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Envy, malice and Pareto efficiency: An experimental examination

Steven R. Beckman[1], John P. Formby[2], W. James Smith[1], Buhong Zheng[1]

[1] Department of Economics, University of Colorado, Denver, Campus Box 181, P.O. Box 173364, Denver, CO 80217-3364, USA
(e-mail: Steven_Beckman@hotmail.com)
[2] Department of Economics Finance and Legal Studies, PO Box 870224, Tuscaloosa AL 35487-0024, USA

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Abstract. Economists have long speculated that envy and malice play important roles in economic decisions. Surprisingly little empirical evidence has been offered in support of such claims. This paper uses experimental and multinomial logit techniques to estimate the effects of envy and malice in economic decisions involving Pareto efficiency. Envy and malice turn out to be powerful motivations with strong differential impacts across countries and relative positions. In some cases, opposition to Pareto gains reaches 60%. Behind a veil of ignorance, however, opposition falls to 10% overall. Pareto efficiency thus garners its greatest support under conditions which can lay claim to greatest legitimacy, those free of situational and personal bias.

> "... the greater part of human actions have their origin not in logical reasoning but in sentiment. This is particularly true for actions that are not motivated economically.... Man, although impelled to act by nonlogical motives, likes to tie his actions logically to certain principles; he therefore invents these a posteriori in order to justify his actions."
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> V. Pareto in *The rise and fall of the elites* (1968, p. 27)

1 Introduction

Pareto efficiency has long held a central place in welfare economics. One reason is that the concept provides, not only an intuitively attractive criterion,

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but one regarded as largely independent of sentiment. Under Pareto efficiency (1935, 1466–1467), if a movement from an existing allocation provides more for some and at least as much for everyone else then it is to be preferred. The criterion should seemingly receive overwhelming, if not universal, support. It is somewhat surprising then that a large proportion of respondents to surveys administered by Amiel and Cowell (1994) oppose it. Fully 44% reject Pareto optimality with some groups voicing considerably greater opposition, peaking at 71% in the case of sociology teaching assistants.

The reasons underlying such responses have not been empirically examined, although many researchers, including Pareto (1935), have long speculated that personal sentiments, in particular envy and malice, play a prominent, if not dominant, role in economic decisions involving more than one person. Kolm (1995, p. 63), for example, notes "Social sentiments such as envy, jealousy ... compassion ... are very widespread ... and play a major role in social ... and economic life." One can find any number of similar statements (e.g., Baumol 1986); but to our knowledge, no study in the economics literature has measured the effects of envy and malice in a social choice context.[1] An obvious reason for the lack of empirical studies is that envy and malice do not readily lend themselves to measurement.

The importance of evaluating economic decisions free of nonlogical sentiments, however, has not gone unrecognized. A large, theoretical literature (see Lambert 1993 for a survey) addresses this issue. An early contribution by J. C. Harsanyi (1953; 1955) cogently argues that economic decisions free of bias can be obtained by placing decisionmakers in a position of ignorance. According to Harsanyi (1953, p. 434–435),

> ... a value judgment on the distribution of income would show the required impersonality to the highest degree if the person who made this judgment had to choose a particular income distribution in complete ignorance of what his own relative position ... would be within the system chosen. This would be the case if he had exactly the same chance of obtaining the first position (corresponding to the highest income) or the second or the third, etc. up to the last position (corresponding to the lowest income) available within that scheme.

A number of experimental studies have followed this suggestion. Frohlich and Oppenheimer (1992), for example, investigate Rawls' theory of justice using the assumption of ignorance of position. Beck (1994) examines group versus individual preferences for inequality in a similar context. No study,

[1] An extensive literature in psychology, however, is principally directed at observing the interactions of relative deprivation, concepts of social justice and collective action (Gilbert et al. 1998, p. 571–573, p. 596–599 and references cited therein). Experimental economists have typically focused on the fairness of the distribution of income between two people. Bolton and Ockenfels (2000) provide a survey and references. This study introduces relative positions representing quintiles and a veil of ignorance to assess support for Pareto optimality.

however, has exploited the contrast between economic decisions made when positions are known and fixed with those made under impersonal circumstances to isolate the marginal impacts of envy and malice.

This paper reports results from experiments addressing this issue with subjects drawn from U.S., Russia, Taiwan and the People's Republic of China. The experimental design is straightforward. In each country, subjects are randomly assigned to groups of five. Each group is faced with a set of choices between vectors A or B, constructed in a manner similar to Amiel and Cowell's alternative income distributions. In six of the seven rounds, one individual receives a Pareto gain if B is adopted with payoffs for all other subjects the same in both vectors. Across different rounds, the gain accrues to different relative positions in the income distribution.[2] Majoritarian voting within each group determines the outcome.[3] A practice round familiarizes subjects with how their choices and votes influence the payoffs.

Each group is twice presented with the same set of choices. In one-half of the experiment, a random assignment of positions is made before voting takes place and in the other half positions are assigned after the vote is recorded. Opposition to a distribution that exists when positions are known and then is seen to evaporate under the impersonal circumstances prevailing when positions are known, is clearly driven by positional bias. Self-serving protestations to the contrary, such opposition may properly be viewed as a-posteriori rationalizations that economists may want to exclude from the social welfare function.[4] The opposition that exists behind the veil of ignorance is more problematic. It may be an impartial concern for even the irrational envy of others or it could be simply error. The difference between the two levels of opposition offers a clear measure of envy due to personal bias while voting behind the veil provides an upper bound to an impersonal social concern for envy.

