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The Tyranny Puzzle in Social Preferences: An empirical investigation

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Revised December 2014

Abstract

When forming their preferences about the distribution of income, rational people may be caught between two opposite forms of "tyranny." Giving absolute priority to the worst-off imposes a sort of tyranny on the rest of the population, but giving less than absolute priority imposes a reverse form of tyranny where the worst-off may be sacrificed for the sake of *small* benefits to *many* well-off individuals. We formally show that this intriguing dilemma is more severe than previously recognised, and we examine how people negotiate such conflicts with a questionnaire-experimental study. Our study shows that both tyrannies are rejected by a majority of the participants, which makes it problematic for them to define consistent distributive preferences on the distribution.

■**JEL:** H20, H21

■**Keywords:** social welfare, aggregation, questionnaire, income distribution

■**Acknowledgment:** We are grateful to Yinfei Dong for research assistance. The survey in Norway was administered by The Choice Lab, Norwegian School of Economics. We are grateful to audiences in London, Leuven and Louvain-la-Neuve for comments.

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1 Introduction

It is now well established that people are deeply concerned about fairness and inequality in the distribution of resources and advantages, and, more interestingly, that there is substantial diversity in their social preferences.[1] In this paper we study how people's social preferences about the distribution of income deal with an intriguing conflict between two very natural fairness principles (Fleurbaey and Tungodden 2010). Each fairness principle seeks to avoid a particular type of "tyranny".

The first type of tyranny is where social preferences are driven entirely by weight of numbers, as in utilitarianism, so that a tiny benefit to sufficiently many rich individuals could justify imposing a large loss on any disadvantaged member of society; the second is where social preferences are driven entirely by the interests of one person, as in maximin which gives absolute priority to the worst-off individual, regardless of the cost to the rest of society. It is actually possible, in theory, to find social preferences that avoid the two types of tyrannies, but the resolution involves a further conflict with other fundamental welfare principles that are almost always taken as given in conventional welfare economics.[2] Hence, in welfare economics we face a dilemma in how to deal with these two tyrannies.

Our paper makes two contributions. First, we show formally that this intriguing dilemma is more severe than previously recognised. It has so far been identified when the possible size of the population is unbounded. We introduce slightly stronger but still compelling versions of the axioms used to formalize the two tyrannies, and we then show that this dilemma may occur even in small populations. Second, we study how people react to this dilemma when they think about the distribution of income. Do they lean in the direction of one type of "tyranny"or the other? Are they concerned about the standard welfare principles that are taken for granted in conventional welfare economics? An empirical analysis of the issue requires elicitation of social preferences over possibly very large populations – in other words in situations where laboratory experiments are impossible; so we pursue these questions using a specially designed questionnaire study of

[1] See, for example Andreoni and Miller (2002), Bellemare et al. (2008), Cappelen et al. (2007), Cappelen, Konow, Sørensen, and Tungodden (2013), Charness and Rabin (2002), Engel (2011), Engelmann and Strobel (2004), Fehr and Fischbacher (2002) Fisman et al. (2007), Henrich et al. (2001), Konow (2000)

[2] Such social preferences have strange forms because of the violation of the Pigou-Dalton condition and replication invariance. They either have thresholds where priority changes sharply, or become more and more inequality averse when the population increases, which is hard to reconcile with conventional welfare principles.

opinions.[3] We find that a majority is indeed against both tyrannies: the dilemma thus appears to capture an important challenge in people's social preferences.

The paper is organised as follows. Section 2 formally explains the nature of the dilemma that lies at the heart of this paper, introduces stronger versions of the fundamental axioms, and reports a formal result showing that this dilemma may even occur in small populations. Sections 3 and 4 set out our approach to an empirical investigation of the problem and present the main results. Sections 5 and 6 examine the role of respondents' background in accounting for the pattern of answers to the questionnaire study and discuss the detailed comments that they provide. Section 7 concludes.

2 Theory

Social welfare functions devised by economists sometimes encounter two problems, both of which are relevant here: (1) they may conflict with certain ethical principles that appear to be reasonable in theory; (2) they may conflict with judgments made by rational, well-informed people in practice. We begin (in subsection 2.1) by setting out the possible theoretical conflict or dilemma at the heart of the present paper; we then modify the theory a little to nudge it in the direction of practical judgments, but show that the dilemma remains (subsection 2.2). We then consider how the modified theory and the puzzle that it presents can be confronted with evidence from people's judgments later in the paper.

2.1 The dilemma

Consider the following four welfare principles that appear to be intuitively reasonable.

- *Avoiding mob tyranny.* Such a tyranny takes place when the weight of numbers is decisive in a social welfare judgment involving many gainers who gain very little and few losers who lose a lot (indeed the loss may be so great that the loser is among the worst-off ex post.).

[3] On the issue of the questionnaire method versus laboratory experiments note that Cappelen et al. (2011) find that questionnaire data and behavioural data support the same conclusions on social preferences. On applications of the questionnaire-experimental method to ethical issues underlying one or other of the tyrannies see, for example, Amiel and Cowell (1999), Amiel et al. (2009), Amiel et al. (2012), Frohlich et al. (1987a), Frohlich et al. (1987b), Gaertner (1994), Gaertner and Schokkaert (2012).

- *Avoiding individual tyranny.* This tyranny takes place when the well-being of one loser is decisive in a social welfare judgment involving many gainers who gain a lot and one loser who loses very little.

- *Respect for progressive transfers.* In its strict form this means that a transfer from a poorer to a richer member of society produces a welfare decrease; in its weaker form it requires that such a transfer should not increase welfare (Dalton 1920, Pigou 1912).

- *Irrelevance of replication.* Social-welfare comparisons of income distributions are unaffected by "scaling up" the population (Dalton 1920).

It is clear that many commonly used welfare criteria are consistent with some, but not all, of these principles. Among the most popular criteria, the additively separable social welfare function $\sum_i \varphi(x_i)$, where x_i denotes the outcome for individual i in terms of utility, income , wealth,... and φ is an increasing transform, fails to avoid mob tyranny, whereas the maximin criterion $\min_i x_i$ fails to avoid individual tyranny.

Previous work has focused on the logically weakest versions of the principles that give rise to the dilemma.[4] This is the usual way in axiomatic analysis, but it may give the impression that the dilemma is weaker than it really is. For example, consider the following axiom to rule out mob tyranny: "if a worst-off person is sufficiently poor and gains enough, there is a small loss that is tolerable for all the best-off people, no matter how many of these best-off people there are" (Fleurbaey and Tungodden 2010). This is clearly violated by the criterion $\sum_i \varphi(x_i)$ when the potential size of the population is unbounded. But if, instead, there were a maximum potential size of the population, M, then even the simple utilitarian criterion $\sum_i x_i$ satisfies the axiom. Indeed, a loss of one unit by any individual will always prevail against a gain of $1/M$ units or less by the rest of the population, when the population size cannot exceed M.

If the dilemma occurs only when there is no limit to the size of the population, one may think that it is not a very serious issue, especially in practical applications. But this impression is misleading. In this paper we demonstrate that the dilemma is more severe than previously recognised, by showing that it may also hold for small populations if the axioms contain bounds on the parameters. The guiding intuition of our result is that even for small population, it may not be possible to give sufficient priority to the

[4] See Fleurbaey and Tungodden (2010) and Fleurbaey et al. (2009), where impossibility theorems are provided for a domain of potential populations that contains populations of arbitrarily large size.

poor person against all the rich. We therefore propose formulating a variant of the axiom that contains bounds in the form of parameters.

A similar issue arises in connection with the following axiom that rules out individual tyranny: "for every person there is some small loss that can be taken as acceptable if all the other members of society have a large enough gain and the size of the population is large enough." In its weakest form it is compatible with an arbitrarily high degree of priority to the worse off (Fleurbaey and Tungodden 2010). Consider the criterion $\sum_i \varphi(x_i)$ with a concave φ. This satisfies the axiom, for any degree of concavity (any degree of inequality aversion) and arbitrarily large populations: but again one may want to limit the degree of concavity of φ, otherwise individual tyranny will prevail at some point in finite populations. Therefore we also formulate a version of this axiom that puts a bound on the priority assigned to the loser.

2.2 Result

Consider a population of size N, belonging to $\mathcal{N}$, a set of non-empty finite subsets of positive integers. An *allocation* is $x = (x_i)_{i\in N} \in \mathbb{R}_+^{|N|}$, where x_i is the outcome for person i and $|N|$ denotes the cardinality of N. Let $x_{-i} = (x_j)_{j\neq i}$, $x_{-M} = (x_i)_{i\in N\setminus M}$ and let $x_{(k)}$ denote the kth component of x by increasing order: $x_{(1)} \leq x_{(2)} \leq \cdots \leq x_{(|N|)}$. Also let $k * N$ denote a k-replica of N (i.e., a population of size $k\,|N|$ containing the members of N and $k-1$ clones for each of them) and $k * x$ the corresponding replica of an allocation x (i.e., an allocation giving x to k disjoint $|N|$-sized subsets of $k * N$, one of which is N itself). The subsets of worst-off and best-off individuals are defined as follows:

$$\begin{aligned} W(x) &= \left\{ i \in N \mid x_i = \min_{j\in N} x_j \right\}, \\ B(x) &= \left\{ i \in N \mid x_i = \max_{j\in N} x_j \right\}. \end{aligned}$$

The mean of the components of x is $\bar{x} = \frac{1}{|N|}\sum_{i\in N} x_i$.

