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Chance versus choice: eliciting attitudes to fair compensations

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This paper reports an experiment designed to elicit social preferences over income compensation schemes, where income differences between subjects have two independent components: one due to chosen effort and the other due to random chance. These differences can be compensated through social dividends, according to principles chosen beforehand by subjects themselves from behind a stylised Rawlsian veil of ignorance, or outside the society on which the principles will be implemented. We test the attractiveness in particular of *Luck Egalitarianism*, compensating inequalities due to chance but not those due to choice. We find modest but not overwhelming support for these principles, suggesting that subjects' actual preferences are more complex.

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Introduction

This paper is about principles of distributive justice. As Gaertner and Schokkaert (2012) emphasise, there are two approaches in the literature: one descriptive and the other normative. Some would argue that the two approaches are completely independent; others would argue that the latter should inform the former. These arguments are clearly relevant to the issue of whether empirical evidence (on what people think are good principles) is of any concern to their status as normative principles. Our experiment talks to various camps: it has evidence relevant to the idea that such principles must be driven by ethical considerations of disinterested but incentivised individuals; and it has evidence relevant to the idea that such principles express statements of interested but impartial individuals – behind, as Rawls would say, the veil of ignorance. Our method is experimental, rather than questionnaire-based (as is most of the material in Gaertner and Schokkaert's book), with appropriate incentives given to the participants. Moreover, we elicit preferences over principles directly rather than indirectly, looking for agreement over general cases rather than specific examples.

We report on an experiment designed to elicit attitudes towards income-equalising compensations, such as through social-security schemes. In particular we are interested in the attractiveness of *Luck Egalitarianism*, which distinguishes between *luck* and *responsibility* in drawing a line between inequalities which should, and should not, be compensated.[1]

Outcomes for which an individual is to be held responsible normally include those which result from that individual's own decisions.[2] Thus, in our experiment each subject's payment depended partly on random chance but also on that subject's decision whether or not to stay for Part 2 of the session, known in advance to be a trivial but time-consuming task. Subjects had been grouped into 'societies' within which their payments could then be adjusted according to mutual

[1] Cohen (1989) is seminal, although drawing critically on Dworkin (1981)

[2] This idea is less straightforward than it might appear, even leaving aside the question of free-will *v* determinism. To the extent that (rational) decisions are entailed, even if not causally, by preferences, responsibility for decisions implies responsibility for preferences, which is perhaps a less intuitive idea. Indeed Luck-Egalitarians do standardly place some preferences on the 'responsibility' side of the cut.

compensation rules, chosen beforehand by the subjects themselves. Would subjects, in choosing compensation rules for their society, treat inequalities due to choice effort differently from those due to chance?

Both the motivation and the design of our experiment were influenced by Fleurbaey (2008). As Fleurbaey shows, and as explained in section 1 below, in general it is arithmetically impossible to compensate all inequalities due to one characteristic (e.g. chance) while preserving all inequalities due to another (e.g. choice). There is, in effect, a trade-off between these two aspects of Luck Egalitarianism. One purpose of the experiment was to discover how subjects attracted to such a policy would respond to this trade-off.

The normative foundation of Fleurbaey's analysis is the familiar idea of fairness as *envy-freeness*, and in section 1 we give an informal account of this as it applies to the setup in our experiment. However, we did not ask our subjects to make judgements in terms of fairness. Indeed in the entire course of the experiment there was no reference at all to fairness or to any related normative concept. We simply asked subjects to choose compensation rules for their society.

In one type of treatment, the *Internal Dictator*, the rule-chooser was a member of the society, his[3] own payment thus being among those to be governed by his chosen rules. Given that his choice of rules was made in advance both of the realisation of his luck and of his decision whether or not to stay for Part 2, and indeed in advance of payoff information relevant to that decision, his position here could be described as *interested* but *impartial*. This is perhaps as close as could be constructed in such an experiment to a Rawlsian veil of ignorance behind which, according to Rawls (1971, chapters 24-5), rational self-interested choice is constitutive of fairness. In the other type of treatment, the *External Dictator*, the rule-chooser was not a member of the society governed by his chosen rules, his own payment being a fixed fee. His position here could be described as *disinterested*, although incentivised to the extent that his chosen rules were actually to be applied, there and then, rather than hypothetical as they would have been in a questionnaire.

[3] For 'his' (and similarly for 'he' etc), read 'his or her' throughout.

There are previous related experiments using a similar veil of ignorance (VOI) treatment. Usually the context is one-dimensional (most commonly over risky money) rather than two-dimensional (over choice and chance) as in ours, but the results are interesting, and mixed. Several of these experiments provided a comparison between a VOI treatment and a non-VOI treatment where the subject had a known position in society.[4] For example Herne and Suojanen (2004) asked subjects to choose between a small set of income distributions and found that subjects in the VOI did not always choose the Rawlsian maximin distribution; neither did they lean towards it more in the VOI treatment. In a different context – a Dictator Game – Schildberg-Horisch (2010) found that subjects preferred more equality in the VOI treatment than in the non-VOI treatment, but very few opted for complete equality as Rawls would predict. Frignani and Ponti (2012) also used a Dictator Game context (as well as a risky choice context) and concluded that there is some move towards the Rawlsian position in the VOI treatment. Sutter and Weck-Hanneman (2003), in the context of an experiment asking subjects to choose tax rates (chosen by one subject) and effort levels (chosen by another), find that in the VOI treatment, "subjects care more about efficiency and restrict the power to tax" more than in the non-VOI treatment. Some experiments simply carry out a VOI treatment, for example Bukszar and Knetsch (1997) and Hey and Pasca (2011) in the context of choice over income distributions, Johannesson and Gerdtham (1995) in the context of choice over risky lotteries (which is of course essentially the same) and Cabrales *et al* (2010) in the context of strategic games. Generally they found some, but not universal support, for the Rawlsian position. Other experiments, for example, Carlsson *et al* (2003) and Andersson and Lyttkens (1999), in the contexts of risky income for future generations and of life expectancy respectively, do not have incentives for the subjects.

For Rawls, the hypothesis of maximin/egalitarian choices in such a context derives from a distinctive account of rationality behind the veil of ignorance, contrasting with an expected-utility

[4] A non-VOI treatment of this type would not have made sense in our framework, where a member's position depends party on his own effort decision, and his optimal decision in turn depends partly on the compensation rules themselves.

account as proposed, notably, by Harsanyi (1976). In discussing below our own hypotheses – or rather, as it turns out, absence of clear hypotheses - we consider both accounts.

The paper is organised as follows. In section 1 we outline the theoretical model behind the experiment. Section 2 describes the experimental design. Section 3 discusses some hypotheses. The results are discussed in section 4, and section 5 concludes.

1. *A model of income-compensation*

There is a fixed society of *n* members. Each member has an *income* (*Y)* which takes one of four values $\{Y_{BL}, Y_{BH}, Y_{GL}, Y_{GH}\}$ depending on whether (i) his luck is *Bad* or *Good*, and (ii) his chosen effort is *Low* or *High*. In each case the second alternative entails no less income than the first, so that $Y_{BL} \leq Y_{BH} \leq Y_{GH}$ and $Y_{BL} \leq Y_{GL} \leq Y_{GH}$. Each member's income having been determined, it is supplemented by a *dividend (D)*, this being his (possibly negative) share of a fixed fund *X* available to the society. (If *X*=0 then dividends are purely income-redistributive.) The sum of a member's income and his dividend we call his *payment (P)*. At each of the four *income positions*, all members in that position receive the same dividend, and thus payment. The whole schema is shown in Table 1.

A dividend *regime* is a rule or set of rules governing members' dividends. For example, the regime *Equal Dividends for All* (EDA) gives every member a uniform dividend of *X*/*n*, thus preserving all income inequalities whatever their source. By contrast, under the regime *Equal Payments for All* (EPA) dividends offset all income inequalities, leaving all members with the same payment. Note that in that case the four dividend values depend not only on the income values but also on the distribution of the *n* members over the four income positions, as determined by (i) and (ii), which we call a *profile*.

When making his effort decision, each member knows the four income values and his own luck, although neither the luck nor the effort decision of any other member. He also knows the dividend regime.

What dividend regime would be fair? On one account fairness, in such a context, is understood as *ex post envy-freeness*.[5] Specifically, an outcome is fair if and only if no member would have preferred any other member's effort and payment, taken together, to his own. This implies that any members with the same level of effort must have the same payment. So members with the same effort and the same luck (and thus the same income) must receive the same dividend, as we have already assumed. But members with the same effort and different luck must receive dividends which offset their income differences, thus giving them equal payments.

Straightforwardly, therefore, EPA ensures envy-freeness between all members with the same level of effort. But envy-freeness between members with different levels of effort will in general require correspondingly unequal payments. Of course under EPA the incentive for a member to choose high effort is mitigated, and if all members were thereby induced to choose low effort then the outcome would trivially be envy-free after all.[6] But this cannot be assumed. The incremental income generated by a member's high effort is in effect shared equally between all members. So if, for some member, a $1/n$ share of that incremental income is sufficient inducement then he will choose high effort, while *ex post* envying those who do not.

