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**Inequality Aversion, Self-Interest and
Oneness: A Ugandan
Lab-in-the-Field Experiment**

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Inequality Aversion, Self-Interest and Oneness: A Ugandan Lab-in-the-Field Experiment

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Abstract

Preferences relating to *inequality aversion*, *self-interest* and *oneness* (the closeness of connection to others) are incorporated in a structural model and estimated in order to explain prosocial behaviour. An incentivised lab-in-the-field experiment was run in Mbale, Uganda (n=156), with both general population and student samples. The experiment was a modified three-person dictator game, run on touch-screen tablets. Decision problems were repeated (54 rounds) to ensure individual-level preferences could be estimated; using the Dirichlet distribution to rationalise *noisy* behaviour. Two within-subject treatments varied if the identity of the ‘recipients’ was *anonymous* or *known*. Results find extensive heterogeneity in prosocial behaviour, which is accounted for through individual preference parameters. On average, there is a substantial regard for others with a preference for reducing inequality, rather than increasing efficiency. Oneness is found to have large and significant effects on giving; with distinctions between *self-other* and *between-other* trade-offs emerging.

Keywords: Distributional Preferences, Prosocial Behaviour, Experimental Economics, Social Distance, Inequality, Altruism, Social Welfare Function.

JEL Classification: C72, C91, D63, D64, I31.

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1 Introduction

Inequality in society is, in part, determined by the distributional preferences held by individuals. The heterogeneity of such preferences leads to differences in prosocial behaviour. When making distributional decisions, some prefer to allocate resources equally, while others give priority to themselves. Notions of efficiency are important for particular individuals, but of little concern to others. Yet, it is not only distributional preferences which determine prosocial behaviour; the ‘recipient’s’ identity is also an integral consideration. Particular individuals will maintain the same prosocial behaviour regardless of the identity of the ‘recipient’, while some will exhibit preferential treatment to those they are closely connected to.

Developed here is a utility function which incorporates *inequality aversion*, the trade-off between equality and efficiency, and *self-interest*, the degree to which the ‘self’ is weighted in relation to the ‘other’. Preferences parameters are introduced which reflect behavioural responses to changes in *oneness*, the closeness of connection to others. These parameters distinguish between how elastic *self-other* and *between-other* trade-offs are, to better explain the distributional effects that differential *oneness* can have. To account for ‘noise’ in decision making, the Dirichlet distribution is proposed as a random behavioural model. Together the proposed utility function and stochastic error model seek to explain individual behaviour, by accounting for heterogeneity in preferences and intuitively modelling ‘noise’ in decision making.

In order to observe individual behaviour, an incentivised lab-in-the-field experiment was run in Mbale, Uganda. The form of the experiment was a modified three-person dictator game, where participants distributed payoffs amongst themselves and two ‘others’. The sample (n=156) was made of two separate groups, general population (n=108) and students (n=48). Two within-subject treatments were administered over 54 rounds. In the *budget* treatment, the ‘others’ were anonymous and budget (stake-size) was varied. In the *oneness* treatment, anonymity was lifted as the identity of the ‘others’ was made known. Decisions were made on touch-screen tablets, using a Z-Tree interface (Fischbacher, 2007). Alongside the experiment, an in-depth survey was conducted to establish an extensive list of demographic characteristics.

This work is situated within the *distributional preferences* literature, within which exists a wide body of research.¹ Papers by Andreoni and Miller (2002) and Fisman, Kariv, and Markovits (2007), are most closely related; where modified dictator games are used to observe the prosocial behaviour of subjects. Both estimate preference parameters within CES utility functions; where the former uses two-person dictator games, and the latter extends the analysis to focus on individual preferences and include a three-person variant of the dictator game.

Several papers have incorporated *social distance* as an explanatory construct within distributional decision making. Leider et al. (2009) use an online field experiment, with real world social network data, to study prosocial behaviour. Using modified two-person dictator games, as in Andreoni and Miller (2002), they find that as social distance increases generosity decreases. Branas-Garza et al. (2010), Goeree et al. (2010), Ligon and Schechter (2012) and Binzel and D. Fehr (2013) reveal similar trends; where the former two use student samples, in a laboratory setting, and the latter two run lab-in-the-field experiments in rural Paraguay and Cairo, respectively.

¹Including: E. Fehr and Schmidt (1999); Bolton and Ockenfels (2000); Charness and Rabin (2002); Cox, Friedman, and Gjerstad (2007); Cappelen et al. (2007); Dolan and Tsuchiya (2009); Breitmoser (2013) and Jakiela (2013)

While the above predominantly establish social network data through named relationships (i.e. friend, friend-of-a-friend, stranger) an alternative is to characterise the closeness of relationship through ‘oneness’; a ‘measure of perceived self-other overlap’ (Cialdini et al., 1997). Gächter, Starmer, and Tufano (2015) adopt the oneness scale, from the psychology literature; which is calculated as the average of the ‘Inclusion of the Other in the Self’ (IOS) scale (A. Aron, E. Aron, and Smollan, 1992) and the ‘we-scale’ (Cialdini et al., 1997). The advantage of such a scale, is that it provides a numerical index of the closeness of connection; without delving into its determinants.

This paper seeks to contribute to the above literature; by proposing a CES utility function which incorporates *oneness levels*, to account for the explanatory power that social distance can have on individual decision making. By estimating preferences relating to *inequality aversion*, *self-interest* and *oneness*, the intricacies of their interactions are explored and individual level behaviour, observed from a lab-in-the-field experiment, is explained.

2 Experiment

2.1 Experimental Session

The general form of the experiment is a modified three-person ‘dictator’ game. ‘Dictators’ are given a budget, m , which they must distribute amongst three players. Player 1 denotes the *self*, while Player 2 and 3 are two *other* real participants (the ‘recipients’). The *allocations*, x_i , are chosen for each Player i ; where $i \in [1, 2, 3]$ and $\sum_i^3 x_i = m$. These *allocations* are then divided by the corresponding *divider*, $1/\pi_i$, to give the *payoff*, $\pi_i x_i$, to each Player i . The *dividers* change the relative prices of giving; meaning that equality-efficiency trade-offs need to be made.

