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Do Gender Preference Gaps Impact Policy Outcomes?

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Many studies document systematic gender differences in a variety of important economic preferences, such as risk-taking, competition and pro-sociality. One potential implication of this literature is that increased female representation in decision-making bodies may significantly alter organizational and policy outcomes. However, research has yet to establish a direct connection from gender differences in simple economic choice tasks, to voting over policy and to the resulting outcomes. We conduct a laboratory experiment to provide a test of such a connection. In small laboratory "societies," people repeatedly vote for a redistribution policy and engage in a real-effort production task. Women persistently vote for more egalitarian redistribution. This gender difference is large relative to other voting differences based on observable characteristics and is partly explained by gender gaps in preferences and beliefs. Gender voting gaps persist with experience and in environments with varying degrees of risk. We also observe policy differences between male- and female-controlled groups, though these are considerably smaller than the mean individual differences—a natural consequence of the aggregation of individual preferences into collective outcomes. Thus, we provide evidence for why substantial and robust gender differences in preferences may often fail to translate into differential policy outcomes with increased female representation in policymaking.

Keywords: gender differences; risk; altruism; redistributive preferences; experiment

JEL codes: C91, C92, J16, H23

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"If Lehman Brothers had been 'Lehman Sisters,' today's economic crisis clearly would look quite different." – Christine Lagarde*, New York Times*

1. Introduction

It is often claimed that the world, if run by women, would be very different than it is today (Funk and Gathmann 2015). However, since men have traditionally dominated cultural, religious, political and economic decision making in most societies, we know very little about which institutions, policies and social outcomes would result if women were in charge. Still, in light of growing female representation in positions of influence, it is important to understand whether, and how, increased female representation impacts policy outcomes.

The idea that female-led institutions would look quite different from those led by men finds support in different strands of the academic literature, among them the observation of gender gaps in important areas of economic decision making and psychological traits (Bertrand 2011; Croson and Gneezy 2009; Niederle 2016). This literature finds women to be, on average, less risk taking, less confident, and less willing to compete than men (e.g. Niederle and Vesterlund 2007; Eckel and Grossman 2008a; Niederle and Vesterlund 2010; Falk, et al. 2015). Moreover, in the context of pro-sociality, existing evidence indicates that women are more concerned with equality than men, who place more emphasis on efficiency (Almås et al. 2010; Andreoni and Vesterlund 2001; Sutter et al. 2010). Empirical evidence from political surveys further suggests that women tend to support egalitarian redistributive policies more than do men (Alesina and Giuliano 2009; Funk and Gathmann 2015). In addition, studies using exogenously imposed variation in the gender of individuals occupying leadership positions sometimes finds evidence that female leaders produce different outcomes than male leaders (e.g. Chattopadhyay and Duflo 2004; Matsa and Miller 2013).

While the above literature *is consistent* with the possibility that gender-based preference gaps lead women to implement different policies when they hold policy control, *it does not establish* a direct channel from gender, through preferences, to voting behavior and to policy outcomes. Gender differences in preferences are typically identified in abstract, individual, one-time choice tasks or survey responses. These are valuable instruments for establishing a baseline of behavioral gender gaps. But, they provide little information about how such gender gaps in individual decision making map into differential support for varying policies in more complex environments,[1] to what extent this differential support impacts

[1] Two recent studies provide suggestive evidence that preferences for risk and equality may partly explain women's support for different policies (Gärtner, Mollerstrom and Seim, 2017; Fisman, Jakiela and Kariv, 2017).

collective outcomes as the gender composition of policymaking bodies varies, or whether such policy influences persist over time. At the other extreme, where evidence exists that female representation in policymaking yields different types of outcomes—though, importantly, this appears not always to be the case (Adams 2016; Eckbo, Nygaard and Thorburn 2016; Campa and Bagues 2017)—it is not yet established that such policy impacts are the direct result of gender-based preference differences.

Our research starts from the recognition that before one can confidently claim that "Lehman Sisters" would have impacted the financial crisis differently than Lehman Brothers, research must first identify more precise links from individual-level gender differences in preferences to richer economic policy outcomes. We begin by noting that, for gender gaps in individual preferences to robustly influence aggregate outcomes and policy, the following four conditions need to be met:

1. Gender gaps in preferences need to be sufficiently widespread and large in magnitude to reliably yield behavioral differences across a wide variety of populations and many contexts.
2. Such preference gaps need to directly translate into relevant policy preferences and votes. Thus, for instance, it is necessary that the observed gender gap in risk attitudes induces women to prefer policies that involve less risk, or that differences in competitiveness between men and women affect their support for policies that produce more or less competition.
3. Preference gaps must persist through the collective decision-making processes used to create policy, so that groups where women hold policy control produce substantively different outcomes than those controlled by men. Even if the first two conditions above hold, this need not be the case. For instance, as we show below, a comparison of majority-male and majority-female groups making collective policy choices may yield much smaller differences in outcomes than the difference in preferences between the average man and the average woman. How the decision-making process translates gaps in individual preferences into collective outcomes likely depends on how the institution interacts with the distributions of preferences in the two groups.[2]

However, these papers do not study concrete policy choices and they find only small (and statistically weak) relationships between gender and indirect measures of policy support. We review these studies below.

[2] For example, a mechanism that selects the most risk-seeking person in a group to be a group's leader and to make decisions on behalf of the group may yield leaders that do not differ much in risk preferences in male- versus female-majority groups—e.g., if the selected leaders tend to be disproportionately male or if male versus female differences in risk preferences do not differ much at the extremes of the distributions.

4. All of the above conditions need to persist over time, as both men and women receive feedback and gain experience with decision making in the relevant policy setting, and with the resulting outcomes.[3]

To our knowledge, no existing study makes all the above connections. There are papers that provide evidence supporting some of the relationships. For instance, some studies indicate that gender differences in preferences may be responsible for different voting behavior by men and women (Alesina and Giuliano 2009; Fisman, Jakiela and Kariv 2017; Gärtner, Mollestrom and Seim 2017), but these studies find either weak relationships between gender and policy choices or relationships that cannot be directly connected to preferences. Other studies test whether groups controlled by men versus women produce different policy and organizational outcomes, but the evidence from these studies is mixed and the connection to preferences implicit (Matsa and Miller 2013; Eckbo, Nygaard and Thorburn 2016; Campa and Bagues 2017). We review this related work in the next section. Importantly, however, none of these studies starts from gender differences in basic preferences, shows that these preference gaps are responsible for different policy choices made by men and women, and demonstrates that these differential choices by men and women yield different outcomes as gender representation in decision making varies.

Therefore, in this paper, we use the control provided by laboratory experiments to test for a connection between gender, individual preference differences, support for policies, and resulting differences in outcomes between groups in which policy control is held by men versus women. While the ultimate objective should, of course, be to identify these relationships in broader populations and with regard to consequential real-world policy outcomes, there are also important reasons why laboratory experiments are a valuable starting point. A laboratory environment allows us to precisely measure a variety of preferences and document whether they differ by gender. Importantly, the laboratory also allows us to create situations in which such preference differences are likely to translate into voting behavior. While non-laboratory settings involve complex policies that bundle many factors related to preference differences between men and women in various and sometimes conflicting ways, we construct a simple and well-defined policy issue for which previously documented gender differences align in their directional predictions. This allows us to generate a clear hypothesis*, ex ante*, that men and women should have opposing tendencies on our

[3] An increased share of female decision-makers may impact outcomes over time in other ways as well. For example, the gender composition of groups may impact group culture, or how men and women behave. As a starting point, this study focuses on a simpler and more direct test of the four conditions listed above.

experiment's single policy dimension, and to test whether voting gaps arise in an environment in which previous research tells us there should be gaps. A laboratory setting also allows us to randomize policy control between groups, thus exogenously generating male-dominated groups ("Lehman Brothers") and female-dominated groups ("Lehman Sisters"), composed of representative members of the two populations.

Our experiment, therefore, creates a context in which many factors are aligned to translate gender preference gaps into differential policy outcomes. If we can establish the above relationships in this setting, then our results suggest there is further value in trying to identify the same relationships in more natural environments. Conversely, if we fail to find the relationships, even here, then one can be skeptical about the likelihood they exist as the mapping from gender, to preferences, to policy votes and outcomes becomes more complex.

Our study allows us to examine the above four conditions, one by one.

For comparability with prior research, and to investigate Condition 1, we first test for the presence of behavioral gender gaps in various individual choice tasks using a large sample of individuals. We do so by employing several choice- and survey-based measures of risk preferences, pro-sociality, and preferences for competition that are used in the literature.

To test the second condition, we then investigate whether these individual behavioral gender gaps translate into a gender gap in preferences over redistributive policies, such that women prefer more egalitarian, less risky and less competitive policies. For this purpose, we develop a novel task in which groups of participants engage in repeated real-effort production and endogenously determined redistribution. In each period, group members first vote for their preferred redistributive policy—analogous to a linear tax rate—before engaging in a real-effort production task. Thus, participants state their preferred redistribution rule before they know their realized earnings from the task. Our design varies whether or not individuals' productive output translates into wealth deterministically, meaning there is no risk, or is subject to random shocks that add risk to the relationship between productivity and income.

In this setting, by means of their vote, participants can support egalitarian redistributive policies that equalize the earnings differences generated through production and decrease variability in payoffs, or competitive policies that magnify these differences. Hence, in our design, voting for egalitarian institutions increases equality and decreases competition and risk. As we note above, prior research on gender differences in preferences finds that women are less risk-seeking, tend to avoid competition, and are often more egalitarian. Our design thus yields a straightforward hypothesis: women will vote for more egalitarian redistributive policies than men.

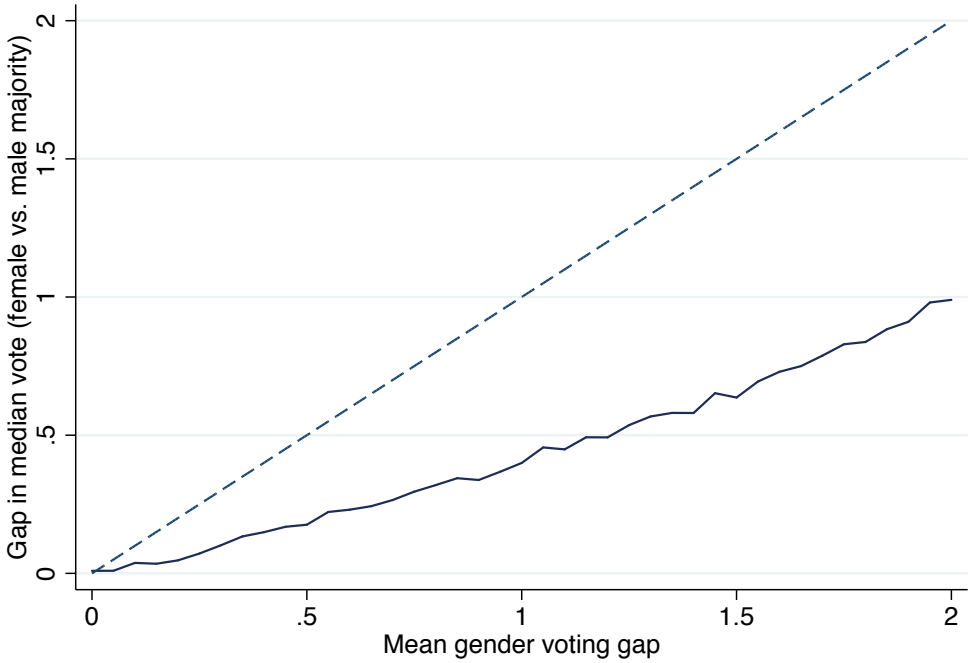
To test the third condition, we study the extent to which the resulting group policies vary with group gender composition. In each period, the implemented redistributive policy is the product of the median vote in the group.[4] Exogenous variation in group composition within our experiment allows us to observe the extent to which gender differences in policy preferences translate into different policy outcomes in groups where the majority is female, rather than male. While our experiment is only illustrative in this regard—since there could be many alternative social choice mechanisms for setting redistributive policy—it provides us with a demonstration of what happens to gender-based preference gaps when they operate through a simple social choice rule. Moreover, the individual voting data allows us to use simulations to explore how outcomes might differ under alternative mechanisms.

While it is natural to assume that a difference in the average preferences for a particular policy between men and women will lead to female- versus male-majority groups reflecting such differences in policy outcomes, collective decision-making and intra-gender heterogeneity may dampen these differences. As a concrete example, Figure 1 presents the results of a simulation exercise studying how varying differences in the mean preferences of men and women over a unidimensional policy issue might translate into differential outcomes when either men or women have policy control. In the simulations, we assume that men's preferences are distributed according to a normal distribution, $v^m \sim N(0,1)$, and that women's preferences are distributed similarly but with a different mean, $v^f \sim N(\theta, 1)$. Hence, θ is the difference in policy preferences, on average, between men and women. Our simulations construct five-person groups at random, classify them as majority male or majority female, and then identify the group's median preference. This simple stylized example of a group making a collective choice parallels our experiment's design. In the graph, the horizontal axis shows the mean gender preference gap, θ, while the vertical axis presents the mean difference in implemented policies between majority-male and majority-female groups. The graph clearly illustrates that the gaps in policies at the group level when men or women hold policy control are considerably smaller—roughly 40-50%—relative to the mean gaps in preferences at the individual level.[5]

[4] While there are many possible social choice rules that one could explore with our design, implementing the median voter's preferences has several desirable properties (cf. Agranov and Palfrey 2015). It is a simple and easy to understand voting mechanism, and one that can be implemented quickly in repeated periods. The median voter's ideal point on a one-dimensional policy issue—the linear "tax rate" in our experiment—is also the outcome likely to arise under majority rule, per the median voter theorem.

[5] As a further illustration of this point, we conducted simulations using the risk attitudes reported in Eckel and Grossman (2008b)—one of the seminal articles on gender gaps in risk attitudes. In this experiment, the primary measure of risk seeking is how many choices (out of 5) were for a riskier option. Men made, on average, 3.63

Figure 1: An example of policy gaps as a function of preference gaps



Simulations with 10,000 replications.

Finally, we test the extent to which gender gaps in individual voting behavior—and their manifestation in outcome differences between male- and female-dominated groups—persist over time and with feedback, the fourth condition above. For this purpose, our study comprises 10 periods of the production and redistribution game, during which individuals learn their relative performance, and gain experience with the decision-making context.

To preview our results, with respect to Condition 1 we confirm, in a large sample, many of the typical results on gender differences in preferences in one-shot individual choice tasks. Women are more risk averse and tend to shy away from competition relative to men. Women also state a higher willingness to share money in an unincentivized survey question and exhibit a greater tendency to prioritize equality over efficiency in a behavioral task involving distributing wealth, though not necessarily to share a greater amount. They also exhibit less overconfidence than men about their relative ability.

Providing support for the second condition, we find that women vote for significantly more egalitarian redistributive policies in the first period of the game. In our setting, gender is a stronger predictor of vote preferences than several other important individual

risky choices, while women made 2.95. We used Eckel and Grossman's data to simulate the decisions made by a body of 10 individuals if the median preference was decisive, as with majority rule. As an example, comparing the number of risky decisions made by a group composed of 1 woman and 9 men (the state of the final Lehman board) with one composed of 6 women and 4 men (a natural minimal threshold for "Lehman Sisters"), the average number of risky decisions decreases from 3.51 to 3.22. This difference (0.29) is less than half the size of the difference in average preferences between men and women (0.68).

characteristics, such as political orientation. We also find that part, though not all, of the gender difference in voting can be accounted for by the above individual differences in preferences and in overconfidence.

When testing Condition 3, we find that institutions attenuate preference differences—the impact on policy outcomes of a group having a male or female majority is approximately 75% of the difference in means between the individual preferences of men and women. While our experiment only demonstrates outcome differences for the specific voting mechanism and group compositions that we employ—where we oversample extreme group compositions with all-male or all-female groups—we also show that gaps in outcomes obtain when simulating policy outcomes under different mechanisms for generating collective outcomes, and with random variation in the gender composition of groups. However, these gaps are consistently only about 35% of the size of the individual-level gap in mean preferences, a magnitude comparable to the relationships in Figure 1.