Consider by contrast the EDA regime. Here, the payments at each of the four income positions are independent of members' effort decisions, and known *ex ante* to be the respective incomes plus in each case the uniform dividend X/n. So, whatever his given level of luck, it can plausibly be supposed that a member chooses high effort only if he does not prefer low effort to high, each together with its known payment. Similarly, he chooses low effort only if he does not prefer high effort to low, each together with its known payment. In either case, *ex post* he does not prefer the payment and effort of any other member with the same luck.

Envy-freeness, therefore, provides grounds for treating income inequalities due to choice differently from those due to luck. Specifically, the foregoing analysis suggests a regime of mixed

[5] See Fleurbaey (2008)

[6] Although (first-best) Pareto-inefficient, in general.

rules, comprising equal payments at each level of effort, and equal dividends at each level of luck. Call this regime *Luck Egalitarianism* (LE).

LE is problematic, however. Given that at each level of effort the dividends must offset the incremental income due to good luck rather than bad, unless this incremental income happens to be the same at each effort level then equal dividends for those with (say) bad luck entails unequal dividends for those with good luck. In other words, in general it will be arithmetically impossible to have equal payments at each respective level of effort, combined with equal dividends at each respective level of luck. Luck Egalitarianism, in this particular form, is simply not coherent.[7]

Actually this assumes that each of the four income positions is occupied by at least one member, i.e. assumes a *saturated* profile. Suppose instead, for example, that all members with good luck choose low effort. Then the rule of equal dividends for all those with good luck is trivial, as is equal payment for those with high effort. In effect, LE requires here only that dividends be equal for those with bad luck, and that payments be equal for those with low effort, which is arithmetically unproblematic. So a *contingent LE* regime is feasible: equal payments at each level of effort, and equal dividends at each level of luck, but on condition that the profile is not saturated.

Given saturation, however, the Luck Egalitarian faces in effect a trade-off. This could feasibly take the form of an *incomplete LE* regime: equal payments at each level of effort, and equal dividends at one level of luck, with inequality at the other level of luck being whatever the arithmetic entails; or, alternatively, equal dividends at each level of luck, and equal payments at one level of effort, with inequality at the other being whatever the arithmetic entails.

Evaluating these lesser versions of LE is far from straightforward. Obviously, an incomplete LE regime, as just described, is generally not envy-free. Less obviously, perhaps, neither contingent LE nor incomplete LE ensures envy-freeness at *any* level of luck. Suppose for example that bad luck dividends are to be equal. If it so happens that all members have bad luck, then the bad luck

[7] Equal payments at each level of effort implies that $D_{BL} - D_{GL} = Y_{GL} - Y_{BL}$ and $D_{BH} - D_{GH} = Y_{GH} - Y_{BH}$, and thus in general that either $D_{BL} \neq D_{BH}$ or $D_{GL} \neq D_{GH}$. This form of impossibility was presented by Fleurbaey (1994), as a generalised version of a problem previously identified by Pazner and Schmeidler (1974).

dividend will be X/n. (And if all members know this then the outcome will plausibly be envy-free, as described above for EDA.) But given also that payments are to be equalised at some level of effort, the bad luck dividend will be greater the more members there are, at that level of effort, with good luck rather than bad, their incremental incomes being in effect redistributed through increased dividends for other members. So a member with bad luck, when deciding his effort level, cannot know the bad luck dividend, and thus his payment at each effort level, without knowing how many members with good luck there are at each effort level for which payments are to be equalised. Of course he does know the difference between his two relevant payments, since he knows that his dividend, whatever it is, will be unaffected by his choice. And if his preferences happen to be linear in the payment then this will suffice for him to know whether or not high effort is *ex post* preferable to low effort, each together with its payment. But given instead non-linear preferences he might make an *ex ante* rational choice of (say) high effort, but *ex post* regret this, correspondingly envying any member with bad luck who chose low effort.

It is at least doubtful, therefore, that with regard to fairness a contingent or an incomplete LE regime is 'second-best' optimal. Partly this is because it is not obvious how to rank outcomes that are not fully envy-free, e.g. in terms of degree of envy-freeness.[8] But also, on any such measure, it is not clear that contingent/incomplete LE will necessarily be superior to EDA or EPA.

2. *Design and implementation of the experiment*

Our experiment was designed to elicit subjects' preferences over dividend regimes within this framework. It was conducted in the EXEC laboratory at the University of York, the subjects being mostly students at the university. Each session had (depending on the treatment) either 20 or 24 subjects, seated at individual computers, screened from each other, and with no communication of any kind between them throughout the session.

[8] Fleurbaey (p 50) discusses what might be meant by this.

The session consisted of two consecutive parts. Part 1 lasted around 40 minutes. Here subjects chose a divided regime, after which there was a playout determining each subject's luck, effort and thus payment. Part 2 was an unrelated onscreen questionnaire with a fixed timing of 20 minutes, the only purpose of which was to provide the effort dimension for Part 1; thus *Stay* for Part 2 represents high effort, while *Leave* at the end of Part 1 represents low effort. The luck dimension was realised by simple 50:50 computer-generated randomisation, independently for each subject.

For Part 1, subjects were partitioned randomly and anonymously into *societies*. Every subject had to make a choice of regime for his society, this providing the data of interest to us. All subjects having done this, within each society one subject was randomly selected by the program as *dictator*, his chosen regime being adopted for that society and made known to all members prior to the playout. In the *Internal Dictator* treatments, the selected dictator remained a member of the society, participating in the playout and with his payment then governed by the chosen regime. In the *External Dictator* treatments he was instead withdrawn from the society, by-passing the playout, and leaving at the end of Part 1 with a fixed independent payment.

The smaller the society, the greater the likelihood of a subject being selected as dictator and thus of him taking seriously the task of choosing a regime. We decided that each society would have four members, this being the smallest size allowing for saturation. So in the External Dictator treatments each society began with five members. Within each society each member was given a unique identifying number (1-4 in Internal Dictator treatments, 1-5 in External Dictator).

The dividend regime had to be selected not only in advance of the playout, but also with incomplete information on the four income values. At the outset subjects were told only that the minimum income would be £0 at (Bad, Leave), while the maximum would be £10 at (Good, Stay). The intermediate income values were to be revealed to subjects immediately prior to the playout, after the dividend rules had been determined for that society. So, in choosing a regime the subject did not know what would be the income increments either from having Good luck rather than Bad, or from deciding to Stay rather than Leave. The dividend fund for each society, denoted *X* in section 1, was revealed from the outset to be £40.

To keep the choice as simple as possible (and prompted by an unsuccessful pilot), we limited the options available, to regimes comprising four dichotomous choice *elements*:

For all members who Leave: either Equal Payments or Equal Dividends;

For all members who Stay: either Equal Payments or Equal Dividends;

For all members with Bad Luck: either Equal Payments or Equal Dividends;

For all members with Good Luck: either Equal Payments or Equal Dividends.

Given that the chosen regime was actually to be applied in the playout, it had to be feasible. As discussed in section 1, if in a society all four income positions are occupied then from the above options only the *unmixed* regimes EPA and EDA are feasible. The subject was able to choose a mixed regime, i.e. with some elements being Equal Payments and others Equal Dividends. But if so then this would conditional on non-saturation, and he additionally had to specify which of the four elements was to be dropped otherwise. Thus a subject was able to choose contingent LE, together with an incomplete LE regime, in each case as defined in section 1.

Partly to assist with his understanding, but also to elicit more simply and clearly the subject's preferences, we graduated the task as a sequence of five playout *scenarios*. Before considering dividend rules for the full *compound* (2×2) scenario, labelled Scenario 3 in the experiment, the subject considered separately each of its four constituent *elementary* scenarios:

Scenario 1a: All members Leave after Part 1; members individually have Bad or Good luck;

Scenario 1b: All members Stay for Part 2; members individually have Bad or Good luck;

Scenario 2a: All members have Bad luck; members individually choose to Leave or Stay;

Scenario 2b: All members have Good luck; members individually choose to Leave or Stay.

The playout thus differed according to scenario. In Scenario 1b, for example, all members would (with common knowledge) be required to Stay for Part 2 and the playout would simply assign each member either Bad or Good luck, followed by the application of the regime, i.e. Equal Payments or

Equal Dividends, that had been chosen by the Dictator for Scenario 1b. In Scenario 2a, by contrast, all members would (with common knowledge) be assigned Bad luck, and each would then decide whether or not to Stay for Part 2, again followed by the application of the regime that had been chosen for Scenario 2a. The playout in Scenario 3 was as already described; independently and privately, each member was assigned either Bad luck or Good, and then decided whether or not to Stay for Part 2.