Within the experiment there are multiple rounds, 54 in total. There are two treatments; the *budget* treatment and the *oneness* treatment, each with 27 rounds. In each round the participants are randomly assigned to a group of three. The dividers change every round; ensuring the relative price of giving to each player varies. Table 1 shows how the dividers change; only Rounds 1 to 9 are shown, but this pattern is repeated every nine rounds. Note that the dividers are such that each player has the same average divider, over all rounds, and that they each have the same number of 1’s, 2’s, 3’s and 4’s that the other has.

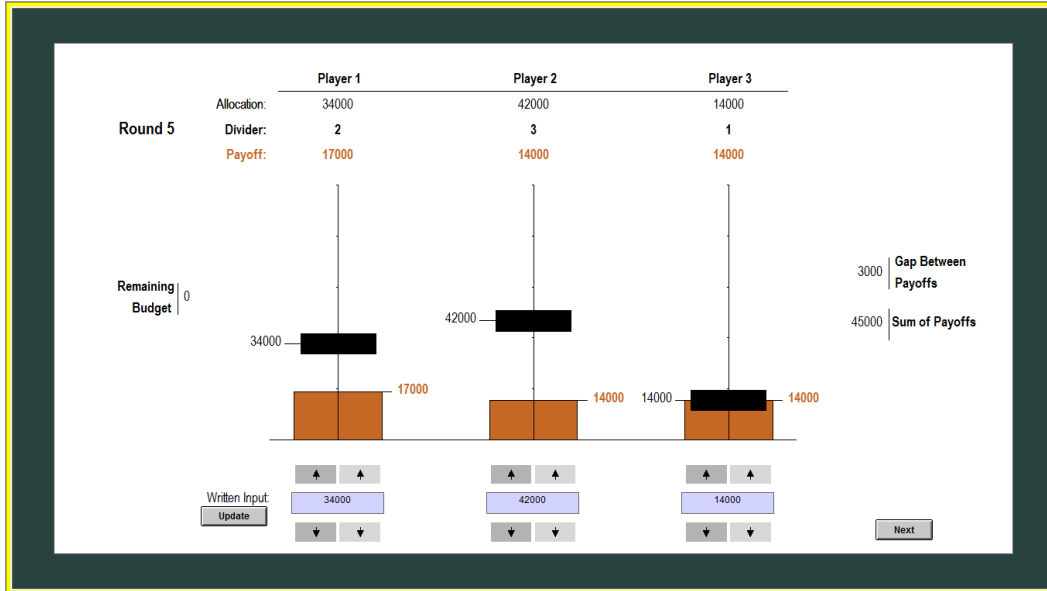
Table 1: Dividers per Round

	Dividers, $1/\pi_i$		
	Player 1	Player 2	Player 3
Round 1	1	1	1
Round 2	1	2	2
Round 3	2	1	1
Round 4	1	2	3
Round 5	2	3	1
Round 6	3	1	2
Round 7	1	2	4
Round 8	2	4	1
Round 9	4	1	2

Within each experimental session there are six participants. Each of the participants make individual decisions; *as if* they were the ‘dictator’. One individual’s decisions, from each group of three, is randomly selected (at the end of the experiment) to determine the payoffs of each member of their group. It is from *one randomly selected round* that all participants receive their payoffs, determined by the ‘dictators’ of that round. In this way, participants are *incentivised*; as each distributional decision they make has an equal chance of determining their payoff and the payoffs of two other individuals within the room. Importantly, each decision is entirely anonymous and without feedback; participants neither know the decisions of any other participants nor the identity of the ‘dictator’ in any round. This removes considerations of reputation and reciprocity, allowing for ‘pure’ altruism to be identified.

Participants make their decisions using a Z-Tree interface, on touch-screen tablets. They are given extensive instructions, including an interactive on-screen tutorial to enable them to use the tablets. A screenshot of the interface is shown in Figure 1. There are three players, Player 1, 2 and 3, amongst whom participants must make allocations, so that the remaining budget reaches zero. Each player has a divider (changing every round), which is used to calculate the payoff to that player. Allocations can be made by using: the slider, arrow keys and written input. The slider (the black bar) can be dragged to make allocations, the arrow keys tapped to make incremental changes (1 or 10), and the written input used to type exact amounts. Calculations of the payoffs are made automatically, and are shown by both the orange numbers and by the height of orange bars. The gap between payoffs, the highest payoff minus the lowest payoff, and the sum of payoffs (aptly named) are shown. All allocations, payoffs and budgets are in Ugandan shillings (*shs*).

Figure 1: Z-Tree Interface



2.1.1 Budget Treatment

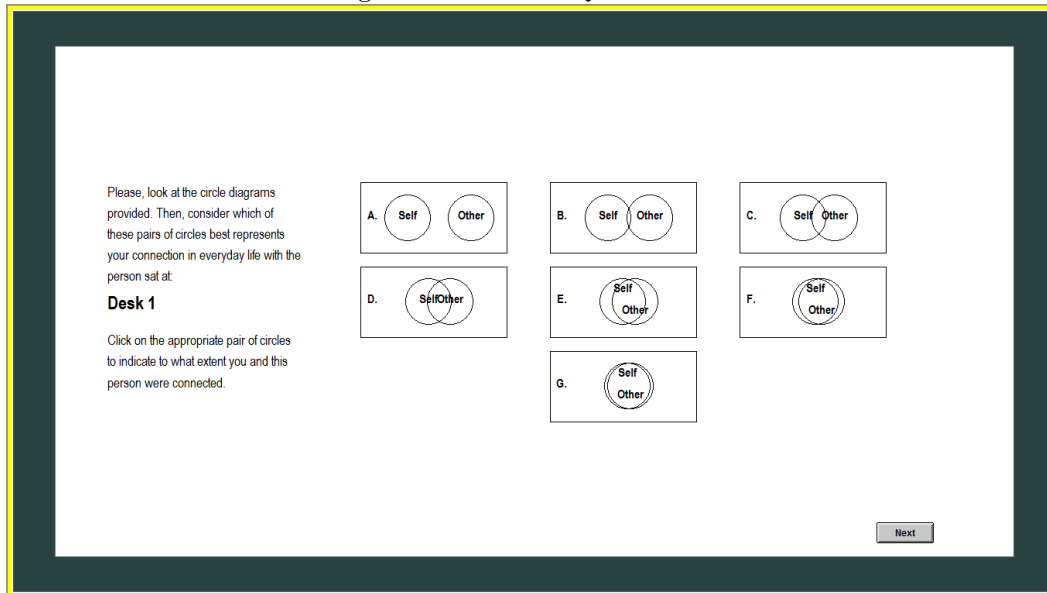
Within the budget treatment, the budget (or stake-size) is varied; *shs*30,000, *shs*60,000 or *shs*90,000. The order of this variation was random, however, in order to aid the understanding of the partic-

ipants it was varied only every nine rounds. For the first nine rounds there was a budget of A, B for the next nine and C the last. The order was random for each participant, but each participant had all of the budgets mentioned above. Importantly, within the budget treatment the other participants remained anonymous. Player 2 and 3 were randomly assigned each round, so while they were known to be selected from the other five participants, their identity was *not known*.