Social preferences are characterised by a *social preordering function* R defined on $\mathcal{N}$, which associates every $N \in \mathcal{N}$ with a preordering R^N on $\mathbb{R}_+^{|N|}$, with P^N denoting the asymmetric part.[5] Consider the following five properties for R^N in which the parameters $q, r, \alpha, \beta, \alpha', \beta'$ are fixed real numbers and n is a given integer:

[5] A preordering on $\mathbb{R}_+^{|N|}$ is a reflexive and transitive binary relation.

Weak Pareto For all $N \in \mathcal{N}$, all $x, y \in \mathbb{R}_+^{|N|}$, if $x_i > y_i$ for all $i \in N$, then $x \; P^N \; y$.

Pigou-Dalton For all $N \in \mathcal{N}$, all $x, y \in \mathbb{R}_+^{|N|}$, all $\delta > 0$, all $i, j \in N$, if
(i) $x_k = y_k$ for all $k \neq i, j$;
(ii) $x_i = y_i - \delta \geq y_j + \delta = x_j$,
then $x \; R^N \; y$.

Replication Invariance For all $N \in \mathcal{N}$, all $x, y \in \mathbb{R}_+^{|N|}$, all $k \in \mathbb{Z}_{++}$, all $k * N \in \mathcal{N}$, $x \; R^N \; y$ iff $k * x \; R^{k*N} \; k * y$.

Non-Aggregation [6] For all $N \in \mathcal{N}$, all $x, y \in \mathbb{R}_+^{|N|}$, all $i \in N$, if
(i) $i \in W(y)$, $y_i \leq q$ and $x_i - y_i \geq \alpha$ and
(ii) for all $j \in N - i$, if $x_j \neq y_j$ then $j \in B(x) \cap B(y)$, $y_j \geq r$ and $y_j - x_j \leq \beta$,
then $x \; R^N \; y$.

Aggregation [7] For all $N \in \mathcal{N}$ such that $|N| \geq n$, all $x, y \in \mathbb{R}_+^{|N|}$, all $i \in N$, if (i) $x_i - y_i \leq \beta'$
(ii) for all $j \in N - i$, $y_j - x_j \geq \alpha'$,
then $y \; R^N \; x$.

We then obtain the following result (the proof is in Appendix 1):

Proposition 1 *No social preordering function satisfies Weak Pareto, Pigou-Dalton, Replication Invariance, Aggregation, and Non-Aggregation if $\mathcal{N}$ contains all populations of size up to n^* where*

$$n^* = n + \frac{n\alpha}{\min\{q, \beta'\}} \left[\frac{\alpha' + 1}{\beta} + 1 \right]$$

2.3 Discussion

As explained in section 2.1, Fleurbaey and Tungodden (2010) have already shown that a "dilemma" result similar to Proposition 1 holds in which the

[6] This is the axiom that protects against mob tyranny. The weaker version ("Minimal Non-Aggregation") used in Fleurbaey and Tungodden (2010) uses quantifiers: "There exist $0 < q < r$ and $\alpha > \beta > 0$."

[7] This is the axiom that protects against individual tyranny. For the "Minimal Aggregation" axiom used in Fleurbaey and Tungodden (2010) one adapts this to "For some $N \in \mathcal{N}$, all $x \in \mathbb{R}_+^{|N|}$, all $i \in N$, there exist $\alpha' > \beta' > 0$ such that for all $y \in \mathbb{R}_+^{|N|}$, if (i) $x_i - y_i \leq \beta'$; (ii) for all $j \in N - i$, $y_j - x_j \geq \alpha'$, then $y \; R^N \; x$.

Non-Aggregation and Aggregation axioms are replaced with weaker counterparts. *Minimal Non-Aggregation* (see footnote 6) is weaker than the Non-Aggregation axiom in that it puts no lower bound on the ratio β/α (loss of the best off relative to gain of the worst off); when $\mathcal{N}$ contains populations below a given size (which may be arbitrarily large), this Minimal Non-Aggregation is satisfied even by the utilitarian criterion $\sum_i x_i$. *Minimal Aggregation* (see footnote 7) is weaker than the Aggregation axiom in that there is no upper bound on the ratio α/β (the gain of all relative to the loss of one) and on the required size of the population.

Proposition 1 itself says more than Fleurbaey and Tungodden (2010). It confirms the intuition that the dilemma is more severe – it may occur even for smaller populations – when the parameters n, α, α' are small and the parameters β, β', q are large. That is, when one accepts a reduction in the outcome for one person for the sake of a gain to all others in a small population and with a low gain-loss ratio, while one also wants to give priority to the worst-offs in the case of a low gain-loss ratio.

However Proposition 1 also raises what sounds like a question in practical ethics: what are reasonable values of the parameters and what is the induced size of the population that generates a dilemma? It is not easy to address these issues purely on principle; and people with similar views may suggest substantially different values. We therefore find it interesting to study what people consider to be reasonable in this context. There is a tradition of empirical ethics that has studied people's attitudes about redistribution by the use of questionnaire-experimental techniques (Amiel and Cowell 1999, Gaertner and Schokkaert 2012). This school has examined in particular if people endorse the Pigou-Dalton principle and has sought to estimate their aversion to inequality. We apply this approach to the study of trade-offs between rich and poor involving the problems of mob tyranny and individual tyranny, and then use our result to derive from the responses the size of the population that makes the dilemma appear for the respondents.

In summary, the tension between avoiding mob tyranny and avoiding individual tyranny depends on the possible size of the population and on the degree of inequality aversion that one is willing to adopt, in other words, on how afraid of individual tyranny one is. The greater the inequality aversion (the less one is afraid of individual tyranny), the greater the size of the population that is needed to make mob tyranny occur. One may therefore ask if, with the typical degree of inequality aversion that one encounters in a society, the population size that is needed to reveal the tension is realistic or astronomical. In the latter case the problem might be dismissed as of purely theoretical interest; but in the former case decision-makers and practitioners

should seriously worry about it.

3 The empirical approach

To establish whether the two tyrannies pose a dilemma in practice we needed to elicit people's social preferences in situations that capture the problems discussed in Section 2. In contrast to many contributions in the social-preference literature, conventional laboratory experiments are not feasible here because we focus on the nature of social preferences for moral questions involving large populations. For this reason we have used the established technique of preference elicitation by means of questionnaire.[8] The questionnaire combines verbal and numerical questions, contains questions in both closed and open form, and allows for respondents' comments.

3.1 Questionnaire summary

The main part of the questionnaire consists of four scenarios, each of which concentrates on one specific principle. In order to make the principles clear to non-specialist respondents we take individual outcomes to be represented by income and focus on just two groups "the poor" and "the rich," defined within the questionnaire as those with £10,000 and £50,000 respectively. The questionnaire itself is reproduced in Appendix 2; here is a sketch of the content and the structure of possible responses:

Scenario 1 (Mob tyranny) Suppose one poor person benefits from an income increase of £G while all the rich, no matter how many there are, suffer an income reduction of £1. If G were large enough would this be a good idea?

- A *Agree*
  - then specify the threshold value of G
- B *Disagree*

Scenario 2 (Individual tyranny) Suppose one poor person suffers from an income cut of £1 while M rich people benefit from an increase of £100. If M were large enough would this be a good idea?

[8] The method is set out in detail in Amiel and Cowell (1999); see also Gaertner and Schwettmann (2007) and the references therein for an application focusing on equity judgments that give priority to the worst-off.

- A *Agree*
  - then specify the threshold value of M
- B *Disagree*

Scenario 3 (Principle of progressive transfers) Suppose a small amount of income ε is transferred from a rich person to a much poorer person. Would this be a good idea?

- A *Agree*
- B *Disagree*

Scenario 4 (Replication) Suppose n_1 people with income y_1 experience an income increase of Δ and n_2 people with income y_2 experience an income decrease of δ and that this change in income distribution is considered a good idea. Would it also be a good idea if the numbers n_1 and n_2 were replaced by mn_1 and mn_2?

- A *Agree*
- B *Disagree*

The relationship between this outline of the questionnaire and Proposition 1 can be seen by noting that $q = £10,000$, $r = £50,000$, $\alpha = G$, $\beta = £1$, $\alpha' = £100$, $\beta' = £1$, $n = M + 1$. In each scenario the respondents were invited to provide comments to elucidate their answers if they wished to do so. The order in which scenarios 1 and 2 were presented was randomly decided, with equal probability for both sequences.

In the final part of the questionnaire, we asked some questions on personal characteristics and background; details on these are to be found in the discussion of the results in section 5.

3.2 Critical population size

The questionnaire has been conceived with a simplified version of the theoretical result presented above, because the values of income at the status quo are given to the respondents and the questions bear only on income variations. The idea is still that the ethical principles underlying the scenarios are incompatible if the possible population is large enough. The argument to derive the dilemma unfolds in the following four simple steps, which mimic the structure of the proof of Proposition 1.