The experimental data provide evidence of significant and large positional biases. Only 10.1% oppose Pareto improvements behind the Harsanyian veil. Opposition to Pareto gains rises to 18% if positions are known and the re-

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[2] It is often remarked that experiments may give rise to game-playing behavior and that the experiments may not reflect real world situations. However, theories that seek to lay claim to generality must necessarily apply in simple circumstances. Further, as Charles Plott (1982, p. 1486) argues, if the theory fails in such an environment it is unlikely to succeed in the more complex environment.

[3] K. O. May (1952) shows that a group-decision function incorporates a simple majority rule if and only if it satisfies axioms of decisiveness, anonymity, neutrality and positive responsiveness. Furthermore, given that our subjects face binary choices, the well-known problems with transitivity do not apply. These properties suggest the adoption of majoritarian rule as a starting point for an experimental group decision function although adoption of other procedures would provide interesting contrasts. Such considerations however are beyond the scope of the present paper.

[4] Presumably the decision to include or exclude will depend on the objective function of the planner. The planner may want to consider even irrational hostility because it leads to socially disruptive behavior.

cipient occupies a lower income position and 34% if the recipient is above the voter. We refer to this behavior as *malice* if the recipient is below the voter and *envy* if he/she is above. There also exist large differences in support across countries and relative positions. In China, for example, under conditions of high pay, support for Pareto gains falls from 91.2% under the Harsanyi regime to 25.5% for recipients who are two income positions above the voter. In the U.S. in comparable circumstances, support falls from 95.1% to 67.1%.

In multinomial logit estimations, envy and malice, measured by opposition to gains accruing to those in a higher or lower income position than the voter, are highly significant across all specifications and are significantly different from each other. In contrast, measures of overall inequality and efficiency are not. This strongly suggests that studies assuming away envy and malice neglect significant factors motivating economic decisions involving more than one person.

The implications of this finding are suggestive. In an intriguing study, Mui (1995) argues that, in socialist or transition economies with emerging democracies, opposition to economic efficiency may pose significant obstacles to economic progress. In our experiments, the greatest opposition to Pareto improvements is found in China and Russia, lending empirical support to Mui's hypothesis. We also investigated how strongly this opposition is held. Specifically, can a minimal redistribution, involving gains 70 times smaller than those accruing to the principal beneficiary, overcome such opposition? With token gains, opposition to Pareto improvements never rises above 20% – down from 55% absent these minimal redistributions. The implication is that broad participation in Pareto gains, at least at minimal levels, is necessary if majoritarian support is to be assured. Absent widespread gains, envy and malice promise to raise serious obstacles to market reform. Similarly, in more authoritarian regimes, there is likely to be an undercurrent of resentment and resistance if some portion of the efficiency gains is not broadly distributed.

2 Preliminaries

Pareto efficiency is arguably the most widely accepted evaluation criterion in welfare economics. As attractive as it is, even Pareto (1935, p. 1467) acknowledged the limited power of this method for ranking alternative states (see also Sen 1973, 1978 and Atkinson 1970). The difficulty arises, according to Pareto, because attempts to go beyond Pareto efficiency immediately come up against the question of how to formally incorporate the myriad of sentiments (e.g., envy, malice etc.) into the analysis.[5]

[5] In addressing this issue, Pareto couched the issue in terms of how to assign weights to individuals in a social welfare function. For example, Pareto (1935, 1469–1470) argued that if government assigns different weights to the preferences of thieves, victims and

One approach is simply to assume away sentiments such as envy and malice. Alternatively, it has been argued that, since such sentiments have no socially redeeming value, they should be assumed away while analyzing social choice and welfare (e.g. Shorrocks 1983). If, however, Pareto, Kolm and Baumol are correct, empirically important motivations affecting economic behavior are left unaccounted for. Moreover, electorates in modern democracies have increasingly shown an inclination to become involved in establishing policies affecting economic exchange. Envy and malice may well play a role in these decisions underscoring the importance of empirical investigation. Thus, it seems judicious to investigate and assess the extent of envy and malice together with their impact on behavior.

The difficulty in doing so is that envy and malice do not lend themselves to straightforward measurement. One cannot simply ask subjects whether and to what extent envy and malice influence their behavior. Pareto (1971, p. 93) was particularly skeptical of expressed motivations of preferences observing, for example, that "[w]e now see the great subjective importance of the concept of the equality of men, an importance which does not exist from the objective point of view. This concept is the means commonly used, especially today, to get rid of one aristocracy and replace it with another." The main difficulty in assessing preferences according to Pareto is,

> ... not that problems simultaneously considering a number of heterogeneous utilities cannot be solved, but that in order to discuss them some hypothesis which will render them commensurate has to be assumed. And when, as is most often the case, that is not done, discussion of such problems is idle and inconclusive, being merely the play of derivations cloaking certain sentiments – and those sentiments we alone should consider, without worrying very much about the garb they wear. (1935, p. 1473)

Unfortunately, Pareto offers no objective procedure for making what he terms heterogeneous utilities commensurate. J. C. Harsanyi (1953, p. 434–

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humanitarians, it necessarily arrives at different optimal criminal justice systems. The complication which sentiment poses for Pareto optimality can be illustrated in the context of Kolm's (1995) definition of envy. Envy for Kolm is an interpersonal externality reducing the utility of one person if they would prefer the consumption bundle of another. If we apply Kolm's definition to income, rather than consumption bundles, and admit envy as a valid consideration then it immediately follows that only improvements in the income of the least fortunate are Pareto efficient. If we allow malice as well, recognizing that some may feel a reduction in their utility even if there is an improvement in the income of someone less fortunate, then the Pareto efficient set may well be empty. One is left with the conclusion that the efficacy of Pareto optimality as a ranking criterion may be severely limited. One could argue that we should exclude the preferences of criminals, politicians or lawyers or economists for that matter. One could hardly expect criminals, politicians, lawyers or economists to agree. The difficulty with this approach is that, unless one incorporates the criterion for exclusion into the analysis, the exercise becomes arbitrary.