Our fourth condition, whether gender gaps are stable over time, is partly supported by the data. The gender differences in individual policy preferences revealed in the first period remain large and stable throughout the 10 periods of the study. This is true both in the environment without risk and the one in which individual productivity is subject to random shocks. At the group level, male-dominated groups implement less redistribution than female groups throughout the experiment, but the observed difference is considerably smaller than when comparing the behavior of individuals, both in magnitude and in statistical significance. We also find no statistically significant differences between male- and female- majority groups with respect to the resulting group inequality, as measured by a Gini coefficient.

Our paper is the first to demonstrate a direct connection between gender, differences in preferences, voting behavior, and policy outcomes. While each connection may seem simple in isolation, collectively they provide an important step in understanding how varying female participation in organizational and policy decision making can shape social and organizational outcomes. Our work provides some support for the potential impact of gender-based preference differences on policy outcomes. However, it also highlights that large gaps in the preferences and behavior of the average man and the average woman need not translate into large gaps in outcomes when comparing groups with more men versus more women determining policy. Thus, we also provide a possible explanation for why gender preference gaps—which appear quite robust at the individual level—yield only mixed evidence in studies that explore the impact of increasing shares of female policymakers on outcomes.

The remainder of this article is structured as follows. Section 2 discusses related

literature, structuring the review around the above four conditions. Section 3 describes the experiment design, while in Section 4 we present the results. Section 5 concludes.

2. Related Literature

A large literature explores gender gaps in economic preferences related to risk, competitiveness, and pro-sociality (for reviews, see Croson and Gneezy 2009; Bertrand 2011; Niederle 2016). While many studies find gender gaps in these domains (e.g., Niederle and Vesterlund, 2007; Eckel and Grossman, 2008a; Falk et al. 2015), some recent literature raises questions about their generality and magnitude. For instance, some recent reviews argue that the gender gap in risk attitudes may be smaller than suggested by previous research (Filippin and Crosetto 2016; Nelson 2014). These reviews note that gender differences vary considerably with the specific measurement method used, with some standard measures systematically producing large gender gaps, while others hardly produce any gaps at all. Similarly, while many studies find a large gender gap in the willingness to enter competitive environments, most of these studies rely on a common, math-based, paradigm inspired by Niederle and Vesterlund's (2007) seminal article. Recent studies indicate that gender differences in competitiveness sometimes disappear, and may even reverse—for example, in tasks that are not male stereotyped (Cárdenas et al. 2012; Dreber, Essen, and Ranehill 2014; Günther et al. 2010; Grosse, Riener, and Dertwinkel-Kalt 2014; Shurchkov 2012, although see also Wozniak, Harbaugh, and Mayr 2014), when time pressure is reduced (Shurchkov 2012), or when information about relative performance is available (Ertac and Szentes 2011; Wozniak et al 2014; though Cason, Masters, and Sheremeta 2010 find the opposite result). Turning to pro-sociality, a meta-analysis of dictator games by Engel (2011) finds only small gender differences. However, a growing number of studies suggests that men and women differ in their preferences for efficiency versus equality, rather than in general pro-sociality (Almås et al. 2010; Andreoni and Vesterlund 2001; Sutter et al. 2010). Thus, while there is often apparent agreement that gender differences in economic preferences are robust and large, recent literature notes that such gaps may be limited to a more specific set of contexts and conditions than sometimes suggested in the literature.

Another strand of literature explores the extent to which women prefer different policies than men, and to what extent female leaders endorse different values or make different decisions than male leaders. While some of these studies indicate that women favor different policies, these findings are also contested. Funk and Gathmann (2015) and Alesina and Giuliano (2010) find that women in Switzerland and the US tend to have more favorable

attitudes toward redistribution, and to prioritize areas such as health, environmental protection and welfare policy more than men. This result holds even after controlling for a range of socio-economic characteristics, suggesting something intrinsically female about such policy preferences. However, Edlund and Pande (2002) find that the emergence of a gender gap in political preferences in the US from 1983 to 2003—with women voting more for left-leaning (Democratic) policies—strongly correlates with the decline in marriage. This leads the authors to speculate that the gender gap in political preferences is the product of higher divorce rates making men wealthier and women poorer. Exploring the extent to which typical gender gaps may persist across the glass ceiling, Adams and Funk (2011) survey directors and CEOs of publicly listed Swedish companies. While they find many similarities between male and female CEOs, they also find, for example, that female directors are *less* risk averse and less traditional than their male counterparts, suggesting a reversal of the basic gender difference in preferences found among a representative sample in their study.

The two studies that are perhaps most closely related to ours explore the relationships between gender, basic preferences for risk and equality and political preferences. Gärtner, Mollerstrom and Seim (2017) use a survey of a representative sample of 1365 Swedish adults to study the relationship between risk preferences and general support for redistribution. They measure risk preferences using eight hypothetical choices between a safe amount and a lottery and measure attitudes toward redistribution by asking, "How much economic redistribution do you want in society?" Controlling for other observable characteristics, women exhibit slightly more favorable responses to the redistribution measure, but this relationship is not robustly statistically significant. Introducing the risk aversion measure—which significantly predicts attitudes toward redistribution—decreases the magnitude of the gender coefficients by approximately 15 percent.[6] In another study, Fisman, Jakiela and Kariv (2017) use a web survey to elicit the distributional preferences of a large sample of the American population. They then explore the extent to which the resulting preference types exhibit differential support for Barack Obama in the 2012 Presidential Election, as well as for the Democratic Party. While their study is not explicitly about gender, women in their sample

[6] More precisely, in a model without controls for socio-economic status—but controlling for age, marital status, number of children, education and employment status—women exhibit more favorable attitudes toward redistribution, by 0.100 of a standard deviation (with a standard error of 0.059) and this coefficient is marginally statistically significant ($p<0.1$). Adding controls for socio-economic status decreases the coefficient to 0.084 (with a standard error of 0.058) and the relationship is no longer statistically significant. These coefficients suggest a modest tendency for women to express more positive attitudes toward redistribution—but do not provide evidence of concrete policy choices. Adding risk aversion as an explanatory variable decreases the above two coefficients, to 0.085 (0.059) and 0.070 (0.059), respectively, which suggests a mediating role of risk preferences for the effect of gender.

are more likely to prioritize equality over efficiency, though the statistical significance of this relationship is not robust to corrections for multiple hypothesis testing. Women are also more likely to report having voted for Obama and for the Democratic party—though neither relationship is statistically significant. Controlling for differences in distributional preferences decreases the relationships between gender and voting for Obama and Democrats by 14 percent and 19 percent, respectively. Hence, these studies find differences in preferences for risk and for equality versus efficiency between men and women (Condition 1). They also observe modest gender differences in support for a specific political candidate or for statements favoring redistribution, which is partly consistent with Condition 2. But, they do not clearly demonstrate that women vote for different policies than men, nor do they inform us about the outcomes that arise when women hold greater policy control.

Other research explores to what extent female leaders make different decisions than men, with somewhat contradictory results. For example, Chattopadhyay and Duflo (2004) make use of random political reservations for women in India and find that the public goods provided in villages with a female head of council are more sensitive to the priorities of female constituencies. In line with the gender gap in preferences for inequality and redistribution, a recent article by Ström et al. (2016) finds that female CEOs and directors of microfinance institutions allocate more resources to the poorest households than do male directors. Matsa and Miller (2013) explore the impact of a Norwegian quota requiring the share of female board members to be at least 40% and find that companies affected by the quota experience higher labor costs—due to fewer layoffs compared to companies unaffected by the quota—and lower operating profits. However, Matsa and Miller's findings (2013) are questioned by Eckbo et al. (2016), who argue that extending the sample period generates a non-significant effect of the quota on company value. Further, Campa and Bagues (2017) explore the effect of a gender quota in candidate lists in local Spanish elections and find no impact on the size, or composition, of public spending. Taken together, evidence of an impact of increased representation of female policy makers is mixed. In addition, the connection with gender-based preference gaps in this literature is implicit; that is, there is no clear measurement of preferences of these policymakers, and of the extent to which such gender gaps in preferences are responsible for differences in enacted policies. Moreover, some of this research suggests that, rather than fundamentally different societies—less competitive, less risky, more egalitarian—female policy control may mainly produce societies that prioritize policies more directly beneficial to women.

There seems to be little evidence regarding the extent to which gender differences in

policy preferences at the individual level persist through collective decision-making processes. In two related studies Eckel and Füllbrunn (2015) and Cueva and Rustichini (2015) explore whether the existence and size of speculative bubbles in experimental asset markets depend on the gender composition of the traders. While Eckel and Füllbrunn (2015) find an inverse relationship between the magnitude of price bubbles and the share of female traders, Cueva and Rustichini (2015) find all measures of mispricing to be comparable, or worse, in all-female markets in comparison with all-male markets. In their experiment, prices deviate the least from fundamentals in markets with a mixed gender composition. Moreover, Eckel and Füllbrunn (2015) find that gender gaps in individual-level preferences, such as risk aversion, have weak and statistically insignificant relationships with bubble formation in markets. Hence, these studies provide only modest evidence of links between basic gender preference gaps and the outcomes produced by male- versus female-controlled groups.

Finally, previous research provides mixed evidence on the persistence of gender preference gaps over time. Charness and Gneezy (2012) review studies measuring risk taking in the investment game and find that gender gaps persist in studies using repeated measurements. In the case of gender differences in competition, the evidence on persistence over time is somewhat contradictory. While Cotton et al (2010), Ertac and Szentes (2010), and Wozniak et al. (2014) find that gender differences in competitive choices diminish with feedback and experience, Cason et al. (2010) and Buser (2016) find the opposite.

Taking all of the above together, there seem to be reliable, but not universal, relationships between gender and preferences for risk, competition and tradeoffs between equality and efficiency (Condition 1). There are some indications—but far from conclusive evidence—that these relationships translate into differential support for policies related to risk and redistribution (Condition 2). However, the evidence that these preference differences produce different outcomes when women hold greater policy control (Condition 3) is inconclusive and there is very little evidence on the extent to which all of these differences persist over time (Condition 4).

3. Experimental Design

Our experiment consisted of three parts. In Part 1 we elicited individual preferences related to risk and concern for others. Participants also answered two questions about their age and gender. In Part 2 we elicited participants' baseline productivity in our production task by letting the participants perform the real-effort task once under an individual piece-rate payment scheme. We then, additionally, measured competitiveness through participants'

choices of whether to submit their initial performance scores to either a tournament or a piece-rate payment scheme. Finally, to elicit a measure of performance beliefs and confidence, participants reported their beliefs regarding relative performance in the task. Participants received no information about outcomes or earnings for the tasks in Parts 1 and 2 until the end of the study.

In the main part of the experiment, Part 3, participants performed the production task with redistribution in groups of five, for 10 periods. Finally, after Part 3, we once again elicited individual productivity. Subjects also completed an exit questionnaire that elicited individual characteristics.

The experiment comprised two treatments, which varied only with respect to how participants generated earnings through their performance in the real-effort task. Specifically, the treatments varied whether participants were paid a fixed piece rate for their productive output (the *No Risk* treatment), or whether individuals' productive output was subject to random shocks (the *Risk* treatment). Below, we describe the experiment as implemented in the No Risk treatment, and then explain how the Risk treatment differs.

2.1. Parts 1 and 2: Preferences, Productivity, and Performance Beliefs

We began by eliciting a variety of individual preferences using both incentivized and non-incentivized measures.

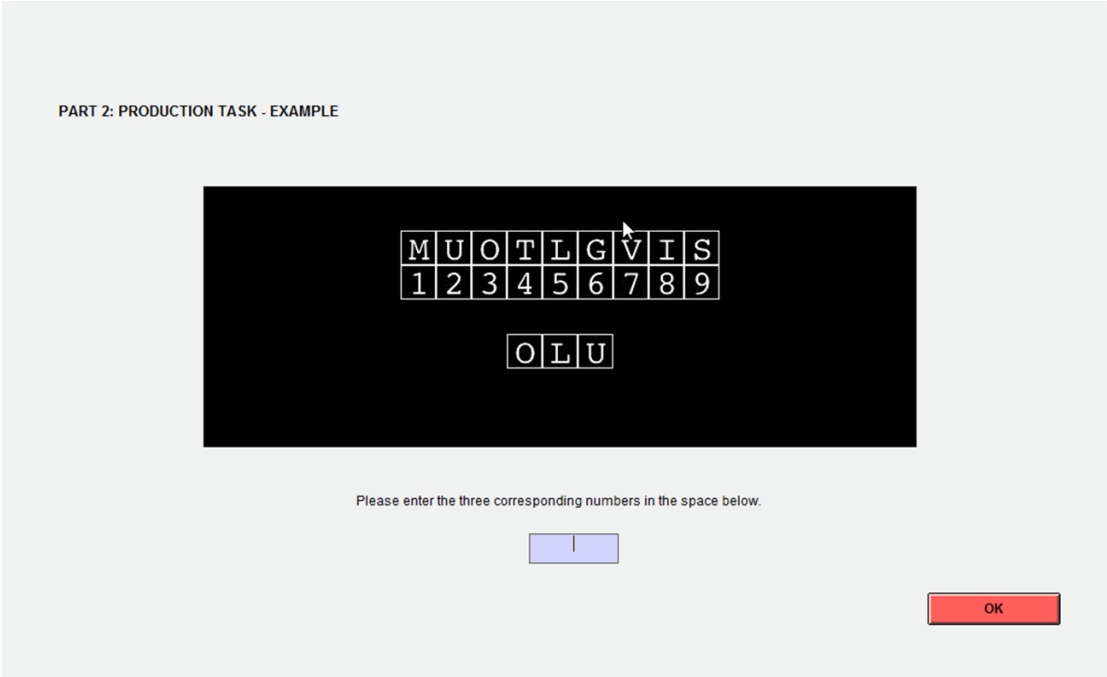
We elicited risk preferences through an incentivized investment game in which participants allocated some portion of an initial endowment of 100 Experimental Currency Units (ECU) to a risky investment (Gneezy and Potters 1997). The investment failed with a probability of 50%, in which case the invested money was lost, while with 50% probability the investment returned 2.5 times the invested amount. We also elicited risk preferences through a non-incentivized survey question in which participants self-reported their general risk-taking propensity on a scale from 0 to 10 (Dohmen et al. 2011).

We also elicited social preferences using one incentivized and one non-incentivized measure. As an incentivized measure we used the full version (15 questions) of the Social Value Orientation scale (Murphy, Ackermann, and Handgraaf 2011). In this task, participants make 15 choices, where each choice involves selecting one outcome from a set of possible allocations between one's self and another randomly selected participant. Choices in the first 6 decisions allow a classification of a participant's type along a spectrum of pro-social motivations, from competitive to altruistic. The remaining 9 decisions allow an identification of a subject's willingness to trade off equality versus efficiency. As a non-incentivized

measure, we administered a hypothetical question about how much a participant would donate to charity if he or she unexpectedly received CHF 1000 (Dohmen et al. 2011).

In Part 2, participants performed the real-effort production task that would form the basis of the main part of the experiment. In this part, participants performed the task once under piece-rate incentives, to provide us with a measure of individual productivity. The task was a computerized version of a digit-substitution task also used by Iriberri and Rey-Biel (2011). Figure 2 provides an example. Participants are shown keys, consisting of a unique mapping of 9 letters of the alphabet to the numbers 1-9, and can decode sequences of three letters into numbers. For example, in Figure 2, the correct code for the sequence "OLU" is 352. Keys are changed every ninth three-letter sequence, meaning that the task involves both memory and codification abilities. If a sequence is decoded incorrectly, a participant must decode the same sequence until the entry is correct. Participants had 90 seconds to decode as many sequences as possible and received a payment of 10 ECU for each correct entry.