1. Suppose there is a population of size $M+1$ containing 1 poor person (in the questionnaire this means with £10,000) and M rich people (with £50,000). Response A in Scenario 2 indicates that it would be acceptable to tax £1 from the poor person to give an amount Δ (where $\Delta = £100$) to each of the M rich people. So the reverse, where the rich lose £Δ and the poor person gains £1, would be unacceptable.

2. Now replicate $m-1$ times to give a population of size $n = m\,[M+1]$. Response A in Scenario 1 implies that it is acceptable to give G to one clone of the poor person and tax £1 from each of the rich people.

3. Equalize among all clones of the poor so that each of them gains G/m. This would be considered acceptable by respect for Progressive Transfers.

4. Now repeat this operation $\Delta - 1$ times so that overall the rich lose £Δ and the poor gain $\Delta G/m$. Steps 2 and 3 above suggest that this should be acceptable; but if

$$\Delta G/m \leq 1 \tag{1}$$

   step 1 above suggests that it must be unacceptable!

Clearly, for the contradiction in step 4 to occur, the replication factor m must be large enough for given Δ, G for (1) to hold: specifically we need $m \geq \Delta G$; this requires that the population size must satisfy $n \geq n^*$, where

$$n^* := \Delta G\,[M+1]\,. \tag{2}$$

In our questionnaire study Δ is fixed (at £100) but G and M are reported by the respondents who select A in scenarios 1 and 2. So the respondents effectively announce the critical value of n^*. The question we are interested in is whether, according to the respondents' views, the clash is severe (a low n^*) or weak (incompatibility only for astronomical populations).

3.3 Sample

The questionnaire was run on a sample of 642 student respondents in three groups. Two groups consisted of first-year and second-year students from the Norwegian School of Economics (labelled NHH1 and NHH2 in the tables below); the third group was from the London School of Economics and consisted of second-year undergraduates taking a mathematically oriented microeconomics course.

The questionnaire was carried out under supervision during class time; respondents were informed that the questionnaire was anonymous and were requested not to interact with each other when filling in their responses.

3.4 Responses

We begin with an impression of the type of distributional judgments made by those in our sample, based on an overview of the pattern of responses.

		Scenario 2	
		A	*B*
Scenario	*A*	ANTI-ANTI	MAXIMIN
1	*B*	AGGREGATIVE	PRO-PRO

Table 1: Types of response

The principal responses to the first two scenarios – on the two tyrannies – can be classified according to four types as in Table 1 where the interpretation is as follows:

- The "anti-anti" respondents (in the AA category) are against both individual tyranny and mob tyranny. Indeed the comments provided by these respondents reveal their concern that the interests of the poor person be protected[9] but also the concern that small changes for the poor do not dominate the wider interests of society.[10]

- The AB category consists of those whose responses are consistent with the maximin principle; these respondents are against mob tyranny.

- The BA category consists of respondents whose responses are consistent with the aggregative approach implicit in welfare principles such

[9] "The person suffering a £1 loss is already well off, so won't be affected much, but gains for the poorer one will increase life standard significantly." "Any increase in income for the person with £10,000 would be a good thing in my opinion, however it would need an extra £10,000 to bring their living standard to decent." "£1 is a small proportion of £50,000. This would not reduce living standards significantly, £10,000 would help the single person to have decent living standards." "The ones who earn £50,000 have enough money, and even the slightest increase of the ones who earn £10,000 is for the good." "The marginal utility for each pound is larger for a person with low income than for a person with a high income. £1 reduction out of £50,000 doesn't change so much for the person with a high living standard."

[10] "If 100 people get an increase in income of £100, it equals £10,000. A reduction of £1 is not that heavy a loss, from my view." "£1 is little, and if the £100 the rich ones gain can contribute to work places and a better economy, it is worth it."

as $\sum_i \varphi(u_i)$; these respondents are against individual tyranny.

- BB-type responses might be given by libertarians.[11]

The proportions of respondents of each type for the three sub-samples are given in Table 2. It is clear that AA is the most common type of response in each of the sub-samples. Furthermore, adding the proportions in columns AA and AB we can see that a majority rejects mob tyranny in scenario 1; however, adding the proportions in columns AA and BA we can also see that a majority also rejects individual tyranny in scenario 2! This result applies in all sub-samples: although there is a relatively lower proportion of LSE respondents in category AB and a relatively higher proportion in category BB, the differences between the sub-samples are not great.

	N	**AA**	**AB**	**BA**	**BB**
LSE	118	33.1%	23.7%	17.8%	25.4%
NHH1	225	33.3%	30.7%	20.0%	16.0%
NHH2	299	32.8%	30.4%	18.1%	18.7%
All	*642*	*33.0%*	*29.3%*	*18.7%*	*19.0%*

Notes: N is the number of participants, AA is the share of participants rejecting both individual tyranny and mob tyranny;
AB is the share of participants rejecting only mob tyranny;
BA is the share of participants rejecting only individual tyranny;
BB is the share of participants not rejecting either of the two tyrannies.

Table 2: Distribution of Responses to Scenarios 1 and 2 by type and sample

The responses to scenarios 3 and 4 are summarised in Table 3 which shows the proportion of respondents that endorse progressive transfers and the irrelevance of replication. It is clear that about 50% respond in accordance with the principle of progressive transfers (There is not much difference in the pattern of responses across the different sub-samples). The proportion of the overall sample that reject *both* principles may seem surprisingly high. However, the comments of the respondents in this category reveal that this heterodox position was often based on some careful reasoning; rejection of progressive transfers on scenario 3 was justified on the

[11] See also Cappelen et al. (2007), Cappelen, Konow, Sørensen, and Tungodden (2013) where the proportion of libertarians found is consistent with the proportion of BB-types in the present study.

grounds of the intrinsic rights of individuals,[12] on the grounds of fairness,[13] speculation about other background issues not specified in the scenario[14] or wider issues of efficiency;[15] rejection of the irrelevance of replication invariance on scenario 4 was justified on the basis of concern for absolute numbers of the poor.[16] However these heterodox arguments do not provide a "solution" to the dilemma: it is straightforward to establish a version of the dilemma within a framework respecting all these concerns except the last one.[17]

	N	Progressive Transfers and Replication Invariance	Progressive Transfers only	Replication Invariance only	neither
LSE	118	18.6%	28.8%	11.9%	40.7%
NHH1	225	19.6%	28.0%	12.0%	40.4%
NHH2	299	11.7%	39.5%	9.7%	39.1%
All	*642*	*15.7%*	*33.5%*	*10.9%*	*39.9%*

Notes. N is the number of participants. Other columns show the share of participants endorsing both progressive transfers and replication invariance, or one of them, or neither.

Of the 642 persons in total 9 did not respond to Scenario 3 and 25 did not respond to Scenario 4.

Table 3: Distribution of Responses to Scenarios 3 and 4, by type and sample.

[12] "There is a reason why some persons have an income of £50,000 so they should be able to keep it for themselves." "One's income should correspond to his contribution."

[13] "It is not fair for the person with £50,000" [and other similar comments]. "I don't think one person should have reduced income to increase another persons income if he doesn't wish this himself." "The tax system does more than this already".

[14] "Depends of level of experience, educational background, skills, if reduction is fairly high the person that is used to the well-off lifestyle may get troubles with his economics." "Depends on how an individual has earned his income." "It depends on their situation, health, family, etc."

[15] "There will be no incentives to better if everyone is equal without a reason." "Simply a redistribution of income: not the creation of wealth. Removes the incentives to earn £50K." "If you end up giving it away i.e. you can be subsistence, not work hard and get by well enough." "A redistribution of income can harm economy if the low income person is not as skilled at investing as the high income person."

[16] "This may result in more people becoming poorer..."

[17] Rights, fairness and efficiency issues can be incorporated in the model; concerns for absolute number of the poor are indeed incompatible with replication invariance.

4 A dilemma in practice?

A large proportion – about a third – of our respondents fall into the "Anti-Anti" category – see table 2. For some of these the dilemma may prove to be a real problem. Rigorously speaking, within our framework, the dilemma concerns only the respondents who endorse all four principles by answering A in all scenarios (and also accept Weak Pareto, which we did not investigate empirically): at NHH, there are 33 such students (7% of a total of 467); at LSE, there are 10 such students (8.5% of a total of 118). As we discussed in section 2 and 3.2, the responses of this group imply a logical contradiction for very large populations. However, it is reasonable to focus on the larger sub-sample of the "Anti-Anti" category, since we find that G and M answers are not significantly influenced by attitudes to the principle of transfer and to replication.[18]

In order to investigate whether the dilemma is a practical problem, we need to look at how the AA types responded in the follow-up numerical questions on scenarios 1 and 2. Recall that question 2 on scenario 1 asked the respondent to report a value of G, given that they had endorsed the mob tyranny axiom; question 2 on scenario 2 asked for a value of M, given that they had endorsed the individual tyranny axiom. A lower value of G or a higher value of M represent two different ways of giving priority to the poor.