435), however, does suggest such a procedure which we adopt in our experimental design.[6]

The crux of the matter, for Harsanyi, is that an individual's economic position has undue influence on decisions which may impact others. To reach judgments free of positional bias, the decision should be made under conditions of ignorance of one's position. This line of inquiry has been pursued using surveys and experiments involving perceptions of and responses to welfare improving changes.

Studies by Amiel and Cowell (1992, 1994) employ survey methods. Respondents are asked to make choices between two distributions of income and to judge which makes a hypothetical community "better off". Vector A for example provides payments of (5, 5, 5, 5) indicating five units of local currency as income for four individuals versus B with (5, 5, 5, 30), the latter which of course is Pareto superior. Participants in the study are placed in the position of impartial observers with no stake in the outcome, neither being paid directly nor indirectly.[7] As previously mentioned, large numbers of respondents oppose Pareto optimality.

Experimental studies take a related, but distinct, approach. Perhaps the best known are those by Frohlich and Oppenheimer (1984, 1992), that focus on Rawlsian justice.[8] Frohlich and Oppenheimer seek to experimentally operationalize the Rawlsian veil of ignorance by focusing on which principle of justice their subjects will collectively select after a discussion period. Since

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[6] Two other lines of inquiry should be noted. Distributional research in experimental economics owes much to the early and influential work of Hoffman and Spitzer (1985) while Bolton and Ockenfels (2000) offer an excellent survey. In ultimatum games a proposer splits a pie of size c by offering the responder a share of size $c\sigma$. If the responder rejects the split, both receive nothing. Bolton and Ockenfels observe that the frequent rejections of lop-sided splits reveal a preference for an equal share of nothing rather than an unequal share of something. They reason the utility function must have at least two parameters, $c\sigma$ and σ. They are well aware that the utility function may be more complex than this but this simple form is sufficient to explain many known experimental effects. A second avenue involves the welfare implications of distribution. Sen (1973), Kolm (1969) and Atkinson (1970) among others have all contributed important insights. As is well known, if Lorenz curves do not intersect and means are equal then all social welfare functions which include a preference for equality will rank welfare states equivalently regardless of the specific weights applied to individual incomes. If Lorenz curves do intersect, unanimity is impossible. As Shorrocks (1983) points out, envy is explicitly excluded from consideration in this literature. Nevertheless, the result appears to at least partially address Pareto's concern over weights in the social welfare function.

[7] We thank Professors Amiel and Cowell for pointing this out to us.

[8] Rawls (1971) objects to the Harsanyi veil because such decisionmakers will trade benefits of the rich against losses of the poor. He charges that such decisions are unjust in that they do not consider the extreme risk the poor may face. Rawls goes on to argue for an even more extensive veil in which individuals are placed in an "original position" of almost complete ignorance about their past, current and eventual place in society. Rawls suggests that individuals in these circumstances will render decisions on the basis of just motives. In Frohlich and Oppenheimer's work, the result which emerges is support for a safety net.

judgments on justice should be made under the Rawlsian original position, Frohlich and Oppenheimer are careful never to fully reveal the link between the principle of justice selected and the pay received. Beck (1994) conducts similar experiments behind the veil of ignorance but with an emphasis on contrasting individual versus group decisions. Both find little support for Rawls' maximin that emphasizes the greatest benefit for the least advantaged.

This paper is related to Frohlich and Oppenheimer's and Beck's work in employing experimental methods. Our focus, however, is different. We are interested in contrasting individual responses in different regimes, behind the veil as well as positions known and fixed. This allows us to isolate the net impact of positional bias and determine whether subjects' behavior reflects envy and malice.[9] To this end, we prohibit discussion and are as clear as possible in describing the link between the subjects' decisions and pay. We also restrict our focus to Pareto optimality and examine the motives behind the opposition to Pareto efficiency uncovered by Amiel and Cowell. In contrast to Amiel and Cowell, however, subjects make decisions, not from the perspective of an impartial observer, but from that of a Harsanyi participant and voter.

3 Experimental procedures

Experiments were conducted in the U.S., Russia, Taiwan and the People's Republic of China. Subjects were recruited at Moscow State University from students at the International College and the College of Foreign Languages. Business and Economics students formed the subject pool at the University of Alabama as well as at Nanjing and Fudan Universities in mainland China and Tamkang and National Chung Cheng Universities in Taiwan. There are four groups of 10 subjects each in the U.S., Russia, Taiwan and P.R. China giving a total of 160 subjects. The 40 subjects in China were asked to participate in the entire experiment twice, once at low and once at high pay levels.

[9] There are few experimental studies on the extent and impact of envy. Indeed, the *Handbook of Experimental Economics* (Kagel 1995) does not list envy in its extensive index. Results of several studies, however, suggest its importance. Kirchsteiger (1994) notes that envy may explain what appears to be anomalous behavior in ultimatum or fairness games. In an early contribution, Frohlich and Oppenheimer (1984) ask subjects to choose which of two vectors of payments will be used to determine the pay of the decisionmaker and one other subject. For example, if $A = 8, 7$ and $B = 7, 2$ and subject one chooses B, ones pay is 7 and twos pay is 2. Such a choice may be rational even though it reduces the pay to both if the decisionmaker is malicious. They find that well over a 1/3 of their subjects show at least some evidence of malicious behavior. Saijo and Nakamura (1995) conduct public good experiments and present evidence that the limited support of public goods arises from a need to do well relative to others even if all collectively do worse.

