small drop in support going from the lowest-income group to the second-lowest-income group, and a general downward trend in support as income increases. When we control for basic demographics and background characteristics such as education, marital status and political affiliation, the relative opposition among the second-lowest-income group increases. Conditional on these

[30] We excluded other Pew surveys that instead asked whether increasing the minimum wage should be a "top priority, important but lower priority, not too important or should not be done," because the wording was not similar to our web survey. The other publicly-accessible national polls on the minimum wage are conducted by the *New York Times* and CBS. We chose Pew over *NYT*/CBS because Pew offers greater disaggregation of income and thus more detail on the income levels of poorer households.

controls, individuals with family income between \$10,000 and \$20,000 are the *least* supportive among all groups with annual family income below \$100,000.

Appendix Figure 2 is analogous to Appendix Figure 1 but includes only the smaller sample of participants (half of the March 2006 survey) who were asked to consider a minimum wage increase from \$5.15 to \$7.15. Individuals with family income between \$20,000 and \$30,000 are, both in the raw data and after controlling for background characteristics, the least supportive of an increase among all respondents with family income below \$100,000. Interestingly, leaving aside the very highest income group, as the hypothetical new minimum wage increases, the income level of the group most opposed to it also increases, consistent with the last-place effect reaching further up in the income distribution.

How might the family income levels in the Pew survey relate to wages? On the one hand, someone working fifty weeks a year and forty hours a week would make \$14,300 at a wage of \$7.15 and \$12,900 at a wage of \$6.45. On the other hand, in the 2004 March Current Population Survey the median family income of a worker between the ages of 23 and 64 who makes between \$5.25 and \$7.15 an hour is between \$25,000 and \$30,000. As such, those who might be most affected by last-place aversion concerns arising from minimum-wage increases would likely have income between \$10,000 and \$30,000, consistent with Appendix Figures 1 and 2. However, it must be emphasized that the correspondence between family income and wage levels is very rough, and thus that these results, while generally consistent with the online data, are at most suggestive.

5.4 Discussion

In both our online survey and the Pew data, we find that low-wage and low-income workers are often the least likely to support increases in the minimum wage. The relatively tepid support among low-income workers for such a transfer is consistent with last-place aversion, as those who are marginally better off seek to retain their ability to distinguish themselves from those in "last place." One might have expected that in moving from the laboratory—where reference groups are fixed and highly salient—to the field—where individuals can be members of many peer groups—would have diminished the LPA effect. In contrast, the minimum wage results suggest that the income or wage distribution is salient to individuals in the bottom of the distribution, resulting in behavior consistent with the behavior observed in the laboratory experiments.

A further prediction of LPA that we do not test with survey data (though which was born out in the redistribution experiments) is that not only are those in the bottom of the distribution opposed to transfers to those just below them, but, relative to those at the bottom, middle- and upper-income individuals are less opposed to a transfer to a marginally worse-off group than themselves. A potential test of this prediction would be to ask survey respondents their income and then describe a tax credit that phased out just below their income level. LPA would predict that support for such a scheme would be weakest among low-income workers. In this paper we wished to focus on an actual policy that would be familiar to respondents, but examining how individuals respond to hypothetical transfer policies that benefit different parts of the income distribution is a potentially interesting question for future research.

As noted earlier, we chose to focus on the minimum wage in part to avoid the strong racial connotations of redistributive programs such as welfare. But future work might wish to explore implications of last-place aversion on racial attitudes. For example, African-Americans have always occupied a lower position in the national income distribution than whites, and thus might well serve as the "last-place" reference group for whites. Of course, individual African-Americans have higher incomes than individual whites, but even today median household income for non-Hispanic whites is over seventy percent higher than that of African-Americans.[31] LPA predicts that this reference group should have little meaning to whites with incomes that are a safe distance from the bottom of the distribution. However, for, say, the thirty percent of whites with household income below that of the median African-American household, any improvement in the social or economic position of African-Americans may cause significant disutility and thus lead them to oppose redistributive policies because they might differentially benefit African-Americans. Indeed, many scholars have noted that support for redistributive programs among working-class whites began to decline abruptly after 1964, when civil rights legislation guaranteed that such programs could no longer exclude African-Americans and other minorities.[32] If anything, given the utility derived from behavior that reflects a valued social identity (Akerlof and Kranton, 2000), we might expect LPA to be even more pronounced in the presence of real-world social group competition, compared to our laboratory experiments in which identity is signaled only by an arbitrary rank that lacks other social meaning for participants.

6 Conclusion

We began by presenting a simple model in which individual utility depends on a standard concave function of income as well as an indicator variable for whether one is in last place among a finite reference group. We then set up an experiment in which the model predicts that the last-place player (and, depending on the degree of strategic sophistication, the

[31]See Income, Poverty and Health Insurance Coverage in the United States, which is based on the 2010 Current Population Survey, at www.census.gov/prod/2011pubs/p60-239.pdf.

[32]See, for example, Edsall (1992).

second-to-last-place player as well) will choose to play a lottery over receiving a risk-free payment of equivalent expected value. The data strongly support this prediction, and the elevated likelihood of players in the bottom of the distribution to choose the risky option stands in marked contrast to the standard prediction that absolute risk aversion diminishes with wealth.

In the money-transfer experiments we conducted, the tendency to give to the lower-ranked player is lowest for the second-to-last place player, again consistent with last-place aversion. Perhaps most striking is that in order to maintain their rank, players close to last place will often give money to players who already have more money than they do rather than give that money to players who have less.