The difficulties discussed in section 1 apply only to the compound scenario. There is no problem applying LE consistently to all the elementary scenarios, in the form of Equal Payments for each of Scenarios 1a and 1b, and Equal Dividends for each of Scenarios 2a and 2b.

Dividend regimes for each of the five scenarios having been determined, the scenario applying to the subject's society was to be selected randomly by the program, with (known) probability 50% that it would be the compound scenario, and with equal probability (12.5%) for each of the elementary scenarios.

So the overall sequence of events in Part 1 was as follows:

Stage 1 Each member chooses a dividend regime for each of the five possible scenarios;

Stage 2 One member is randomly selected as Dictator (and in the External Dictator treatments takes no further part);

Stage 3 Each member is informed:

- which (numbered) member is selected as dictator for his society;
- which of the five scenarios applies to his society;
- the income values relevant to that scenario;
- the dividend regime, as chosen by the dictator;

Stage 4 The scenario is then played out, determining for each subject whether he has Bad or Good luck, whether or not he Stays for Part 2, and also his final payment.

Preceding Stage 1 was a (silent) PowerPoint show explaining the task, auto-timed and running simultaneously at each subject's computer screen, and lasting 15 minutes. Each subject also had a hardcopy complete handout of that show, to which they could refer at any time during Part 1.[9]

Stage 1 took 20 minutes. Subjects considered the five scenarios in sequence, starting with Scenario 1a and ending with Scenario 3. In each case our experimental software allowed each subject, before making a choice, to explore, through simulation, the effect of different regimes, against different hypothetical profiles and intermediate income values, all controllable by the subject. The Appendix contains screenshots, for Scenarios 1a and 3. For each elementary scenario there were two minutes for simulation, followed by a further period of 30 seconds within which the choice had to be submitted (although simulation could continue up to the moment of submission). For the more complex compound scenario, there were eight minutes of simulation followed by a two minute period for submission. The countdown clock can be seen in the screenshots, above the large 'Submit your choice' button which was greyed out until the submission period.

For the compound scenario, if at any time in the simulation the subject had a mixed regime and a saturated profile, then the program prompted him to select one of the four elements (in the graphic, one of the two rows or one of the two columns) as *droppable*, before he could continue. It then revealed the hypothetical implications of this for the dividends and payments, as for example in scenario 3 screenshot in the Appendix, where the droppable element is identified by the check box. A similar prompt appeared if he tried to submit as his choice a mixed regime without having selected a droppable element.

In the event of non-submission within the allotted time, (known) default rules were in place. Within each society, the same default rule (either Equal Dividends or Equal Payments) applied to all subjects in their choices for all four elements, and in all five scenarios. [10] To control for default-bias,

[9] This can be found at http://www.york.ac.uk/economics/research/research-clusters/experimental-economics/research/ongoing-projects/#tab-2. Also available at this site is the PowerPoint presentation of the Instructions, and the experimental software (written in Python by Crosetto).

[10] The default rule had an additional role in the compound scenario. Each of the four elements constrains dividends either along a row or down a column of Table 1. In the event that, after the playout, all members of

we gave half of our societies a default of Equal Dividends, and the other half Equal Payments. This produced a 2x2 treatment structure as set out in Table 2, which also records the number of subjects in each treatment (see section 4 below).

Stage 1 having been completed, Stages 2 and 3 followed almost instantaneously, with the relevant information appearing onscreen for each subject. The playout in Stage 4 used a software interface similar to that in Stage 1. In Scenarios 1a and 1b, each subject individually clicked a button to reveal his luck. In Scenarios 2a and 2b each subject individually registered his effort decision by clicking one of two buttons, labelled Leave and Stay respectively. In Scenario 3 each of these events occurred in turn. In all cases the onscreen display then revealed the positions of each of the four members of that society, and the consequent incomes, dividends and payments.

Part 1 was then complete. Those subjects staying for Part 2 remained in their places. The others left, collecting payment on the way out.

3. *Hypotheses*

In discussing hypotheses and results, we code a subject's possible responses as follows. For the four elementary scenarios we will refer to a *sequence* of dividend rules, denoted by a string of four letters representing the four consecutive scenarios (1a, 1b, 2a, 2b): in each case either 'D' indicating Equal Dividends or 'P' indicating Equal Payments. Thus for example DDPD denotes the sequence comprising Equal Payments for Scenario 2a, and Equal Dividends for each of the other three scenarios, while PPDD denotes the LE sequence of Equal Payments for each of 1a and 1b, and Equal Dividends for 2a and 2b. A regime for the compound scenario is denoted correspondingly but underlined. For example <u>DDPD</u> denotes a regime of Equal Payments for all members with Bad Luck, Equal Dividends for all with Good Luck, and Equal Dividends at each level of effort. The droppable

the society were located on one or other of the two diagonals, none of these constraints would be binding, leaving dividends undetermined. After considering several contingencies for this event, including randomisation, we decided that the given default rule should apply. This had an obvious downside, however. For example, a subject was unable to impose EPA, on such a profile, given a default of Equal Dividends.

element in a mixed regime we denote as lower case. Thus DdPD entails, for a saturated profile, as above less the requirement of Equal Dividends for all those who Stay.

To the extent that our Internal Dictator treatment could be interpreted as a Rawlsian veil of ignorance, a natural hypothesis would be one based on the Rawlsian maximin assumption, i.e. in that a subject considers only the worst possible outcome for him (or equivalently any member), under each available regime.[11] Consider for example scenario 1a. Here, under Equal Dividends, the worst that can happen for any member is that he has Bad Luck, which results in him leaving, with payment $X/4$. Under Equal Payments, the worst that can happen is that all members have Bad Luck, which again results in him leaving, with payment $X/4$. So on that basis our subject would be indifferent between these two regimes, as he would be similarly in scenario 1b. In scenario 2a, under Equal Dividends the worst that can happen is that Y_{BH} is not sufficient to induce him to stay, so that he leaves with payment $X/4$. Under Equal Payments, the worst outcome is no better than this, since if Y_{BH} induces no subject to stay then again they each leave with payment $X/4$, although it could in some cases be worse for reasons similar to those discussed towards the end of section 1.[12]

So this maximin-type account provides no clear hypothesis over even the elementary scenarios. Following Harsanyi (1976), we could alternatively assume expected utility maximisation behind our veil of ignorance. Analysis of scenarios 1a and 1b is relatively straightforward. In each scenario his expected payment is the same under Equal Dividends as under Equal Payments. The latter is not riskless, with his payment depending on an unknown income value, and also on the number of members having good luck rather than bad. But it is 'locally' riskless at each given income value and each given number of members with good luck, where it gives a subject the same

[11] Following Rawls (1971, ch25), we assume that behind the veil of ignorance our subject is self-interested, which in our context means that he cares only about his own effort and payment.

[12] Suppose that our subject's effort/payment preferences are non-linear in the payment, and that under Equal Payments the incremental payment of $Y_{BH}/4$ would be sufficient compensation for him to stay, if and only if at least one other member stays (although note this means that leisure is not a normal good, for him). If at the moment of his effort decision he believes this to be sufficiently likely, then he will stay. But in the event that no-one else stays he will end up worse off than if he had left with payment $X/4$. Of course, if from behind the veil of ignorance he could bind his 'future' self to leave, or to remain 'maximin' rather than be EU-maximising, then this situation could not arise, which suggests interesting questions for an analysis of this type.

payment regardless of whether or not he is among them. So if a subject is risk-averse, and his preferences satisfy Independence, then he prefers Equal Payments here. If risk-neutral, he is indifferent between Equal Payments and Equal Dividends, while if risk-loving then he prefers Equal Dividends. Theoretically his risk-attitude to payment could depend on his effort level, thus varying as between scenarios 1a and 1b. But the analysis suggests an at least plausible hypothesis that a subject will be consistent, in his choice of regime, over scenarios 1a and 1b.

Scenarios 2a and 2b are less straightforward. Given that a subject leaves, his payment under Equal Payments is higher than under Equal Dividends unless all other members also leave, in which case there is no difference. Similarly, given that he stays, his payment under Equal Payments is lower than under Equal Dividends unless all other members also stay, in which case there is no difference. So if our subject knows for sure that he will leave then he prefers Equal Payments, while if he knows for sure that he will stay then he prefers Equal Dividends. Otherwise, however, his rational choice of regime depends, in a potentially complicated way, on his expectations regarding (i) the as-yet-unknown income value, and (ii) the effort/payment preferences of other members,[13] leaving us with no confident hypothesis here, even regarding consistency over 2a and 2b.