Table 1. Payments made after majority vote for A or B

Round/Vote	Position assigned by distributing five cards				
	Ace	Two	Three	Four	Five
1A	40	80	120	160	200
B	40	80	120	160	230
2A	40	80	120	160	200
B	40	80	120	190	200
3A	40	80	120	160	200
B	40	80	150	160	200
4A	40	80	120	160	200
B	40	110	120	160	200
5A	40	80	120	160	200
B	70	80	120	160	200
6A	40	80	120	160	200
B	40	80	120	160	500
7A	40	80	120	160	200
B	45	85	125	165	480

Note: Six additional rounds were conducted. We do not present them to conserve space.

Students were randomly divided into two groups of five at the beginning of the experiment.[10] Each was provided with a record sheet and payoff table, reproduced here as Table 1, after which instructions were read and a practice round conducted.[11] In each round, the experimenter shuffles five cards, ace through five, fans them out face down and walks before each subject in the group of five who then points to a card which is placed face up in front of him/her. The card determines position within the possible payoff vectors. By marking ballots, subjects vote for vector A or B or abstain. The experimenter then tabulates the vote and announces the majority decision that determines which vector is used for payoffs. In event of a tie, the outcome is determined by tossing a coin. Subjects record the number of points earned. The experimenter checks each record sheet and the next round begins.

In all experiments, the set of payoff vectors is used twice. The only difference between the two sets is whether voting occurs before or after cards have been distributed. Half the experiments begin with voting before cards are distributed and half with voting after cards are distributed. This allows evaluation of the effects of experience. Votes cast in the second half of the experiment are hereafter referred to as cast by experienced subjects.

The rounds are designed to address a number of issues. Here we consider

[10] Subjects are kept in the same room so that they know the payments to others are real. Seats were spaced apart, except in Russia, where space was scarce. As subjects were drawn from classes, as in most experiments, subjects may have some acquaintance with one another.

[11] The payoff table for Taiwan had 16 rounds including rounds 1–7 which are the subject of this paper. The instructions are available from the authors.

only the first seven rounds where vector B represents a Pareto improvement. In the first 5 rounds 30 points are added to position 5 then 4, 3, 2, and 1.[12] These rounds allow tests of support for modest payments in all 5 positions. Round 6 adds 300 points to position 5 and is used to test support for large increases in pay for the person in the highest position. Round 7 redistributes income slightly compared to round 6 as 20 points are taken from the potential gain to position 5 and divided equally among the four remaining positions. Taken together rounds 6 and 7 are used to determine whether allowing everyone to have at least token participation in economic gains will offset opposition to Pareto optimality that benefits only the upper end. This also permits us to examine the possibility, related to Mui's analysis, that support for Pareto efficiency can be inexpensively built in formerly or currently socialist countries.

In the U.S., points were converted to dollars at the rate of 200 points = \$1. In China, the experiments were run twice at different pay scales with each set of subjects. In the initial set, 200 points were set at the official yuan-rate-equivalent of \$.10. Subjects were then asked if they would like to repeat the experiment for 10 times the initial pay.[13] All readily agreed. In the high pay experiments, subjects received the equivalent of more than a month's earnings for an unskilled worker. It would take a professor more than a week to earn as much.[14] The object is to determine whether the level of pay affects voting behavior. The experiment was run four times in all locations to allow replications of the two different orderings.

4 Data description and model specification

A multinomial logit model was estimated using maximum likelihood techniques. The dependent variable takes on the value of one, zero or two if the subject votes to support Pareto optimality, reject Pareto optimality, or to abstain. We investigated a number of specifications, multinomial logit, ordered probit and weighted least squares models with data either pooled across the

[12] The order of rounds is deliberately kept the same following evident confusion among even the US graduate student subjects in a pilot experiment that randomized round order. Keeping the round orders the same is intended to reduce confusion as the order is quite natural but opens us up to the charge that the order itself is important. In response to this possible criticism we control for "order" effects econometrically and find them to be statistically insignificant.

[13] Kachelmeier and Shehata (1992) calibrate low and high pay experiments in the same way. We also followed the practice of employing two sets of translators. Instructions were first translated from English into, for example, Chinese by one set of translators. The resulting translation was then translated back by a second set of translators. Adjustments were then made to the Chinese translation to ensure clarity and consistency.

[14] Average pay for a professor in China is \$100 per month but housing and fundamental medical services are essentially free. The experiment paid about \$20 to \$25 per subject.

two regimes defined by knowledge of position or lack thereof or separately for each regime. The results from all are consistent. In the interest of space, we confine discussion to pooled results and multinomial logits.[15]

The variable **KNOW** (abbreviated as **K** in interaction terms) is a dichotomous variable taking on the value of one if the subject knows his/her position when the votes are cast and zero if not. **KNOW** serves as a proxy for positional bias and measures the overall effect of Harsanyi's hypothesis.