We then apply the insights from the redistribution experiments to predict respondents' preferences regarding a particular redistributive policy—the minimum wage. Last-place aversion would predict that those making just above the current minimum wage would face a trade-off: on the one hand, they may receive a raise if the new minimum wage is above their current wage; on the other hand, they would then join the "last-place" group. In data we collect ourselves, we find that support for a minimum wage increase is lowest among those making just above the current minimum. Using data from the Pew Research Center, we also find that support for a minimum wage increase is relatively low among groups whose income would suggest they themselves make close to the minimum wage.

Future research might explore the implications of LPA in a seemingly unrelated domain: consumer behavior. Past work has noted consumers' tendency to purchase the second cheapest wine on a menu (McFadden, 1999). While consumers might be making rational inferences about product attributes (see, e.g., Kamenica, 2008), they might also be exhibiting a standard response to price but simultaneously avoiding association with the "last-place" product. In a choice set of three or four, these tendencies would lead consumers to pick a "middle" option—the "compromise effect" in behavioral decision theory (Simonson, 1989). Similarly, LPA might relate to consumers' decisions to remain in or leave a queue. Indeed, Zhou and Soman (2003) show that the probability of an individual reneging from a line diminishes as the number waiting behind him grows, controlling for the number ahead of him. Perhaps firms could increase sales by engaging with customers at the very end of the line, until a new arrival takes over last place.

Turning to a very different application, LPA might also contribute to our understanding of the higher incidence of crime and delinquency exhibited by members of lower socio-economic groups. Violent crime, especially among males, is often related to status and "saving face," and LPA would indeed predict status anxiety to be most acute near the bottom of a given distribution.[33] For example, LPA might help explain why criminal activity increased among the boys who moved to better neighborhoods in the Moving-to-Opportunity study (Kling *et al.*, 2005), as they now attend better schools where they are more likely to be at the bottom of the classroom distribution.

Finally, modifying certain aspects of our experimental design would shed further light on last-place aversion. While we took steps to design the experiments in a manner that would not bias us toward finding evidence for last-place aversion, future research could relax some of these conditions in order to examine which factors intensify or diminish LPA. We suspect that making payoffs public or making rank a function of task performance would increase the magnitude of LPA. Outcomes besides risk aversion and redistribution could also be studied; for example, will those in last place work especially hard at a given task to try to move up in rank, or will they instead tend to give up?[34] In our experiments, the peer groups were randomly assigned and fixed throughout the game, but future work may focus on the role of LPA in endogenous group formation. For example, LPA would predict that those with the lowest rank in a current game would be the most likely to choose to join a different game with lower average payoffs but the promise of an improved rank.

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[33] The classic study of Philadelphia homicides by Wolfgang (1958) found that nearly 40 percent began with an "[a]ltercation of relatively trivial origin: insult, curse, jostling."

[34] Genicot and Ray (2009) model the interaction of aspirations and investments, with poverty traps arising because the very poor will likely remain at least somewhat poor regardless of their investments, leading them to not invest at all. Empirically, Hoxby and Weingarth (2005) use random assignment to classrooms to estimate peer effects and find that low-achieving students perform better when they are not the only low-achieving student in the classroom.

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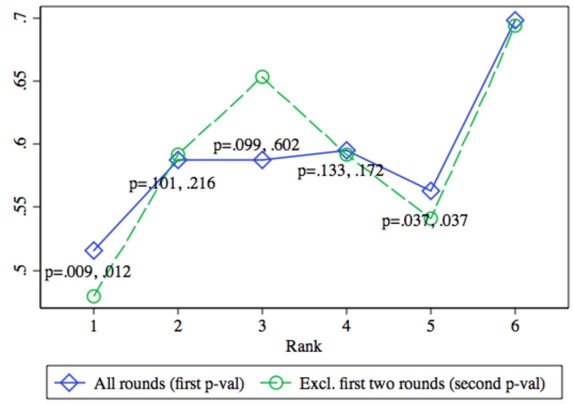
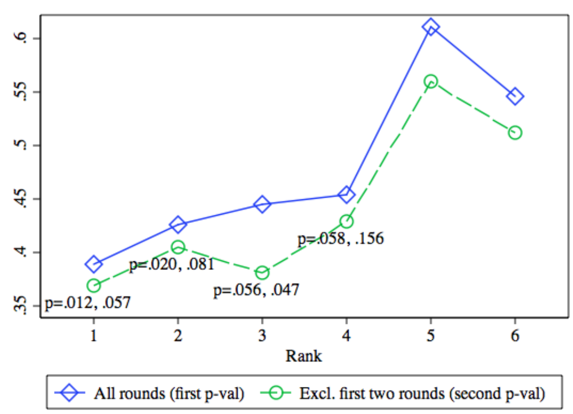
Figure 1: Share choosing the lottery over the "sure" payment (one-shot games)



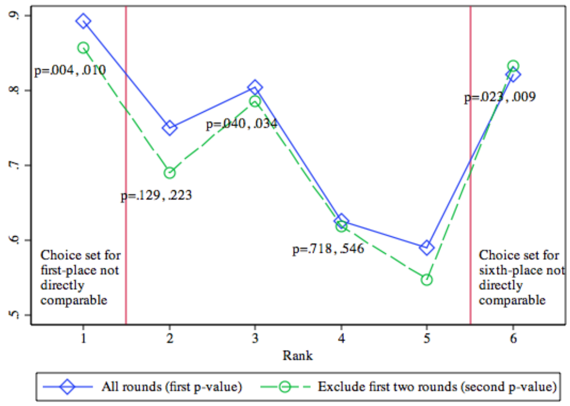
Notes: Based on fourteen six-player games of nine rounds each, for a total of 756 observations. Each round every player was given the same choice between a two-outcome lottery and a risk-free payments of equivalent expected value. See Section 3.1 for details. All p-values are based the OLS regression: $chose\,lottery_i = \sum_{k=1}^{5} \beta^k rank_i^k + \epsilon_i$, where $rank_i^k$ is an indicator variable for player i having rank k, standard errors are clustered by player, and no other controls are included. Thus, last (sixth) place is the omitted category. For each rank, the first p value refers to its estimated fixed effect from estimating the equation on all rounds of data, and the second p-value from all rounds of data except the first two.