2.1.2 Oneness Treatment

The oneness treatment was preceded by the oneness questionnaire, based on the work by Gächter, Starmer, and Tufano (2015).² Oneness denotes the degree of closeness that the respondent (the ‘self’) feels towards another individual (the ‘other’); defined here as the connection the self feels in everyday life with the other. Figure 2 shows the computer interface with diagrams which represent the ‘oneness level’ - an integer scale between 1 (‘most distant’) and 7 (‘closest’). The simple tool effectively captures what a multitude of psychometric questions could do, in a quick, easy and accessible form. Participants were asked the question in Figure 2 for each of the other five participants in the room.

Figure 2: Oneness Questionnaire



Following this they began the oneness treatment. Unlike the budget treatment, here the budget was kept constant (at *shs*60,000). But crucially participants now knew the identity of Player 2 and Player 3, revealed by their desk number. They were encouraged to look around, every round, to see which players were in their group and only then to make their decisions. As before, the participants within each group randomly changed every round and decisions were made anonymously, as before.

²The interface is derived from A. Aron, E. Aron, and Smollan (1992), the IOS (‘Inclusion of the Other in the Self’) Scale. Gächter, Starmer, and Tufano (2015) introduce *oneness* to the economics literature constructing their ‘Oneness Index’ from both the IOS scale and the We-Scale (Cialdini et al., 1997). Due to language barriers, the We-Scale was dropped from our experimental design, so our ‘oneness level’ is measured only by the IOS scale. The words ‘in everyday life’ were used instead of ‘before the experiment’, as the cultural interpretation of ‘before the experiment’ would have meant the time immediately before the experiment, which was not desirable.

2.2 Survey Session

Alongside the experiment an in-depth survey was run. The surveys were implemented with the World Bank’s Survey Solutions, on Asus touchscreen tablets, and ran one-on-one; one enumerator-one participant. The survey was split into four sections: Individual Characteristics; Household Characteristics; Assets, Wealth and MPI; and Preferences. The survey allowed for the creation of variables which represented individual level characteristics; including the creation of a Wealth Index (WI) and Multidimensional Poverty Index (MPI).

2.3 Sampling and Sample

Two sampling frames were created in order to recruit participants for the experiments. The first, from a general population in the Mbale District, the second, from student records from the Ugandan Christian University (UCU), Mbale. Between experimental days there were two separate samples, the general population (n=102) and the student population (n=48).

Further details of the experimental design (A.1), sampling (A.2), sample characteristics (A.3), wealth and multidimensional poverty indices (A.4) alongside the script (A.5) and tutorial script (A.6), can be found in the Appendix.

3 Theoretical Model

3.1 Utility

The theoretical model proposed takes the form of a Constant Elasticity of Substitution (CES) function, similar to that of Andreoni and Miller (2002), where utility is equivalent to the Equally Distributed Equivalent (EDE).³ Utility is determined by payoffs, $x_i\pi_i$, distributed amongst the ‘self’ ($i = 1$) and ‘others’ ($i > 1$). Individuals striving to maximise utility would, then, make decisions based upon distributing allocations, x_i according to: their preferences, r , α , ϕ and ψ ; how *closely connected* they were to the others θ_i ; and the multiplication factors: π_i , the reciprocals of the dividers, $1/\pi_i$.

Our utility function is, then:

$$U_1 = \left(\sum_{i=1}^N (\omega_i (\pi_i x_i)^{-r}) \right)^{-\frac{1}{r}} \quad (1)$$

Where:

$$\omega_1 = \frac{\alpha}{\alpha + \frac{1-\alpha}{n} \sum_{j=2}^N \theta_j^\phi}, \quad \omega_{i \neq 1} = \frac{\theta_i^\psi}{\sum_{j=2}^N \theta_j^\psi} (1 - \omega_1)$$

Self-interest is denoted by α , where $0 \leq \alpha \leq 1$, and can be thought of as the extent to which the individual weights *themselves*, in relation to *others*. Where n is the number of *others* (and

³The EDE represents the mean level of payoffs, if equally distributed, which would ensure the individual was indifferent between that and the current distribution of payoffs (Atkinson, 1970). It provides a meaningful ranking of alternative distributions of payoffs (or income) and is, as such, a Social Welfare Function.

$N = n + 1$) the weight to each other is denoted by $(1 - \alpha)/n$. If $\alpha = 1$ (and therefore $1 - \alpha = 0$) individuals are ‘egoists’, whose utility is only dependant upon their own payoff. When α decreases more weight is put upon others; where $\alpha = 1/N$ reflects equal weighting of themselves and others.

Inequality aversion is represented by r , where $-1 \leq r \leq \infty$ and $r \neq 0$, and can be interpreted as the trade-off individuals are willing to make between *efficiency* and *equality*. When $r = -1$ preferences reflect a concern for *efficiency*, or ‘Utilitarianism’, where utility is determined by summing (weighted) payoffs. As r increases less concern is given to *efficiency*. ‘Cobb-Douglas’ preferences are represented when $r \rightarrow 0$; which implies that optimal allocations reflect the proportions set by ω_i . As r increases more weight is placed upon the payoff of the worst-off, ‘Weighted Prioritarianism’ (Parfit, 1997), until $r = \infty$ which represents ‘Maximin’ preferences, where only increases to the worst-off increase utility (Rawls, 1999).

The closeness of connection to others is characterised by the oneness levels denoted by θ_i , for each respective i .⁴ These levels are bounded between 1 (‘most distant’) and 7 (‘closest’). The inclusion of oneness levels, within the functional form, allows for two additional properties: (A) in general, as connectedness to the others increases, *less* weight is given to Player 1; (B) the greater the connectedness to Player 2, relative to Player 3, the *more* weight is given to Player 2, relative to Player 3, and vice versa. The parameters ϕ and ψ are the *oneness elasticities*; determining the responsiveness of the individual weights, ω_i , to changes in oneness levels, where $\phi, \psi \geq 0$. The *self-other oneness elasticity*, ϕ , determines the responsiveness of (A), while the *between-others oneness elasticity*, ψ , determines that of (B). The higher ϕ the greater the willingness to trade-off between the self and others, as oneness varies; the higher ψ the greater the willingness to substitute between others as their relative oneness levels change.