Knowledge of position may be broken down into a variety of components. In the absence of the veil the voter knows he/she is the recipient, or that the recipient occupies a higher or lower position in the income distribution. The variables **SELF, ABOVE,** and **BELOW** indicate these three possibilities and enter as interaction effects with **KNOW** to reflect the fact that all are unknown behind the veil of ignorance.[16] The coefficient of **K*SELF** measures the effect of self-interest relative to voting free of positional bias. The coefficient of **K*ABOVE** provides a measure of envy because it captures support for gains accruing to those higher up the income distribution relative to voting behind the veil. **K*BELOW** reflects the difference in support when the voter knows that the recipient is lower in the income distribution and its coefficient measures the effect of malice.

Round 7 permits us to test whether token participation in the gains significantly affects voting. In round 7, we code **K*SELF** = 1 only for the principal beneficiary in position 5 and use a dummy variable for round 7 (**R7**) to measure whether the token payments are independently important.

A set of locational variables (**CHINA**, **RUSSIA**, **TAIWAN**) is introduced to capture cultural influences with the U.S. as the omitted value. The literature in social psychology suggests that core cultural values are modified by the political and legal system as well as by the home and workplace (Gilbert et al. 1998, p. 918). Asian culture is generally considered to be more collectivist and to place a higher value on equality while American culture is judged to be more individualist with an emphasis on efficiency (James 1993, p. 25). The four locations in the study will allow us to shed some light on the relative strength of cultural and political differences. By pairing the U.S. with Taiwan and China with Russia, we are able to observe behavior in politically similar

[15] The principal advantage of the specification is that it allows discussion of cultural effects, the effects of relative position and the effect of the Harsanyi veil all in a single pass. The principal disadvantage is that cultural differences in the weighted least-squares and positional influences in fixed-effect logistic regressions emerge more sharply. Aggregating voter support levels within a round to provide the continuous dependent variable needed by weighted least squares precludes variables for position. The fixed effect for each subject in fixed effect logistic regressions precludes variables for location. Ordered logits tend to produce somewhat higher *t*-statistics while the coefficients are remarkably similar. Ordering the vote from opposition to abstention to support seems reasonable but we chose to report the less restrictive and more conservative estimates.

[16] Note that KNOW = K*SELF + K*ABOVE + K*BELOW therefore KNOW may not be used with these variables.

countries that are culturally distinct. The Taiwan and China pair is culturally similar but politically distinct.

The remaining variables deal with alternative interpretations or possible problems in estimation. The possibility that voting behavior may be motivated by concerns for overall inequality or efficiency and not envy is investigated by including a variable **DGINI**, the difference in the Gini coefficient between payoff vectors B and A, and **DMEAN**, the difference in overall mean payoffs. In experiments with multiple rounds, the possibility exists that accumulated payoffs may alter behavior. We adopt the procedures of Cox and Epstein (1989) and include a variable on lagged wealth (**LW**) to account for these effects.[17] In the same vein, subjects may alter their behavior due to learning as the experiment progresses. We include a dichotomous variable, **PART1**, to designate whether voting takes place in the first half of the experiment or not. The variable **HIGH** is dichotomous and takes on a value of one for that part of the experiment conducted at high pay in China, testing whether the level of pay changes support for Pareto optimality. Finally, a significance test for a set of dummy variables for the first five rounds is also included. **Rnds 1–5** allows a test of whether knowledge of round placement, apart from the variables above, is significantly related to behavior.[18]

Tables 2 and 3 present statistics and summaries of voting behavior. Differences by location and by relative position are clearly evident. Moreover, round 7 garners greater support than 6. The information contained in the tables is self-explanatory and serves as a backdrop for discussion of estimation results reported in the next section.

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[17] Wealth effects in experiments are a controversial issue as the survey by Holt and Davis (1993, p. 451–455) points out. Whether wealth effects exist is an open question at both the theoretical and empirical levels. Nevertheless, it has become common to include controls for potential wealth effects. The dominant experimental control procedure is to select one round at random and pay only for that round. Given 26 rounds it would be standard to multiply the payoffs in the randomly selected round by 26 to avoid reducing incentives. However, as Holt and Davis point out, if someone is risk averse, then the utility of 26 times as much money in an uncertain environment is not worth 26 times as much to the subject. The procedure thus introduces a compound lottery which reduces incentives in proportion to the risk aversion of subjects. In short, risk neutral subjects would remain as motivated, but risk averse subjects' motivation would diminish. Given Pareto's presumption that the economically unmotivated are more likely to be ruled by sentiment, such a procedure seems inappropriate for our purposes. We therefore opt for one of the alternatives suggested by Holt and Davis and econometrically control for the influence of wealth using accumulated wealth in the regressions. This procedure is not without criticism. Specifically, it is argued that subjects in the experiment may not respond to wealth as accumulated but may forecast their wealth at some unknown stage reducing the power of statistical tests. We prefer less powerful tests of a subsidiary issue over an incentive structure that may bias our main results. While the context is quite different, Holt refers to the compound lottery procedure as a "dilution" (Holt 1986, p. 512) which expresses our sentiments as well.

[18] We exclude rounds 6 and 7 as round 7 already has a variable and the use of a constant requires one unspecified round.