Table 4 presents a summary of the responses and Figures 1 and 2 show the marginal distributions of the reported values of G and M.[19] Table 4 reveals substantial heterogeneity of response across the sub-samples. In particular, from the lower half of Table 4 we observe that the mean value of reported M for LSE is substantially greater than that for either of the NHH groups. We might expect G and M to be negatively correlated, so that both indicators of priority to the poor are in the same direction, so to speak; this is true for the NHH1 sub-sample, but not for LSE or NHH2.[20]

[18] See Table 7 below. In other words, one could hope to convince the respondents to endorse the principle of transfers and indifference to replication without altering their G and M answers.

[19] Notes for Figures 1 and 2: G is reported threshold income in scenario 1 q2; M is reported threshold population in scenario 2 q2; labels on horizontal axis give upper bound of each bin into which the observations have been sorted. The figures show the distribution just for AA types – those who responded "A" in *both* the first two scenarios. However if we plot the distributions of all responses to Scenario 1 question 2 and all responses to Scenario 2 question 2 we obtain the same shapes. Invalid responses – such as specifying a range of values rather than a single number – have been excluded.

[20] There is quite a wide dispersion of reported values: 37.1% of the G responses were

	Median	Mean	Std. Dev.	Max	Obs	Corr (G, M)
			G			
LSE	1,000	6,533.73	12,420.93	50,000	30	0.1881
NHH1	1,000	2,705.90	5,408.53	40,000	69	-0.0729
NHH2	1,000	2,870.40	4,034.79	20,000	87	0.2376
All	1,000	3,400.24	6,663.96	50,000	186	0.1898
			M			
LSE	500	177,494.30	375,319.50	1,000,000	30	
NHH1	1,000	62,851.14	200,586.96	1,000,000	72	
NHH2	500	83,394.78	249,229.86	1,000,000	93	
All	1,000	90,286.29	258,297.03	1,000,000	195	
			n^* (millions)			
LSE	37.58	207,200.45	914,013.89	5,000,005	30	
NHH1	10.01	9,790.14	25,420.50	100,001	69	
NHH2	10.00	38,308.57	161,763.92	1,000,001	87	
All	10.01	54,969.78	384,720.27	5,000,005	186	

Notes: N(LSE)=39, N(NHH1)=75, N(NHH2)=98, N(ALL)=212
Obs: number of valid numerical responses of G and of M
G: reported threshold income in scenario 1 q2 (min val is 1)
M: reported threshold population in scenario 2 q2 (min val is 1)
n^*: critical population size for a contradiction

Table 4: AA types. Numerical responses in scenarios 1 and 2

Figures 1 and 2 show that both distributions are clearly bimodal for all three sub-samples, and the median is much lower than the mean. This pattern is consistent across the three sub-samples.

The lower mode in Figures 1 and 2 is striking: in the case of scenario 2 almost a quarter of the respondents say that if just one rich person benefits from £100 this is worth cutting the poor person's income by £1. The

less than 10% of the median, 15.1% were more than 10 times the median; 37.1% of the G responses were less than 10% of the median, 44.6% of the M responses were less than 10% of the median, 35.9% were more than 10 times the median; 22.6% of the M responses were located at the logical minimum (1 person). The two observations of positive correlation are attributable to two substantial outlier values of G, one of £50,000 (LSE) and one of £20,000 (NHH2).

Figure 1: AA types. Distribution of G

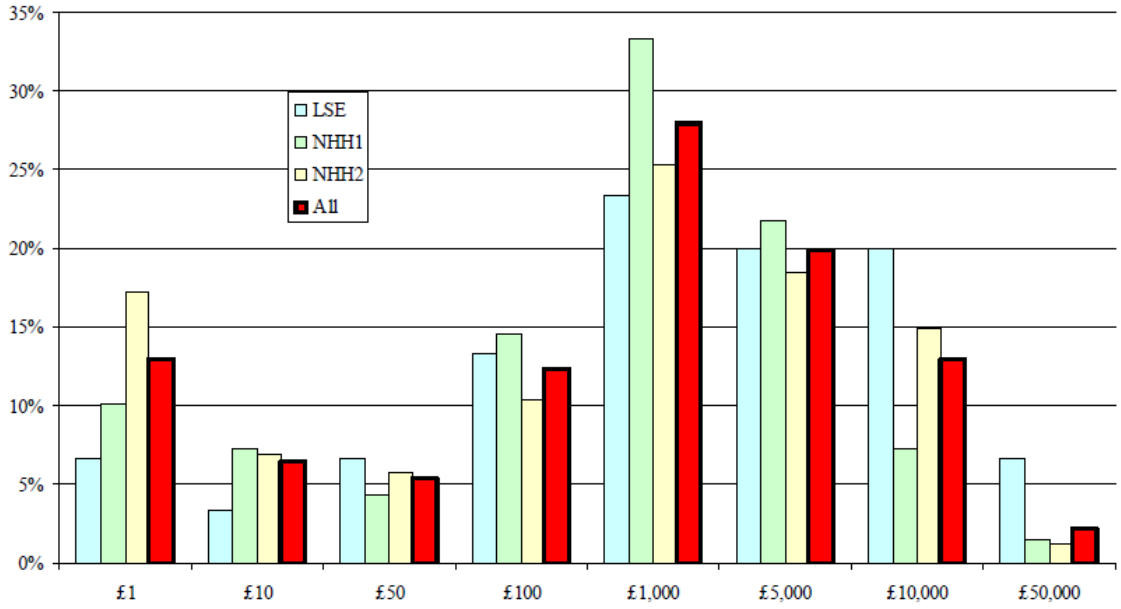


Figure 2: AA types. Distribution of M

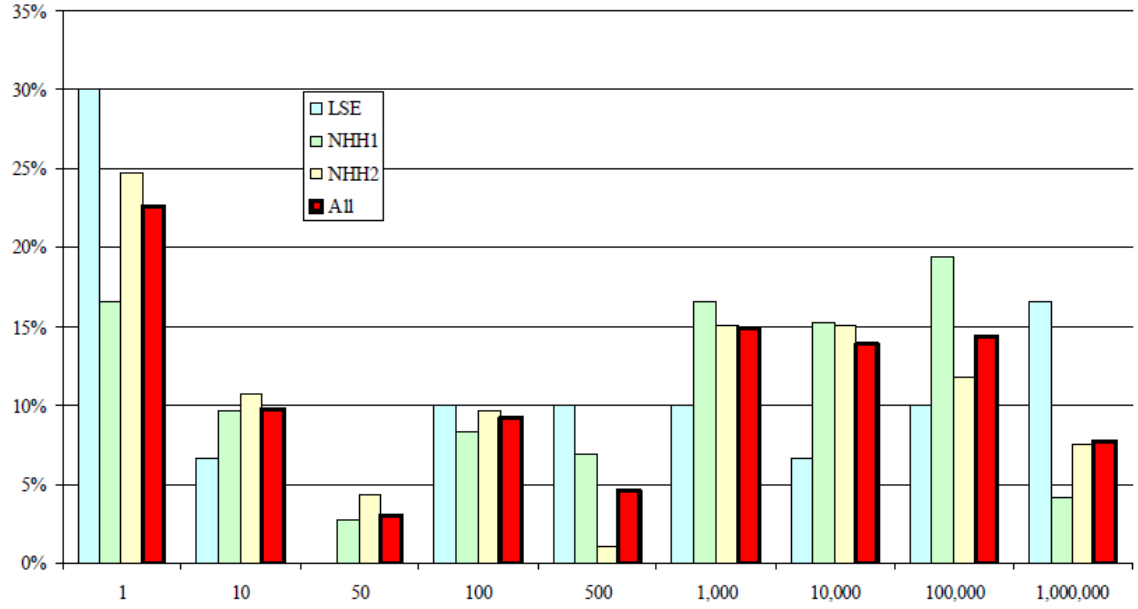
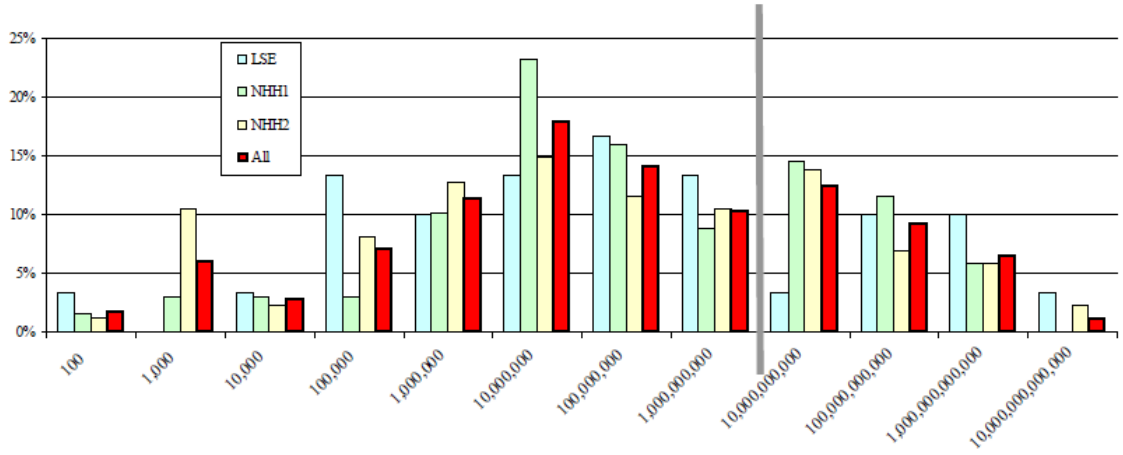


Figure 3: AA types. Distribution of Critical Population $n^* = 100G\,[M+1]$



presence of this mode might be interpreted in two ways: it could be taken as a left-censoring of the distribution of responses; or we can see a spike at the value 1 acting as a focal point for responses whose views are essentially "this is a good idea, whatever the numbers". The latter interpretation is clearly consistent with the comments of the AA-types who responded with the value £1 in scenario 1.[21] This interpretation is also consistent with each of two threads of comment on scenario 2: that there is a clear overall income gain which must be desirable, whatever the value of M[22] or that the loss to the poor is vanishingly small.[23] The spike would probably have been lower if the rich person's gain in scenario 2 had been lower than £100.