The oneness elasticities, ϕ and ψ , allow distributional decisions to be affected by how closely connected to the others the individual is. Self-interest, α , represents the weight the individual gives to themselves, when they have the least possible connection to the others. The higher ϕ and ψ the greater the weights deviate from α when oneness levels increase. Indeed, when $\theta_2 = \theta_3 = 1$ or $\phi = \psi = 0$, then the weights ω_i are determined solely by α .

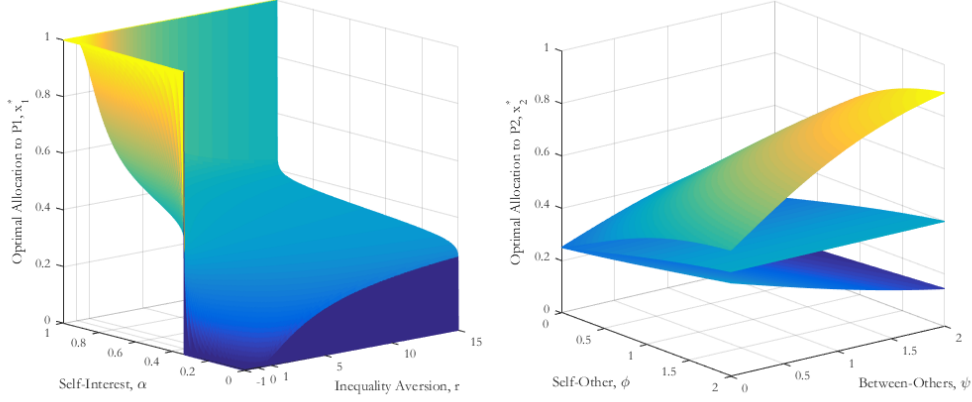
Given the above utility function and the budget constraint $m = \sum_{i=1}^N x_i$, where m is the budget, the following optimal allocations (which maximise utility) can be obtained, $\forall i$:

$$x_i^* = \frac{m}{1 + \sum_{j \neq i}^N \left(\frac{\pi_i}{\pi_j} \left(\frac{\omega_j \pi_j}{\omega_i \pi_i} \right)^{\frac{1}{1+r}} \right)} \quad (2)$$

Figure 3 illustrates how the optimal allocations change due to different preferences; both are surface plots where the height denotes an optimal allocation for a set of preference parameters. The left panel plots x_1^* for differing α and r values; setting $\theta_2 = \theta_3 = 1$, $\pi = [1, 1, 1]$ and $m = 1$. As α increases, x_1^* increases, until $\alpha = 1$ where individuals take all for themselves. As r increases, x_1^* approaches equal sharing, while as $r \rightarrow -1$ efficiency motivates allocations to reflect the weights according to α .

⁴In the Budget treatment, where the identity of each player is unknown, θ_i is calculated as the ‘expected oneness level’. An alternative function could model ‘expected utility’ rather than ‘expected oneness’, but due to reasons of tractability of the model the latter was assumed. Sensitivity analysis in Appendix A.7, compares parameter estimations using data from all 54 rounds and only the 27 rounds of the *oneness* treatment (to circumvent this assumption).

Figure 3: Optimal Allocations to P1 and P2: r, α, ϕ and ψ



To illustrate the effect of the *oneness elasticities* the right panel shows how x_2^* differs due to ϕ and ψ . Three different oneness levels are represented by the three surfaces; in order from highest to lowest $(\theta_2, \theta_3) = (7, 2), (2, 2)$ and $(1, 2)$. Constant throughout, is: $\alpha = 0.5, r \approx 0, \pi = [1, 1, 1]$ and $m = 1$. The surfaces intersect at $x_2^* = 0.25$, when $\phi = \psi = 0$, but as ϕ, ψ increase they diverge due to the different oneness levels. For the highest surface, when $\theta_2 = 7$ and $\theta_3 = 2$, x_2^* increases as ϕ and ψ increase; as the oneness level is higher for P2 the rate of increase is high. For the middle surface, oneness levels are equal and both greater than 1 ($\theta_2 = \theta_3 = 2$); therefore, increases in ψ have no effect on x_2^* , as no between-other substitution occurs, however, as ϕ increases so does x_2^* , as trade-offs are made between the self and others. The lowest surface, when $\theta_2 = 1$ and $\theta_3 = 2$, shows a decrease to x_2^* as ϕ, ψ increase; due to an increase in ω_3 relative to ω_2 .

3.2 Dirichlet Error Modelling

While the above utility model provides precise *optimal* allocations, x_i^* , for a particular decision problem and preference set, participants are assumed to make ‘error’ when calculating, or choosing, these allocations. Instead, we assume they draw their *actual* allocations, x_i , from the Dirichlet distribution (Dirichlet, 1839); where the expected values, $E[X_i]$, equal the *optimal* allocations, x_i^* .

This is an extension of work done by Hey and Panaccione (2011) and Hey and Pace (2014) where the Beta distribution is used for similarly bounded decision problems, for ambiguous and risky decisions. The Dirichlet distribution is a multinomial Beta distribution, allowing for N variables, which here correspond to individual allocations (i.e. x_1, x_2, \dots, x_N), where $x_i \in (0, 1)$ and $\sum_{i=1}^N x_i = 1$. The below formulates the Dirichlet distribution as a random behavioural model.