Figure 2: Share choosing the lottery over the "sure" payment when balances accumulate



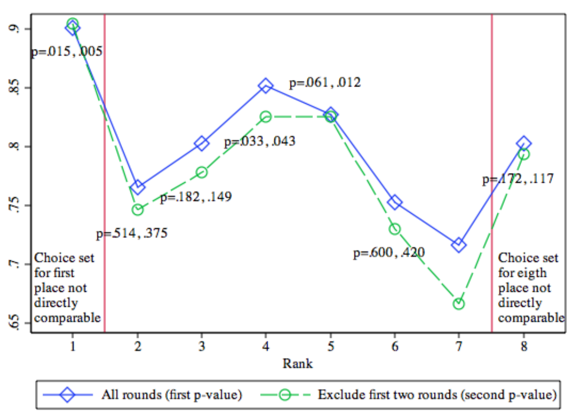
Notes: Based on twelve six-player games of nine rounds each, for a total of 648 observations. Each round every player was given the same choice between a two-outcome lottery and a risk-free payments of equivalent expected value. See Section 3.4 for details. All p-values are based on the OLS regression: $chose\,lottery_i = \sum_{k=1}^{4} \beta^k rank_i^k + \epsilon_i$, where $rank_i^k$ is an indicator variable for player i having rank k, standard errors are clustered by player, and no other controls are included. Thus, last and second-to-last (sixth and fifth) places are the omitted categories. For each rank, the first p value refers to its estimated fixed effect from estimating the equation on all rounds of data, and the second p-value from all rounds of data except the first two.

Figure 3: Share choosing to give \$2 to the lower-ranked player in their choice set



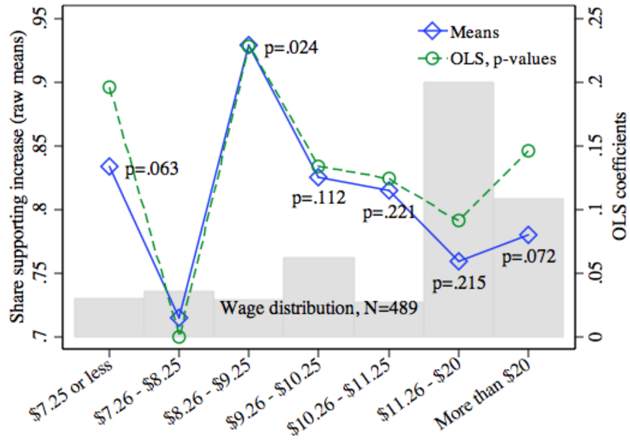
Notes: Based on seven six-player games of eight rounds each, giving a total of 336 observations. Each player except the first- and last-place player were given the choice between giving an extra \$2 to the person directly above or below them in the distribution. The first-place player decided between the second- and third-place player, while the last-place player decided between the fourth- and fifth-place player. See Section 4.1 for details. All p-values are based the OLS regression: $\textit{gave to lower rank}_i = \sum_{k\neq 5}^{6} \beta^k rank_i^k + \epsilon_i$, where $rank_i^k$ is an indicator variable for player i having rank k, standard errors are clustered by player, and no other controls are included. Thus, second-to-last (fifth) place is the omitted category. For each rank, the first p value refers to its estimated fixed effect from estimating the equation on all rounds of data, and the second p-value from all rounds of data except the first two.

Figure 4: Share choosing to give \$2 to the lower-ranked player in their choice set (eight-player game)



Notes: Based on nine eight-player games of nine rounds each, giving a total of 648 observations. Each player except the first- and last-place player were given the choice between giving an extra \$2 to the person directly above or below them in the distribution. The first-place player decided between the second- and third-place player, while the last-place player decided between the sixth- and seventh-place player. See Section 4.4 for details. All p-values are based the OLS regression: $\textit{gave to lower rank}_i = \sum_{k\neq 7}^{8} \beta^k rank_i^k + \epsilon_i$, where $rank_i^k$ is an indicator variable for player i having rank k, standard errors are clustered by player, and no other controls are included. Thus, second-to-last (seventh) place is the omitted category. For each rank, the first p value refers to its estimated fixed effect from estimating the equation on all rounds of data, and the second p-value from all rounds of data except the first two.

Figure 5: Support for increasing the minimum wage from $7.25, by wage rate



Notes: Based on authors' online survey of employed individuals ages 23 to 64. See Section 5.2 for details. The first series displays the share of each wage group that supports increasing the minimum wage. The second series plots the coefficients (with p-values labeled) on the wage-category fixed effects (omitted category $7.25 $> wage \geq$ $8.25) from an OLS regression that also controls for gender, race, ethnicity, educational level, party affiliation, marital and parental status, approval rating of President Obama, and union status.