The compound scenario brings further complexities of its own, too difficult for us, let alone our subject, to analyse exhaustively. To illustrate, consider a subject who is risk-averse and also sure that, given the option, he will stay. The elementary scenarios are straightforward for this subject, the LE sequence PPDD being uniquely optimal for him. But in the compound scenario he could plausibly prefer <u>DPDD</u> to <u>PPDD</u>. There are some profiles where, given any (Y_{BH},Y_{GL}), his payment is higher under <u>PPDD</u> than <u>DPDD</u>, such as where the only unoccupied position is Good/Stay, and where

[13] Consider scenario 2a, where the income from leaving is 0 and that from staying Y_{BH}. Assume our subject prefers to stay if this increases his payment (given the dividend regime) by more than £a. Now suppose that he knows, when considering his choice of regime, the value both of Y_{BH} and of s=σ(Y_{BH}), the number of members (other than himself) who would stay under Equal Payments. If Y_{BH}>4a then he will stay under either regime, and so prefers Equal Dividends. If Y_{BH}<a then he will leave under either regime, and so prefers Equal Payments. If a<Y_{BH}<4a, then under Equal Dividends he will stay, and receive payment Y_{BH}+X/4, while under Equal Payments he will leave and receive payment (sY_{BH}+X)/4. So here he prefers Equal Payments if (sY_{BH}+X)/4 > Y_{BH}+X/4-a, or equivalently if s > 4-(4a/Y_{BH}). The critical s here is an increasing concave function of Y_{BH}, which may therefore have multiple intersections with the increasing step function σ(Y_{BH}). So our subject's preference between regimes may switch several times as Y_{BH} increases within this interval. Of course neither Y_{BH} nor σ(Y_{BH}) are known to our subject at the time of choosing regime, thus increasing the complexity.

equalisation of payments, rather than dividends, between the leavers benefits our subject indirectly since he receives the same dividend as the leaver(s) with bad luck. But symmetrically there are profiles where the reverse is true, such as where the only unoccupied position is Bad/Stay and where, in effect, PPDD conversely imposes on our subject a share in the burden of payment-equalisation between the leavers. Across non-saturated profiles these differences offset each other, in that at any given (Y_{BH},Y_{GL}), if all non-saturated profiles with our subject staying were equally likely,[14] then DPDD and PPDD would entail the same expected payment for him. But for saturated profiles DPDD is unambiguously better than PPDD for our subject. Here, of course, we need to consider which element is droppable. It turns out that a good candidate for the LE regime is PPdD which, in equalising dividends (only) between the two members with good luck gives them in effect an equal share in the total burden of payment-equalisation at both effort levels, to the mutual advantage of the stayers if their income difference is greater than that between the two leavers.[15] But then DPdD would do even better for the two stayers. In equalising dividends rather than payments between the two leavers, DPdD in effect gives three members (Good/Stay, Good/Leave and Bad Leave) an equal share in the burden of equalising payments between the two stayers, thus making that payment higher, at any given (Y_{BH},Y_{GL}), than under PPdD.

For a self-interested (prospective) Internal Dictator, in summary, the optimal sequence in the elementary scenarios could be anything, depending on his attitude to risk, and his beliefs about income values and the effort/payment preferences of other members. We could plausibly hypothesise consistency of choice between 1a and 1b, but less plausibly between 2a and 2b. And it is difficult to make any clear or confident hypotheses regarding consistency between elementary and compound scenarios.

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[14] Of course this is a tenuous assumption since members' effort decisions will in general depend on (Y_{BH},Y_{GL}).

[15] Conversely, of course, if the stayers' income difference is less than the leavers', then PPDd, in giving the two members with bad luck an equal share in the benefit of total redistributions, is to the mutual advantage of the two stayers. However, assuming a uniform probability distribution across all (Y_{BH},Y_{GL}), PPdD and PPDd produce the same expected payment to stayers, but with PPdD having the lower variance.

Suppose instead that our subject, whether in the Internal or External Dictator treatment, is intent on being fair, rather than pursuing his self-interest. Of course if a (prospective) Internal Dictator has read Rawls then he might consider these to be equivalent, in which case the above observations apply. Otherwise, however, an obvious hypothesis is that based on fairness as envy-freeness. In the elementary scenarios this implies the luck-egalitarian sequence PPDD. As discussed in section 1, however, no clear corresponding hypothesis is available in the compound scenario, given the impossibility of envy-freeness in a saturated profile.

4. *Results*

For each of the four treatments we had 60 subjects in the laboratory. However, in the External Dictator, Equal Dividends treatment there was a computer problem for one subject, which led to the loss of that subject's data (see Table 2 above) but not the subject's participation.

4.1 *The four elementary scenarios*

Table 3 records for each elementary scenario the number of subjects choosing Equal Payments for that scenario. Each cell in the 'by treatment' column contains data separately from the four treatments, in the same 2×2 array as in Table 2, in each case giving both the rounded percentage and the headcount. Evidence here of treatment effects is patchy and contradictory, as exemplified nicely by Scenarios 1b and 2a. The latter shows a marked correlative response to the default rule from each dictator type and, under each default, little difference between dictator types. But the former shows equally-marked opposite tendencies, as between dictator types, in both respects.

Equal Payments is the LE rule for Scenarios 1a and 1b, but not for 2a and 2b. So in each case a majority of subjects chose the LE rule, with the sole exception that, given a default of Equal Dividends, only 49% of External Dictators chose Equal Payments for Scenario 1a. And aggregating across all treatments the majority choosing the LE rule was very similar (around 60%) for each scenario. But within each treatment these majorities varied in their subject composition across scenarios, as revealed by Table 4a.

The core 4×4 block of Table 4a records the subject distribution over the 16 possible sequences over the four scenarios, using the notation given in Section 3. In each cell of the table the four numbers are rounded percentages of subjects in the four treatments. The final row aggregates over the four rows in the main block, distinguishing subjects only according to their choices for Scenarios 1a and 1b; similarly the final column aggregates over the main four columns, focusing on 2a and 2b.

The LE sequence here is PPDD, the darkly-shaded upper left cell of the core block. We could define a *somewhat LE* (SLE) sequence as differing from PPDD in exactly one element, in the lightly shaded cells. Aggregate data for LE and SLE together is given outside the top left of the core block. A still broader class of *orthodox* responses comprises these together with PPPP and DDDD, characterised as responses with either Equal Dividends for each level of luck, or Equal Payments for each level of effort. These seven cells occupy the left and upper edges of the core block.

The most obvious place to look for treatment effects with respect to the default rule is in the PPPP and DDDD responses. But the most marked effect here is the perversely fewer Internal Dictators choosing PPPP under the Equal Payments default than under Equal Dividends (8% cf. 17%). Among External Dictators there is a slight effect in the expected direction, with more choosing PPPP (17% cf. 14%), and fewer choosing DDDD (12% cf. 14%), under Equal Payments than under Equal Dividends. As regards differences between dictator types, the evidence is again unclear, as reflected in the data for LE + SLE, showing a pattern not unlike that for Scenario 1b in Table 3.

PPDD is the modal response in each treatment. But it accounts for only a small minority of subjects, around 20% in each case, and slightly lower for External than for Internal Dictators. Adding the SLE responses still accounts for a majority of subjects in only one treatment (53% in Int-Pay). The orthodox responses, however, together provide a clear majority in each treatment, this being higher among Internal Dictators (77% under each default) than among External Dictators (resp. 68% and 61%). Figure 1 gives a stacked-column visualisation of the same data, showing for each treatment five categories of response: PPPP, DDDD, LE, SLE, and all others (note that the shading here does not correspond with that in Table 4a).

Table 4b gives data regarding consistency of choice as between scenarios 1a and 1b, and/or between 2a and 2b, as discussed in section 3. Averaging over the defaults, Internal Dictators were more consistent between 1a and 1b (i.e. either PP** or DD**) than between 2a and 2b (i.e. either **DD or **PP), as tentatively hypothesised on the assumption of EU-rational self-interest, while External Dictators were less consistent between 1a and 1b, both relative to Internal Dictators and also to their own consistency between 2a and 2b. In all treatments, around half the subjects were consistent both between 1a and 1b and also between 2a and 2b.

4.2 *The compound scenario*

Figure 2, similarly to Figure 1, visualises the responses for the compound scenario, showing the corresponding five categories of regimes over the four treatments. Recall that with the exception of DDDD and PPPP, each regime in the compound scenario is contingent on at least one income position being unoccupied, the subject specifying which one of the four elements is droppable otherwise.

As with the elementary scenarios, orthodox responses (i.e. non-'other') account for a majority of subjects in each treatment, although a smaller majority in most treatments. LE responses (here PPDD) are markedly fewer than in the elementary scenarios, for all treatments, and no longer modal for any treatment, being almost everywhere less attractive than each of DDDD and PPPP. These are the only obvious systematic patterns. For example, PPPP is markedly higher than PPPP (and also modal) in three of the four treatments but lower in the other (Int-Div). Evidence of treatment effects appears similarly mixed.