Table 2. Definitions of variables and descriptive statisitics

Variable	Definition	% of Votes			% of Obs.
		Oppose	Support	Abstain	
	Full sample of 2,800 votes	15.4	78.6	6.0	100
U.S.	0, 1: Indicates data collected in U.S.	6.4	91.0	2.5	20
CHINA	0, 1: Data collected in P.R. China	20.0	73.8	6.2	40
RUSSIA	0, 1: Data collected in Russia	21.4	73.8	4.8	20
TAIWAN	0, 1: Data collected in Taiwan	9.1	80.2	10.7	20
PART 1	0, 1: Data from the first half of the experiment.	14.0	80.3	5.7	50
HIGH	0, 1: Data from the high pay exp. in P.R. China	19.1	75.7	5.2	20
KNOW	0, 1: Subjects know their position before voting.	20.6	69.4	10.0	50
	Subjects vote not knowing positions	10.1	87.7	2.1	50
ABOVE	0, 1: Recipient's position is above the voter	28.8	59.3	11.9	26
BELOW	0, 1: Recipient's position is below the voter	18.3	69.2	12.5	14
SELF	0, 1: Recipient of Pareto gain is the voter.	3.2	95.4	1.4	10
K*R7	0, 1: Data from round 7 and positions known.	10.0	87.0	3.0	7
	Data from round 6 and positions known.	30.5	61.0	8.5	7
DGINI	Gini coeff. of B – Gini coeff. of A for each round. Range is from −0.05 to +0.18.				
DMEAN	Mean pay of B – Mean pay of A. It is 6 for rounds 1–5 and 60 for rounds 6 and 7.				
LW	Lagged wealth: Cumulative points earned through the prior round. Mean = 1680.				
Rnds 1–5	Refers to a set set of five (0, 1) variables indicating an individual round. Only the overall test of significance for the group is reported.				

Notes: 0, 1, indicates a dichotomous variable that takes the value 1 if the condition is true.

5 Estimation results

Table 4 reports estimated coefficients and *t*-statistics for three alternative specifications with the likelihood of supporting Pareto optimality relative to opposition as the dependent variable. Model 1 focuses on whether the opposition to Pareto optimality can be given a quasi-rational foundation. Envy represents the reduced utility of one person given the higher income of another. If subjects are envious and are aware of envy in others then they may well believe it is reasonable to reduce the income of the rich to increase the utility of the poor. Interacting the change in the Gini coefficient with **KNOW** allows a separate evaluation of whether subjects trade off efficiency for equity behind the veil of ignorance or with positions known. The results strongly

Table 3. Percentage opposition to pareto optimality

	China	High Pay	Russia	Taiwan	US	Part 2	All
Rounds 1–5							
Behind veil	14.0	6.0	21.5	5.5	8.0	9.4	11.0
Positions known	29.5	30.0	24.0	14.5	6.0	24.2	20.8
Self	2.5	7.5	7.5	0.0	0.0	4.0	3.5
Above	43.8	47.5	36.3	20.0	12.5	38.0	32.0
Below	28.8	23.8	20.0	16.3	2.5	20.5	18.3
Round 6							
Behind veil	12.5	7.5	20.0	5.0	2.5	9.0	9.5
Positions known	32.5	55.0	32.5	17.5	15.0	40.0	30.5
Self	0.0	12.5	12.5	0.0	0.0	10.0	5.0
Above	40.6	65.6	37.5	21.9	18.8	47.5	36.9
Round 7							
Behind veil	10.0	5.0	12.5	5.0	0.0	5.0	6.5
Positions known	20.0	20.0	7.5	0.0	2.5	13.0	10.0
Self	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above	25.0	25.0	9.4	0.0	3.1	16.3	12.5
All							
Behind veil	13.2	6.1	20.0	5.4	6.1	8.7	10.1
Positions known	28.6	32.1	22.9	12.9	6.8	24.9	20.6

Notes: Opposition is defined as a vote for A, and does not include abstentions. In round 7 Above implies the voter is not the principal beneficiary.

support the quote used as our epigraph. Where the Harsanyian veil has been used to provide economic motivation there is no sign of any inappropriate tradeoff. But once positions are known, and most subjects no longer have a direct stake in the outcome, the joint significance of **K*GINI** and **K*MEAN** reported in Table 5 underscores Pareto's claim that sentiments hold sway in weakly motivated circumstances.

Model 2 breaks down **KNOW** into its constituent parts: **K*SELF, K*ABOVE,** and **K*BELOW**. All are highly significant and once included, **K*GINI** and **K*MEAN** become insignificant.

Model 3 drops variables that were insignificant in previous models and tests for envy and malice. Support for Pareto optimality behind the veil of ignorance is captured in the constant term. The positive coefficient of **K*SELF** and negative coefficients of **K*ABOVE** and **K*BELOW** (both significant at the 1% level) confirm the impressions from Table 3, namely, that support is stronger when the voter is the recipient and weaker when not. If we agree with Harsanyi and take voting behind the veil of ignorance as delivering the "required impersonality" then the deviations reflected by **K*SELF, K*ABOVE** and **K*BELOW** show the biases produced by position.[19]

[19] Fixed effect logits offer a check for robustness. Using the first five rounds behind the veil and positions known (*LIMDEP*'s limit for this type of panel) then K*SELF, K*ABOVE and K*BELOW are measured relative to the likelihood of supporting

Table 4. Overview and summary of main results: Multinomial logit estimates of effects of knowledge of relative position on support for Pareto optimality