Table 1: Probit regressions of the propensity to choose the lottery (one-shot games)

	Dept. variable: Chose to play the lottery					
	(1)	(2)	(3)	(4)	(5)	(6)
In last place	0.344**	0.377**	0.354**	0.349**	0.499*	0.289
	[0.145]	[0.147]	[0.174]	[0.159]	[0.259]	[0.180]
Below median				0.0477		
				[0.105]		
Δ Disadv. inequality					-0.116	
					[0.137]	
Δ Adv. inequality					0.900	
					[0.666]	
Rank						0.0294
						[0.0362]
Rounds	All	All	Ex. early	All	All	All
Round and game FE?	No	Yes	Yes	Yes	Yes	Yes
Observations	756	756	588	756	756	756

Notes: Based on 14 six-player games of nine rounds each. All regressions are estimated via probit and cluster standard errors by individual player. The dependent variable for all regressions is an indicator variable coded as one if the subject chose the gamble over the risk-free payment. See Section 3 for further details on the experiment. In specifications that "exclude early" rounds, the first two rounds are not included. Following Fehr and Schmidt (1999), *Disadvantageous inequality* is defined as $\sum_{j \neq i} \max\{x_j - x_i, 0\}$ and *Advantageous inequality* as $\sum_{j \neq i} \max\{x_i - x_j, 0\}$. The Δ for each of these variables is defined as the expected value when player i plays the lottery minus the value when he takes the sure payment. $^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 2: Probit regressions of the propensity to choose the lottery (balances accumulate)

	Dept. variable: Chose to play the lottery							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Last or fifth place	0.402*** [0.122]	0.369** [0.144]	1.144*** [0.383]	0.495*** [0.124]	0.479*** [0.130]	0.398** [0.176]	0.463*** [0.132]	0.308 [0.225]
Current balance				0.0318** [0.0139]	0.0328** [0.0137]	0.0340** [0.0139]	0.0516** [0.0247]	0.0364*** [0.0137]
Winning lottery payment				22.69 [15.49]	22.71 [15.50]	22.56 [15.58]	42.16 [30.94]	22.50 [15.65]
Certain payment				-30.27 [20.66]	-30.30 [20.67]	-30.11 [20.78]	-56.29 [41.26]	-30.03 [20.87]
Losing lottery payment				7.600 [5.162]	7.606 [5.164]	7.558 [5.191]		7.535 [5.214]
Could catch next player					0.0578 [0.148]			
Below median						0.139 [0.163]		
Δ Disadv. inequality							4.686 [3.436]	
Δ Adv. inequality							-4.700 [3.437]	
Rank								0.0668 [0.0631]
Rounds	All	Ex. early	First	All	All	All	All	All
Observations	648	504	66	648	648	648	648	648

Notes: Based on twelve six-player games of nine rounds each. All regressions are estimated via probit and include round fixed effects and cluster standard errors by individual player. The dependent variable for all regressions is an indicator variable coded as one if the subject chose the gamble over the risk-free payment. See Section 3 for further details on the experiment. In specifications that "exclude early" rounds, the first two rounds are not included. "Could catch next player" is an indicator variable for $x_i + \textit{winning payment} > x_{i+1}$, where x_i is player i's current balance and x_{i+1} is that of the player directly above him. Following Fehr and Schmidt (1999), *Disadvantageous inequality* is defined as $\sum_{j \neq i} \max\{x_j - x_i, 0\}$ and *Advantageous inequality* as $\sum_{j \neq i} \max\{x_i - x_j, 0\}$. The Δ for each of these variables is defined as the expected value when player i plays the lottery minus the value when he takes the sure payment. $^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 3: Probit regressions of the propensity to give $2 to the lower-ranked player

	Dependent variable: Gave money to the lower-ranked player											
	Six-player games		Eight-player games								Both	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Second from last	-0.412*	-0.113	-0.266*	-0.346**								
	[0.231]	[0.256]	[0.154]	[0.164]								
Second or third from last					-0.256**	-0.300**	-0.307*	-0.320**	-0.465	-0.533*	-0.358**	-0.361**
					[0.116]	[0.128]	[0.186]	[0.133]	[0.288]	[0.296]	[0.111]	[0.112]
Below median		-0.472*					0.0675					
		[0.251]					[0.198]					
Δ Gini coefficient								34.08				
								[32.80]				
Rank									0.0689	0.0763		
									[0.0852]	[0.0896]		
Rounds	All	All	All	Ex. early	All	Ex. early	All	All	All	Ex. early	All	Ex. early
Observations	336	336	648	504	648	504	648	648	648	504	984	756

Notes: The first two columns are based on seven six-player games of eight rounds each, giving a total of 336 observations, and the next eight columns are based on nine eight-player games of nine rounds each, giving a total of 648 observations. All regressions are estimated via probit, include round and game fixed effects, and cluster standard errors at the individual level. The dependent variable is an indicator variable for whether the individual chose to give $2 to the lower ranked of the two players in his choice set. See Section 4 for further details on the experiment. $\Delta Gini$ is defined as the Gini coefficient if the player gives the additional $2 to the higher-ranked player minus the Gini coefficient if he gives the $2 to the lower-ranked player. $^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$.

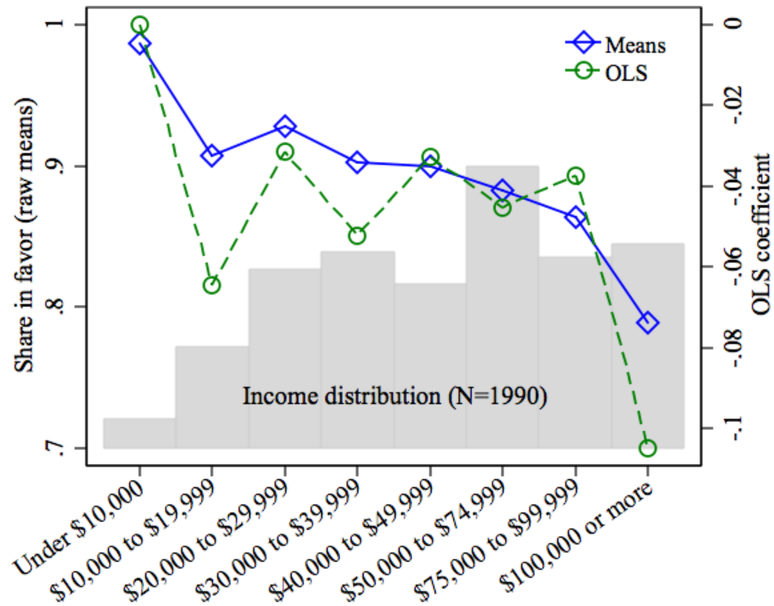
Table 4: Probit regressions of the propensity to support a minimum wage increase