The reported values of G and M can be used to derive the critical population size n^* above which the AA-position proves to be problematic in practice; for each individual respondent one simply applies the formula (2). Figure 3 shows the distribution of the resulting n^* for each sub-sample of respondents and overall; the bottom part of Table 4 gives the summary statistics for these distributions.[24]

[21] "Any increase in income will be good for a person." "The amount is not relevant, seeing as those with high income lose little." "The ones who earn £50,000 have enough money, and even the slightest increase of the ones who earn £10,000 is for the good." "£1 is better than nothing."

[22] There were many comments along the lines of "Here, the social surplus larger...," "this increases the total income in the economy, which is good,"or "society earns £99."

[23] "£1 in a yearly income is barely noticeable."

[24] The way the distribution of n^* changes in response to changes in the questionnaire

How large would n^* need to be to be effectively infinite, so that the dilemma becomes a real problem? In Figure 3[25] the grey vertical line marks the position on the horizontal scale of the total population of the world and it is clear that a substantial proportion of each sub-sample of AA types lies to the right of this line and that some of those observations produce values that are hundreds of times the world population. It is also clear, from Table 4, that the mean value of n^* exceeds the present world population, but that the median is a much more modest number, about $37\frac{1}{2}$ million for the LSE sub-sample, about 10 million for the NHH sub-samples and overall. However, we might seek other reference groups to determine how large is "large." Table 5 gives the size n of a number of possible reference groups and the value of $F(n)$ where F is the empirical distribution function of the computed n^*.[26] If we compare the median value of n^* with any of these reference groups we can see that for Norway (and smaller countries) there is no problem of the two-tyrannies dilemma if applied to the overall population; for the UK and larger there is indeed a potential problem; Belgium is, perhaps, borderline.

In summary, our analysis indicates that, for most individuals, this dilemma does not seem to be of practical importance for local moral questions only involving a small number of individuals. But it may be of importance for national considerations, and most likely is relevant for moral questions related to global and intergenerational injustice. Note that the one-many persons tradeoffs need not occur often for the problem to be serious. The problem afflicts the SWF itself: the failure to find a SWF that avoids both tyrannies is of concern even if the instances arise only rarely in practice.

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parameters is the subject of future research. The particular values presented elicit a particular range of quantitative responses; but our goal was merely to have a preliminary estimate of the distribution ofn^*.

[25]Notes. AA: those against both individual tyranny and mob tyranny. Labels on the horizontal axis give the upper bound of each bin into which the observations have been sorted.

[26]However, if we were to consider an application of our analysis to questions of intergenerational justice then a much larger reference group would be relevant. Asheim (2010) suggests that the number of people who will potentially live in the future is 10 million times the current world population; if this were added to Table 5 then clearly we would have $F(n) = 100\%$.

	n	$F(n)$
Vatican City	800	7.0%
Liechtenstein	36,000	14.0%
Luxembourg	508,000	24.2%
Norway	4,891,000	40.3%
Belgium	10,941,000	53.2%
UK	62,066,000	59.7%
Nigeria	159,708,000	65.6%
USA	312,247,000	66.7%
China	1,359,821,000	74.7%
World	*6,916,183,000*	*82.3%*

Source: UN Dept of Econ and Social Affairs 2013
n: size of reference group
$F(n)$: proportion of n^* values $\leq n$

Table 5: AA types. Size of reference groups and the n^* distribution

5 Responses to the questionnaire – the effects of background

It is clear from the above discussion that there is considerable variability within the combined sample in the social values implied by the questionnaire responses. What can explain the observed heterogeneity in responses? We first study the factors associated with the described patterns, before we turn to a detailed analysis of how the critical population size is associated with background variables. First, in section 5.1, we look at the factors associated with the response patterns that were described in Section 3.4; then, in section 5.2, we look at the influences on the numerical values that determine the critical population size.

The variables used are mostly derived in an obvious way from the responses on the last page of the questionnaire (see Appendix 2). In addition we had available two more dummy variables related to the way in which the questionnaire session was run. To control for the possibility that the ordering of the first two scenarios might affect how people respond on the tyranny questions, half of the questionnaires presented scenarios 1 and 2 in reverse order (variable **version**). Also the order of finishing the questionnaires was preserved so that we have an ordinal indicator of the time that the respondents spent in completing the questionnaire (variable **pos**). The notes to Table 6 give a description of the coding of each variable.

5.1 Patterns of response

To investigate the determinants of particular patterns of response we estimate a standard probit model

$$\pi = \Phi(b_1 x_1 + b_2 x_2 + ... + b_n x_n) \tag{3}$$

where π is the probability of a particular response pattern, Φ is the Normal distribution function, $(b_1, ..., b_n)$ is a vector of coefficients and $(x_1, ..., x_n)$ is a vector of characteristics.[27]

From the probit regression model some clear conclusions can be drawn about the characteristics of people with a particular response pattern. First let us examine the responses to the tyranny questions – scenarios 1 and 2. Table 6 presents the outcome of applying the model (3) to the cases where $\pi = \Pr(\text{pattern } k)$ where $k =$ AA, AB or BA; in each case we present the results for the standard list of explanatory variables and for an augmented model which incorporates the responses to the axioms of Progressive Transfer and Replication Invariance as factors that may be associated with the responses to the tyranny scenarios.

As far as the four types in Table 1 are concerned, respecting Progressive Transfers increases the probability of being of type AB. Violation of Replication Invariance reduces the probability that the person responds AA; it also increases the probability that the person responds BB.[28]

More right-wing political views increase the probability of a type BA response (not concerned about mob tyranny, concerned about individual tyranny) and decrease the probability of a type AB response; males are more likely to have a BA type of response pattern and less likely to be of AB type. Finally note that there is an ordering effect – putting scenario 2 first reduces the probability of an AB response and increases the probability of a BA response. This priming effect means that thinking about a non-aggregation scenario first pushes respondents in the non-aggregation direction, making them less prone to accept aggregation later and vice versa.

[27] As a robustness check we applied this model both in an untransformed version – where the xs are simply the raw values of the variables described above – and a transformed version – where the explanatory variables familyincome and prospects are replaced by exp(familyincome) and exp(prospects). We used this transformation because, instead of data recorded in monetary units (where it is common to take a log transformation), our data are on a scale of 1 to 7.

[28] Underlying these conclusions is the following result: if the subject endorses Progressive Transfers or Replication Invariance then he is more likely to respond A in scenario 1 (in the case of Progressive Transfers this is to be expected).

Now let us consider the "basic" distributional principles, respect for Progressive Transfers and for Replication Invariance, where π in (3) means "probability that response conforms to the principle." Table 8 shows that, once again, political views and sex of the respondent are important: being female or being more right wing is related to being more likely to reject the principle of progressive transfers (see the results from scenario 3): the female effect is in line with findings in other contexts (Amiel and Cowell 2002, 2007). Being female means that you are also more likely to reject Replication Invariance. The conclusions remain unchanged if we use the transformed version of the model; it is also clear that the other personal characteristics, version of the questionnaire, the length of time the person took over the responses and the sub-sample dummies play no role.

5.2 Reported thresholds – effects of background

We may also investigate the effect of background variables on the threshold income G (scenario 1, question 2) and the threshold number M (scenario 2, question 2). The principal results are summarised in Table 7. This reports the results of a simple loglinear regression against personal characteristics; again we do this for the basic set of explanatory variables and for the augmented model that also uses the responses to scenarios 3 and 4 as explanatory variables.[29]

We observe that family income, income prospect, sex, and political views are associated with reported thresholds G and M, whereas the responses to scenario 3 and 4 have no association with reported G and M. Higher family income, left-wing political views, and surprisingly, being a male, are factors associated with giving more priority to the poor in scenario 1, that is, assigning a lower value of G. In contrast, being male is associated with given less priority to the poor in scenario 2. In scenario 2, there is no significant associations with family income and political views, but higher income prospects are associated with giving less priority to the poor in these situations. Finally, we note that the ordering of scenarios also matter for

[29] As robustness checks we also did the following. (a) We tried using exp(familyincome) and exp(prospects) as explanatory variables rather than their untransformed counterparts – again this change in specification had no effect. (b) Using the same sub-sample of respondents we tried a simple linear regression of G and M: in this case only nhh1 was significant (in the G equation). (c) We also ran the equations on the full sample applying a Heckman regression to allow for non-response on question 2 where the person gave response B rather than A in question 1. This led to a set of coefficient estimates and P-values that were very similar to those reported in the simple regression of Table 7.