Table 5 gives more detail, distinguishing individually the four SLE responses and also correlating with the corresponding summary data for the elementary scenarios. The clustering of responses around the leading diagonal here suggests a definite if weak correspondence, at least among orthodox responses, between the elementary scenarios and the compound scenario. The proportion of subjects precisely repeating their elementary scenario choices might be expected to be highest for PPPP and DDDD, given that the corresponding regimes <u>PPPP</u> and <u>DDDD</u> are each unproblematic in the compound scenario. This is indeed mostly the case, although these proportions vary considerably across treatments, as recorded in Table 6a. Repetition of PPDD is lower overall, not unexpectedly, although with less variation across treatments. Table 6b shows the number and proportion of subjects who remained within the same given response class. The 63% overall remaining in **DD, for example, represent all those in the 4×4 cell area to the top left of Table 5.

Figures 3 and 4 give further perspective on subjects' consistency between the elementary and compound scenarios. Figure 3 shows, for each treatment, the distribution of subjects according to the number of elements *r* (= 0,..,4) in which the subject's elementary and compound responses differed. The modal value of *r* is 1 in each Internal Dictator treatment, and 0 in each External Dictator treatment. Figure 4 shows, for each value of *r*, the distribution of subjects according to their elementary scenario response, and with the width of each column proportionate to the number of subjects at that value of *r*. Among the completely inconsistent (*r* = 4) subjects a large majority chose 'other', i.e. non-orthodox sequences, in the elementary scenarios, while among the completely consistent (*r* = 0) subjects a large majority choose orthodox sequences, PPPP being modal here.

A central purpose of the experiment was to see how subjects attracted to LE would respond to its infeasibility in a saturated profile, and in particular which rules they would select as droppable in the event that they chose (contingent) <u>PPDD</u> in the compound scenarios. Unfortunately the number of subjects we can identify as being attracted to LE, on the basis of choosing PPDD in the elementary scenarios, is small, and with only a handful in each treatment repeating this response in the compound scenario. Table 7 sets out the data on droppable rules among all 25 subjects choosing

PPDD in the compound scenario. Again the data is given by treatment, although there is no obvious treatment effect here. Of particular interest are the 17 subjects who also chose PPDD in the elementary scenario. Four of them selected as droppable one of the Equal Payments rules (in each case for members who Leave). The other 13 selected one of the Equal Dividends rules. In that sense, three times as many LE-inclined subjects here attached priority to Equal Payments for members with the same effort, than did so to Equal Dividends for members with the same luck.

5. *Conclusions*

In its complexity this was a challenging experiment both for us, as designers, and for our subjects. Our priority in designing the structure, the program/interface and the instructions, as described in Section 2, was to make the experiment as simple and intelligible as possible. Indeed in the structure we may have oversimplified in some ways, for example by offering only dichotomous choices of Equal Dividends or Payments. Some subjects might have wanted more subtle options, such as only partially compensating for bad luck, or inducing a specific (fair?) incremental payment for effort (although of course effort was a voluntary decision made with knowledge of the income values and dividend regime).

For a subject there was the double challenge of firstly understanding the nature of the problem, and then identifying a best response to it. Probably some subjects were unable to clear the first of these hurdles despite their, and our, best efforts. But even given full comprehension of the problem, comparing regimes was a complex task, especially in the compound scenario. Furthermore, as discussed in Section 3, optimal choices could vary substantially across subjects depending on their (e.g. self-interested) motivation, attitude to risk, effort/payment preferences, and beliefs about the corresponding preferences of other members and about the unknown income values. For all of these reasons, the disparate results reported in Section 4 were perhaps to be expected.

Subjects' overall responses are clearly not arbitrary, however. And we know, both from informal observation and also from our background data recording every keystroke and mouse click, that most subjects, in all treatments, made full use of the simulation program (screenshots in the Appendix) to explore the implications of different regimes.

As regards our principal interest, Luck Egalitarianism receives modest but far from overwhelming support even in the elementary scenarios where, perhaps surprisingly, there was slightly less support among External Dictators than among Internal Dictators. Whether our experiment provided an appropriate and intelligible test of the attractiveness of Luck Egalitarianism is certainly debatable. We hope that it is at least a provocative and interesting contribution to empirical social choice.

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Table 1: the luck/effort payment schema, where $Y_{BL} \leq Y_{BH} \leq Y_{GH}$; $Y_{BL} \leq Y_{GL} \leq Y_{GH}$

		effort	
		Low	High
luck	Bad	$P_{BL} = Y_{BL} + D_{BL}$	$P_{BH} = Y_{BH} + D_{BH}$
	Good	$P_{GL} = Y_{GL} + D_{GL}$	$P_{GH} = Y_{GH} + D_{GH}$

Table 2: the 2×2 treatment structure, with subject numbers

		default dividend rule	
		Equal Dividends	Equal Payments
dictator type	Internal	*Int-Div* (*n*=60)	*Int-Pay* (*n*=60)
	External	*Ext-Div* (*n*=59)	*Ext-Pay* (*n*=60)

Table 3: subjects choosing Equal Payments in elementary scenarios

	by treatment				all	
Scenario 1a	63%	(38/60)	65%	(39/60)	59%	(141/239)
all members Leave	49%	(29/59)	58%	(35/60)		
Scenario 1b	57%	(34/60)	70%	(42/60)	63%	(150/239)
all members Stay	68%	(40/59)	57%	(34/60)		
Scenario 2a	32%	(19/60)	42%	(25/60)	38%	(90/239)
all members have Bad Luck	32%	(19/59)	45%	(27/60)		
Scenario 2b	38%	(23/60)	35%	(21/60)	38%	(91/239)
all members have Good Luck	37%	(22/59)	42%	(25/60)		

Within each cell the four numbers correspond to the four treatments, as follows

Int-Div	*Int-Pay*
Ext-Div	*Ext-Pay*

Table 4: subjects' responses over the four elementary scenarios (rounded percentages)

4a: distribution of subjects over all 16 sequences

LE + SLE

43, 53
41, 33

PPDD 20, 23 17, 17	PDDD 10, 0 5, 8	DPDD 5, 5 14, 7	DDDD 17, 15 14, 12	**DD 52, 43 49, 43
PPDP 7, 12 3, 0	PDDP 3, 3 5, 2	DPDP 3, 0 8, 8	DDDP 3, 0 2, 2	**DP 17, 15 19, 12
PPPD 2, 13 2, 2	PDPD 3, 2 2, 7	DPPD 0, 2 7, 2	DDPD 5, 5 3, 5	**PD 10, 22 14 ,15
PPPP 17, 8 14, 17	PDPP 2, 3 2, 7	DPPP 3, 7 3, 5	DDPP 0, 2 0, 2	**PP 22, 20 19, 30
PP** 45, 57 36, 35	PD** 18, 8 14, 23	DP** 12, 13 32, 22	DD** 25, 22 19, 20	**** 100, 100 100, 100

4b: consistency between scenarios 1a and 1b, and/or between scenarios 2a and 2b

	**DD + **PP	other	all
PP** + DD**	53, 48 44, 47	17, 30 10, 8	70, 78 54, 55
other	20, 15 24, 27	10, 7 22, 18	30, 22 46, 45
all	73, 63 68, 73	27, 37 32, 27	100, 100 100, 100

Within each cell the four numbers correspond to the four treatments, as follows

Int-Div	*Int-Pay*
Ext-Div	*Ext-Pay*

Table 5: responses across all scenarios (headcount)

			compound scenario							
			<u>DDDD</u>	<u>DPDD</u>	<u>PDDD</u>	<u>PPDD</u>	<u>PPDP</u>	<u>PPPD</u>	<u>PPPP</u>	other
		60, 60 59, 60	9, 7 7, 8	4, 4 7, 3	4, 5 3, 4	6, 9 3, 7	2, 3 2, 3	2, 1 1, 4	8, 13 11, 14	25, 18 25, 17
elementary scenarios	DDDD	10, 9 8, 7	5, 1 3, 6	0, 1 1, 0	2, 3 1, 0	0, 2				3, 2 3, 0
	DPDD	3, 3 8, 4	1, 1	1, 1 1, 1	1, 0 2, 1				 2, 0	0, 1 3, 2
	PDDD	6, 0 3, 5	1, 0 2, 0	 1, 0	 0, 1	 0, 2				5, 0 0, 2
	PPDD	12, 14 10, 10	2, 1	2, 1 3, 1	0, 2	4, 6 3, 4	0, 1	 1, 1	1, 1 1, 1	3, 2 2, 3
	PPDP	4, 7 2, 0	0, 2 1, 0				0, 1 1, 0	0, 1	1, 3	3, 0 0, 0
	PPPD	1, 8 1, 1	 1, 0			0, 1		 0, 1	0, 2	1, 5 0, 0
	PPPP	10, 5 8, 10			1, 0		1, 0 0, 1	1, 0	5, 2 5, 8	2, 3 3, 1
	other	14, 14 19, 23	0, 2 0, 2	1, 1 1, 1	0, 0 0, 2	2, 0 0, 1	1, 1 1, 1	1, 0 0, 2	1, 5 3, 5	8, 5 14, 9