Figure 2: The digit-letter substitution task



We implemented this particular production task mainly because previous research shows the task to yield both no significant gender differences in performance and considerable variation in performance (Iriberri and Rey-Biel 2011). While the first characteristic simplifies the analysis by not biasing the effect of the redistribution policy by gender, the second is a necessary condition to create a motive for redistribution.

After participants performed the task under piece-rate incentives, we elicited an incentivized choice to measure willingness to engage in competition. Specifically, participants were offered a second payment for their performance. For this payment, they chose between a piece-rate payment scheme and a competitive payment scheme. Under the piece-rate payment, a participant received a second payment identical to the payment received for the initial performance (10 ECU per correctly completed entry). Alternatively, under the competitive payment, the participant's score would be compared to that of a randomly selected other participant, and would yield either double the original piece-rate payment (20 ECU per correct entry) if the participant's performance was higher than that of the other person or, otherwise, would yield nothing. Ties were broken randomly. This binary choice is our measure of competitiveness.

We also elicited subjects' beliefs about their relative performance. At the conclusion of Part 2, participants guessed their performance rank in the task relative to other participants in the experimental session. Accurate responses were incentivized: participants received an extra payment of 50 ECU if their guessed rank was within two ranks of their actual rank.

2.2 Part 3: A Production Game with Redistribution

At the beginning of Part 3, participants were randomly assigned to five-person groups. These groups then remained the same for the 10 periods of Part 3. The five-person groups repeatedly engaged in the game with voting, production and redistribution for 10 periods. Below we first describe the general game, and then explain each part in detail.

2.2.1. Overview of the Game

Each period of the game followed the same course of events. Participants first voted for their preferred redistribution policy. The computer then presented the outcome of the vote—i.e., the group's redistribution policy in the period—to the group members. Group members thus cast their vote for a redistributive policy and observed the group policy *before* they performed the production task and knew the exact individual earnings they and others obtained. Below, we describe the voting process and the ensuing redistributive policies in more detail. Group members thereafter engaged in the real-effort production task, which was the same task as in Part 2. Participants engaged in the task under the same-piece rate incentives as in Part 2 and generated an income proportional to their productivity. Once the production phase was over, this income was subject to redistribution per the policy

determined at the beginning of the period. At the end of the period, participants received detailed information about individual outcomes for all group members, as described below.

2.2.2. The Vote

At the beginning of each period, all five group members simultaneously cast a vote for a redistribution parameter, $t \in [-1.00, 1.00]$, analogous to a linear tax rate. The median vote in a five-person group was implemented and applied to the group earnings at the end of the relevant period. We implemented this particular voting mechanism because it allows a flexible choice of *t* and thereby enables a varied set of preferences and outcomes. Using the median vote, in contrast to using, for example, the average vote, implies that each participant is incentivized to provide his or her preferred value of *t*, reducing strategic voting. Following the vote, all group members observed the resulting redistribution parameter for that period.

2.2.3. Production

Subjects then worked independently on the same real-effort production task as in Part 2. Each production period lasted 90 seconds, during which each correctly completed entry by a subject generated 10 ECU of income. In the Risk treatment, this certain 10 ECU was replaced by a stochastic payment, as described below.

2.2.4. Redistribution

Following production in a period, the income generated by group members was redistributed according to the implemented redistribution policy for that period. Given a policy, *t*, defined by the median vote, the formula for calculating final payoffs is given by:

$$\pi_i\left(x_i, x_{j\neq i,} t\right) = (1-t)x_i + t\sum_{i=1}^{n}\frac{1}{n}x_i \qquad \textit{(Eq. 1)}$$

In this payoff equation, π_i denotes the final payoff of individual *i* in the period, x_i denotes the individual's earnings from production, $x_{j\neq i}$ the earnings of other individual group members, and *t* denotes the tax rate.

In essence, redistribution is made by collecting a portion of the individual earnings from production, and redistributing this amount back to group members. The tax rate, *t*, has two main effects. First, depending on whether *t* is positive or negative, it either attenuates or amplifies income inequalities generated in the production task. A value of $t > 0$ decreases the earnings differences arising in the task, while a value of $t < 0$ increases any earnings differentials. Second, the farther *t* is from 0, the more redistribution takes place.

Some special cases illustrate the redistributive policies allowed by this mechanism. Egalitarian and maximin policies coincide at $t = 1$, when all participants receive the same amount. Libertarian and meritocratic choices coincide at $t = 0$, in which case everyone simply keeps the earnings they generate through production. Purely selfish behavior implies a vote for $t = -1$ for participants who perform above the group mean, and a vote for $t = 1$ for participants who perform below the mean.[7]

The instructions carefully described the properties of the tax rate to the participants.[8] It was clearly explained that a positive *t* would "decrease the payment differences arising in the task," while a negative *t* would "reward those group members who generate more money in the production task." Hence, a negative transfer parameter can be understood as a redistribution rule that implements heightened competition by allocating a larger share of the group's total production to the most productive group member.

2.2.5 Learning Measurement and Exit Questionnaire

After the 10th and last period of the redistribution game, participants ended the study with one more round of the production task. The final, individual, round of the real-effort task was incentivized through the same piece rate as before, 10 ECU per completed entry; but, in this case, there was no redistribution. We included this additional performance measure to get an indication of the level of learning in the task, since a participant's performance during the 10 periods of the production and redistribution game may be influenced both by varying productivity, as with learning, or by strategic responses to implemented redistribution policies.

We also administered an exit questionnaire. This comprised various questions about demographics and political orientation.

2.2.6 Treatments: No Risk vs. Risk

As described above, participants generated 10 ECU of earnings for each correct entry in the redistribution game in the *No Risk* treatment. To explore the effects of introducing risk

[7] When *t* was negative, we limited its magnitude such that no group member would have negative earnings in a period. Thus, in cases with strongly regressive taxes and an unequal distribution of earnings from the production task, the program would adjust *t* upwards such that the least productive group member received a payoff of 0. This adjustment occurred rarely (in 4.6 percent of cases).

[8] The instructions emphasized the effect of the sign and the magnitude of the redistribution coefficient. They also provided examples in text and in tables of the impact of negative and positive redistribution coefficients, and illustrated the three special cases of *t* = -1, 0 and 1. Finally, all participants also answered control questions consisting of numerical examples of both negative and positive redistribution policies. Full instructions are available in Appendix B.

into the production context, the *Risk* treatment added random variation in the individual performance payments in the 10 periods of Part 3. (The payment remained fixed at 10 ECU in Part 2 and in the final piece-rate performance measurement at the end of Part 3.)

During the 10 periods of Part 3, the computer randomly drew a productivity parameter in each period, separately for each participant. This parameter was equally likely to be any number from 0 to 20. The number of ECU generated from the production task in a period by a group member in the Risk treatment equaled the number of correct entries times this individual, random, productivity parameter. All other parts of the game were the same. This treatment thus increases the variability in pay, or the risk associated with competitive redistribution policies, and allows us to explore the extent to which increased risk impacts potential gender voting gaps in the redistribution game.

2.3 Implementation and Information

The experiment took place in English at the laboratory for experimental and behavioral economics at the University of Zurich. We recruited 415 students from the University of Zurich and the Swiss Federal Institute of Technology using the software h-root (Bock, Nicklisch and Baetge, 2014). We conducted 17 sessions—16 sessions with 25 participants and one with 15—using the software z-Tree (Fischbacher 2007). In total, 200 participants took part in the No Risk treatment and 215 in the Risk treatment. In each session, five randomly chosen men and five randomly chosen women were assigned to same sex groups for Part 3, while the remaining participants were randomly grouped, independently of their sex. In total we have 18 all-female, 17 all-male, and 48 mixed groups.[9] Table 1 presents the number of male- and female-majority groups in our experiment by treatment.

Table 1: Overview of Experiment

	Subjects		Groups	
	Male	Female	Male majority	Female majority
No Risk	107	93	25	15
Risk	111	104	25	18
Total	218	197	50	33

[9] One all-male group and two all-female groups arose through random group assignment. We oversampled the assignment of men and women to single gender groups in order to increase variability of group composition. The number of such groups is too small to allow for a meaningful statistical analysis, and these groups are not analyzed separately. There was a slight gender imbalance in our remaining population, as men attended the experiment more frequently. This, along with the overrepresentation of all-male and all-female groups, yielded a substantially higher proportion of male-majority groups through random group assignment.

Participants received full instructions for each part of the study at the onset of that part. They were informed that each part was independent, such that any decision taken in one part would not influence the course of events in other parts. We took several steps to clearly explain the instructions and procedures to subjects. We particularly spent significant time explaining the redistribution mechanism. In addition, after hearing the instructions read aloud, all participants saw a calculation screen for three minutes, in which they could test the effect of different redistribution parameters for any hypothetical distribution of earnings among the five group members. Participants also saw the same calculation screen for 60 seconds at the onset of each subsequent period, together with information about the five group members' earnings from production and final earnings in all prior periods.

Each period concluded with feedback. In addition to the redistributive policy, participants saw a table indicating, for each group member in that period, the income generated from production, the member's rank in the group, the net transfers, and final earnings. Participants could also see, for each group member, the average amount of money earned through production across all previous periods. A scrollable box also provided information on the redistribution policy, as well as each group member's production and final earnings for all previous periods.

In addition to a 10 CHF participation payment, participants were paid for all incentivized tasks, and for all 10 periods of the production and redistribution game in Part 3. Earnings in ECU were converted to money at the end of the experiment at the rate of 50 ECU to 1 Swiss Franc (CHF). Participants earned, on average, 50.5 CHF.

3. Results

We consider, separately, the four conditions we listed in the introduction. We start by looking at individual behavior in Parts 1 and 2, to see whether we replicate the differences in preferences between men and women observed in much of the prior literature. To test the second condition, we then study whether these differences yield behavioral differences in voting behavior in the first period of Part 3—the part of the experiment with voting and redistribution. Next, we examine to what extent gender based gaps in policy preferences are aggregated through the voting mechanism and impact the policies implemented in groups with different gender majorities, our third condition. Here, we also provide some evidence, based on simulations, on what types of collective outcomes might have obtained under different social choice mechanisms. Finally, to test the fourth condition, we study the development of behavior across the full length of the study, as participants receive feedback

and gain experience with the choice environment. For most of the analysis, we pool the two conditions that vary in risk. At the end of this section we consider differences between the two treatments and find that the gender differences are highly similar.

3.1 Part 1: Initial Gender Differences in Preferences

Table 2 lists the preference measures elicited in Part 1, with averages presented separately for men and women. We replicate many of the gender differences observed in previous research. Men exhibit greater risk tolerance both in the incentivized investment task and in the survey question. Men are also more willing to have their payment determined through a competitive incentive scheme. While the gender gap in overconfidence is only marginally significant, the point estimates are also in line with previous literature finding that men are more overconfident.

Table 2: The gender gap in preferences and performance

Variable	Men	Women	Cohen's d	p-value
Risk (Investment task) (incentivized 0-100, 100 = risky)	70.54 (2.02)	55.72 (1.88)	0.525	< 0.001
Risk (Survey question) (non-incentivized 0-10, 10 = risk taking)	6.10 (0.15)	5.03 (0.16)	0.481	< 0.001
Social Value Orientation (Primary) (Incentivized, -45 = competitive; 90 = altruistic)	17.12 (0.94)	18.26 (0.95)	-0.084	0.298
Social Value Orientation (Secondary) (Incentivized, 0 = egalitarian; 1 = efficiency)	0.67 (0.01)	0.61 (0.01)	0.408	< 0.001
Giving, (Survey question) (non-incentivized, 0-1000, 1000 generous)	135.55 (11.93)	202.34 (12.24)	-0.384	< 0.001
Competitiveness (0 or 1, 1 = competitive)	0.43 (0.03)	0.16 (0.03)	0.614	< 0.001
Overconfidence (guessed rank - actual rank)	1.15 (0.50)	-0.09 (0.46)	0.178	0.076
Average performance (Initial piece rate)	12.05 (0.19)	11.61 (0.17)	0.164	0.188
Average performance (Final piece rate)	17.14 (0.24)	16.34 (0.20)	0.247	0.018[a]
Observations	218	197		

The table reports p-values from Wilcoxon Mann-Whitney tests. Cohen's *d* is a standardized measure of the difference in means between two variables (the difference in means divided by the pooled standard deviation).
[a] Since the data in period 11 are not independent, we also estimated an OLS regression of performance in the final piece-rate round on gender, clustering at group level. This also yields a significant difference (p=0.010).

Turning to pro-sociality, women state a higher willingness to donate money in a non-incentivized survey question. However, in the primary Social Value Orientation measure,[10] which classifies subjects on a continuum from competitive to altruistic, women are only slightly more pro-socially oriented than men. On the secondary Social Value Orientation measure, though, which identifies a tendency toward efficiency versus equality, we find that women are more equality oriented and men more efficiency oriented.

The second to last row in Table 2 presents the average performance on the real-effort production task at the onset of the study. We observe a slight, but statistically insignificant difference between male and female performance at this stage, and the distributions of performance do not differ significantly (p=0.481, using a Kolmogorov-Smirnov test). However, we do find ample variation in initial task performance: the minimum performance is 5, maximum performance is 23, and only 14 percent of observations lie at the median of 12. This is important, as such variation creates a potential motive for redistribution.

Table 2 additionally provides average performance in the final instance of the task, performed at the end of the experiment under piece-rate incentives. Comparing male and female performance at the beginning and end of the study, we find evidence of learning by both men and women—performance is considerably higher in this final measure than in the initial one, by 42 and 41 percent for men and women, respectively. We also find that the initially small male advantage is now larger and statistically significant in a Wilcoxon rank-sum test, although, the distributions of performance by gender at the end of the study do not differ significantly (p=0.121, Kolmogorov-Smirnov test).[11]

Result 1: The main gender differences found in the previous literature are also present in the current sample. Men are more willing to take risk and more willing to opt for competitive payments schemes. Men are also marginally significantly more likely to exhibit overconfidence. Women state a larger willingness to share wealth in a survey question and they tend to prioritize equality over efficiency more than men.

[10] The primary score, from the Social Value Orientation's first six items, is an angle between -45 and 90 degrees. These items allow for the categorization of individuals as altruistic (90), pro-social (45), individualistic (0) or competitive (-45), on a continuous scale. The remaining 9 items provide a score measuring a tendency to prioritize equality (0) versus efficiency (1). In the table, we report the scores on the secondary measure for the entire sample of 415 participants. Restricting our analysis to the 160 individuals who expressed a pro-social orientation yields similar results; men demonstrate greater concern for efficiency than equality, relative to women (respectively, 0.64 (0.03) vs. 0.54 (0.02); $d = 0.408$; $p < 0.001$, Wilcoxon-Mann-Whitney).

[11] Figure A1 in the Appendix plots the performance over time for women and men separately, while Table A1 provides the corresponding means. Note that there is an apparent, though small, discontinuity in performance between Period 10 (with redistribution) and the final piece-rate performance measure (without redistribution). This suggests some strategic reduction of effort in response to the presence of redistribution.

3.2 Preferences for Redistribution in Period 1

In this section we test the second condition—whether gender gaps in preferences translate into a gender gap in policy preferences in the first period of the production and redistribution task in Part 3. Recall that votes for the redistribution parameter, *t*, may range from -1 to 1, with values above 0 corresponding to more egalitarian institutions and negative values indicating a preference for competitive institutions. In addition, the further from 0, the more redistribution takes place.

A direct comparison of male and female votes in the first period supports the hypothesis that gender preference gaps translate into policy preferences, in a manner consistent with women preferring less competition and risk and more equality. Specifically, in Period 1, men vote for little redistribution, on average ($\bar{t}_{\text{men}} = 0.019$), while women tend to vote for substantially more egalitarian policies ($\bar{t}_{\text{women}} = 0.218$, p-value of difference < 0.001, Wilcoxon-Mann-Whitney).