	Type AA		Type AB		Type BA	
version	0.0689	0.0672	-0.2326**	-0.2457**	0.2026*	0.2287*
	(-1.01)	(0.62)	(-2.14)	(-2.19)	(1.70)	(1.87)
pos	0.2244	0.2405	-0.0112	-0.0497	-0.0508	-0.0490
	(1.23)	(1.29)	(-0.06)	(-0.26)	(-0.24)	(-0.23)
nhh1	-0.0174	-0.0405	0.2463	0.1957	-0.0159	0.0673
	(-0.11)	(-0.26)	(1.50)	(1.17)	(-0.09)	(0.37)
nhh2	-0.0165	-0.0089	0.2571	0.1645	-0.0044	0.0778
	(-0.11)	(-0.06)	(1.58)	(0.98)	(-0.02)	(0.42)
sex	0.1319	0.0935	-0.1849*	-0.2124*	0.1694	0.1993
	(1.21)	(0.83)	(-1.66)	(-1.84)	(1.36)	(1.55)
age	-0.0030	-0.0028	0.0147	0.0174	-0.0354	-0.0437
	(-0.12)	(-0.11)	(0.59)	(0.70)	(-1.05)	(-1.26)
politicalviews	0.0434	0.0594	-0.1428***	-0.1283**	0.1070*	0.1126*
	(0.91)	(1.19)	(-2.92)	(-2.50)	(1.94)	(1.94)
familyincome	-0.0535	-0.0586	-0.0258	-0.0021	0.0360	0.0026
	(-0.98)	(-1.06)	(-0.45)	(-0.04)	(0.59)	(0.04)
prospects	0.0346	0.0085	-0.0875	-0.0905	0.0413	0.0341
	(0.49)	(0.12)	(-1.17)	(-1.18)	(0.52)	(0.42)
progressivetransfers		0.0039		0.2504**		-0.1160
		(0.04)		(2.19)		(-0.94)
replication		0.3279***		0.0740		-0.2176
		(2.74)		(0.59)		(-1.52)
_cons	-0.6972	-0.6709	0.3845	0.1055	-1.1975	-0.8335
	(-1.01)	(-0.95)	(0.55)	(0.15)	(-1.40)	(-0.94)

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%
version: 1 if scenarios 1 and 2 were in the reverse order, 0 otherwise.
pos: position in sample (small values = took longer to complete)
nhh1, nhh2: sub-sample dummies
age: in years
sex: 1 if reported male, 0 otherwise
pol: self-rated political views; seven-point scale from left (1) to right (7)
familyincome: self-rated income position of family looking back 10 years
prospects: prospective income position of self looking forward 10 years
progressivetransfers: 1 if in line with principle of progressive transfers, 0 otherwise
replication: 1 if in line with principle of replication, 0 otherwise

Table 6: Probit Results for Question 1 (scenarios 1 and 2) by types

	Threshold income, log(G)		Threshold number, log(M)	
	Basic model	Augmented model	Basic model	Augmented model
version	-0.6750**	-0.6166*	1.9204***	2.1633***
	(-2.04)	(-1.81)	(3.74)	(4.17)
pos	-0.0461	0.1041	-0.1204	0.0339
	(-0.08)	(0.18)	(-0.13)	(0.04)
nhh1	-1.0029*	-0.9830*	0.7365	0.8753
	(-1.93)	(-1.88)	(0.90)	(1.07)
nhh2	-1.2340**	-1.2929**	-0.1073	-0.0535
	(-2.40)	(-2.46)	(-0.13)	(-0.07)
sex	-0.6091*	-0.5889*	-2.2660***	-2.3302***
	(-1.79)	(-1.67)	(-4.18)	(-4.18)
age	0.0769	0.0829	0.0606	0.0758
	(0.94)	(1.00)	(0.40)	(0.50)
politicalviews	0.4323***	0.4162***	-0.0443	-0.0591
	(2.88)	(2.66)	(-0.19)	(-0.24)
familyincome	-0.4008**	-0.4117**	0.1919	0.1847
	(-2.15)	(-2.17)	(0.72)	(0.69)
prospects	0.2398	0.1347	-0.6647**	-0.7872**
	(0.93)	(0.51)	(-1.98)	(-2.34)
progressivetransfers		-0.0467		0.7766
		(-0.13)		(1.44)
replication		0.0762		0.7961
		(0.21)		(1.41)
_cons	4.5041*	4.9465**	7.6591**	7.1676*
	(1.90)	(2.00)	(2.00)	(1.86)
R^2	0.0679	0.0665	0.1372	0.1597

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%
Sample: those with a non-null response to question 2 in each scenario
Variables: as for Table 6

Table 7: Regression Results for Question 2 (scenarios 1 and 2)

	Progressive Transfers		Replication Invariance	
	untransformed	transformed	untransformed	transformed
version	-0.0202	-0.0092	-0.0100	-0.0009
	(-0.20)	(-0.09)	(-0.09)	(-0.01)
pos	0.0412	0.0498	-0.0408	-0.0199
	(0.23)	(0.28)	(-0.21)	(-0.10)
nhh1	0.0719	0.0457	0.0433	0.0310
	(0.46)	(0.30)	(0.27)	(0.19)
nhh2	0.1502	0.1306	-0.2211	-0.2328
	(0.98)	(0.86)	(-1.35)	(-1.43)
sex	0.1894*	0.2028*	0.1907	0.2163*
	(1.77)	(1.90)	(1.64)	(1.87)
age	-0.0027	-0.0013	-0.0115	-0.0071
	(-0.11)	(-0.06)	(-0.43)	(-0.27)
politicalviews	-0.2156***	-0.2158***	-0.0743	-0.0689
	(-4.55)	(-4.54)	(-1.48)	(-1.37)
familyincome	-0.0411	0.0000	-0.0273	-0.0001
	(-0.77)	(0.00)	(-0.48)	(-0.34)
prospects	-0.0043	-0.0002	0.1154	0.0002
	(-0.06)	(-0.68)	(1.51)	(0.92)
_cons	1.0210	0.8231	-0.5064	-0.2053
	(1.52)	(1.48)	(-0.69)	(-0.34)

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%
version: 1 if scenarios 1 and 2 were in the reverse order, 0 otherwise.
pos: position in sample (small values = took longer to complete)
nhh1, nhh2: sub-sample dummies
sex: 1 if reported male, 0 otherwise
pol: self-rated political views; seven-point scale from left (1) to right (7)
familyincome: self-rated income position of family looking back 10 years
prospects: prospective income position of self looking forward 10 years

Table 8: Probit Results for Scenario 3 (Progressive Transfers) and Scenario 4 (Replication Invariance)

threshold responses. A participant who is first presented with the individual tyranny scenario, assigns less priority to the poor in both scenarios.

6 Discussion: Comments by respondents

The comments provided by the participants may reveal something about what our respondents thought they were doing and something about why the tyranny puzzle emerges.

As Table 10 shows the breakdown across the four scenarios and across the three subgroups. 36 percent of the student-respondents were motivated to comment (231 out of 642) on at least one of the scenarios. It is clear that far fewer found something to say about Scenario 4 than the others.

	N	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Any**
LSE	118	42	42	35	19	56
NHH1	225	22	34	27	6	53
NHH2	299	78	68	61	35	122
All	*642*	*142*	*144*	*123*	*60*	*231*

Notes: N is the number of participants, Columns "Scenario 1",..., "Scenario 4" give number of participants offering a comment on each scenario. "Any" gives numbers commenting on any of the scenarios.

Table 9: Participation in comments

What predisposes respondents to provide a written comment?

At first glance it seems that being from the LSE (where 47% of the respondents commented) rather than NHH (where 33% commented) is an important factor. But this is to overlook the heterogeneity in the NHH combined sample. The proportion of the NHH2 sub-sample that commented (43%) is not significantly different from that of the LSE, but of course there is a big difference between the NHH1 proportion and either of the other subgroups. Both LSE and NHH2 are typically second-year students, so it may be that longer experience of university makes one more willing to comment. However, there is no significant difference in the overall mean age of commenters and non-commenters. In fact the only personal characteristic which does show up as important in understanding the difference between commenters and non-comments is the respondent's political views, which is not surprising since we saw in section 5 that political views were highly significant in terms of response pattern (those reporting as right-wing were more likely to

be more concerned about individual tyranny and less about mob-tyranny). We also find that the individual is more likely to comment if his or her political views are to the left (the proportion of those with **politicalviews**< 4 is significantly higher in the "commenters" sub-sample).

rank	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
1	Insignificance [**A**]	Efficiency [**A**]	Entitlement [**B**]	Efficiency [**B**]
2	Concern for poor [**A**]	Numbers [**A**]	Concern about equality [**A,B**]	Proportionality [**A**]
3	Utilitarian [**A**]	Concern for poor [**A,B**]	Fairness [**B**]	(Inflation)
4	(Concern about equality)	Concern about equality [**B**]	(Efficiency)	(Fairness)
5	(Fairness)	Utilitarian [**A,B**]	(Utilitarian)	
6	(Numbers)	Insignificance [**A**]	(Concern for poor)	
		Fairness [**B**]		

Notes: Rank 1,..,6 refer to rank of the comment category for each scenario by numbers of comments. Parentheses indicate cases where there were fewer than 10 comments in a particular category for a particular scenario. [A], [B] indicates whether comment type was principally associated with A or B response

Table 10: Category ranking of comments

What type of comments?