	Support min wage increase (Yes/No)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Just above current min wage	-0.243	-0.580**	-0.443*	-0.467*	-0.521**	-0.562**	-0.548**
	[0.234]	[0.283]	[0.248]	[0.255]	[0.260]	[0.270]	[0.274]
Hourly wage		-0.119**					
		[0.0510]					
Male			-0.262*	-0.250*	-0.279*	-0.227	-0.253
			[0.140]	[0.144]	[0.148]	[0.157]	[0.160]
Black			1.084**	1.135**	1.067**	0.512	0.569
			[0.449]	[0.476]	[0.496]	[0.526]	[0.542]
Hispanic			-0.392	-0.367	-0.392	-0.367	-0.320
			[0.447]	[0.466]	[0.479]	[0.487]	[0.479]
Age divided by 100			-0.609	-0.547	-0.214	0.234	0.172
			[0.624]	[0.646]	[0.708]	[0.761]	[0.781]
Native born			0.184	0.354	0.392	0.417	0.529
			[0.332]	[0.348]	[0.355]	[0.377]	[0.374]
Min. wage increase threatens job							-0.178***
							[0.0421]
Specification	Probit	Probit	Probit	Probit	Probit	Probit	Probit
Sample	All	Low-wage	All	All	All	All	All
Demographic controls	No	No	Yes	Yes	Yes	Yes	Yes
Geographic controls	No	No	No	Yes	Yes	Yes	Yes
Background controls	No	No	No	No	Yes	Yes	Yes
Political controls	No	No	No	No	No	Yes	Yes
Observations	489	244	486	481	481	481	481

Notes: All data are from the minimum wage Internet survey (see Section 5.2 for further detail) and all regressions are probit regressions for whether a respondent answered that the minimum wage should be increased. In col. (2), individuals with wages above the median of $13.80 are excluded. In col. (4), "geographic controls" include fixed effects for the eight Census divisions, the level of the state minimum wage, and an indicator variable for whether the state minimum is above the federal minimum. In col. (5), "background controls" include marital status; and indicator variables for no high school, some high school, high school degree, some college, two-year college degree, four-year college degree, master's degree, doctoral degree, professional degrees. In col. (6), "political controls" include fixed effects for major party affiliation; a one-to-seven approval rating of President Obama; and union status. Col. (7) includes the control "Min wage increase threatens job." This variable is based on the following question: "Do you worry that if the minimum wage is set too high, it might make employers reduce hiring and possibly cause you to lose your job?" where one indicates "not at all worried" and seven indicates "very worried." $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

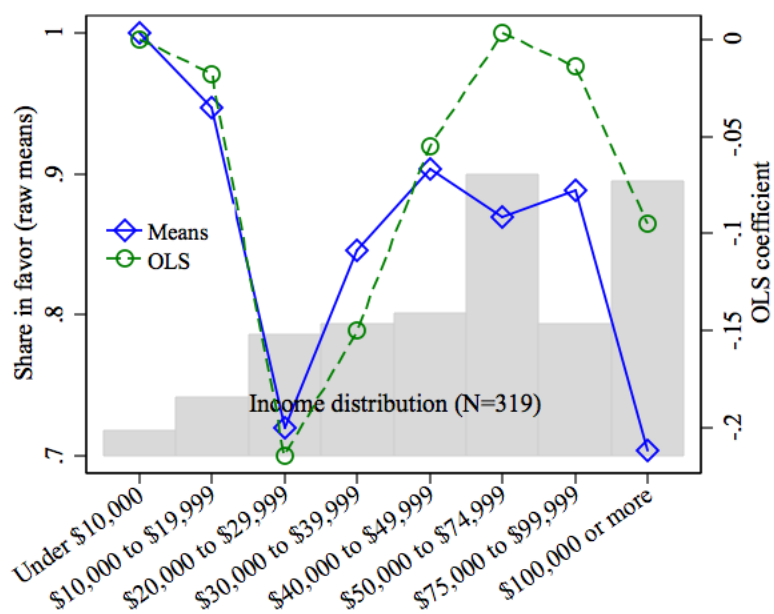
Appendices

Appendix Figure 1: Support for increasing the minimum wage to \$6.45, by family income



Notes: Based on employed individuals ages 23 to 64 in June 2001, December 2004 and March 2006 Pew surveys. See Section 5.3 for further detail. The first series displays the share of each income group that supports increasing the minimum wage. The second series plots the coefficients on the income-group fixed effects from an OLS regression that also controls for gender, race, ethnicity, educational level, party affiliation, marital and parental status, approval rating of President Bush, and union status.

Appendix Figure 2: Support for increasing the minimum wage to \$7.15, by family income



Notes: Based on employed individuals ages 23 to 64 in the March 2006 Pew survey. Otherwise all analysis follows that in Appendix Figure 1.