Within each cell the four numbers correspond to the four treatments, as follows

Int-Div	*Int-Pay*
Ext-Div	*Ext-Pay*

Table 6: subjects repeating elementary choices for the compound scenario

6a: repeating specific responses

	by treatment		all
DDDD	50% (5/10) 38% (3/8)	11% (1/9) 86% (6/7)	44% (15/34)
PPDD	33% (4/12) 30% (3/10)	43% (6/14) 40% (4/10)	37% (17/46)
PPPP	50% (5/10) 63% (5/8)	40% (2/5) 80% (8/10)	61% (20/33)
other	7% (2/28) 18% (6/33)	6% (2/32) 15% (5/33)	12% (15/126)
all	27% (16/60) 29% (17/59)	18% (11/60) 38% (23/60)	28% (67/239)

6b: remaining within response classes

	by treatment		all
**DD	61% (19/31) 58% (17/29)	73% (19/26) 62% (16/26)	63% (71/112)
LE + SLE	31% (8/26) 50% (12/24)	44% (14/32) 60% (12/20)	39% (46/102)
PP**	48% (13/27) 52% (11/21)	53% (18/34) 76% (16/21)	56% (58/103)

Within each cell the four numbers correspond to the four treatments, as follows

Int-Div	*Int-Pay*
Ext-Div	*Ext-Pay*

Table 7: rules selected as droppable from PPDD for the compound scenario (headcount)

			droppable from PPDD			
			pPDD	PpDD	PPdD	PPDd
		6, 9 3, 7	3, 3 1, 3	0, 0 0, 0	1, 4 0, 0	2, 2 2, 4
elementary scenarios	DDDD	0, 2 0, 0	0, 2 0, 0			
	DPDD	0, 0 0, 0				
	PDDD	0, 0 0, 2	0, 0 0, 1			0, 0 0, 1
	PPDD	4, 6 3, 4	2, 0 1, 1		0, 4 0, 0	2, 2 2, 3
	PPDP	0, 0 0, 0				
	PPPD	0, 1 0, 0	0, 1 0, 0			
	PPPP	0, 0 0, 0				
	other	2, 0 0, 1	1, 0 0, 1		1, 0 0, 0	