Of course, in all three sub-samples, there was considerable variation in the type of comment made: some provided an ethical or economic argument; some gave a reaction based on intuition; some just wanted to hedge their response to the scenario with a request for more information. Table 10 gives a snapshot view of the categories of comments, scenario by scenario. Where a particular comment type is strongly associated with a specific A or B answer within a scenario this has been indicated by an **[A]** or **[B]** label as appropriate; where a comment type was associated with both A and B answers the label **[A,B]** is used (for example "Concern about equality" can cut both ways: some respondents commented that inequality is good for incentives) .

The "Insignificance" category – top-ranked in Scenario 1 and quite low down for Scenario 2 and associated overwhelmingly with "A" answers – is a typical example of intuitive comments ("An income reduction of £1 is negligible, no matter how many are concerned."). Sometimes these intuitive comments hint at a utility basis for their reasoning but in general explicitly utilitarian arguments are quite low in the comment ranking ("The marginal

utility of such a very small increase in income to a person at subsistence level will be huge. On the other hand, marginal utility of £1 to £50,000 people income will be minimal."). The "Efficiency" comments – top-ranked in Scenarios 2 and 4 – typically have to do with concern about national income ("The distribution of income should maximize the society's total income") and about individual incentives and skills ("There will be no incentives to be better if everyone is equal without a reason"; "A redistribution of income can harm economy if the low income person is not as skilled at investing as the high income person") It is interesting that that the top-ranked category for Scenario 3 (the simple progressive transfer) is "Entitlement," which is typically expressed in comments such as "Those with high wages may have deserved the high wages - does not deserve to be deprived of it", "People get rewarded for their work", "There is no reason why they should give their money away." Unsurprisingly these comments are typical for persons at the right wing of the political spectrum (with **politicalviews**> 4**).**

However, one might be surprised by the fact that "Fairness" (or unfairness) does not feature higher in the category rankings. One reason for this is that sometimes the responses straddle more than one category, so that fairness concerns also enter some of the comments included in "Concern for poor" and "Concern about equality" (at one end of the political spectrum) and "Entitlement" (at the other end of the spectrum). Furthermore it is interesting to note that in scenarios 1 and 2 (mob and individual tyranny) the comments reveal concern for the welfare of the poor rather than concern for equality per se, whereas in scenario 3 the comments can largely be characterised as a simple dichotomy between the right-wing "Entitlement" view[30] and the more left-wing "Concern for equality." Fairness may also have been implicit in the comments of those who stated some version of a proportionality argument in commenting on scenario 4.

The "Numbers" category is the major example of an implicit request for more information. Typically this expressed the thought the person would need to know more precisely the numbers involved before committing to one or other of the propositions in the scenario.

Three lessons can be drawn from the written comments. First, the comments do not undermine the validity of the questions asked or the ability of the respondents to understand them. Second, in evaluating ethical propositions people may rely on simple intuition rather than the niceties of a

[30]For experimental studies on the role of entitlements see, for example Cappelen et al. (2007), Cappelen, Konow, Sørensen, and Tungodden (2013), Cappelen, Moene, Sørensen, and Tungodden (2013), Konow (2000).

formal welfare-economic argument; this pragmatic approach plays an important role in understanding the "A"-responses in Scenario 1. Third, some apparently basic principles – such as the principle of progressive transfers – are not accepted by respondents, either because they demand more contextual information, or because they see it as being in conflict with other basic principles such as that which we have characterised as "Entitlement".

7 Conclusion

We have shown that the tyranny puzzle represents a real dilemma for people in practical reasoning. Among the students in the present study, there was a majority against both individual tyranny *and* mob tyranny Indeed, in the four categories of possible responses in our "tyranny" scenarios, the "Anti-Anti" case is a clear winner. This fact is in the context of mainly coherent views from our respondents on all four principles (the two tyrannies plus progressive transfers and replication), backed by a large number of comments explaining their reasoning.

We have also shown that the population size does not have to be all that large to make this dilemma a practical problem. To summarize, whether there is a dilemma facing Anti-Anti people in practice depends on the size of the population under consideration, as we explained in section 2: think of this as the potential size of a reference group. We can compute the required critical size from the questionnaire responses and it is not necessarily astronomical: the reference group does not need to be all that large to present a problem. To summarise roughly, three quarters of our respondents would face a dilemma if the reference group were as huge as China; but (more surprisingly perhaps) about a quarter of our respondents would still face a dilemma if the reference group were as tiny as Luxembourg.

The respondents' backgrounds are associated with their responses to these dilemmas. In particular, we note that right-wingers and males are more willing to tolerate mob tyranny and less willing to tolerate individual tyranny.

References

Amiel, Y. and F. A. Cowell (1999). *Thinking about Inequality*. Cambridge: Cambridge University Press.

Amiel, Y. and F. A. Cowell (2002). Attitudes towards risk and inequality: A questionnaire-experimental approach. In F. Andersson and H. J.

Holm (Eds.), *Experimental Economics: Financial Markets, Auctions, and Decision Making*, Chapter 9, pp. 85–115. Dewenter: Kluwer.

Amiel, Y. and F. A. Cowell (2007). Social welfare and individual preferences under uncertainty: A questionnaire-experimental approach. *Research on Economic Inequality 14*, 345–362.

Amiel, Y., F. A. Cowell, and W. Gaertner (2009). To be or not to be involved: A questionnaire-experimental view on Harsanyi's utilitarian ethics. *Social Choice and Welfare 32*, 299–316.

Amiel, Y., F. A. Cowell, and W. Gaertner (2012). Distributional orderings: an approach with seven flavors. *Theory and Decision 73*, 381–399.

Andreoni, J. and J. Miller (2002). Giving according to GARP: An experimental test of the consistency of preferences for altruism. *Econometrica 70*, 737–753.

Asheim, G. (2010). Intergenerational equity. *Ann Rev Econ 2*, 197–222.

Bellemare, C., S. Kröger, and A. van Soest (2008). Measuring inequity aversion in a heterogeneous population using experimental decisions and subjective probabilities. *Econometrica 76*, 815–839.

Cappelen, A. W., A. D. Hole, E. Ø. Sørensen, and B. Tungodden (2007). The pluralism of fairness ideals: An experimental approach. *American Economic Review 97*, 818–827.

Cappelen, A. W., A. D. Hole, E. Ø. Sørensen, and B. Tungodden (2011). The importance of moral reflection and self-reported data in a dictator game with production. *Social Choice and Welfare 36*, 105–120.

Cappelen, A. W., J. Konow, E. Ø. Sørensen, and B. Tungodden (2013). Just luck: An experimental study of risk taking and fairness. *American Economic Review 103*, 1398–1413.

Cappelen, A. W., K. O. Moene, E. Ø. Sørensen, and B. Tungodden (2013). Needs versus entitlements - an international fairness experiment. *Journal of the European Economic Association 11*, 574–598.

Charness, G. and M. Rabin (2002). Understanding social preferences with simple tests. *Quarterly Journal of Economics 117*, 817–869.

Dalton, H. (1920). Measurement of the inequality of incomes. *The Economic Journal 30*, 348–361.

Engel, C. (2011). Dictator games: A meta study. *Experimental Economics 14*, 583–610.

Engelmann, D. and M. Strobel (2004). Inequality aversion, efficiency, and maximin preferences in simple distribution experiments. *The American Economic Review 94*, 857–869.

Fehr, E. and U. Fischbacher (2002). Why social preferences matter – the impact of non-selfish motives on competition, cooperation and incentives. *The Economic Journal 112*, C1–C33.

Fisman, R., S. Kariv, and D. Markovits (2007). Individual preferences for giving. *American Economic Review 97*, 1858–1876.

Fleurbaey, M. and B. Tungodden (2010). The tyranny of non-aggregation versus the tyranny of aggregation in social choices: A real dilemma. *Economic Theory 44*, 399–414.

Fleurbaey, M., B. Tungodden, and P. Vallentyne (2009). On the possibility of non-aggregative priority for the worst off. *Social Philosophy and Policy 26*, 258–285.

Frohlich, N., J. A. Oppenheimer, and C. Eavey (1987a). Choices of principles of distributive justice in experimental groups. *American Journal of Political Science 31*, 606–636.

Frohlich, N., J. A. Oppenheimer, and C. Eavey (1987b). Laboratory results on Rawls' principle of distributive justice. *British Journal of Political Science 17*, 1–21.

Gaertner, W. (1994). Distributive justice: Theoretical foundations and empirical findings. *European Economic Review 38*, 711–720.

Gaertner, W. and E. Schokkaert (2012). *Empirical Social Choice: Questionnaire-Experimental Studies on Distributive Justice*. Cambridge University Press.

Gaertner, W. and L. Schwettmann (2007). Equity, responsibility and the cultural dimension. *Economica 74*(296), 627–649.

Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, H. Gintis, and R. McElreath (2001). In search of homo economicus: Behavioral experiments in 15 small-scale societies. *The American Economic Review 91*, 73–78.