Appendix Table 1: Summary statistics, experimental data

	Section 3		Section 4	
	One-shot	Cumulative	Six-player games	Eight-player games
Answered background questions	0.964	0.639	0.690	0.972
	(0.187)	(0.484)	(0.468)	(0.165)
Male	0.370	0.391	0.552	0.557
	(0.486)	(0.493)	(0.506)	(0.500)
Age	24.15	25.74	24.83	24.61
	(4.299)	(2.955)	(4.184)	(4.154)
Black	0.0988	0.0652	0.103	0.0571
	(0.300)	(0.250)	(0.310)	(0.234)
Hispanic	0.0617	0.239	0.0690	0.114
	(0.242)	(0.431)	(0.258)	(0.320)
Full-time student	0.568	0.761	0.690	0.800
	(0.498)	(0.431)	(0.471)	(0.403)
Very conserv. (1) to very liberal (7)	5.247	5.261	5.414	5.343
	(1.445)	(1.219)	(1.701)	(1.295)
Not at all (1) to very religious (5)	2.654	2.326	2.586	2.371
	(1.153)	(1.156)	(1.323)	(1.265)
Observations	84	72	42	72

Notes: All observations are drawn from the pool of individuals who registered with the Harvard Business School Computer Lab for Experimental Research (CLER). In order to be eligible, individuals must not be on the Harvard University payroll, must be 18 or older, fluent in English and comfortable using a computer. For tax purposes, they must have a valid Social Security number or letter of sponsorship and visa connected to their country of tax residency. All subjects were paid $15 per hour. Additionally, in the second (cumulative) lottery experiment, they were told a randomly chosen player would receive a cash payment equal to $20 plus his current balance in the game at that point. The $20 was given so that no player would actually leave the experiment with less money than their hourly compensation.

Appendix Table 2: Additional specifications from the lottery experiments in Tables 1 and 2

	Dependent variable: Chose the lottery over the "sure" payment								
	Table 1, col. (2)			Table 2, col. (4)			Table 2, cols. (6), (7), (8)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Last or fifth place	0.435***	0.464***	0.644**	0.561***	0.575***	0.666**	1.379**	2.864***	1.623***
	[0.151]	[0.154]	[0.310]	[0.147]	[0.146]	[0.261]	[0.601]	[1.000]	[0.621]
Male		0.149			-0.0347				
		[0.197]			[0.140]				
Black		-0.476**			-0.461				
		[0.240]			[0.518]				
Hispanic					-0.0707				
					[0.177]				
Age		-0.0228			-0.0184				
		[0.0215]			[0.0238]				
Very conserv. (1) to very liberal (7)		0.133**			-0.126**				
		[0.0599]			[0.0493]				
Not at all (1) to very religious (5)		0.0547			-0.0357				
		[0.0777]			[0.0688]				
Estim. method	Probit	Probit	C. logit	Probit	Probit	C. logit	Probit	Probit	Probit
Player fixed effects	No	No	Yes	No	No	Yes	No	No	No
Payment controls	No	No	No	No	No	No	No	No	No
Below-median control	No	No	No	No	No	No	Yes	No	No
Ineq-aversion controls	No	No	No	No	No	No	No	Yes	No
Linear rank control	No	No	No	No	No	No	No	No	Yes
Round	All	All	All	All	All	All	First	First	First
Observations	729	729	576	414	414	594	72	66	66

Notes: The dependent variable for all regressions is an indicator variable coded as one if the subject chose the gamble over the risk-free payment (see Section 3 for further details on the experiment). Each specification tests the robustness of a key result from the main text, and the column headings refer to the specification being tested. In cols. (1) and (4), observations with any missing value for the variables included in, respectively, cols. (2) and (5) are dropped so that the sample is constant for each pair of specifications. Cols. (7) through (9) use only observations from the first round of the (cumulative) lottery experiment to test whether the effect of being in fifth or sixth place can be separated from, respectively, the effect of being below the median, inequality-aversion controls, and a linear effect of rank. Note that the Hispanic indicator variable is collinear with other controls in col. (2) so drops out. $^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$.

Appendix Table 3: Summarizing choice sets for players in the redistribution game

Rank	Initial balance	Choice set: Give $2 to...
First	$6	Second- or third-place player
Second	$5	First- or third-place player
Third	$4	Second- or fourth-place player
Fourth	$3	Third- or fifth-place player
Fifth	$2	Fourth- or sixth-place player
Sixth	$1	Fourth- or fifth-place player

Appendix Table 4: Additional specifications from the redistribution experiment in Table 3

	Dependent variable: Gave money to the lower-ranked player in choice set									
	Eight-player							Both six- and eight-player		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Second from last	-0.266*	-0.346**	-0.228	-0.336**	-0.301**	-0.270	-0.370*			
	[0.154]	[0.164]	[0.165]	[0.167]	[0.153]	[0.201]	[0.203]			
Second or third from last								-0.272**	-0.271**	-0.463*
								[0.118]	[0.123]	[0.276]
Below median			-0.0643	-0.0165						
			[0.135]	[0.151]						
Δ Gini coefficient					24.76					
					[29.08]					
Rank						0.00126	0.00801			
						[0.0477]	[0.0513]			
Male									-0.182	
									[0.210]	
Black									0.147	
									[0.304]	
Hispanic									-0.236	
									[0.369]	
Age									-0.0109	
									[0.0255]	
Very conserv. (1) to very liberal (7)									0.0942	
									[0.0758]	
Not at all (1) to very religious (5)									0.175**	
									[0.0810]	
Rounds	All	Ex. early	All	Ex. early	All	All	Ex. early	All	All	All
Player fixed effects	No	No	No	No	No	No	No	No	No	Yes
Observations	648	504	648	504	648	648	504	862	862	489

Notes: The dependent variable for all regressions is an indicator variable coded as one if the subject chose to give to the lower-ranked member in his choice set. In col. (8), observations with any missing value for the variables listed in col. (9) are dropped so that the sample is constant for both specifications. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

Appendix Table 5: Summary statistics, minimum wage surveys

	Online survey	Pew Research Center surveys	
	All	All	Fam. inc.< $50,000
Male	0.301	0.561	0.499
	(0.459)	(0.496)	(0.500)
Married	0.280	0.571	0.424
	(0.450)	(0.495)	(0.494)
Age	44.32	41.39	39.51
	(10.72)	(13.38)	(13.14)
Black	0.0593	0.116	0.162
	(0.236)	(0.320)	(0.368)
Hispanic	0.0184	0.115	0.134
	(0.135)	(0.319)	(0.341)
College graduate	0.382	0.329	0.187
	(0.486)	(0.470)	(0.390)
Family income last year	59458.1	70609.5	30355.4
	(43498.5)	(51487.2)	(11138.7)
Supports minimum wage increase	0.785	0.870	0.903
	(0.411)	(0.336)	(0.296)
Observations	489	2354	1032

Notes: All data taken from Pew surveys from June 2001, December 2004, and March 2006. Only individuals who report being employed are sampled.