The following assumptions are made: (1) $E[X_i] = x_i^*$, and (2) $Var(X_i) = \frac{(x_i^*(x_0^* - x_i^*))}{s}$, therefore:

$$E[X_i] = \frac{a_i}{a_0} = x_i^* \quad (3)$$

$$Var(X_i) = \frac{(a_i(a_0 - a_i))}{(a_0^2(a_0 + 1))} = \frac{(x_i^*(x_0^* - x_i^*))}{s} \quad (4)$$

Where:

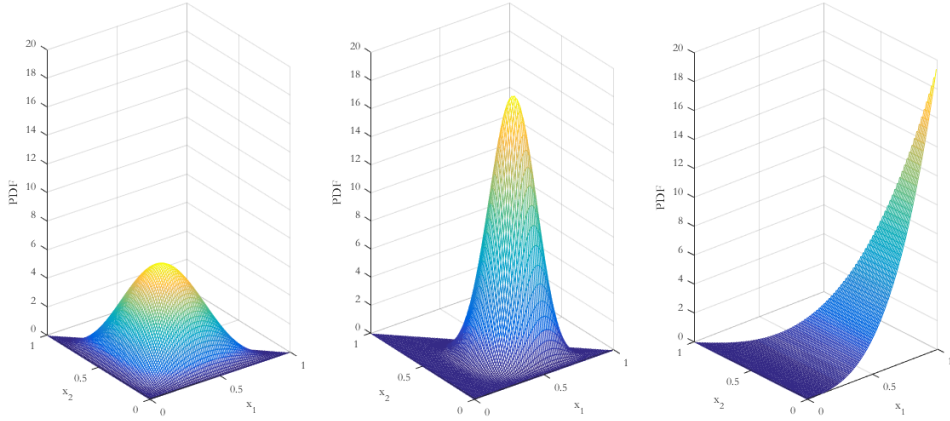
$$a_0 = \sum_{i=1}^N a_i, \quad x_0^* = \sum_{i=1}^N x_i^*$$

It follows that, $\forall i$:

$$x_i^*(s-1) = a_i \quad (5)$$

The a_i 's determine the shape of the Dirichlet probability density function (*pdf*) and represent the weight given to a particular i . Precision, or how *noisy* decisions are, is represented by s . Note that, the higher the value of s , and therefore the higher α_0 , the lower the variance will be. To illustrate the above, Figure 4 shows the *pdf*'s of alternative Dirichlet distributions, where $N = 3$ and $x_3 = 1 - x_1 - x_2$. The left shows an imprecise individual, $s = 10$, who aims to allocate equally $E[X] = [0.33, 0.33, 0.33]$, with $A = [3, 3, 3]$. Second, with $A = [10, 6, 6]$, an individual allocating slightly more to themselves, $E[X] = [0.45, 0.27, 0.27]$, with a greater deal of precision, $s = 23$. Third, with $A = [4, 1, 1]$ more self-interested preferences, here $E[X] = [0.67, 0.17, 0.17]$, can be represented; with a mode where $x_1 \rightarrow 1$ (here precision is low ($s = 7$) but precision can be increased). The flexibility of the Dirichlet distribution is a useful property, and the above derivations allow for easily interpretable parameters to be estimated.

Figure 4: Dirichlet Distribution: Probability Density Function



The preference parameters: α, r, ϕ, ψ and s ; are estimated, for each individual, through maximising the following log-likelihood function. The preference parameters determine the optimal allocations, x_{it}^* , and consequently the shape parameters, a_{it} , in each round $t \in T$. The multiple integral of the *pdf*, determined by a_{it} , is taken over the n-dimensional ‘rounding’ interval V_t . V_t is determined by the *observed* decisions, x_{it} ; where the ‘rounding’ interval, around the *observed* decision, is necessary as decisions are not strictly continuous (only to the nearest *shs*). Estimated parameters are those which maximise the log-likelihood function, hence are the ‘most likely’ fit for the observed data.

$$\sum_{t=1}^T \log \left(\int \cdots \int_{V_t} \left(\frac{1}{B(a_{0t})} \prod_{i=1}^N \ddot{x}_i^{a_{it}-1} \right) d\ddot{x}_1 \dots d\ddot{x}_n \right) \quad (6)$$

Where:

$$B(a_{0t}) = \frac{\prod_{i=1}^N \Gamma(a_{it})}{\Gamma\left(\sum_{i=1}^N a_{it}\right)}, \quad \ddot{x}_N = 1 - \sum_{i=1}^n \ddot{x}_i,$$

$$V_t = \left\{ (\ddot{x}_{1t}, \dots, \ddot{x}_{nt}) \in \mathbf{R}^n : x_{it} - \frac{0.5}{m} \leq \ddot{x}_{it} \leq x_{it} + \frac{0.5}{m}, \forall i \in [1, n] \right\}$$

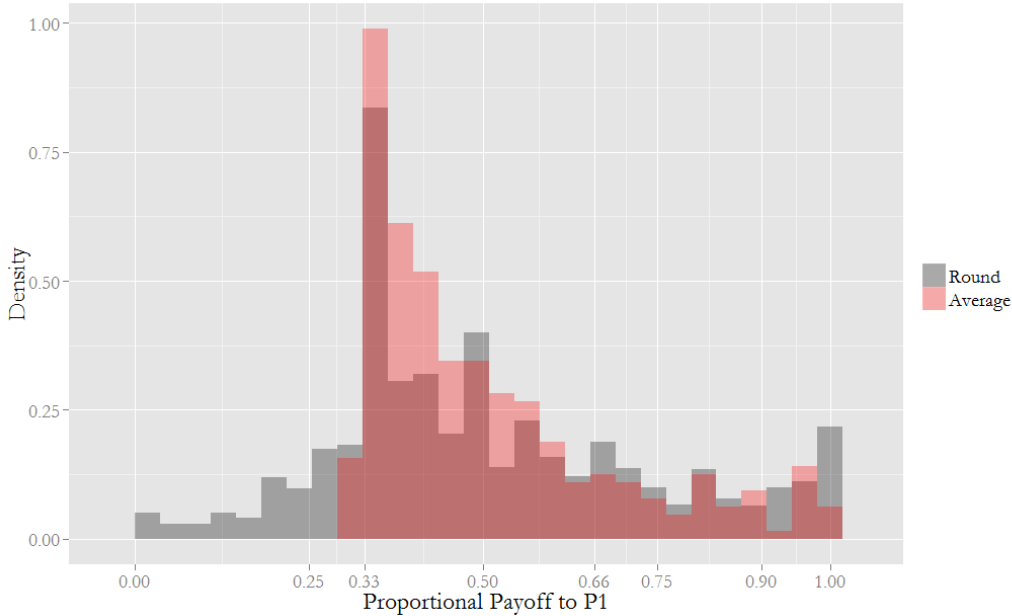
The multiple integral is reduced to n dimensions (hence $\ddot{x}_N = 1 - \sum_{i=1}^n \ddot{x}_i$) as $\sum_{i=1}^N x_i = 1$. This ensures the above condition is met and computational demands are lowered. Due to the flexibility of the Dirichlet distribution, if $a_i < 1$, $\forall i$ the PDF is no longer unimodal, leading to singularity at the bounds. A penalty function is used when $a_i < 1$ to ensure parameter estimates exclude this possibility. For sample parameter estimates, the log-likelihood contributions for the decisions of every individual within that sample are summed.