Konow, J. (2000). Fair shares: Accountability and cognitive dissonance in allocation decisions. *American Economic Review 90*, 1072–1091.

Pigou, A. C. (1912). *Wealth and Welfare*, Chapter 2, pp. 14–32. London: Macmillan.

Appendix 1: Proof

The following is the proof of the proposition in section 2.2.

Proof. Let N be such that $|N| = n$. For simplicity of notation, we assume $N = \{1, ..., n\}$.

Consider an allocation $x \in \mathbb{R}^n_+$ such that for all $i, j > 1$, $x_i = x_j$ and for all $j > 1$, $x_j = r + 1 > r > q = x_1 > 0$.

Let $y \in \mathbb{R}^n_+$ be such that:
- for all $i, j > 1$, $y_i = y_j$;
- for all $j > 1$, $y_j = x_j + \alpha' > r > q = x_1 > y_1 = x_1 - \beta' > 0$ (case $q > \beta'$);
- for all $j > 1$, $y_j = x_j + \alpha' > r > q = x_1 > y_1 = 0$ (case $q \leq \beta'$).

By Aggregation, $y \; R^N \; x$.

Let $m = \left[\frac{\alpha'+1}{\beta}\right]^+$ (the first integer that is at least as great as $\frac{\alpha'+1}{\beta}$) and $\gamma = \frac{\alpha'+1}{m}$. This guarantees that $\gamma \leq \beta$ and for all $j > 1$, $r \leq y_j - m\gamma = r + 1 + \alpha' - m\gamma \leq x_j = r + 1$. Let $\delta = (x_1 - y_1)/(m + 1)$ and $p = [\alpha/\delta]^+$.

We now consider the following sequence, where the first allocation is a p-replica of y. We assume for the moment that the population of this size is in the domain $\mathcal{N}$.

$$p * y = \left(\underbrace{y_1, \ldots, y_1}_{p}, \underbrace{(y_j, \ldots, y_j)_{j>1}}_{p} \right),$$

$$z^1 = \left(y_1 + p\delta, \underbrace{y_1, \ldots, y_1}_{p-1}, \underbrace{(y_j - \gamma, \ldots, y_j - \gamma)_{j>1}}_{p} \right),$$

$$w^1 = \left(\underbrace{y_1 + \delta, \ldots, y_1 + \delta}_{p}, \underbrace{(y_j - \gamma, \ldots, y_j - \gamma)_{j>1}}_{p} \right),$$

and for $t = 1, ..., m - 1$,

$$z^{t+1} = \left(y_1 + t\delta + p\delta, \underbrace{y_1 + t\delta, \ldots, y_1 + t\delta}_{p-1}, \underbrace{(y_j - (t+1)\gamma, \ldots, y_j - (t+1)\gamma)_{j>1}}_{p} \right),$$

$$w^{t+1} = \left(\underbrace{y_1 + (t+1)\delta, \ldots, y_1 + (t+1)\delta}_{p}, \underbrace{(y_j - (t+1)\gamma, \ldots, y_j - (t+1)\gamma)_{j>1}}_{p} \right).$$

By Non-Aggregation, $z^1\ R^{p*N}\ p*y$ and, for $t = 1, ..., m-1$, $z^{t+1}\ R^{p*N}\ w^t$. Observe that for all $j > 1$, $y_j - m\gamma > r$, so that in this sequence the best-off are always better-off than r, as requested for the application of Non-Aggregation. Similarly, $y_1 + m\delta < q$, meaning that the worst-off is always below q.

For every $t = 1, ..., m$, by applying Pigou-Dalton $p-1$ times (between the first individual and the next $p-1$ individuals), one has $w^t\ R^{p*N}\ z^t$.

By transitivity, it follows that $w^m\ R^{p*N}\ p*y$, where w^m is equal to:

$$w^m = \left(\underbrace{y_1 + m\delta, \ldots, y_1 + m\delta}_{p}, \underbrace{(y_j - m\gamma, \ldots, y_j - m\gamma)_{j>1}}_{p} \right).$$

One has $y_1 + m\delta < x_1$ and for all $j > 1$, $y_j - m\gamma < x_j$, so that by Weak Pareto, $p*x\ P^{p*N}\ w^m$. Hence, by transitivity, $p*x\ P^{p*N}\ p*y$. By Replication Invariance, $x\ P^N\ y$, which contradicts the supposition in the first part of this step of the proof.

The dimension of y is n. The value of p is no greater than

$$\begin{aligned}
\frac{\alpha}{\delta} + 1 &= \frac{\alpha\,(m+1)}{x_1 - y_1} + 1 \\
&\leq 1 + \frac{\alpha}{x_1 - y_1}\left(\frac{\alpha' + 1}{\beta} + 2\right) \\
&= 1 + \frac{\alpha}{\beta'}\left(\frac{\alpha' + 1}{\beta} + 2\right) \qquad (\text{case } q > \beta') \\
&= 1 + \frac{\alpha}{q}\left(\frac{\alpha' + 1}{\beta} + 2\right) \qquad (\text{case } q \leq \beta')
\end{aligned}$$

which implies that the possible size of a p-replica of y is at most n times this quantity. Therefore the above contradiction will occur if N contains all populations of that size or less. ■

Appendix 2: Questionnaire

The following is the standard version of the questionnaire used in this study. About half of the respondents received an alternate version that presented the second scenario before the first.

Questionnaire

Ethical views on the distribution of income

Thank you for participating in this survey. We are interested in *your opinion* on ethical issues related to the distribution of income in society. Your response will be most important for our research project, so we ask you carefully to consider the questions that we pose below. We are not looking for the "right" answers to the questions, so please feel free to express *your views* on these issues. The questionnaire is anonymous, so we will not at any point ask you to reveal your identity.

The questions are stated with reference to a society where the average annual income of an individual is £20,000 and the lowest annual income is £10,000, and where all individuals work equally hard and have the same needs. In this society, an annual income of £10,000 ensures a living standard slightly above the subsistence level, whereas an annual income of £20,000 ensures a decent living standard. In each of the scenarios we ask you to consider, there is an unforeseen event which happens this year. Its effects on people's living standards are limited to this year *only* and differ across income groups. So this means that in all the following years everybody's living standard are unaffected by this event.

Please note that this is not a test of logic. Each of the questions is a "stand alone", so it can be answered independently of any of the other questions.

Scenario 1:

- everyone with income over £50,000 experiences a £1 reduction in income;
- one person with income of £10,000 experiences an increase in income;
- no-one else is affected.

▪ Which of the following views do you agree with?

A: "if the gain for the person with £10,000 is sufficiently large, this is a good thing no matter how many people have incomes over £50,000" □

B: "even if the person with £10,000 gains a huge amount, this is not a good thing if there are very many people with incomes over £50,000" □

▪ If you selected **A**, how large must the gain be for the person with £10,000 to ensure that this is a good thing?

£1 □ £10 □ £50 □ £100 □ £500 □ £1,000 □ £5,000 □ £10,000 □ other (£_____)

▪ Please feel free to explain your answer: ……
……
……

Scenario 2:

- one person with income of £10,000 experiences a £1 reduction in income;
- all persons with income over £50,000 experience a £100 increase in income;
- no-one else is affected.

▪ Which of the following views do you agree with?

A: "if the number of persons with income over £50,000 is sufficiently large, this is a good thing" □

B: "even if the number of persons with income over £50,000 is very large, this is not a good thing" □

▪ If you selected **A**, how many people must have an income over £50,000 to ensure that this is a good thing?

1 □ 10 □ 50 □ 100 □ 500 □ 1,000 □ 10,000 □ 100,000 □ 1,000,000 □ other (_____)

▪ Please feel free to explain your answer: ……
……

Scenario 3:

- one person with income of £10,000 experiences an increase in income;
- one person with income of £50,000 experiences a corresponding decrease of exactly the same amount;
- no-one else is affected.

▪ Which of the following views do you agree with?

A: "this is a good thing, as long as the person who starts out with £10,000 does not end up richer than the person who starts out with £50,000" □

B: "even if the person who starts out with £10,000 does not end up richer than the person who starts out with £50,000, this is not necessarily a good thing" □

▪ Please feel free to explain your answer:
……

Scenario 4:

- everyone with income of £10,000 experience an increase in income;
- everyone with income of £50,000 experience a decrease in income;
- no-one else is affected.

▪ Which of the following views do you agree with?

A: "if this were a good thing, then it would also be a good thing if the number of persons at all income levels in society were doubled (i.e., a doubling of the number of persons with £10,000, £50,000, and so on)" □

B: "even if this were a good thing, it would not necessarily be a good thing if the number of persons at all income levels in society were doubled (i.e., a doubling of the number of persons with £10,000, £50,000, and so on)" □

▪ Please feel free to explain your answer:

……

Background information

- What is your age? _____ years
- What is your gender? Male□ Female□
- Are you a student? Y□ N□
- (For students) What is your field? _____
- (For employed non-students) What is your profession? _____

- How would you rate your political views? Please put a √ on this scale.

- "How would you rate your family's income ten years ago (relative to average income in the country where you lived then)?"

- "How would you rate your own income prospects ten years from now (relative to average income in the country where you plan to live)?"