Appendix A Instructions for the lottery game

Scrambled is a game of chance, where you play against other players in your row. In this version of the game, most of you are not playing for real money. However, at the end of the session, the computer will automatically select one round from one player in the session. That player will be given an extra $20.00 plus whatever they won or lost in the selected round. With that in mind, you should play the whole game as if you are playing for real money.

To get started, please type your name or nickname in the field provided and click the button to continue. Then, wait for further instructions.

[Wait 15 seconds People should be standing up.]

At this point, everyone should see a big red stop sign on their screen. Please raise your hand if you dont see a stop sign.

[Fix problems until everyone sees the stop sign.]

Before we continue, there are two things I need to mention:

(i) You will play a number of rounds in this game. In each round, before you can proceed to the next round, everyone in your row must first make a decision. If you feel you have been waiting too long, please raise your hand and I will come around and see whats going on.

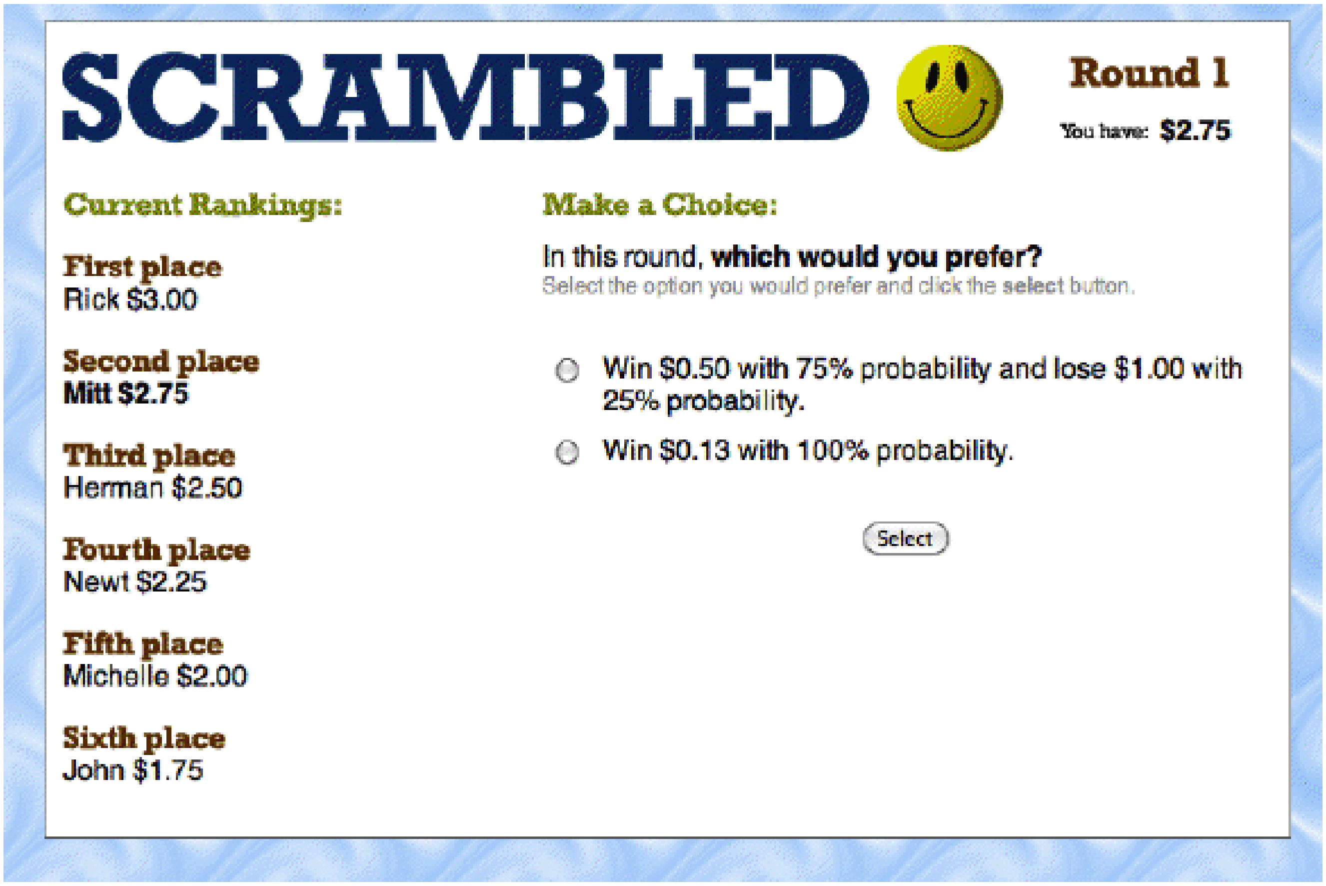
(ii) Please dont click the next, back or refresh buttons in your browser while playing this game. If you do, it will break the game for all of the players in your row.

Does anyone have any questions at this point?

Please sit down and click the button to continue. You will now see instructions about how to play the game. Once you have read the instructions, you will be able to click the button to get started.