4 Results

4.1 Proportional Payoffs

The Proportional Payoff to P1 (PP to P1) is the share of payoffs given to Player 1 in relation to the total payoffs ($\pi_1 x_1 / (\sum_{i=1}^N \pi_i x_i)$). Figure 5 illustrates the distribution of observed PP to P1; split into per *Round* decisions ($n = 8,046$) and the individual treatment *Average*, the mean over the 27 rounds of each treatment ($n = 298$). The ‘grand’ mean is 0.5045; on average participants gave 50.45% of the payoffs to themselves. The percentage of the sample who distributed 0.33 to themselves (to the nearest 2d.p.) was 13.57% and 5.03%, for the round and average respectively. While there were only 3.58% and 0.34%, respectively, who took all payoffs for themselves.

Figure 5: Proportional Payoff to Player 1: Per Round and Average



To explain the variation in the PP to P1 (per round), explanatory variables for experimental effects and demographic characteristics are used within a random effects model (with robust standard errors); the results of which are shown in Table 2. Observations in the oneness treatment, where others are *known*, are 2.9 pp higher than in the budget treatment, where others are *anonymous*. Partaking in experiment in the PM session rather than the AM session has no significant effect, neither does the round number of the decision, nor the presence of a foreign enumerator in the tutorial session. Getting more questions correct in the tutorial has no significant effect and there are no significant differences between the general population and the student samples. The relative divider ($\pi_i/(\sum_{j=1}^3 \pi_j)$) is included to account for changes in the relative price of giving; a more in depth analysis on the effect of the dividers on allocations is in Section 4.1.4.

Although extensive demographic data has been obtained the PP to P1 is not significantly effected by *any* of the included demographic characteristics, with the exception of the religious activity. Those who had participated in more ‘religious activity’ in the previous 30 days were more generous, 0.38 pp less to themselves per activity. From the results, neither the gender, attainment of a higher education degree, the household size, belonging to the Bagisu tribe, being Christian, the level of wealth nor extended MPI significantly affect the responses. Age also has no significant effects, but is dropped due to missing data. The explanatory variables in Table 2, bar the first, are included as controls in all following random effects models; as the effects of some controls become significant in particular models they are included to reduce potentially confounding effects.

Table 2: Random Effects Model: Proportional Payoffs to P1

	(1)	
	PP to P1 Coef.	Std. err.
Experiment Effects		
- Treatment Dummy	0.0290***	(0.0094)
- Round Number	0.0004	(0.0003)
- PM Session Dummy	0.0054	(0.0300)
- Foreign Enumerator Dummy	-0.0573	(0.0378)
- Correct Questions	-0.0242	(0.0390)
- Student Dummy	-0.0221	(0.0367)
- Relative Divider	-0.4403***	(0.0341)
Demographics		
- Gender	0.0051	(0.0259)
- Higher Education Dummy	0.0353	(0.0335)
- Household Size	0.0087	(0.0075)
- Religion Dummy	0.0150	(0.0411)
- Religious Participation	-0.0038**	(0.0016)
- Tribe Dummy	-0.0333	(0.0287)
- Wealth Index	0.1036	(0.1292)
- EMPI Index	0.0658	(0.1872)
Constant	0.5615***	(0.1322)
N	149	
Observations	8046	
R-squared	0.1323	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.1.1 Budget Treatment

Within the budget treatment the effects of a change in the budget upon behaviour were tested. Three budgets - *shs*30,000, *shs*60,000 and *shs*90,000 - were varied, randomly, between rounds for each participant. These budgets were chosen as they represented substantial increases in the amount of wages; approximately two, four and six times the median daily wage of the participants, respectively. The mean PP to P1 was 0.4813, 0.4934 and 0.4953, for the three respective budgets. As the size of the budget is increased, participants are, on average, allocating relatively more to themselves and less to the others. These differences are, however, only significant ($p < 0.1$) between the budgets of *shs*30,000 and *shs*90,000, there is no significant difference between *shs*60,000 and the others.

4.1.2 Oneness Treatment

Within the oneness treatment each of the others were *known*, identified by their desk number. Before the session the oneness questionnaire was conducted to determine the oneness levels between the participant and the other five people in the room. Table 3 shows the descriptive statistics for the oneness levels, where 1 is the least connected, and 7 the most. Just under half, 49.3%, of responses show that participants consider the others to be the least connected, with the remaining responses showing some degree of connection. The mean oneness levels are, 2.15, 2.03 and 2.11 for the general, student and total samples, respectively. While these samples are not statistically different (10% level), there is a higher proportion of ‘most connected’ individuals in the general sample.

Table 3: Oneness Levels

	Sample					
	General		Student		Total	
	No.	%	No.	%	No.	%
Oneness Level						
1 - Least Connected	263	52.4%	102	42.9%	365	49.3%
2	109	21.7%	71	29.8%	180	24.3%
3	45	9.0%	32	13.4%	77	10.4%
4	25	5.0%	15	6.3%	40	5.4%
5	20	4.0%	11	4.6%	31	4.2%
6	13	2.6%	5	2.1%	18	2.4%
7 - Most Connected	27	5.4%	2	0.8%	29	3.9%
Total	606	100.0%	288	100.0%	894	100.0%

Using oneness levels as explanatory variables, the effect of the closeness of connection on distributional decisions can be tested. Table 4 shows the effects of the oneness level on the distribution of payoffs amongst P1, P2 and P3. The results show that when participants are more connected to the other players they sacrifice their own payoffs in order to give more to that individual. Each increase of the oneness level decreases the PP to P1 by 1.23*pp* and 1.28*pp*, for P2 and P3 respectively. A change in the oneness level of Player 2, from the least to the most connected, would result in a 7.39*pp* decrease in the PP to P1, and a 7.67*pp* decrease, if it were Player 3. If the closeness to both P2 and P3 changed, as such, there would be a 15.06*pp* decrease.