Figure 3: Cumulative distributions of Period 1 votes by gender

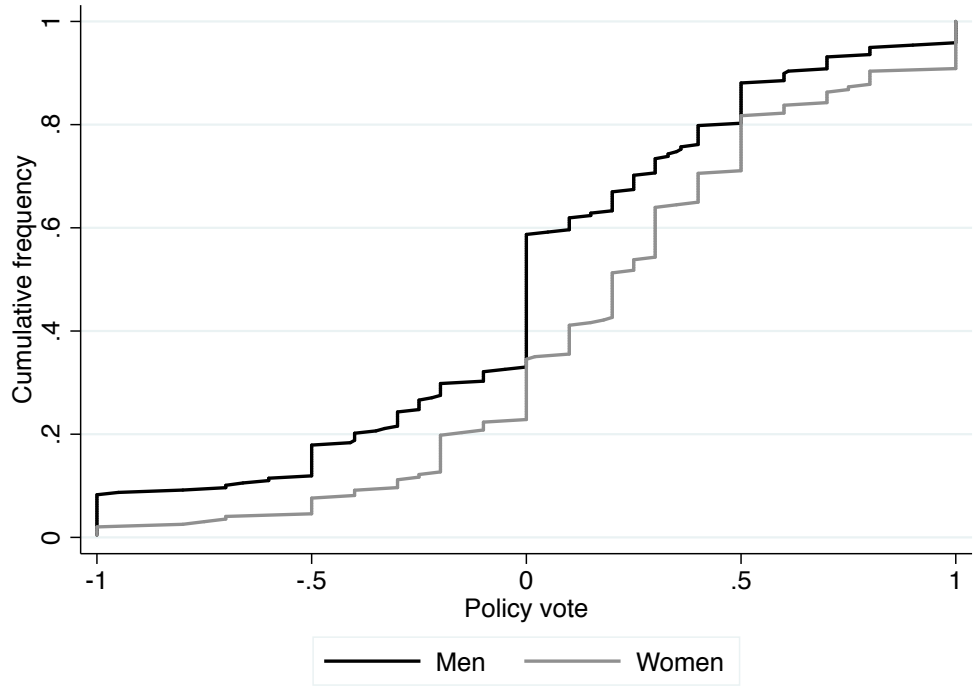


Figure 3 shows the cumulative distribution functions of first period votes, separately for men and women.[12] The male distribution function is located to the left of the one for females, indicating that more men than women vote for low redistribution policies. The

[12] Appendix Figure A2 shows, separately by gender, histograms of the votes in Period 1.

difference between the two distributions is statistically significant (Kolmogorov-Smirnov test, $p < 0.001$). A majority of the female participants, 65 percent, vote for a positive redistribution coefficient, whereas only 41 percent of men do so; this difference in proportions is significant (two-sample test of proportion, $z = -4.931$, $p < 0.001$).

Table 3: Determinants of votes in the first period

Dependent variable:	*Vote in Period 1*		
	(1)	(2)	(3)
Female	0.198***	0.145***	0.096**
	(0.046)	(0.048)	(0.047)
Risk (Investment task, standardized)		0.021	0.014
		(0.026)	(0.025)
Social Value Orientation (Primary, standardized)		0.076***	0.073***
		(0.027)	(0.027)
Social Value Orientation (Secondary, standardized)		-0.055**	-0.045*
		(0.024)	(0.023)
Competition (1 = competitive)		-0.131**	-0.055
		(0.056)	(0.056)
Relative performance beliefs (standardized)			-0.130***
			(0.025)
Stage 2 task performance (standardized)			-0.019
			(0.023)
Constant	0.019	0.084**	0.084***
	(0.034)	(0.038)	(0.037)
Observations	415	415	415
R-squared	0.042	0.102	0.173

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

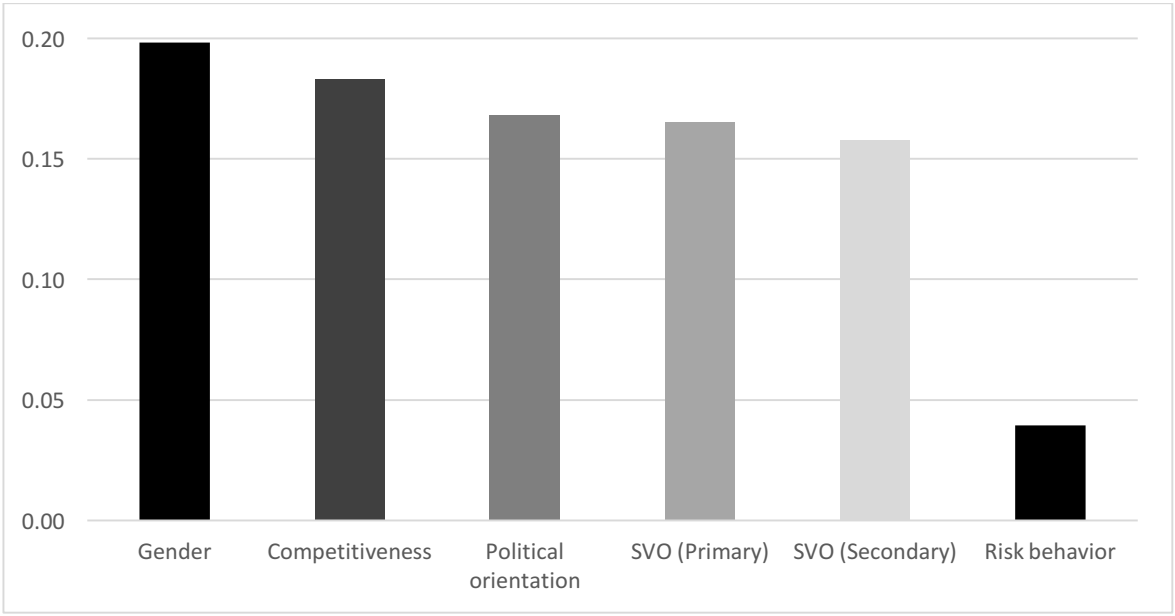
We further analyze the Period 1 gender difference in Table 3, which presents OLS regressions with a subject's first period vote as the dependent variable. In the first specification, we identify the overall gender effect on votes, without any additional controls. This regression shows the large and significant effect of gender in Period 1. The second specification adds the set of preferences we collected at the onset of the study: risk aversion, both measures from the Social Value Orientation, and willingness to compete.[13] Including these explanatory variables decreases the coefficient on the binary gender variable somewhat; however, it remains sizeable and statistically significant (p=0.003). People who are more pro-social, as indicated by the primary Social Value Orientation measure, vote for more

[13] We chose a specification with the incentivized preference measures. Including the survey questions pertaining to risk and altruism does not change the results qualitatively. In additional analysis (not reported here), we find that maternal and paternal education, number of siblings and age do not correlate with votes. However, participants who report being more to the right of the political spectrum vote for lower redistribution policies.

egalitarian policies. Moreover, individuals who tend to prioritize efficiency over equality vote for less egalitarian redistribution, indicated by the negative coefficient on the secondary Social Value Orientation measure. Furthermore, individuals who are more competitive vote for less egalitarian policies.

The third specification additionally controls for actual performance and beliefs about relative performance. The impact of beliefs on first-period votes is large and statistically significant—believing one is better at the task than others yields votes for less egalitarian redistribution.[14] Furthermore, the coefficient for competitiveness diminishes and becomes insignificant, indicating that beliefs explain a considerable portion of the effect of this factor. However, while the coefficient on gender diminishes, it remains sizable and statistically significant at the 5% level (p=0.040).[15]

Figure 4: Gaps in preferred policy based on gender and other individual characteristics



Gender: mean female minus mean male vote. Competitiveness: mean vote among those who chose the piece rate minus mean vote for those who chose competition. Political orientation: mean vote for those placing themselves toward the left of the political spectrum minus mean vote for those on the right (based on median split of 9-point Likert scale responses). SVO (Primary): mean vote among those with higher scores (more prosocial) minus those with low scores (based on median split). SVO (Secondary): mean vote among those with higher scores (more egalitarian) minus those with low scores (based on median split); the secondary SVO comparison omits the 27.7 percent of individuals exactly at the median value of 0.667, yielding a sample of 149 subjects below and 151 above the median. Risk behavior: mean vote by those taking less risk minus mean vote among those taking more risk in the incentivized risk task (based on median split).

[14] Adding only a control for performance yields an almost identical coefficient for female as in model 2. Controlling only for performance beliefs yields similar results as in model 3. Thus, beliefs about relative performance, rather than actual performance, seem to be more important determinants of voting behavior.

[15] We also estimated separate versions of model 3 for men and for women, to study whether the relationship between our explanatory variables and the dependent variable differs by gender. These regressions indicate that beliefs significantly predict the chosen redistribution coefficient for both genders. For women, but not for men, the primary Social Value Orientation is also a significant predictor (p=0.003).

As the above analysis reveals, we find a gap of approximately 0.2 in the mean tax rate preferred by men and women. To get a sense of the importance of this difference, we compare it to gaps that arise if we divide our population by other relevant individual characteristics. Figure 4 shows the difference in mean Period 1 votes when we conduct median splits of our sample based on gender, as well as competitiveness, left-right political orientation, the two measures of Social Value Orientation, and risk preferences. The gender gap in votes is comparable, and even somewhat larger, than the gaps along all other dimensions. Hence, the gender gap in voting behavior is not only statistically significant, but also substantive relative to gaps produced by other observable characteristics.[16]

Result 2: In the first period, women vote for more egalitarian redistribution policies than men. This gender difference persists with the introduction of individual level measures of risk taking, Social Value Orientation, and willingness to compete. Additionally controlling for relative beliefs about performance indicates that beliefs are important for redistributive preferences, and beliefs somewhat mitigate the gender gap in votes. However, the gender gap in votes remains significant at the 5% level. The gender gap in voting behavior is also large relative to gaps based on other individual characteristics.

3.3 Does Group Gender Composition Impact Group Policy Choices?

In the analysis above, we find that female participants differ in their preferences from male participants and vote for more egalitarian redistribution policies. This section addresses how this gender gap plays out at the group level, and whether it impacts the redistribution policies adopted in groups with either male or female majorities.

Recall that the individual votes were aggregated into collective outcomes through a median-voting rule. Comparing the median vote in male-majority groups to female-majority groups in Period 1, we find that the previously observed gender difference persists at the group level. Female majority groups implement significantly higher redistribution policies ($\bar{t}_{\text{female majority}} = 0.219$, $\bar{t}_{\text{male majority}} = 0.069$, p-value of difference = 0.010, Wilcoxon-Mann-Whitney), though this difference of 0.15 is 75% of the difference in means of 0.20 when considering individual voting behavior. Further, a majority of the groups with more women than men, 76%, implement positive redistribution policies, whereas only 38% of the groups with a male majority do so (two sample test of proportion, $z = -3.373$, $p < 0.001$).

[16] While gender is correlated with preferences for competition and risk in our sample, we do not find a correlation between stated political orientation and gender. We speculate that political orientation may reflect a varied set of considerations, which may be related to gender in sometimes opposing ways.

Figure 5 shows the cumulative distribution function for the policies implemented in the first period, by the gender majority of a group. The graph shows that more male majority groups implement low redistribution policies. The difference between the two distributions is statistically significant (Kolmogorov-Smirnov test, p = 0.004).

Figure 5: Cumulative distribution of first period votes by group gender majority

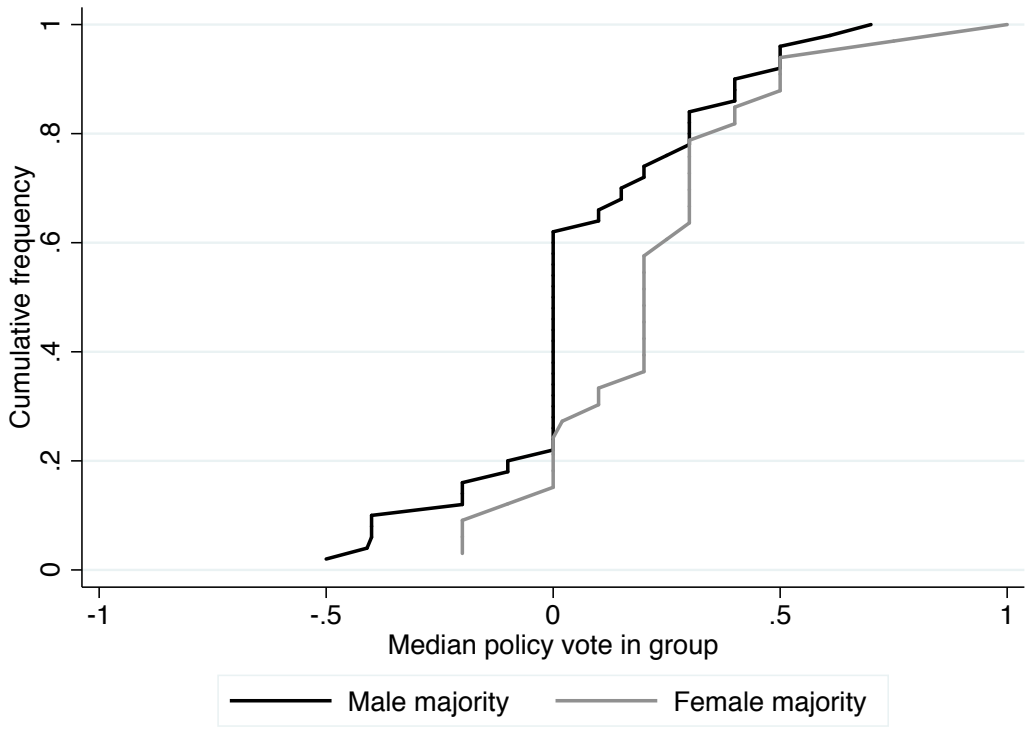


Table 4 provides regression analysis comparable to that in Table 3, but now using the median vote in a group in Period 1 as the dependent variable and a group as the unit of analysis. The first model shows the substantial difference in selected policies between groups with female, relative to male majorities. Models 2 and 3 add group-level averages of the preferences and beliefs similar to those in Table 3. The preference measures in model 2 do not statistically significantly predict the group median vote, nor do they have a large effect on the magnitude or significance of the female majority variable. In the third model, the additional inclusion of the average relative confidence in a group yields a marginally statistically significant relationship in the expected direction—groups in which individuals believe they are relatively more productive than others vote for lower tax rates. With the additional group-level explanatory variables in model 3, the coefficient for female majority is roughly two-thirds the size of that in model 1 and is marginally statistically significant.

Table 4: Determinants of selected policy in the first period

Dependent variable:	*Group median vote in Period 1*		
	(1)	**(2)**	**(3)**
Female majority	0.150**	0.125**	0.109*
	(0.058)	(0.061)	(0.061)
Mean Risk preference (Investment task, standardized)		0.025	0.026
		(0.062)	(0.062)
Mean Social Value Orientation (Primary, standardized)		0.059	0.071
		(0.065)	(0.065)
Mean Social Value Orientation (Secondary, standardized)		-0.064	-0.052
		(0.060)	(0.062)
Mean Competition (1 = competitive)		-0.074	0.017
		(0.151)	(0.157)
Relative performance beliefs (standardized)			-0.103*
			(0.062)
Constant	0.069*	0.101*	0.080
	(0.038)	(0.059)	(0.062)
Observations	83	83	83
R-squared	0.074	0.099	0.124

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Result 3: The significant gender gap in individual policy votes translates into a gap in initial implemented policies between male- and female-dominated groups. In Period 1, male-majority groups implement less egalitarian redistribution policies than female-majority groups. The difference at the group level is somewhat attenuated compared to individual-level differences and it is partly explained by average beliefs about relative ability.