	Model 1	Model 2	Model 3
CONSTANT	3.320**	3.451**	3.237**
	(7.301)	(7.370)	(12.318)
CHINA	−1.457**	−1.552**	−1.573**
	(−6.852)	−(7.122)	−(7.486)
RUSSIA	−1.416**	−1.500**	−1.557**
	(−6.669)	−(6.897)	−(7.437)
TAIWAN	−0.341	−0.355	−0.578*
	(−0.924)	−(0.949)	−(2.471)
PART1	−0.515	−0.576	−0.322
	(−1.246)	−(1.359)	−(1.763)
HIGH	1.025**	1.045**	1.150**
	(3.589)	(3.650)	(4.067)
DGINI	−0.144	−0.375	
	(−0.032)	−(0.082)	
DMEAN	0.004	0.005	
	(0.249)	(0.308)	
R7	0.445	0.446	0.581
	(1.136)	(1.138)	(1.733)
LW	−0.011	0.000	
	(−0.553)	−(0.694)	
KNOW	−1.307**		
	(−4.714)		
K*ABOVE		−1.803**	−1.955**
		−(6.309)	−(9.796)
K*BELOW		−0.723*	−0.904**
		−(1.975)	−(4.049)
K*SELF		1.314**	1.070**
		(2.840)	(2.821)
K*PART1	0.923**	0.992**	0.988**
	(3.803)	(4.003)	(4.183)
K*HIGH	−1.346**	−1.413**	−1.495**
	(−4.244)	−(4.367)	−(4.701)
K*GINI	−9.293	3.084	
	(−1.679)	(0.477)	
K*MEAN	0.020	−0.016	
	(0.950)	−(0.674)	
K*R7	0.930	1.355**	1.061**
	(1.881)	(2.669)	(2.603)
Log. Like.	−1,520.069	−1,436.018	−1,520.567
Cases correct	2,079	2,104	2,227
Cases incorrect	561	536	573

Notes: * and ** reflect significance at the 5% and 1% levels; *t*-statistics are in parentheses. Dependent variable = log (probability of support/probability of opposition). Results for log (probability of abstaining/probability of opposition) are not presented. A theory based on individual personal utility functions would predict indifference therefore active opposition is required to be evidence of interpersonal utility functions.

Table 5. Wald tests of models 1–3

Model	Coefficients of	χ^2(d.f.)	Prob. of larger χ^2
1	**K*GINI = K*MEAN = 0**	$\chi^2(2) = 7.90$	$p = 0.019$
2	**K*GINI = K*MEAN = 0**	$\chi^2(2) = 0.82$	$p = 0.663$
2	**DGINI = DMEAN = K*GINI = K*MEAN = LW = 0**	$\chi^2(5) = 1.86$	$p = 0.866$
3	**K*ABOVE − K*BELOW = 0**	$\chi^2(1) = 26.4$	$p = 0.000$
3	**CHINA + HIGH = 0**	$\chi^2(1) = 1.75$	$p = 0.185$
3	**Dummies for rounds 1–5 = 0**	$\chi^2(5) = 3.91$	$p = 0.562$

Model 3 also offers a second more robust test of envy. Some readers may be unwilling to accept voting behind the veil as establishing the requisite impersonality. Once positions are known and another person is the recipient, subjects may simply lose interest and behave more randomly. However, the support for gains accruing to someone higher in the distribution is less than support for gains going to someone lower in the distribution: the coefficients of **K*ABOVE** and **K*BELOW** are significantly different as reported in Table 5. Therefore even skeptical readers must acknowledge that relative position matters among subjects whose pay is already determined. At a minimum, our subjects exhibit envy. Only the evidence for malice relies on the veil of ignorance.[20]

Model 3 also adds dummy variables for rounds 1–5. These are individually and collectively insignificant at conventional levels. Whatever effects may exist because the round order is kept the same are overwhelmed by the random assignment of position within a round.[21]

A number of variables appear in all three models. The locational variables tend to confirm the initial hypothesis that countries with a socialist history tend to support equity over efficiency and therefore are more likely to oppose Pareto optimality. The coefficients for **CHINA** and **RUSSIA** are negative, significant at the 1% level, nearly of the same magnitude, and robust with respect to specification. The coefficient of **TAIWAN** is also negative and at times significant but always smaller in absolute value. The political system appears to emerge as a significant influence while the effect of group orienta-

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Pareto improvements behind the veil of ignorance estimated separately for each person. The resulting coefficients of K*ABOVE and K*BELOW are −1.945 and −1.060 with *t*-statistics of 11.41 and 6.11.

[20] The test also demonstrates that the two-parameter utility function of Bolton and Ockenfels (2000) may be too simplistic. Recall that their utility function includes only own income and own share of the total income. Under this utility function subjects care only if the money goes to them or someone else, the relative income of the recipient does not matter. However our subjects are more likely to object to points offered to someone richer.

[21] Round dummies are added only after the Gini coeficient is dropped due to strong collinearity.

tion associated with Asian cultures receives somewhat weaker support. This serves to underscore Mui's concern that socialist and formerly socialist countries may face greater obstacles to economic progress than more market-oriented countries.[22]

The coefficient of **HIGH** is positive and significant while the coefficient of **K*HIGH** is negative and significant indicating that subjects make a sharper distinction relative to the veil of ignorance when pay is high. The positive and significant coefficient of **K*PART1** indicates that opposition to Pareto optimality increases with experience if positions are known. Therefore high pay and experience tend to strengthen the conclusion that opposition to Pareto optimality is associated with knowledge of positions. The fact the sum of coefficients of **CHINA** plus **HIGH** is insignificantly different from zero supports the hypothesis that well-motivated subjects behind a veil of ignorance vote according to Pareto optimality regardless of cultural background.

R7 is insignificant in all models while **K*R7** is significant in Models 2–3 with a positive sign indicating that the provision of small gains increases support for the large gain to the top position. In these models, the evidence indicates that support for Pareto gains can be significantly expanded at relatively low cost.