Table 4: Random Effects Model: Proportional Payoffs to P1, P2 and P3

	(1) PP to P1		(2) PP to P2		(3) PP to P3	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Oneness Level						
- Player 2, θ_2	-0.0123***	(0.0021)	0.0162***	(0.0021)	-0.0042***	(0.0013)
- Player 3, θ_3	-0.0128***	(0.0022)	0.0004	(0.0014)	0.0123***	(0.0023)
Constant	0.5746***	(0.1409)	0.3802***	(0.0703)	0.3872***	(0.0721)
N	149		149		149	
Observations	3969		3969		3969	
R-squared	0.1394		0.1347		0.1372	
Controls	YES		YES		YES	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Similar results (in the opposite direction) can be seen for PP to P2, an increase of 1.62ppt, and for PP to P3, an increase of 1.23pp, for an increase in their respective oneness levels. The results are, however, asymmetric when considering the oneness level of the *alternative other* (i.e. the oneness level of P3 when considering the PP to P2 and vice versa). When distributing to P3, if the oneness level of P2 is higher, there is a significant negative effect. Yet, there is no significant effect on the PP to P2, when P3's oneness level is increased.

4.1.3 Cluster Analysis

In order to identify *differential* effects amongst those in the sample, clusters of individuals can be classified into *types*. A finite mixture model has been run to determine the optimal clusters of responses. The PP to P1, averaged over all rounds and both treatments, has been used to denote decisions. The analysis reveals three *types*, shown in Figure 6, denoted as A, B and C. From the clusters we find: mixing proportions of 0.4096, 0.4885 and 0.1019; means of 0.3748, 0.5330 and 0.8893; and variances of 0.0012, 0.0098 and 0.0057 for A, B and C, respectively. In other words, a group of 41% of the sample who share payoffs roughly equally, 49% who weight themselves somewhat higher than others, and the remaining 10% who distribute the majority to themselves.

Table 5 models the Proportional Payoff to Player j (PP to P j), separately for each *type*; where $j \neq 1$. Pooling the data allows for the oneness level for Player j (θ_j) and Player k (θ_k), to be used as explanatory variables, where $j \neq 1$ and $k \neq 1, j$. The results show *differential* effects between types. An increase in θ_j , increases the PP to P j by (0.44pp), (1.81pp) and (2.19pp), for Type A, B and C, respectively. An increase in θ_k , however, only significantly decreases the PP to P j for Type A (0.44pp) and Type B (0.25pp).

This implies that those who share most equally, Type A, alter distributional giving by substituting between others, but are not willing to sacrifice their own payoffs as their connection to others increases. Type C individuals, on the other hand, are not, on average, willing to trade-off between others, but sacrifice their own payoffs in order to increase the payoffs to those they are more closely connected to. Type B lies in between the two, willing to substitute payoffs between themselves and others and between others, but to a lesser magnitude for the latter. To reinforce these observations Table 5 shows the effects of increases to θ_2 and θ_3 on the PP to P1. Type A individuals do not, on

Figure 6: Clustered Proportional Payoff to Player 1

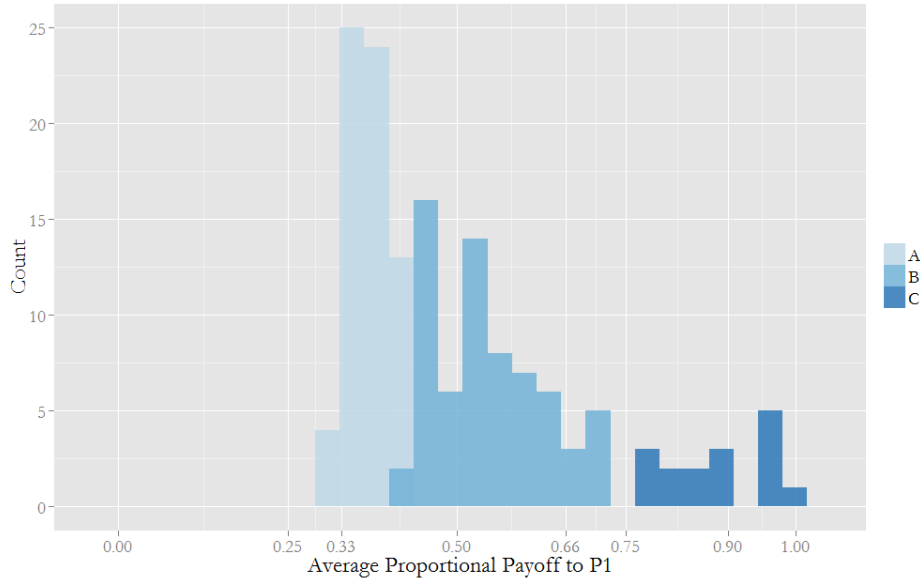


Table 5: Random Effects Model: Proportional Payoff to Others, Dependent Upon Cluster

	(1) Type A		(2) Type B		(3) Type C	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Oneness Level						
- Player j, θ_j	0.0044***	(0.0013)	0.0181***	(0.0030)	0.0219***	(0.0059)
- Player k, θ_k	-0.0044**	(0.0017)	-0.0025*	(0.0014)	0.0024	(0.0018)
Player 3 Dummy	-0.0017	(0.0039)	-0.0065	(0.0046)	-0.0050	(0.0040)
Constant	0.4239***	(0.0300)	0.3182***	(0.0634)	0.0402**	(0.0181)
N	66		67		16	
Observations	3470		3604		864	
R-squared	0.1390		0.1766		0.3379	
Controls	YES		YES		YES	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

average, significantly change the payoffs to themselves, while Type B do significantly reduce their own proportional payoffs, and Type C does so to an even greater magnitude.