The results above demonstrate the consequences of differences in the policy preferences of men and women for outcomes in male- versus female-led groups. However, our results are based on one particular kind of institution for aggregating individual preferences into collective outcomes—voting with the median preference in the group implemented as policy. The results are also based on the particular constellation of groups in our experiment, which oversamples all-male and all-female groups. An important question is how the results might differ under alternative mechanisms for determining group policy.

While the only way to definitively demonstrate the policy impacts of male versus female majorities under different mechanisms is to conduct versions of our experiment in which groups collectively decide in different ways, we attempt to use our current data to

cautiously obtain insights into what such outcomes might be. Specifically, we start from the assumption that the Period 1 vote by each individual accurately reflects that group member's preferences and how that group member would vote in other contexts and then simulate group outcomes under different institutions. We then randomly draw from our population a group of 5 individuals and classify this group according to whether it has a male or female majority. We simulate policy outcomes under three institutions: (1) median voter: as in our experiment, individuals vote for their preferred redistribution level and the median vote is enacted as policy, (2) random dictator: one person in the group is randomly selected and this person's preferred policy is enacted, (3) a simple form of two-candidate plurality rule: two group members are randomly selected to provide their preferred policies as proposals and each of the three remaining group members votes for the proposal that is closer to her preferred policy. The simulations are based on 100,000 randomly drawn groups.

Table 5. Simulated policies under alternative mechanisms

	$\bar{t}_{\text{female majority}}$	$\bar{t}_{\text{male majority}}$	difference	$\bar{t}_{\text{fem. maj.}} > 0$	$\bar{t}_{\text{male. maj.}} > 0$
Median voter	0.167	0.096	0.071	64%	48%
Random dictator	0.152	0.080	0.073	58%	49%
Two-candidate plurality	0.172	0.104	0.069	61%	48%

Table 5 provides summary statistics of simulated policy outcomes in male- and female-majority groups, under the above three mechanisms. The first thing to notice is that the simulated outcomes under the same median voter mechanism employed in our experiment are less distinct between male- and female-majority groups than the empirical outcomes in our experiment, by about 50 percent. Female-dominated groups enact redistribution policies that are approximately 0.07 higher than male-dominated groups. The second observation is that the policy outcomes under the two alternative mechanisms we consider are generally quite similar to those that obtain under the median voter. Hence, while this analysis relies on assumptions regarding the stability of policy preferences and actions under different mechanisms, and should therefore be interpreted cautiously, it suggests that our observation of different policy outcomes in male- and female-dominated groups is also likely to arise under at least some other mechanisms, though it is only about 35 percent of the difference between the average policy preferences of men versus women.

Broadly, we view the evidence above as generally supportive of the relationships we set out to test in this study. We observe strong evidence that men and women differ in their preferences, that they vote differently in a redistributive policy domain and that the former observations explains at least part of the latter. Moreover, these differences translate into different policies adopted by male- versus female-majority groups, although the differences at the group level are considerably smaller than those at the individual level, as suggested by Figure 1. Hence, our study provides clear evidence that the first three conditions for gender gaps in preferences to translate into policy outcomes can be satisfied.

3.4 Persistence of Gender Gaps across Periods

In this section we explore the extent to which the gender gaps we observe in Period 1 persist across the 10 periods of the game. Before we explore gender gaps, however, we briefly summarize a few general observations about voting behavior over time.

Looking at voting behavior over time indicates that participants understood their decision environment fairly well. While there is variation in individual votes, we also find substantial consistency. There is a strong positive correlation between average votes in Periods 1-5 and in Periods 6-10 (see Figure A3 in the Appendix). This consistency may be explained by the high positive correlation of 0.70 between the individual performance rankings from one period to the next throughout the experiment. Participants also vote self-servingly—there is a negative correlation between a participant's relative performance compared to the group and her vote in the next period (see Figure A4 in the Appendix).

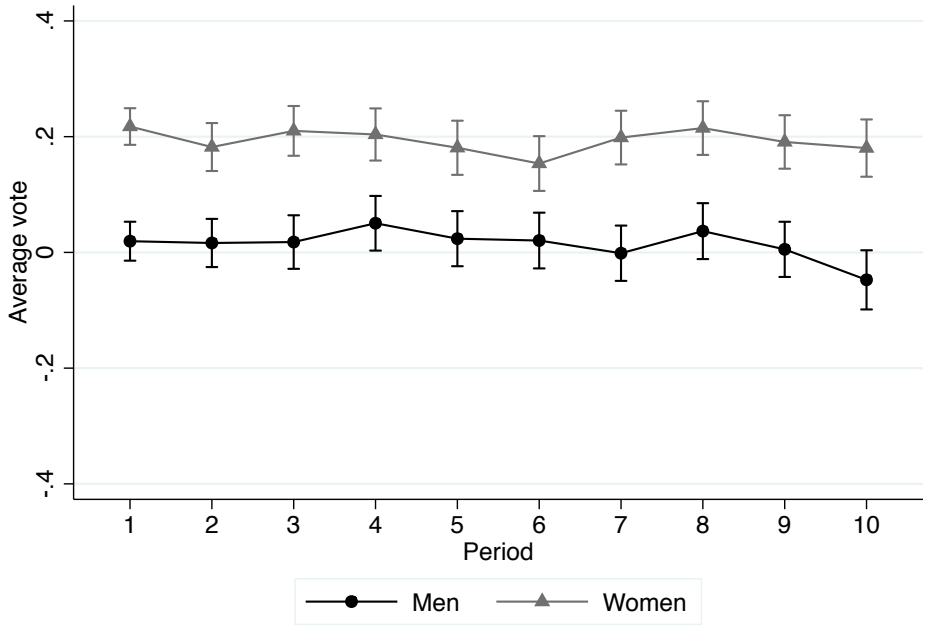
3.4.1 Persistence of Gender Gaps at the Individual Level

Figure 6 shows the average votes cast by men and women across the 10 periods. The figure shows that the gender difference essentially persists at slightly less than 0.2—the initial gap in Period 1—across the 10 periods. The average vote by male participants across all periods is 0.01; the corresponding number for women is 0.19.

As a complement to Figure 6, the first three models in Table 6 present the results of random-effects regressions of individuals' votes across time, with standard errors clustered at the group level. Model 1a shows that the average preferred policies of men and women across the experiment differ by 0.18 and this difference is highly statistically significant ($p<0.001$). Model 1b introduces period and its interaction with gender as covariates, finding no significant time trends for either men or women—although, if anything, the signs of the coefficients suggest that gender differences in voting increase over time—and no substantive

impact on the overall gender difference. Thus, there seems to be no significant time trend that affects the voting gap between men and women.[17]

Figure 6: Average votes for redistributive policies by period and gender



Bars indicate standard errors.

Model 1c introduces a measure of relative performance beliefs. For Period 1 these are the same relative performance beliefs elicited in Part 2 that we used in Table 3. For Periods 2 through 10, we use the lagged actual relative performance rank, which we transform into a standardized variable such that a higher value indicates better relative performance. In combination, this gives us a rough measure of how a subject expects to perform relative to others. This variable is statistically significant and large in magnitude—an increase in standard deviation of one unit corresponds to voting for a coefficient lower by roughly 0.19. This is consistent with the strong relationship between lagged rank and current votes shown in Appendix Figure A4. The introduction of lagged relative beliefs diminishes the coefficient for gender by about one-third, but it remains positive and statistically significant. Hence, part, but not all, of the difference in voting by men and women seems to be accounted for by differences in (expected) relative task productivity.

Result 4: Women vote for more egalitarian redistribution policies than men throughout the 10 periods of the experiment. However, this gender difference in policy preferences is

[17] We also regress, separately for each period, individual votes on female, clustering standard errors at the group level. The gender gap is significant at the 5 percent level in all 10 periods (see Table A2 in the Appendix).

reduced by roughly one third if we control for relative prior performance. This suggests that some of the gender-gap in redistributive preferences is driven by performance expectations.

Table 6. Differences in voting and group outcomes across 10 periods

Dependent variable:	*Individual vote*			*Group median vote*	
	(1a)	(1b)	(1c)	(2a)	(2b)
Female / Female Majority	0.179*** (0.046)	0.164*** (0.046)	0.108** (0.044)	0.111* (0.063)	0.061 (0.070)
Period		-0.004 (0.004)	-0.006 (0.004)		-0.007 (0.007)
Female / Female Majority X Period		0.003 (0.007)	0.006 (0.007)		0.009 (0.008)
Lagged Relative Beliefs or Performance (standardized)			-0.185*** (0.014)		
Constant	0.014 (0.036)	0.039 (0.038)	0.065* (0.036)	0.080* (0.041)	0.116*** (0.042)
Observations	4,150	4,150	4,150	830	830
R-squared	0.028	0.028	0.382	0.036	0.036

Standard errors (clustered by group) in parentheses; all models are GLS with random-effects at the subject (models 1a and 1b) or group (models 2a and 2b) level. *** p<0.01, ** p<0.05, * p<0.1.

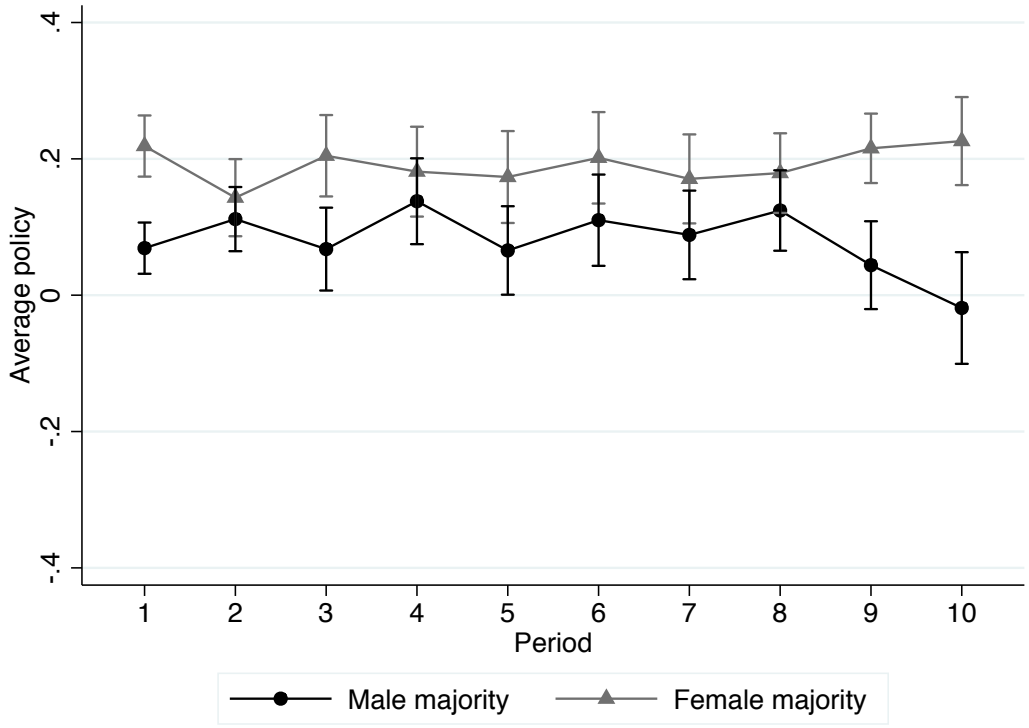
3.4.2 Persistence of Gender Gaps by Male versus Female Majority

Our findings above indicate that women support more egalitarian redistributive policies than men throughout the 10 periods of the game, although the difference is somewhat attenuated controlling for prior performance. In this section we study group level outcomes, comparing groups in which either males or females are in the majority, to address whether male- and female-controlled policymaking *persistently* yields different kinds of redistributive policies. Additionally, we also explore whether groups with male versus female policy control yield different outcomes in other dimensions, for example, in terms of inequality.

Figure 7 shows the average redistribution policy implemented in groups across periods, based on whether either men or women are in the majority. Models 2a and 2b in Table 6 present random effects regressions of the median vote in a group. As Figure 7 shows, the median vote lies in the direction of more egalitarian redistribution in female-majority groups in all periods. This is consistent with the behavioral difference we observe at the individual level but, as with Period 1, this difference is smaller than the individual-level gaps—on average, 0.11. Moreover, as Table 6 shows, this difference is only marginally significant when considering the entire experiment (p=0.078, model 2a) and is not

statistically significant when controlling for time trends (model 2b). Hence, the strong differences at the individual level are substantially attenuated when aggregated through a collective decision making process, and the result is group level differences that are modest in size and statistical significance.

Figure 7: Redistribution policy and gender majority



Lastly, we can also study other dimensions of the differences between male- and female-led groups. For example, in total, male- and female- majority groups generate slightly different payoffs from the production and redistribution game. Male-majority groups earn average payoffs of CHF 26.8, while female majority groups generate average payoffs of CHF 25.8 ($p=0.018$, Wilcoxon-Mann-Whitney test). However, the precise origin of this difference is hard to identify, since it is potentially partly dependent on the incentive properties of different policies adopted in male- and female-majority groups and also partly based on differences in task ability that seem to arise by the end of the experiment. As a potentially more direct consequence of differences in policies adopted by male- and female-majority groups, we can also study inequality in the two kinds of groups. The mean Gini coefficients of group-level inequality indicate slightly higher inequality in male-majority groups, but we fail to reject the null hypotheses of equal levels of inequality between male- and female-majority groups ($p=0.377$, Wilcoxon Mann-Whitney test).

Result 5: After the first period, policies implemented in groups with a male versus a female majority generally display persistent but statistically weak differences. Male-majority groups generate higher aggregate earnings, though the exact source of this difference is unclear. We find no substantive differences between male- and female-majority groups in inequality.

3.5 Differences between Treatments – The Impact of Risk

We next explore whether there are differences in selected policies between the No Risk and Risk treatments. Figure 8 shows the average vote for redistributive policy, by an individual's gender and by whether the individual is in the No Risk (left panel) or Risk (right panel) condition. The overall tendency to vote for egalitarian redistribution is considerably higher under Risk, and this is true for both genders. However, both graphs reveal similar gender gaps in policy preferences, of approximately 0.2, on average.

Table 7 presents regressions of policy votes by gender and treatment. Model 1 uses only the first period and includes, as explanatory variables, gender, treatment and their interaction. Model 2 extends this analysis to all 10 periods, introducing subject-level random effects. In both cases, the variables for gender and treatment are large—at least 0.17—and statistically significant, confirming that women vote for more egalitarian redistribution as do people in production environments involving more risk. Importantly, the interaction terms are small and statistically insignificant in both models, indicating that the effects of treatment and gender operate independently, which is consistent with the patterns in Figure 7.