The row labeled "correct, incorrect" in Table 4 reports the number of observations which are correctly and incorrectly predicted.[23] For example, for Model 1, 2079 cases were correctly predicted with 561 incorrect.[24] Overall, the predictive power of the models varies between 78.75% to 79.70%.[25]

In sum, the effect of knowledge of position is robust with respect to specification. The results thus strongly support Harsanyi's hypothesis. They also support Pareto's, Kolm's and Baumol's contention that envy and malice play important roles in economic decisions.[26] The effect of envy in Models 2–3 emerges quite clearly and strongly, while malice is somewhat less clear. In

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[22] In a second unpublished paper, Cason and Mui (1998) find that innovations adopted by player A in stage one often are rejected by player B in stage two. The innovation helps A and harms B while rejection harms both but harms A more. Therefore rejection by B may be due either to envy or retaliation by B stemming from a sense of procedural injustice. They find that sharing the wealth reduces rejections.

[23] The summary regressions can also be broken down by round or by whether positions are known. Formal pooling tests suggest each is worthwhile although the results reported here carry through quite well. The effects of location are attenuated behind the veil and change slightly across rounds; experience effects are strongest in rounds 6 and 7. The results are only very marginally different than ones reported in the body of the paper. The "improvements", while statistically significant, are not of sufficient interest to justify the additional space required for their exposition.

[24] The use of lagged wealth reduces the number of observations in models 1 and 2.

[25] A table comparing predicted and actual values for various conditions and locations has been omitted for space reasons. Essentially, the table shows that the model predicts envy well while the largest errors occur from under-predicting malice in China.

[26] It is natural to ask whether there is evidence of altruism as well. The literature on altruism is in the process of being reinterpreted following a paper by Holt et al. (1998). Contributions to public goods experiments in excess of the Nash prediction have frequently been attributed to altruism. Holt et al. argue that errors are more likely the less

addition, China and Russia show the greatest opposition, a finding which further supports the hypothesis that countries with socialist traditions may face significant obstacles to economic progress. Moreover, support for Pareto gains is significantly greater under Harsanyi's regime than when positions are known. Pareto optimality thus garners the greatest support under the very conditions which can lay claim to the greatest legitimacy.

6 Conclusion

This paper employs experimental methods to examine the role of positional bias, including envy and malice, in decisions concerning Pareto optimality. We adopt a suggestion by Harsanyi and investigate decisions when positions in the income distribution are not known and contrast them with those made with positions known and fixed. With positions randomly assigned, envy and malice associated with rank in the distribution should play no role. With positions known and fixed, envy and malice are given full play. The observed difference in behavior provides the basis for directly estimating what has proven so elusive since at least the time of Pareto, namely, the marginal effects of envy and malice.

We find that envy and malice are powerful motivations. When experienced subjects know their positions before voting and the gain is large, 47.5% of nonbeneficiaries oppose Pareto efficient allocations. Opposition, however, varies widely among locations and the recipient's position in the distribution. When the gain accrues to the subject at the top, opposition from those occupying positions below the recipient reaches 66% in P.R. China but only 19% in the U.S. Near majority opposition, 49%, among nonbeneficiaries in P.R. China and Mosow extends to the lowest and middle positions as well. Frohlich and Oppenheimer's (1984) finding that about one third of their subjects exhibit at least some malicious behavior is consistent with these results.

We test whether this voting behavior is due to subjects' concerns about overall inequality and efficiency. Results indicate that they are not. In the absence of information on position, measures of inequality and mean gains are jointly significant. However, when proxies for envy and malice, measured by relative positions, are also included, inequality and mean gains turn to insig-

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heavily errors are penalized and that the evidence in public goods experiments is consistent with greater deviation from Nash equilibria as penalty for deviation declines. To test this, we coded the vote as 0,1 or 2 for opposition, abstention and support then used a dummy variable to identify when support rose with positions known relative to behind the veil. Greater support observed when the recipient is another is interpreted as altruistic. Finally we regressed this binary variable on the variables above. Only high pay has a statistically significant coefficient and that coefficient is negative. This is quite consistent with Holt's hypothesis that errors are more common in low pay conditions. Our results and Holt's interpretation of the public goods experiments tends not to support the concept of Pareto optimal redistribution put forward by Hochman and Rogers (1969).

nificance with envy and malice emerging as highly significant. The evidence thus supports the conclusion that envy and malice take on important roles in decisions involving Pareto improvements as Pareto (1968), Kolm (1995), Baumol (1986) and others surmise.

The importance of these results goes beyond the finding of the presence of envy and malice. They also support V. L. Mui's (1995) observation that envy and malice may represent major obstacles to market reform in transition economies. In response to these concerns, we include two rounds in which a large gain accrues to the top position but in one round no one else gains and in the other very nominal gains are also allocated to other participants. With broad participation, opposition from those below the recipient in high pay China, for example, falls from 66% to 25%. From all evidence, support can be built for Pareto improvements at relatively nominal costs. A warning is also clear: failure to create support runs the risk of broad opposition from a large segment of the population, opposition that may politically block Pareto improvements.

Support for Pareto efficiency is also significantly bolstered when voting takes place under the Harsanyi regime. For all rounds, impersonal voting increases support for Pareto gains by 8%. Even in China where support for Pareto improvements was weak, opposition to Pareto gains fades to 6% under high pay, approximately the level, 8%, found among U.S. subjects.

Pareto efficiency thus garners the greatest support under the very conditions that can lay claim to the greatest legitimacy, those free of situational and personal bias. Harsanyi's proposed method for delivering impersonal voting thus advances Pareto efficiency as a powerful tool for selecting among alternative economic states even in populations where envy and malice are pervasive. The fact that it does so lends substantial support for its use.

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