Please read the instructions and click the button marked Continue to begin the game

Typical screenshot from the lottery game



Appendix B Solving for the Nash Equilibirum of the Lottery Experiment

Claim. *The dominant strategy of players in ranks one through four is to choose the "sure" (risk-free) option, whereas for sufficiently large α the players in ranks five and six will play a mixed strategy between the "sure" option and the lottery.*

Proof. The proof for ranks one through four is outlined in Section 3 and here we just focus on the last- and fifth-place players.

Since the game is finite by assumption and meets the other conditions of the Nash Existence Theorem, there must be an NE between these two players. Here, we show that there is no pure-strategy NE, so it must be the case that the two players play a mixed strategy between taking the lottery option and taking the sure option.

Below we show that for sufficiently large α none of the four potential pure strategies are NEs.

Both pick "sure" option

If the fifth-place player picks the sure option, then the last-place player will play the lottery whenever

$$\frac{3\alpha}{4(1-\alpha)} > f(y+\theta_{sure}) - (\tfrac{1}{4}f(y-\theta_{lose}) + \tfrac{3}{4}f(y+\theta_{win})),$$

equation (3) from the text (y is his current balance). In other words, so long as α is sufficiently large, the last-place player is willing to take on additional risk for the possibility of escaping last place.

Last-place player picks "sure" option and fifth-place player picks lottery

If the last-place player plays sure, then the fifth-place player can always maintain his rank by also playing sure. He will always prefer this option because he is risk-averse and prefers not to take a gamble of equal expected value to the sure option. Moreover, this option also brings a risk of losing the lottery and falling into last-place himself, which has additional, negative utility consequences for any positive value of α.

Fifth-place player picks "sure" option and last-place player picks lottery

This case was already examined in Section 3. If the last-place player plays the lottery, then the fifth-place player would rather play the lottery whenever

$$\frac{9\alpha}{16(1-\alpha)} > f(y+\theta_{sure}) - (\tfrac{3}{4}f(y-\theta_{lose}) + \tfrac{1}{4}f(y+\theta_{win})),$$

equation (4) from the text.

Both pick lottery

The last-place player would rather pick the "sure" option, because if the fifth-place player picks the lottery, then playing the lottery never gives the last-place player any greater chance of moving up than does playing the sure option regardless of whether the fifth-place player wins or loses. Thus, he would rather avoid the risk and play the safe option.

Consider the two possibilities when the fifth-place player picks the lottery. If he wins, then even if the last-place player also wins the lottery he cannot move up, so playing the lottery offers him no greater chance of moving up than does the sure option (both offer a probability of zero).

If the fifth-place player loses the lottery, then, as we show below, he will fall into last place with probability one if the last-place player picks the "sure" option. Thus, playing the lottery gives the sixth-place player no greater chance of moving up under this scenario either.

Using the notation from Section 3, let the current balances of the last-place, fifth- and fourth-place place player be, respectively, $\delta_6 < \delta_5 < \delta_4$. Recall that $\theta_{sure} = \frac{\delta_5-\delta_6}{2}$ and $\theta_{win} = \delta_4 - \delta_6$.

By construction, $\frac{3}{4}\theta_{win} - \frac{1}{4}\theta_{lose} = \theta_{sure}$, or, $\theta_{lose} = 3\theta_{win} - 4\theta_{sure}$.

Substituting the formulae for θ_{win} and θ_{sure} gives:

$$\theta_{lose} = 3(\delta_4 - \delta_6) - 4\left(\frac{\delta_5 - \delta_6}{2}\right),$$

or,

$$\theta_{lose} > 3(\delta_5 - \delta_6) - 4\left(\frac{\delta_5 - \delta_6}{2}\right) = \delta_5 - \delta_6.$$

So, if the fifth-place player loses the lottery, we have that

$$\delta_5 - \theta_{lose} < \delta_5 - (\delta_5 - \delta_6) = \delta_6.$$

Therefore, the last-place player will always move up by picking the sure option (or, in fact, by doing nothing, though that is not an option). ■

Appendix C Instructions for redistribution games

The Moneybags Game is a game where you play with X other players in the lab. During the game, you will play several rounds, and at the beginning of each round, the computer will randomly hold a lottery, and give you and the other players in your group different amounts of money.

During each round, you will be presented with a choice about who should get more money. This additional money is drawn from a separate pool and does not take away from the amount of money you have. The choices you make are private, and will not be shown to anyone playing the game at any time.

Once everyone in your group has made a choice, the computer will randomly select one players choice, and award the additional money as that player decided. At that point, everyones score will be updated, but you will not be shown the final score from the round. Then, a new lottery will be held and the next round will automatically begin.

In this version of the game, most of you are not playing for real money. However, at the end of the session, the computer will automatically select one round from one group and every player in that group will receive their final score from that round. With that in mind, you should play the whole game as if you are playing for real money.

To get started, please type your name or nickname in the field provided and click the button to continue. Then, wait for further instructions.

[Wait 15 seconds People should be standing up.]

At this point, everyone should see a big red stop sign on their screen. Please raise your hand if you dont see a stop sign.

[Fix problems until everyone sees the stop sign.]

Before we continue, there are two things I need to mention:

(i) As I mentioned before, you will play a number of rounds in this game. In each round, before you can proceed to the next round, everyone in your group must first make a decision. If you feel you have been waiting too long, please raise your hand and I will come around and see whats going on.

(ii) Please dont click the next, back or refresh buttons in your browser while playing this game. If you do, it will break the game for all of the players in your group.

Does anyone have any questions at this point?

Please sit down and click the button to continue. Well now play a practice round together. This round is for practice only. If you have any questions during the practice round, please raise your hand. When the practice round ends, you will automatically begin with round 1. Click the continue button to start the practice round.

Typical screenshot from the redistribution game