Figure 8. Average vote by gender (separately by Risk and No Risk treatments)

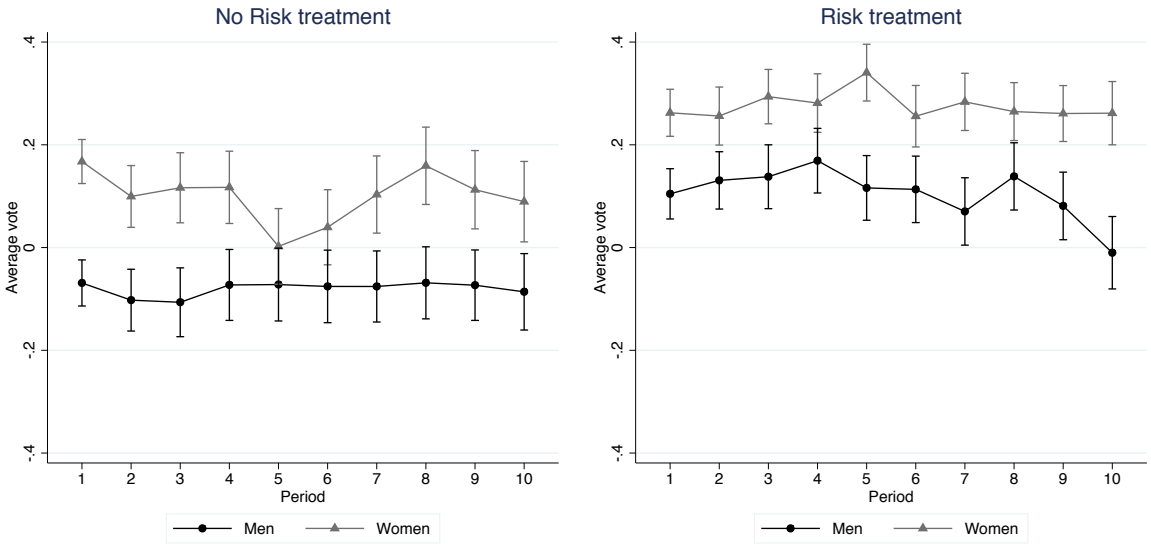


Table 7. Differences in voting by treatment

Dependent variable:	*Individual Vote*				
	Period 1	*All periods*			
	(1)	(2)	(3)	(4)	(3)
Female	0.236***	0.181***	0.202***	0.130***	0.151**
	(0.058)	(0.058)	(0.054)	(0.047)	(0.062)
Risk Treatment	0.173***	0.185***	0.249***	0.169***	0.173**
	(0.064)	(0.066)	(0.068)	(0.063)	(0.072)
Female X Risk Treatment	-0.079	-0.010	-0.080	0.019	0.049
	(0.094)	(0.087)	(0.086)	(0.077)	(0.092)
Period			0.001		
			(0.005)		
Female X Period			-0.004		
			(0.011)		
Risk Treatment X Period			-0.012		
			(0.008)		
Female X Risk Treatment X Period			0.013		
			(0.013)		
Lagged Relative Beliefs or Performance (standardized)				-0.254***	
				(0.026)	
Female X Lagged Relative Beliefs or Performance				0.005	
				(0.044)	
Risk Treatment X Lagged Relative Beliefs or Perf.				0.116***	
				(0.033)	
Female X Risk Treatment X Lagged Rel. Beliefs or Perf.				0.023	
				(0.052)	
Risk Seeking (Investment task, standardized)					0.034
					(0.048)
Female X Risk Seeking					-0.136*
					(0.079)
Risk Treatment X Risk Seeking					0.008
					(0.074)
Female X Risk Treatment X Risk Seeking					0.152
					(0.114)
Constant	-0.069*	-0.080**	-0.088**	-0.053	0.084**
	(0.036)	(0.039)	(0.040)	(0.036)	(0.040)
Observations	415	4,150	4,150	4,150	4,150
R-squared	0.064	0.056	0.056	0.419	0.068

Standard errors (clustered by group) in parentheses; model 1 is OLS; models 2 through 5 are GLS with random-effects at the subject level. *** p<0.01, ** p<0.05, * p<0.1.

Models 3, 4 and 5 add as explanatory variables, respectively, period, lagged relative beliefs (defined as in Table 6) and the incentivized measure of individual risk propensity (as in Table 3). The models also include all possible interactions between these variables and

gender and treatment. Consistent with the results for models 1 and 2, women and participants in the risk treatment vote for significantly more egalitarian redistributive policies in all models. Model 3 additionally reveals no significant time trends for any combination of treatment or gender. Model 4 confirms our earlier observation that relative performance beliefs are important: a one standard deviation increase in this variable yields a vote that is 0.25 lower. However, this relationship is about one half as strong in the Risk treatment, naturally reflecting the weaker relationship between ability and earnings in the task. In model 5, the individual risk measure adds little explanatory power, though women who are risk seeking tend to vote for marginally significantly less egalitarian redistributive policies.

Altogether, Figure 7 and Table 7 demonstrate that an environment in which the relationship between individual work and earnings is subject to random shocks yields preferences for more egalitarian redistributive policies. However, the relationships between gender and voting for redistributive policies are very similar in environments with and without this underlying risk. Moreover, the effect of gender on voting behavior is roughly the same size as the change when people move from an environment with no risk to one with a substantial amount of risk.

Result 6: Gender gaps in voting are present and similar in magnitude in both environments with and without risk in production. The presence of risk yields an overall increase in support for egalitarian redistribution and yields a weaker relationship between relative ability and preferred policies.

4. Conclusion

We study the connection between gender gaps in individual economic preferences and policy-related behaviors and outcomes. There is widespread evidence that men and women differ in their attitudes toward risk and competition and in some aspects of their pro-sociality. Several studies also document that men and women sometimes exhibit different voting behavior. However, there is no evidence directly connecting gender gaps in preferences to the policy choices of men and women, and to the outcomes that result when men or women exert greater control over policy.

To address this gap, we identify four conditions that are necessary for gender-based preference gaps to yield large and persistent differences in collective policy outcomes, and design a study to test each of these conditions. Our study includes a novel laboratory experiment in which participants engage in repeated production and redistribution, with

endogenous redistribution policies determined through a group vote. We also independently measure preferences over risk, competition and social outcomes.

Our results replicate many of the previously observed gender gaps in preferences. Women prefer less risk and less competition, appear to prioritize equality over efficiency and report a greater willingness to share wealth. Hence, our initial results support the first condition necessary for gender-based preferences to translate regularly into policy outcomes.

We then identify how the same participants vote on redistributive policies, on a policy dimension ranging from highly competitive and unequal to highly egalitarian. Women vote for substantially higher, more egalitarian, tax rates. We also document that a large part, though not all, of this difference in policy preferences can be accounted for by more fundamental preferences and by differences in beliefs about relative performance, a measure of (over)confidence. Hence, our results support the notion that gender-based differences in preferences and beliefs may directly translate into differences in policy-related preferences and behavior.

As a third step, we study the extent to which gender differences in policy preferences yield substantively different policies in male- and female-majority groups. The differences persist, but are attenuated relative to the average difference between men and women. This is a natural consequence of many rules for aggregating individual choices into collective outcomes—such as the "median-vote" rule that we employ. This illustrates the straightforward, but important, point that policy differences between male- and female-controlled groups will often not be as extreme as the policy preference differences between the typical man and woman. Moreover, simulations, based on the preferences in the population in our experiment find regular and substantial differences in group outcomes based on whether men or women are in the majority, though these are considerably smaller than the difference between men's and women's average votes. Hence, we offer evidence that gaps in individual preferences between men and women can scale up to produce differential collective outcomes when men and women hold policy control, though our results suggest that group level gaps will often be smaller than the gaps in individual preferences.

We also provide evidence on the stability of the above differences over time. Across our experiment, gender differences in voting persist at the individual level. Differences in policies adopted by male- and female-majority groups also persist, though they are smaller in magnitude and statistically weaker than the individual-level differences.

Finally, we also demonstrate that environments with greater risk yield preferences for more egalitarian—and less risky—redistributive policies and that in such environments the

connection between relative performance beliefs and voting behavior is weaker. However, the gender gap in voting is robust across contexts with varying risk. In fact, the difference in average votes between men and women is roughly equal to the difference in votes between an environment with no risk and one with high degrees of randomness in earnings.

Taking all of the above together, we draw two main conclusions. First, gender differences in preferences can translate into policy choices and different outcomes for male- and female-majority groups. The effects of gender on voting that we observe are at least as large as those of other important factors, and gender majority impacts outcomes quite strongly in the first period of our experiment. Hence, we provide some evidence that "Lehman Sisters" may have acted differently from "Lehman Brothers." Second, the differences in outcomes may often be substantially smaller than the differences observed in the average behavior of males and females. Our empirical results yield a difference in mean group policies that is roughly 75 percent of the difference between the average policy preferences of men and women, while our simulations yield differences, including when using different institutions, which are closer to 40 percent of the mean gender preference gap. Hence, the gap in outcomes produced by Lehman Brothers and Lehman Sisters may be much smaller than the difference in preferences between the average man and the average woman. Our findings provide an interpretation for why male- and female-majority groups often do not produce very different outcomes, despite the fact that gender differences in preferences seem quite reliable.

Our work highlights the importance of being cautious about making claims about how different the World would be if women controlled it. We provide evidence that men and women *can* produce different types of groups and societies, and we document that at least part of this is based on widely studied preference gender gaps. However, our evidence comes only from contexts that we designed to make it easy for such differences to arise. A natural open question is whether such differences persist in other contexts—for example, when the relationship between gender gaps in preferences for risk, competition and equality do not line up to predict identical effects on policy preferences. Our work thus highlights the need for more careful study of precisely how gender differences scale up and persist over time to shape firms, institutions and societies.

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Appendix A

Table A1: Performance over time

Period	Men	Women	p-value
Piece rate Stage 1	12.0	11.6	0.188
Period 1	11.9	11.3	0.010
Period 2	12.6	12.2	0.090
Period 3	13.1	12.4	0.003
Period 4	13.6	13.0	0.034
Period 5	13.3	12.7	0.024
Period 6	12.9	12.4	0.061
Period 7	13.6	13.9	0.033
Period 8	14.2	13.5	0.013
Period 9	14.9	13.9	<0.001
Period 10	14.0	13.5	0.045
Piece Rate Stage 3	17.1	16.3	0.010
Observations	218	197	

P-values denotes the significance of the coefficient on female in the per period OLS regression of performance on female, clustering at group level, for Periods 1-10 and the last piece rate performance.

Table A2: Difference between male and female votes over time

	Mean difference (female – male)	p-value
Period 1	0.20	0.000
Period 2	0.17	0.002
Period 3	0.19	0.001
Period 4	0.15	0.009
Period 5	0.16	0.013
Period 6	0.13	0.032
Period 7	0.20	0.003
Period 8	0.18	0.006
Period 9	0.19	0.002
Period 10	0.23	0.001
Observations	415	

P-values denotes the significance of the coefficient on female in the per period OLS regression of votes on female (and performance), clustering at group level.

Figure A1. Performance in task over time

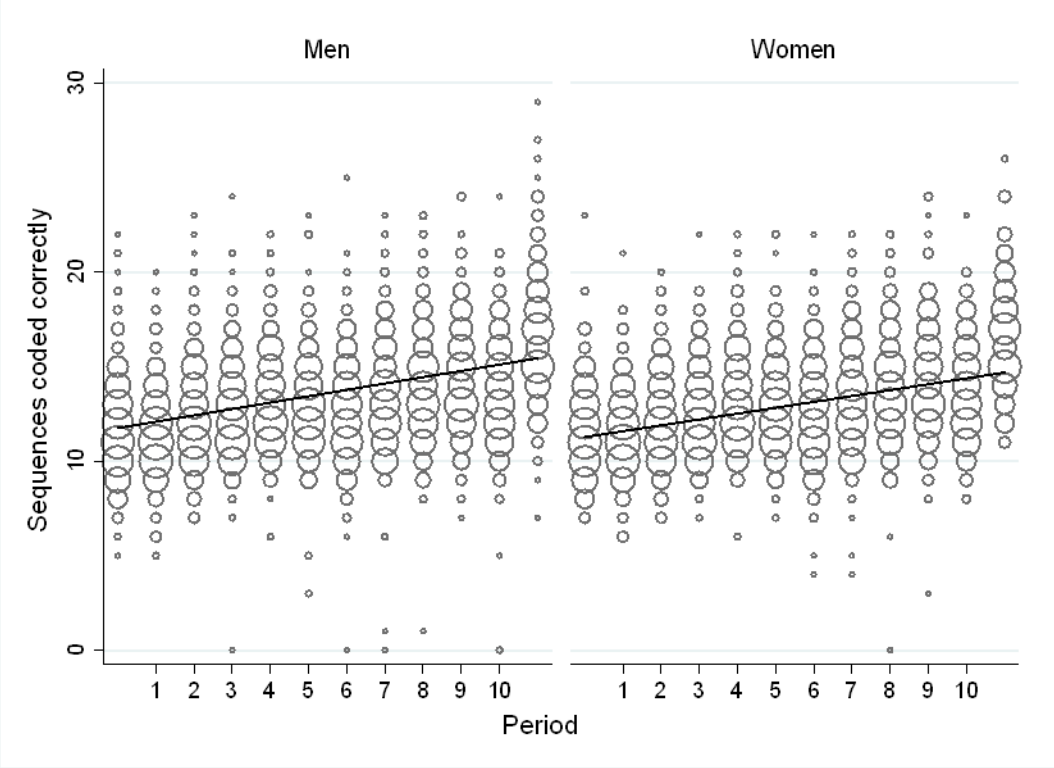


Figure A2. Histograms of Period 1 votes (separately by gender, kernel density estimates)

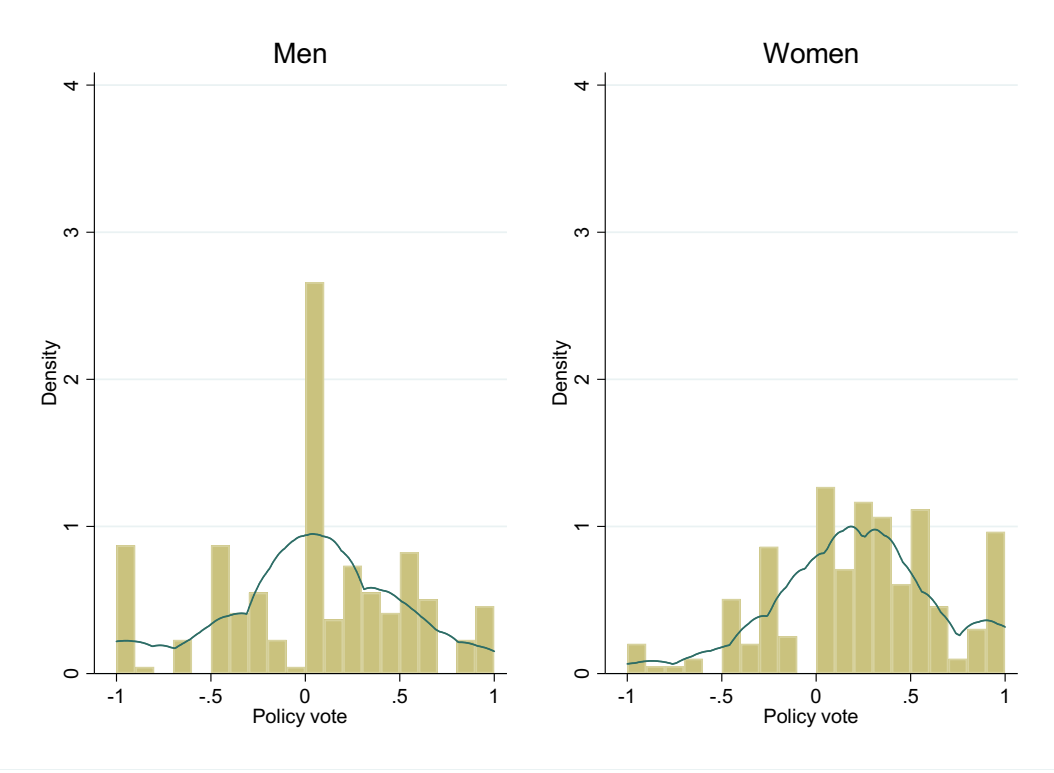


Figure A3. Comparison of votes (first vs. second half of Stage 3)