Within each cell the four numbers correspond to the four treatments, as follows

Int-Div	*Int-Pay*
Ext-Div	*Ext-Pay*

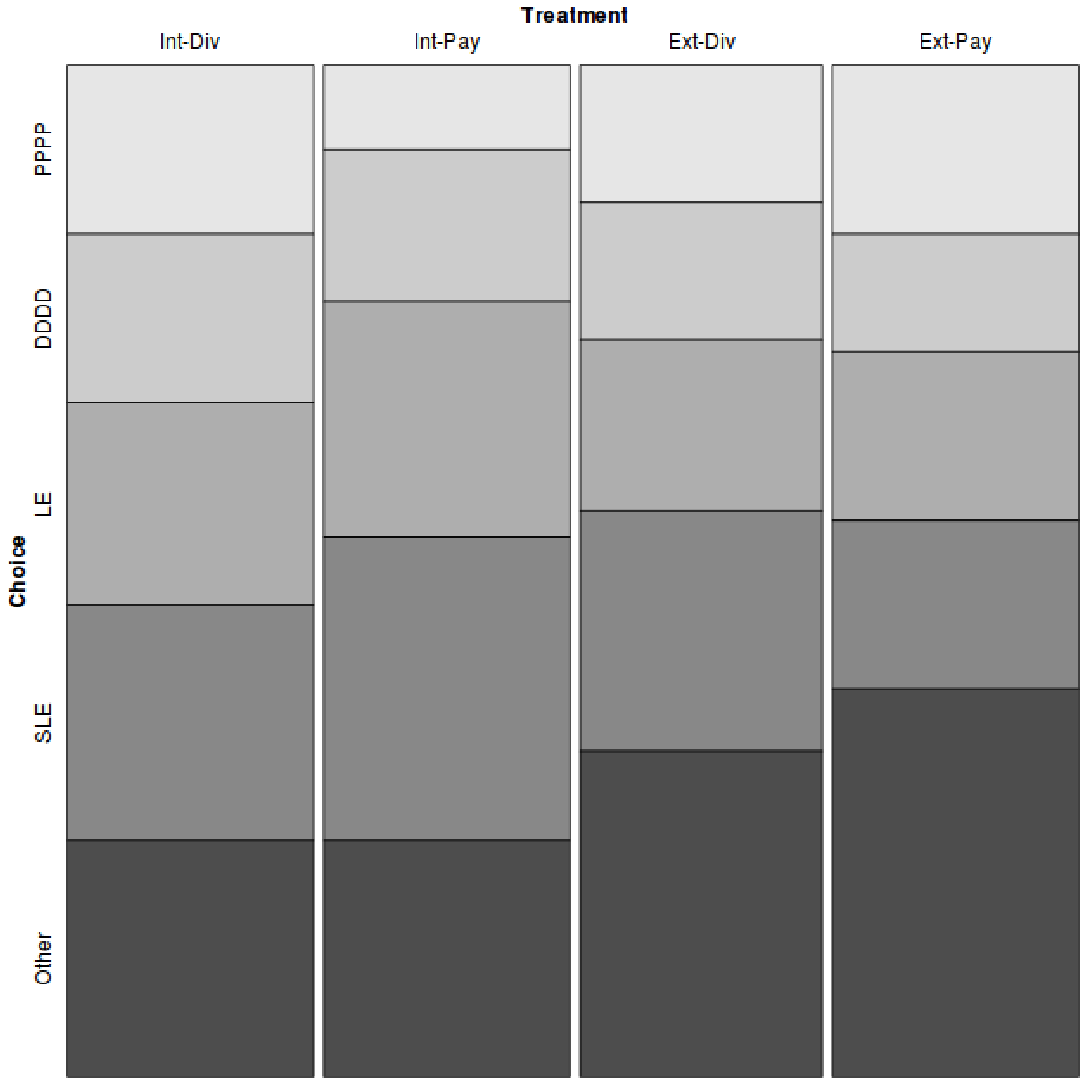


Figure 1: Choices in the elementary scenarios across treatments

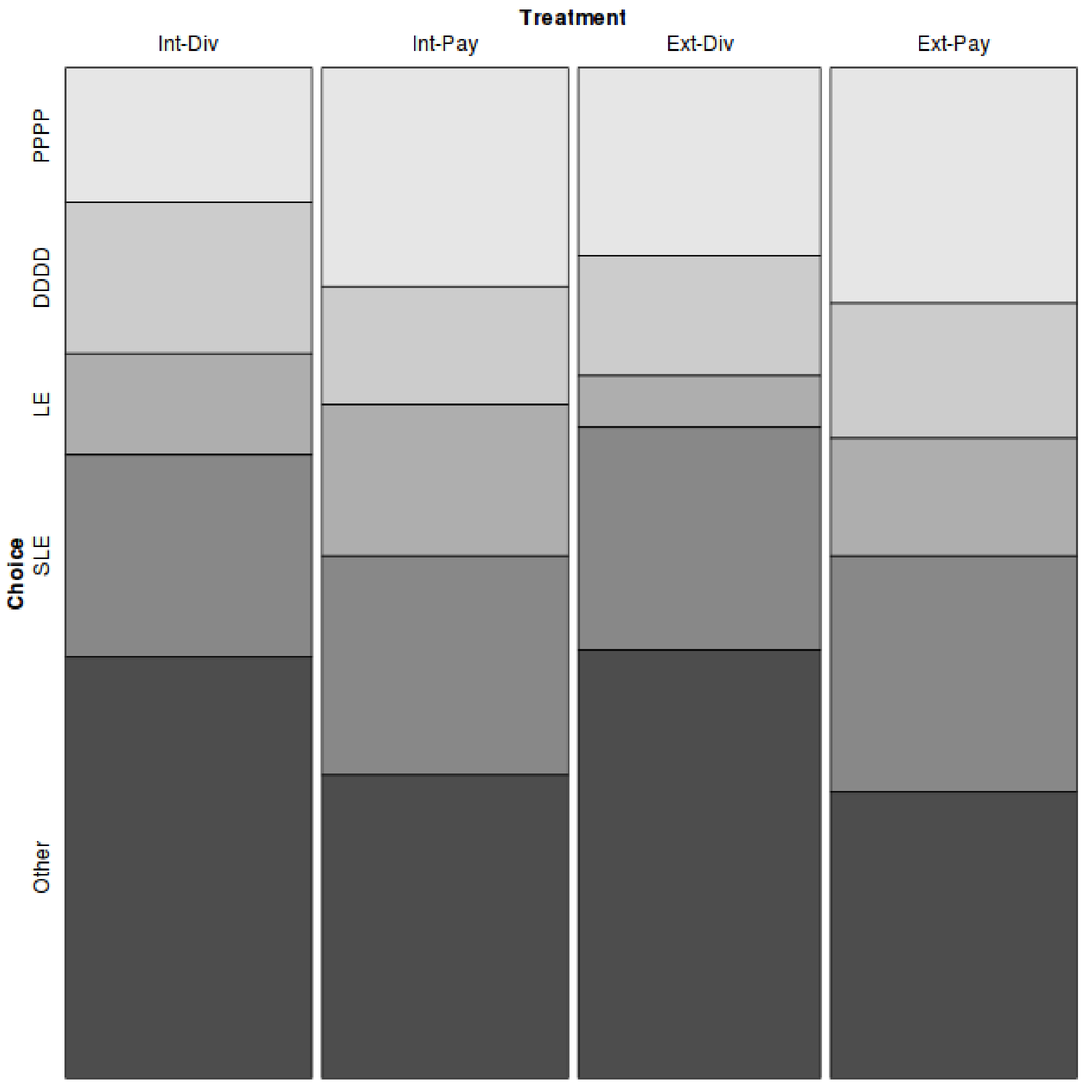


Figure 2: Choices in the Compound Scenario across treatments

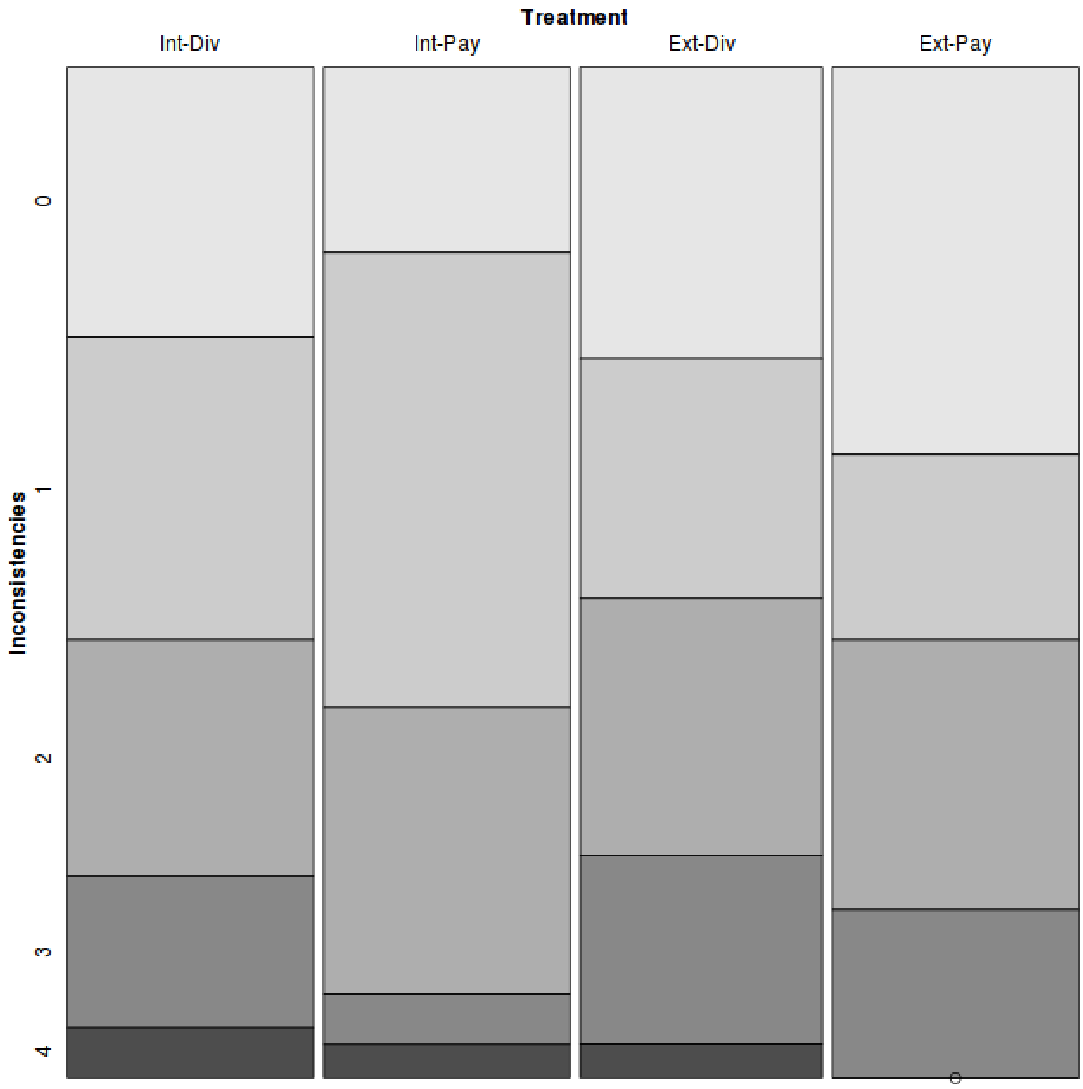


Figure 3: Compound cf. elementary inconsistencies by treatment

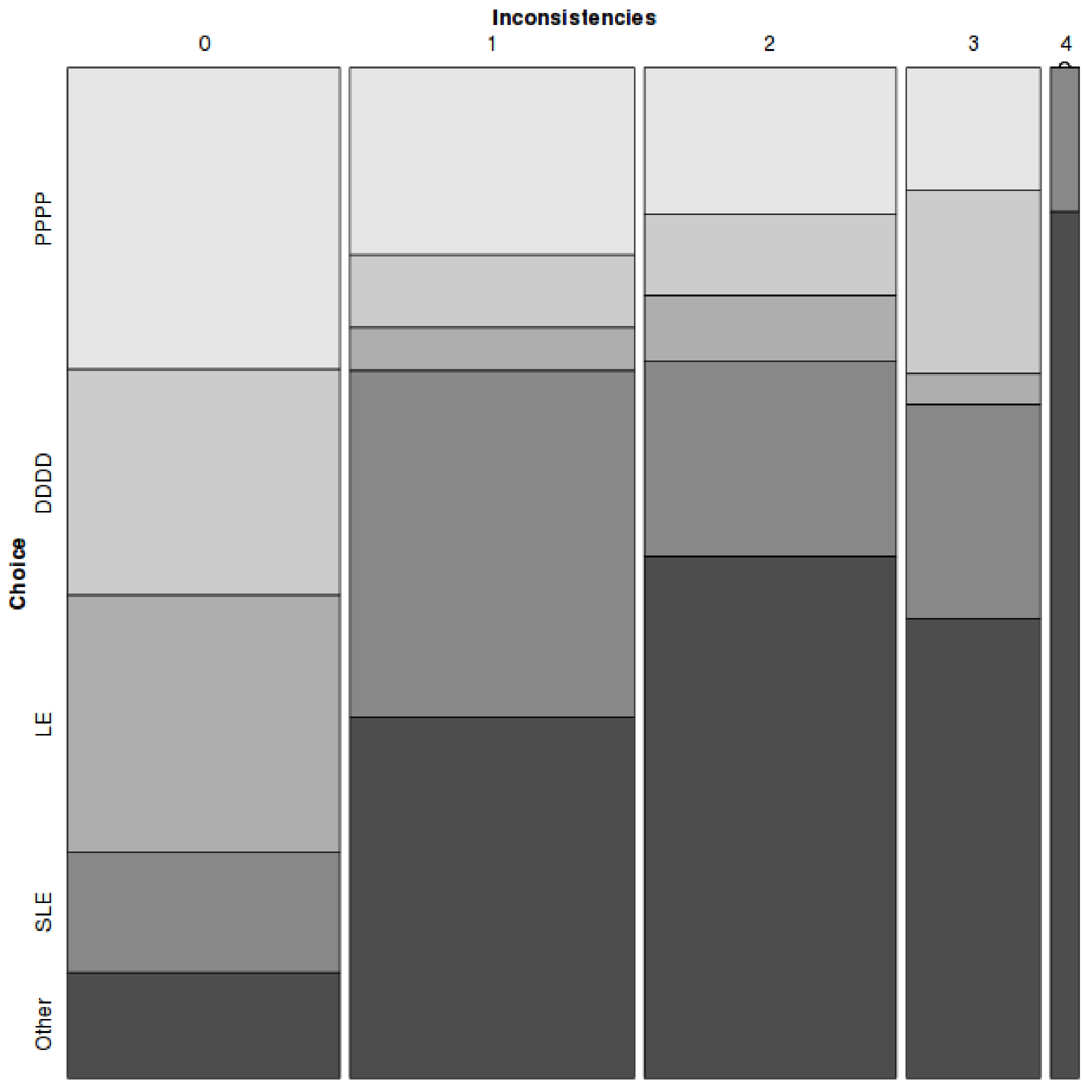
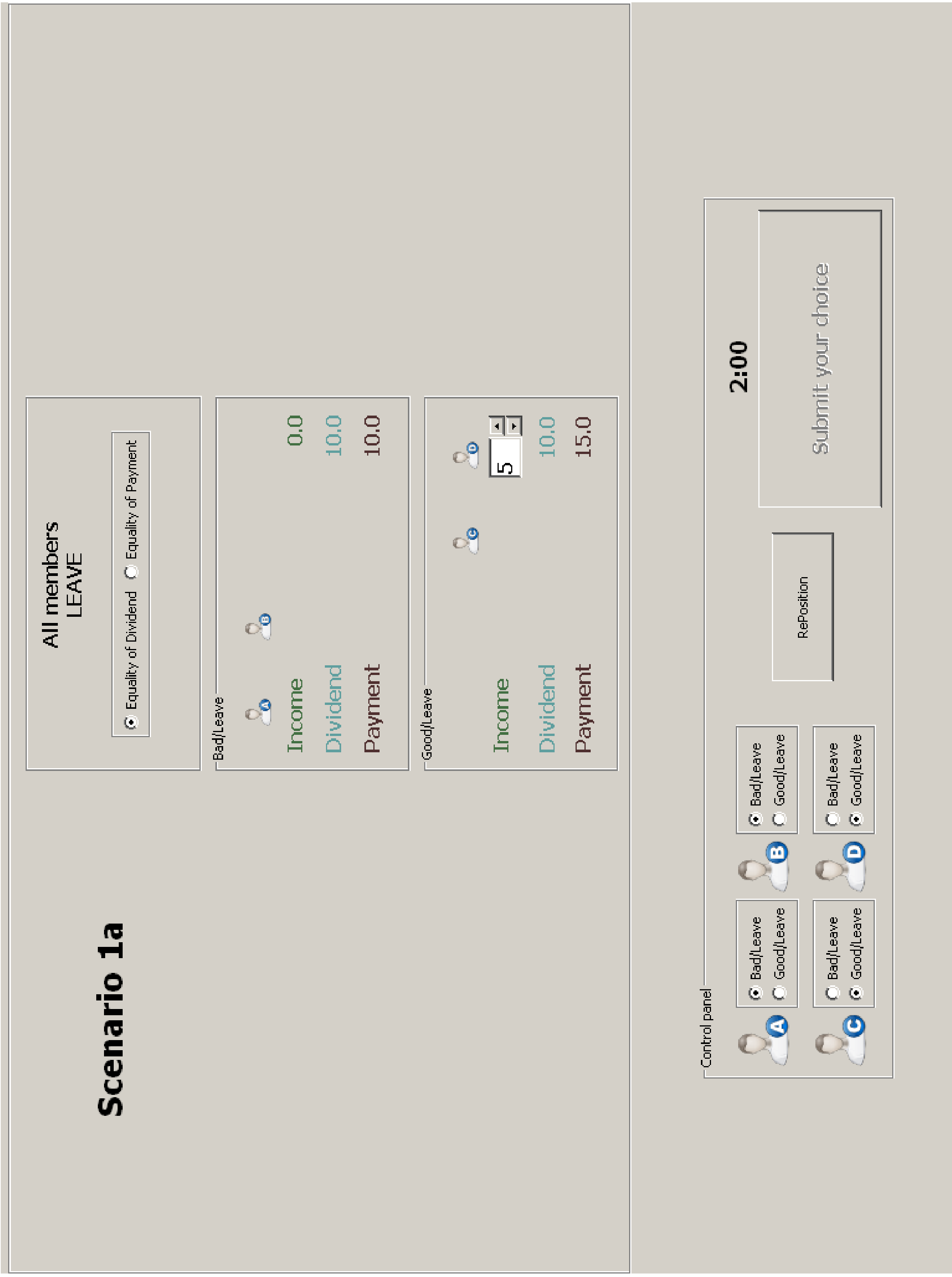
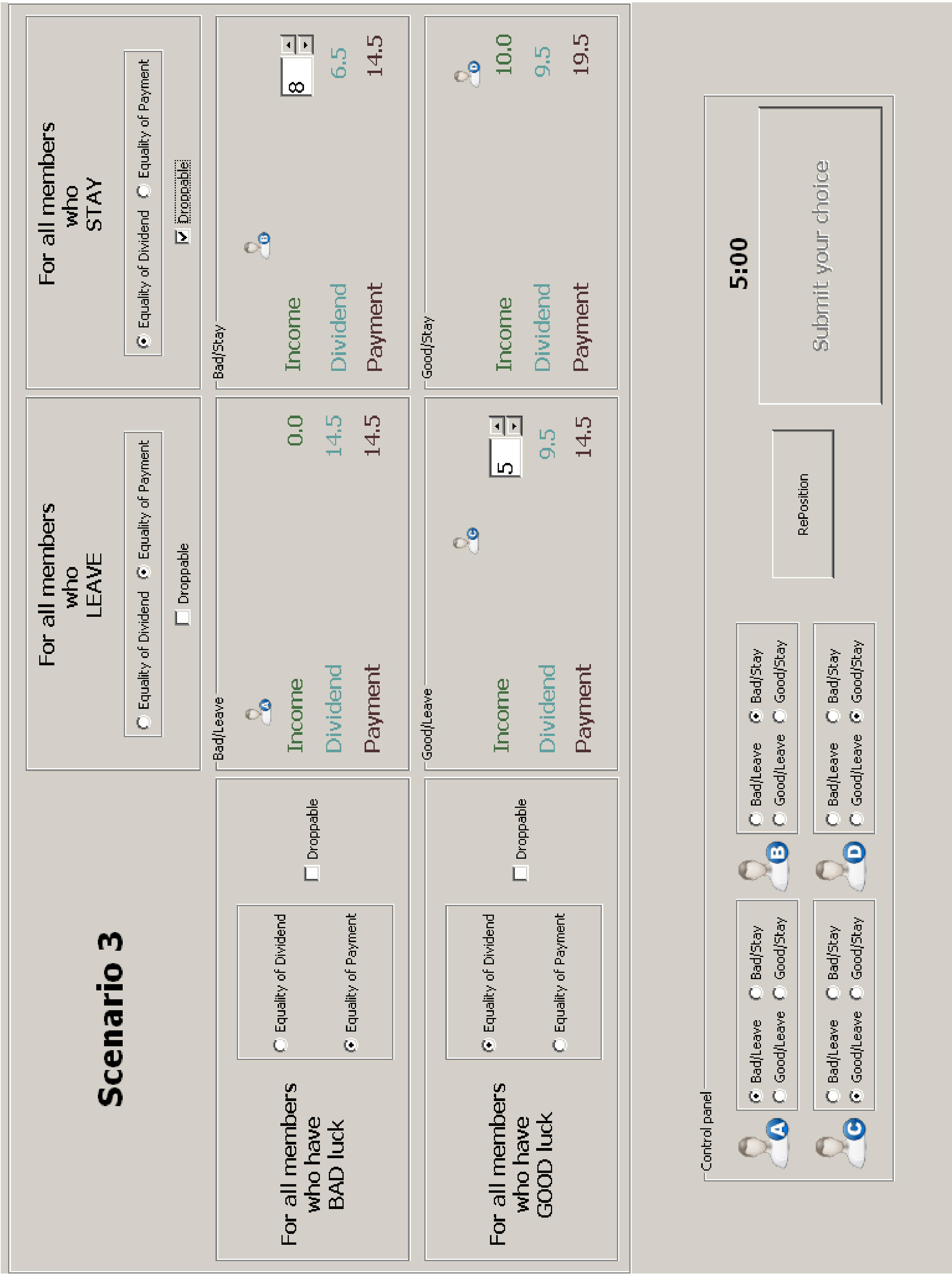


Figure 4: Compound cf. elementary inconsistencies, by elementary choice

APPENDIX Screenshots from Stage 1





Scenario 3
For all members who LEAVE
Equality of Dividend
Equality of Payment
Droppable
For all members who STAY
Equality of Dividend
Equality of Payment
Droppable
For all members who have BAD luck
Equality of Dividend
Equality of Payment
Droppable
Bad/Leave
Income 0.0
Dividend 14.5
Payment 14.5
Bad/Stay
Income 8
Dividend 6.5
Payment 14.5
For all members who have GOOD luck
Equality of Dividend
Equality of Payment
Droppable
Good/Leave
Income 5
Dividend 9.5
Payment 14.5
Good/Stay
Income 10.0
Dividend 9.5
Payment 19.5
Control panel
A
Bad/Leave
Bad/Stay
Good/Leave
Good/Stay
B
Bad/Leave
Bad/Stay
Good/Leave
Good/Stay
C
Bad/Leave
Bad/Stay
Good/Leave
Good/Stay
D
Bad/Leave
Bad/Stay
Good/Leave
Good/Stay
RePosition
5:00
Submit your choice