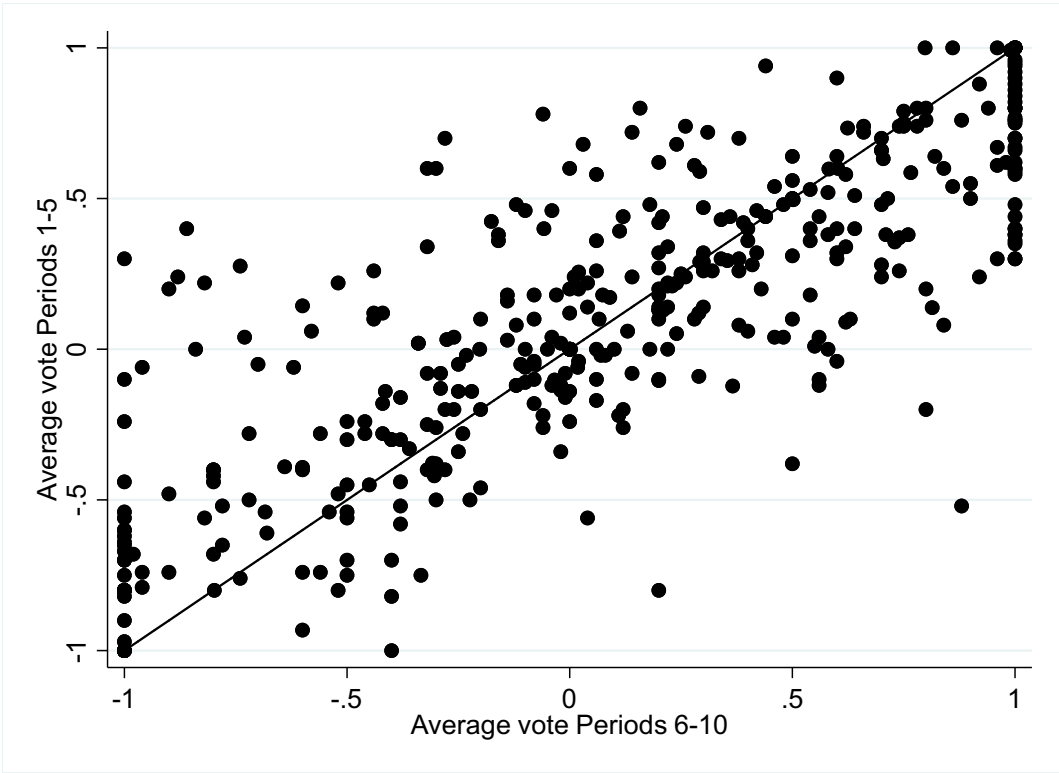
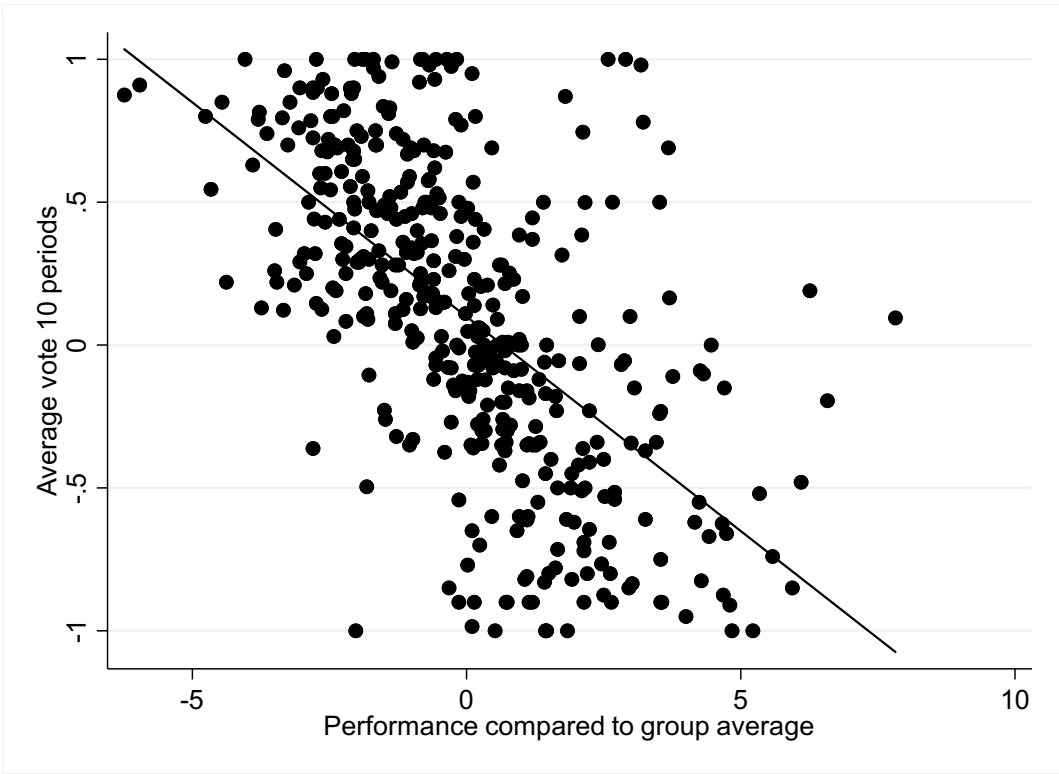


Figure A4. Correlation between policy votes and lagged relative performance



Appendix B : Instructions

Initial Instructions

The experiment comprises three parts. We will provide you with detailed instructions before each part.

In addition to the CHF 10 payment that you receive for your participation, you will be paid an additional amount of money that you accumulate from decision tasks in the three parts of the study. The exact amount you receive will be determined during the experiment, and will depend on your decisions, and the decisions of others. Please note that the decisions you make in any part of the experiment will have no effect on what happens in other parts.

All monetary amounts you will see in this experiment will be denominated in experimental currency units (ECU). At the end of the experiment, your earnings in ECU will be exchanged into CHF at a rate of

50 ECU = 1 CHF

Note that all your interactions in the study are anonymous. This means that you will not know the identity of any other participant with whom you interact and no other participants will know your identity.

If you have any questions during the experiment, please raise your hand and wait for an experimenter to come to you. *Please do not talk, exclaim, or try to communicate with other participants during the experiment. Participants intentionally violating the rules may be asked to leave the experiment with only their participation payment.*

Please click “Continue” now to see the instructions for the first part of the study.

Instructions to Part 1

In Part 1 you will make a few simple economic decisions and answer some questions. You will receive detailed instructions before each decision.

Please note that each of the decisions you make in this part is independent and does not influence the future course of the study. For each decision you will be informed about the outcome, and the earnings you received, at the end of the study.

Please press the "Continue" button now to see the instructions for the first decision.

Investment Decision

The first decision is an investment decision. This decision is for real money; the result of your decision will be added to your account and paid to you at the end of the experiment.

You start the investment task with a balance of 100 ECU. You choose how much of this amount (from 0 ECU to 100 ECU) you wish to allocate to the investment.

The ECU that you choose *not to invest* will be saved in your account and cannot be lost. You will receive these ECU at the end of the experiment.

The value of the ECU you choose *to invest* depends on the success or failure of the investment.

The success or failure of the investment will be determined by a computerized random draw, similar to a coin flip. There are two possible outcomes:

- With 50% probability the investment fails and you lose the amount invested.
- With 50% probability the investment succeeds and you receive 2.5 times the amount invested.

So, for any amount X that you invest, you will keep 100 – X, regardless of what happens with the investment. If the investment fails, which happens with 50% probability, your earnings from this decision will be **100 – X**, since you lose the amount that you invested. If the investment succeeds, which also happens with 50% probability, your earnings from the decision will be 100 – X + 2.5*X = **100 + 1.5*X**

Please enter the amount you wish to invest on your screen now. If you have any questions about the investment task please raise your hand and an experimenter will come to you.

Your Decision:
Please enter the amount of money (from ECU 0 to ECU 100) you wish to invest:
ECU _____

Once you enter a number, please submit your investment by clicking "Continue".

If you have any questions about the investment task please raise your hand and an experimenter will come to you.

Allocation Decisions

In the second task, you will make 15 decisions in which you allocate ECU between yourself and an anonymous other participant. You are again making decisions for real money; the payoff from this task will be added to your account and paid to you at the end of the experiment. Any money you allocate to another participant will be paid to another randomly selected participant at the end of the experiment.

For each of the 15 decisions, you will see a range of possible allocations. Your task in each decision is to choose your preferred allocation among the alternatives.

After you have made your allocation decisions, one randomly chosen decision (among the 15) will be chosen for each participant and implemented. This means that you will receive payment for two randomly chosen decisions. This is because each decision involves a decision-maker and a receiver. You will be paid once for a randomly selected decision in which you chose, and once as a receiver for the allocation chosen by another participant. The participant you interact with in these two cases will not be the same. That is, the receiver from your implemented decision will not be the decision-maker in the decision for which you are the receiver.

Below you see a sample of what your screen will look like for each of the 15 allocation decisions. The numbers in this example are used only to illustrate the task and do not correspond to the numbers in the actual decisions. In the upper row, you will see the allocation for you, and in the bottom row the allocation for the randomly chosen receiver. In the example below, if you choose the leftmost allocation, you receive 1 and the other participant receives 9. If you choose the rightmost allocation, you receive 9 and the other participant receives 1. Notice that each time you select an allocation the corresponding payments for you and the receiver will be displayed to the right of the table.

You will see 15 decisions, with varying allocations for you and another randomly selected participant. In each case, click on the button corresponding to the decision you would like to implement.

Once you are ready, please start the task by clicking "Continue".

If you have any questions about the allocation task please raise your hand and an experimenter will come to you.

Questionnaire

Before Part 1 ends, we would like you to answer a few additional questions. Please fill in your answers to the questions on the screen. If you have any questions raise your hand and an experimenter will come to you.

You confirm your entries by clicking the "Continue" button. Once everybody has answered these questions, Part 2 will begin.

1. First, state, in general, how willing or unwilling you are to take risks on a scale from 0 to 10. 0 means you are "completely unwilling to take risks" and a 10 means you are "very willing to take risks". You can also use any integer number between 0 and 10 to indicate where you fall on the scale. Possible choices are: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

2. Second, imagine the following situation: Today you unexpectedly received CHF 1,000. How much of this amount would you donate to a good cause? Values between 0 and 1,000 are allowed for the donation.

3. How old are you?

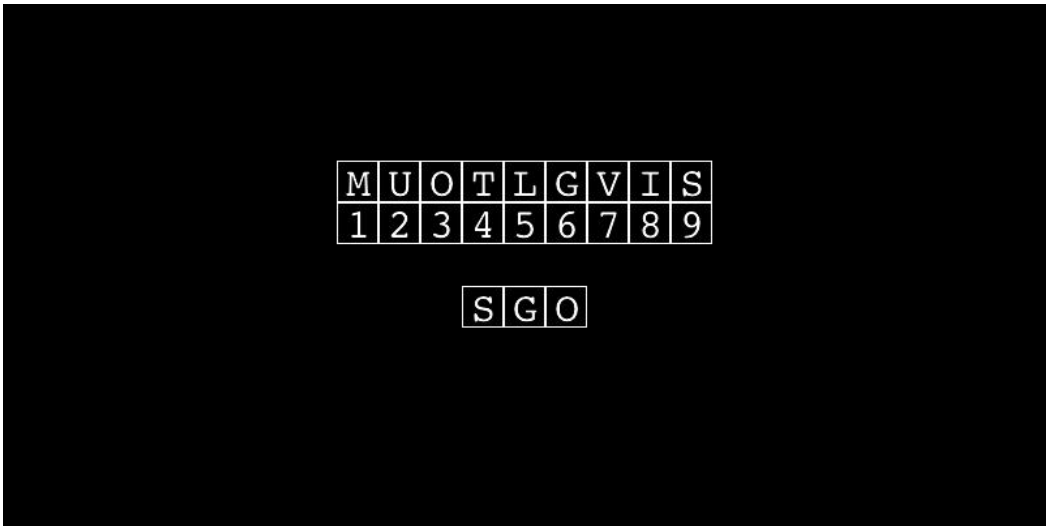
4. Are you male of female?

Instructions to Part 2

In Part 2 you will work on a task for 90 seconds. You will be paid, as explained in more detail below, based on your performance on the task. You will also make a few decisions in which you can make additional money. Your actions in Part 2 are independent of the other parts of the study, and do not in any way influence the future course of the study.

The Production Task

The task for Part 2 consists of a coding task. During the task, your screen will display a key, which consists of a series of unique matches between letters and numbers. More precisely, each key will show the numbers 1-9, and a series of 9 letters of the alphabet, displayed such that one letter corresponds to one number. An example of such a key is in the picture below. In this example, M corresponds to 1, U to 2, O to 3, and so on.



During the task, you will be shown sequences of three letters. Your task is to enter the corresponding three numbers on your computer. For example: if the sequence you are asked to code is SGO, as indicated in the picture, the correct answer for the key above is 963. You obtain this sequence of numbers by exchanging the S for a 9, the G for a 6, and the O for a 3.

The sequences of three letters will appear on your screen, one at a time. Once you enter the corresponding three digits, you confirm your answer with the "OK" button. If the entered sequence is correct, a new sequence will appear on your screen, otherwise you will be asked to recode the three-digit sequence until it is entered correctly. For each key of letters and digits, you will see nine three-digit sequences to code into numbers. Then a new key appears, for which you will get nine consecutive three-digit codes, and so on. You will have 90 seconds to enter as many sequences as you can.

Your payment from the task depends on the number of sequences you code correctly. In particular, you will be paid 10 ECU per correctly coded sequence. At the end of the experiment, you will be informed about your resulting earnings.

On the next screen, you will see an example screen similar to the one you will see during the actual task. In the upper half of the screen you will see a picture of the key, consisting of nine letter-number pairs. Below that you will see the sequence of three letters that you are to recode into a three-digit number, as well as the box where you enter your answer. Remember that you will receive 10 ECU for each sequence that you correctly type in during the 90 seconds.

Please click the "Continue" button on your screen now. You may then try the task on the example screen by filling in the correct three-digit number in the empty box. If the cursor is not positioned within the box, you will need to click inside the box to allow you to type in the box. Confirm your entry with the "OK" button. You will then be able to click to start the actual task for Part 2.

If you have any questions about the task please raise your hand and an experimenter will come to you.

Part 2 – Additional Decisions

To conclude Part 2, we would like to ask you a few questions related to the task you just completed.

First, we offer you the possibility to get paid once more for your performance in the task you just completed. This payment will be paid to you at the end of the experiment, in addition to all other payments, including the one you already earned for performing the task.

Specifically, we here ask you to make a choice regarding how you would like to be paid. In particular, you can choose between two different payment methods, method 1 and method 2.

Payment method 1
The first method is a certain payment of 10 ECU per correctly entered three-digit sequence. This method is the same as the payment you already received for performing the task. If you choose this payment method, you will receive an additional payment of the same size as before. So, under payment method 1, your payment depends only on how many sequences you entered correctly.

Payment method 2
If you choose the second method, your performance will be compared to the performance of a randomly chosen participant present here today, which could be any other participant in the room. You will be paid 20 ECU per correctly entered sequence, *only if you entered more three-digit sequences than this randomly chosen participant*. If you entered fewer sequences than this randomly chosen person you get nothing. If you entered equally many sequences, then the computer will randomly decide, with equal probability, whether you receive 20 ECU per correctly entered sequence, or whether you receive 0 ECU. So, under payment method 2, your payment depends partly on whether you entered more or fewer sequences correctly than another randomly selected participant.

Please indicate your choice by clicking on the payment method according to which you would like to get paid. You confirm your choice by clicking "Continue."

If you have any questions about the task please raise your hand and an experimenter will come to you.

Part 2 – Additional Decisions

Finally, we ask you to assess your performance (how many three-digit sequences you coded correctly) during the 90-second task, in comparison to the performance of the other participants in the room. Please enter your guess of your performance ranking in the box below. There are *[Number of participants]* participants present today. If you, for example, think that you copied the most sequences, and that no other participant copied as many, you enter the rank of 1. If you think that 6 participants performed better than you, you enter the rank 7. If you think you copied the fewest sequences, and that all other participants copied more than you, you enter the rank [*Number of participants*]. You submit your guessed rank by clicking the "Continue" button.

Please consider your guess well. You will earn an additional 50 ECU if your answer lies within 2 ranks of the true one. That is, if your true ranking is only 0, 1, or 2 away from the rank that you guess, you will receive an extra payment of 50 ECU at the end of the study.

If you have any questions about the task please raise your hand and an experimenter will come to you. Otherwise, please enter your guess below.

My estimated rank: _____

Instructions to Part 3

Part 3 mainly comprises 10 periods of the decision-task described below. After the 10 periods, you will perform the same 90-second task as in Part 2 once more. We will then conclude the study with a short questionnaire.

At the beginning of Part 3, you will be randomly assigned to a group of 5 participants. For the remainder of the experiment, you will interact only with the other 4 participants in your group.

Each participant in a group will be randomly assigned a unique ID (A, B, C, D, or E). A participant's ID remains constant for the entire study and allows you to follow other group members across different periods. Participants will be identified only by ID number, meaning that you will not know the identity of any other participant with whom you interact and no other participants will know your identity.

The course of each of the 10 periods in Part 3 is the same. Each period contains 3 steps. Below, we give you an overview of these steps. We then explain each step in detail.

1. The vote: In each period the participants may generate money. As a first step in a period the five group members will vote how they intend to allocate the money the group members generate in that period. The result of the vote is presented to all group members directly after the vote.

2. The production task: As a second step, participants take part in the production task, in which each participant can generate ECU. This is the same as the task from Part 2.

3. Display of final earnings: After everyone has performed the task, the computer reallocates the money produced from the task among the group members, based on the outcome of the vote at the beginning of that period.

Below we will explain each step of a period in detail.

The production task

In each period of Part 3, each group member may work on the same production task as in Part 2, coding sequences of three letters into digits for 90 seconds and generating 10 ECU per correctly coded sequence. However, a group member's final earnings in a period may differ from the money that person generates in the production task. How the final earnings differ from the money generated in the production task depends on the outcome of the group vote.

The vote

At the beginning of each period, before participating in the production task, the members of a group will vote on a rule for reallocating the money generated by each of the five group members in the production task. This vote is taken before knowing the exact amounts of money generated by each group member in the task.

Specifically, group members must vote on a transfer parameter, **t**. Via their vote on t, the group members have the possibility to influence the final distribution of earnings among the group members in a period.

The final earnings in a period are determined by collecting a share of the earnings produced by each group member and by then redistributing this collected amount among the group members. The amount collected from a member may differ from the transfer the member gets back.

The transfer parameter, t, indicates how large the effect is on the individual earnings. Specifically, t has two effects:

1. First, the distance of t from zero indicates how much redistribution takes place. When **t = 0**, then all group members keep the money they generated in the production task and no redistribution takes place. As t gets farther from zero, a larger share of the group's total production is collected for redistribution. The values of t can range from -1.00 to 1.00.

2. Second, t can be either positive, meaning it is greater than zero, or negative, meaning it is lower than zero. When **t is positive**, this means that the redistribution primarily collects money from those who generated more money in the production task and rewards those who generated less money in the production task. When **t is negative**, this means that the redistribution primarily rewards those who generated more money in the task and collects money from those who produced less in the production task.

We will explain in detail below what different values of t imply for the final payoffs, and illustrate it with a few examples.

At the beginning of a period, all group members vote for t by stating their preferred value. Each group member can propose any value of t, with a precision of two decimals, between -1.00 and 1.00.

Once the votes are cast, the group members' 5 proposed values for t are compared, and the median value is implemented for the group in the relevant period. The median is the value that lies in the middle when the five votes are ordered from highest to lowest. In each period, a new vote is taken and **t takes the value of the median vote** for that period. Thus, depending on the votes by the group members, t may take a new value in each period.

Note that using the median vote means that each participant does best by specifying the true value of t that they prefer. That is, there is no reason to try to strategically manipulate your vote. Your vote cannot affect the value of t, unless it lies in the middle of all the votes and in that case your vote determines t for that period.

Final earnings: The transfer parameter t

The transfer parameter allows the group members to influence the final earnings in a period. Depending on the value of t, groups may choose to either compensate group members who generate less money in the production task (who coded fewer sequences) or to reward group members who generate more money. In particular,

- if the value of t is positive, group members who generated *less* money than the group average end up benefitting from the redistribution;

- if the value of t is negative, group members who produced *more* money than the group average end up benefitting from the redistribution.

We will now provide you with the formula that determines how t affects the earnings of group members. However, if you do not understand the formula in detail, do not worry. The key facts to remember are that i) the farther t is from zero the more redistribution takes place and ii) a positive value of t benefits those who generated less money than the group average while a negative value of t benefits those who generated more money than the group average.

Let x_i denote the money generated by participant i in the production task, and t the transfer parameter. Remember that there are 5 participants in each group. You can calculate the individual final earnings in a period according to the formula below (we also illustrate the formula with two examples).

$$Payoff(x_i) = (1-t)x_i + t * \frac{1}{5}\sum_{i}^{5} x_i$$

The case when $0 < t \leq 1$

If t is positive, a fraction equal to t is collected from the money generated by each member in the production task. This means that the group member keeps (1–t) of the money that group member generated in the production task. That is, when t is positive, each group member keeps the sum $(1–t)*x_i$, while contributing $t*x_i$ to the common pool. This is illustrated in the first term of the payoff equation.

For example, if t = 0.5, half of the money generated (50%) from production is collected from each group member. Each group member keeps the remaining half. Thus, participants who generated more money pay higher amounts to the common pool than participants who generated lower amounts.

The money collected from all five group members is added up, divided into 5 equal parts, and returned to the group members, such that the total sum collected from the 5 group members always equals the sum paid out. This is illustrated in the second term of the payoff equation, $t*1/5 \sum x_i$.

Thus, all participants in a group pay different amounts in, which are proportional to their earnings from the task, but get the same amount back. Therefore, if t is positive, group members who generated less money than the average receive more money back than they contribute, whereas those who generated more money than the group average receive less money back than they contribute.

Example:

We will now go through an example. Please note that the numbers used in this example are also shown on the table on the next page.

- Assume that the five votes for the transfer parameter are: -0.5, -0.3, 0.4, 0.5 and 0.7.
- The median vote is thus 0.4, and implies that each group member will contribute a share of 0.4 (40 percent) of the money they generated to the common pool.
- Assume further that the ECU generated from production by the five group members are 50, 100, 150, 200 and 250.
- In this case, a value of t = 0.4 means that participant A, who generated 50 ECU in the production task, contributes 20 ECU (0.4*50 = 20) to the common pool, and keeps 30 ECU (50*(1-0.40) = 30). The other group members contribute 40, 60, 80 and 100 ECU, respectively.
- The common pool is then, in total, 300 ECU (20 + 40 + 60 + 80 + 100 = 300).
- The common pool is divided in 5 equal shares of 60 ECU. Each of the five group members receives an equal share.
- Thus, the final earnings for the period for participant A are 50 - 20 + 60 = 90 ECU, for participant B the final earnings are 100 - 40 + 60 = 120 ECU, and so on.

The table below shows you, for each group member, the **ECU generated** in the production task, the **amount collected** from that group member and placed into the common pool, the **amount paid back** to that group member, and the **final earnings** of the group member in the example above.

Since t is greater than zero, group members who generate more money in the production task contribute more to the common pool, and members who generate less money in the production task contribute less, while all members get an equal share back from the common pool.

As you can see, when t is positive, it decreases the payment differences arising in the task.

	A	**B**	**C**	**D**	**E**
Vote for t	**-0.5**	**-0.3**	**0.4**	**0.5**	**0.7**
Value of t for group (median vote)			**0.4**		
ECU generated by production (xi)	**50**	**100**	**150**	**200**	**250**
Amount collected (Proportional: t*xi)	**20** *0.4*50=20*	**40** *0.4*100=40*	**60** *0.4*150=60*	**80** *0.4*200=80*	**100** *0.4*250=100*
Total amount collected	**300**				
Amount paid back (Equal: total amount collected/5)	**60** *300/5=60*	**60** *300/5=60*	**60** *300/5=60*	**60** *300/5=60*	**60** *300/5=60*
Total amount paid back	**300**				
Net gain/loss	**40** *60-20=40*	**20** *60-40=12*	**0** *60-60=0*	**-20** *60-80= - 20*	**-40** *60-100= - 40*
Final earnings	**90** *50+40=90*	**120** *100+20=120*	**150** *150+0=150*	**180** *200-20=180*	**210** *250-40=210*

The case when $-1 \leq t < 0$

If t is negative then 1–t is larger than 1, which means that the first term of the payoff equation, $(1–t)*x_i$ is larger than x_i. This means that the group members receive an additional payment equal in a to $t*x_i$. Thus, contrary to the case where t is positive, when t is negative the sum paid out to the group members is proportional to the sum of money they generated in the production task. Group members who produced more money receive a larger payment, and group members who produced less receive a smaller payment.

For example, if t = - 0.5, each of the group members get an additional payment corresponding to 50 percent of the money that group member generated in the production task, or $0.5*x_i$. Thus, participants who generated more money receive higher amounts.

The total money that is to be paid out to the group members is collected in equal shares from all the group members. Specifically, the 5 amounts to be paid out are added up and divided into 5 equal parts. Each group member pays one of these equal shares. This is illustrated in the second term of the payoff equation, $t*1/5 \sum x_i$. The amount is equal to the average of the payments made to the five group members.

Thus, all participants in a group get different amounts back, which are proportional to their earnings from the task, but pay the same amount in. Therefore, if t is negative, group members who generated less money than the average receive less money back than they contribute, whereas those who generated more money than the group average receive more money back than they contribute.

Example:

We will now go through an example. Please note that the numbers used in this example are also shown on the table on the next page.

- Assume that the five votes for the transfer parameter are: -0.7, -0.5, -0.4, 0.3 and 0.5.
- The median vote is thus -0.4, and implies that each group member will receive an additional payment equal to 0.4 (40 percent) of the money they generated.
- Assume further that the ECU generated from production by the five group members are, as before, 50, 100, 150, 200, 250.
- In this case, a value of t = – 0.4 means that participant A, who generated 50 ECU in the production task, receives 20 ECU (0.4*50 = 20). The other group members receive 40, 60, 80 and 100 ECU, respectively.
- The total sum of payments to the group members is then 300 ECU (20 + 40 + 60 + 80 + 100 = 300).
- The total sum of payments is collected from the group members as 5 equal shares of 60 ECU each (300/5 = 60).
- Thus, the final earnings for the period for participant A are 50 + 20 – 60 = 10 ECU, for participant B the final earnings are 100 + 40 - 60 = 80 ECU, and so on.

The table below shows you, for each group member, the **ECU generated** in the production task, the **additional payment** to that group member, the **amount collected** from that group member, and the **final earnings** of the group member in the example above.

Since t is less than zero, group members who generate more money in the production task receive a larger additional payment, and members who generate less money in the production task receive less, while all members contribute an equal share to the common pool.

As you can see, when t is negative, it rewards those group members who generate more money in the production task.

	A	B	C	D	E
Vote (t)	**-0.7**	**-0.5**	**-0.4**	**0.3**	**0.5**
Value of t for group (median vote)	**-0.4**				
ECU generated by production (xi)	**50**	**100**	**150**	**200**	**250**
Additional payment received (Proportional: t*xi)	**20** *0.4*50=20*	**40** *0.4*100=40*	**60** *0.4*150=60*	**80** *0.4*200=80*	**100** *0.4*250=100*
Total amount paid back	**300**				
Amount collected **(Equal: total amount paid back/5)**	**60** *300/5=60*	**60** *300/5=60*	**60** *300/5=60*	**60** *300/5=60*	**60** *300/5=60*
Total amount collected	**300**				
Net gain/loss	**-40** *20-60= - 40*	**-20** *40-60= - 20*	**0** *60-60=0*	**20** *80-60=20*	**40** *100-60=40*
Final earnings	**10** *50-40=10*	**80** *100-20=80*	**150** *150+0=150*	**220** *200+20=220*	**290** *250+40=290*

Three special cases

Below we further illustrate the effects of t by three special cases:

- If t = 1, 100 percent of the ECUs the group members generate through production is collected and transferred back in equal amounts. Thus, if t = 1, all group members end up with the same final earnings in a period, regardless of how much money they generate from the production task.

  In the example above, the group members generated 750 ECU from the production task in total. If t = 1, the entire 750 would be collected into the common pool and each group member would thus receive a final payoff of 750/5 = 150 ECU.

- If t = 0, nothing is collected from the money the group members generate from production. In this case, each group member receives, as final payoff, the amount that group member generated from production in the task.

- If t = -1, the final earnings for the group members who generated the least money in the production task may end up being negative. However, earnings may not be negative for any participant or period. Therefore, we restrict t such that the lowest earnings possible in a period will be 0. If the median vote for t ends up, at the end of the period, leaving any group member with negative final earnings in that period, then the computer adjusts t upwards until no group member is left with negative earnings.

  For example, assume that in the example above t = -1. This implies that each group member receives an additional payment equal to the amount that group member generated from production. The group member who generated 50 ECU receives an additional payment of 50 ECU. This also means that a total of 750 ECU is paid out and an equal sum of 750/5 = 150 ECU is collected from each group member. The final earnings of the group member who generated 50 ECU would then be 50 + 50 – 150 = -50 ECU. Hence with this distribution of money generated from production, a value of t equal to -1 cannot be implemented, since earnings cannot be negative. Instead, the lowest value of t that leaves no group member with negative earnings will be implemented. In this example, the lowest value of t that satisfies this requirement is t = -0.5, which leaves the least productive group member with final earnings of 0 ECU.

Before we continue, you will have the opportunity to familiarize yourself with how t influences final payoffs. Please click “Continue” on your screen now. You will then see an example of a practice screen in which you can test the effect of different values of t on the distributions of final earnings.

You now see an example of the practice screen. At present, you cannot insert any values. Once I describe the screen, you will again be asked to click “Continue” and the real practice screen will appear.

The practice screen allows you to enter various values of t, and see how these values influence the redistribution and final earnings, for different amounts of money generated by the members of a group.

In the upper part of the screen, under “Transfer parameter” you can fill in hypothetical values for the transfer parameter, t. During the experiment, the transfer parameter will be decided by the median vote cast by the group’s members.

In the table below, under “Redistribution” you can fill in hypothetical amounts of money generated in the production task for each of the five group members.

Once you have filled in hypothetical values, you can click “OK”, and the table then displays, for each group member, the amount collected from that group member, the amount of money received by that group member, the corresponding net transfer, and the final earnings for that group member.

Remember that a positive value of t benefits group members who generated less money than the group average, and a negative value of t rewards group members who generated more money in the task than the group average.

Please now press “Continue” to get to the practice screen. You will then have 3 minutes to test different combinations of t and the money generated by group members. If you need a calculator, you can click on the symbol in the lower right corner, and a calculator will become visible.

Information about current and previous periods

In each period, after all group members vote on the value of t in a period, you will see the transfer parameter, t, for your group for that period. You will see this before starting the production task for that period.

In addition, at the end of each period you will see a feedback screen with information about the outcome of the current period for all members of your group. Specifically, you will see the value of the transfer parameter, as well as a table including the amount of money each group member generated from production, the group member's rank in the group for that period, and the net transfer and final earnings for each group member. For each group member, you will also see the average amount of money produced by that group member across all previous periods.

The information screen will also provide the transfer parameter and all group members' production and final earnings for all periods. This will be at the bottom of the screen, in a scrollable box.

In addition, at the beginning of each period, before you vote for a value of t, a screen will be available for up to 60 seconds where you may calculate the effect on final earnings due to different values of t. On this screen, you can also find the results of previous periods, as well as individual average production and earnings across previous periods.

Comprehension Questions

Before starting the first period of Part 3, we would like you to answer a few questions to ensure everyone understands the instructions. Please click the "Continue" button on your screen now. You will then see a table with an example of the votes for a hypothetical group. A few cells in this table are empty.

First, we ask you to fill in the transfer parameter, given the hypothetical votes given by the group members. Please remember that the median is the value that lies in the middle when the five votes are ordered from highest to lowest.

Once you have confirmed the correct answer, the next part of the table, which displays the outcomes of the production task, appears. Please continue entering the correct amounts collected or paid back to the group members where this information is missing. In total, you will see two different examples.

If anything is unclear, please raise your hand and an experimenter will assist you. When everybody has answered the comprehension questions Part 3 will start.