4.1.4 Proportional Allocations

To identify the effects of the dividers on decision making, the proportional allocations ($x_i / \sum_{j=1}^N x_j$) are used, rather than the proportional payoffs, as the dividers constitute part of the latter's calculation. Table 7 shows how the proportional allocations, change in relation to an increase in the dividers; the inverse of which can be interpreted as an increase in the price of giving. An increase of each respective divider leads to an increase in the proportional allocation of that respective player; 4.59pp, 4.71pp and 4.59pp. The opposite is true for the opposing dividers, for instance an increase

Table 6: Random Effects Model: Proportional Payoffs to P1, Dependent Upon Cluster

	(1)		(2)		(3)	
	Type A		Type B		Type C	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Oneness Level						
- Player 2, θ_2	-0.0002	(0.0025)	-0.0162***	(0.0029)	-0.0241***	(0.0045)
- Player 3, θ_3	-0.0027	(0.0022)	-0.0150***	(0.0033)	-0.0285***	(0.0069)
Constant	0.4597***	(0.0544)	0.9464***	(0.1436)	1.0939***	(0.0525)
N	62		58		16	
Observations	1640		1559		432	
R-squared	0.1724		0.2266		0.4425	
Controls	YES		YES		YES	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

of the dividers for P2 and P3 lead to a decrease in the proportional allocations to P1 by 3.31pp and 2.53pp, respectively. These results hold, and are highly significant ($p < 0.01$), for each divider in relation to each proportional allocation. The results show that participants are, on average, more concerned with distributing more equally, than maximising the total surplus. When it is relatively more efficient to give to a particular player, less is given, so those efficiency gains can be redistributed.

Table 7: Proportional Allocation to P1, P2 and P3; Random Effects

	(1)		(2)		(3)	
	PA to P1		PA to P2		PA to P3	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
- Divider for P1	0.0459***	(0.0050)	-0.0205***	(0.0032)	-0.0254***	(0.0022)
- Divider for P2	-0.0331***	(0.0025)	0.0471***	(0.0041)	-0.0140***	(0.0029)
- Divider for P3	-0.0253***	(0.0029)	-0.0206***	(0.0017)	0.0459***	(0.0039)
Constant	0.4318***	(0.1353)	0.2843***	(0.0666)	0.2839***	(0.0699)
N	149		149		149	
Observations	8046		8046		8046	
R-squared	0.1389		0.1735		0.1698	
Controls	YES		YES		YES	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2 Aggregate Preference Parameters

Preference parameters can be estimated on a sample level; to identify an aggregate preference of the society or group. These parameter values are the ‘most likely’ given the allocations made by all individuals within the sample. The sample estimates show $r = 0.0191$ and $\alpha = 0.5094$, reflecting a *weakly* ‘Weighted Prioritarian’, allocating just under half to themselves, and distributing the remainder between other two. The oneness elasticities, $\phi = 0.1552$ and $\psi = 0.0001$, reflect a greater willingness to trade-off between the self and others, as oneness increases; but less willingness

to substitute between others, as the relative oneness between them changes. A low precision parameter, $s = 5.1152$, reflects the ‘noise’ within decisions, which reflects heterogeneity in decisions.

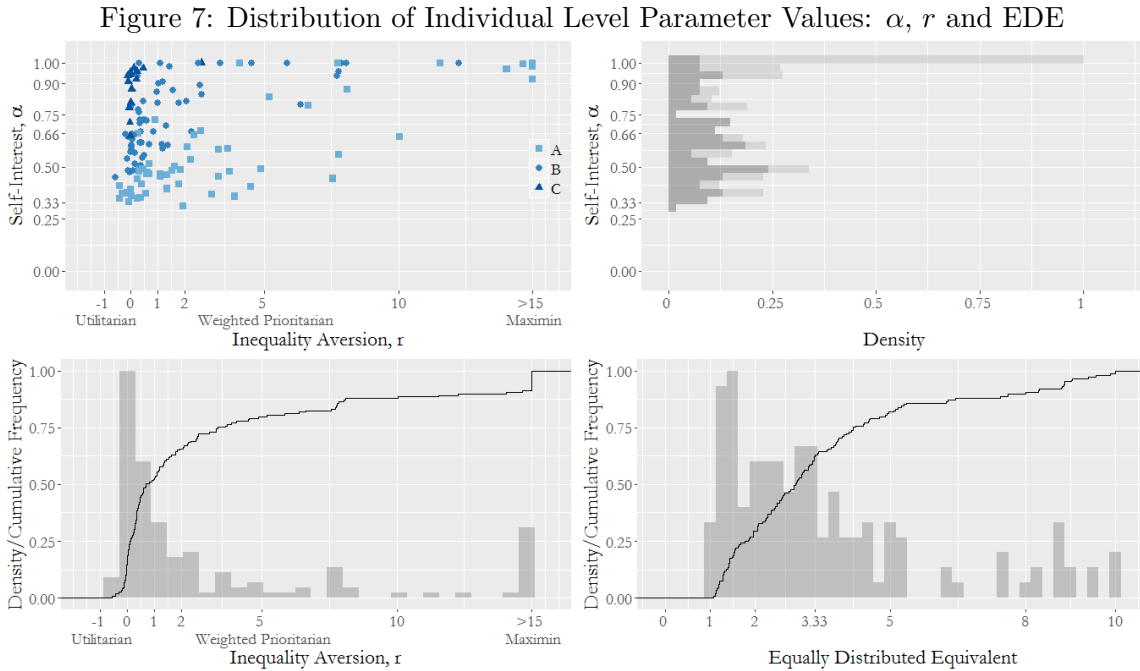
4.3 Individual Preference Parameters

While the above analysis delves into aggregate trends, it reveals little of the decisions made by individuals. To address this, individual level preferences are estimated; as parameters within the proposed utility function. The results shown below are estimated from the full 54 rounds.

4.3.1 Inequality Aversion and Self-Interest Parameters

Figure 7 shows the distribution of each Self-Interest, α , Inequality Aversion, r and Equally Distributed Equivalent (EDE). The top-right and bottom-left histograms show the distribution of α and r , respectively, and map onto the scatter plot in the top-left. The EDE, which conveniently combines both preferences to form an index from 1 to 10, is shown in the bottom-right.

The distribution of r reveals how individuals trade-off between equality and efficiency. We observe 15.44% of the sample are ‘Efficiency Prioritarians’ ($r < -0.005$), 2.01% are ‘Cobb-Douglas’ ($-0.005 \leq r < 0.005$), 74.50% are ‘Weighted Prioritarians’ ($0.005 \leq r < 15$), and 8.05% are ‘Maximin’ ($r \geq 15$). The median respondent has an r value of 0.69, a ‘Weighted Prioritarian’.



The self-interest parameter is somewhat more difficult to interpret. Within the estimation procedure, as higher values of r are estimated the interpretation of α becomes increasingly irrelevant. This is problematic when interpreting the distribution of α . As a result the histogram for α is shown as a stacked distribution, estimated values of α when $r \geq 3$ are shown in light grey. The dark grey distribution, then more closely resembles what is expected from the average PP to P1 results.

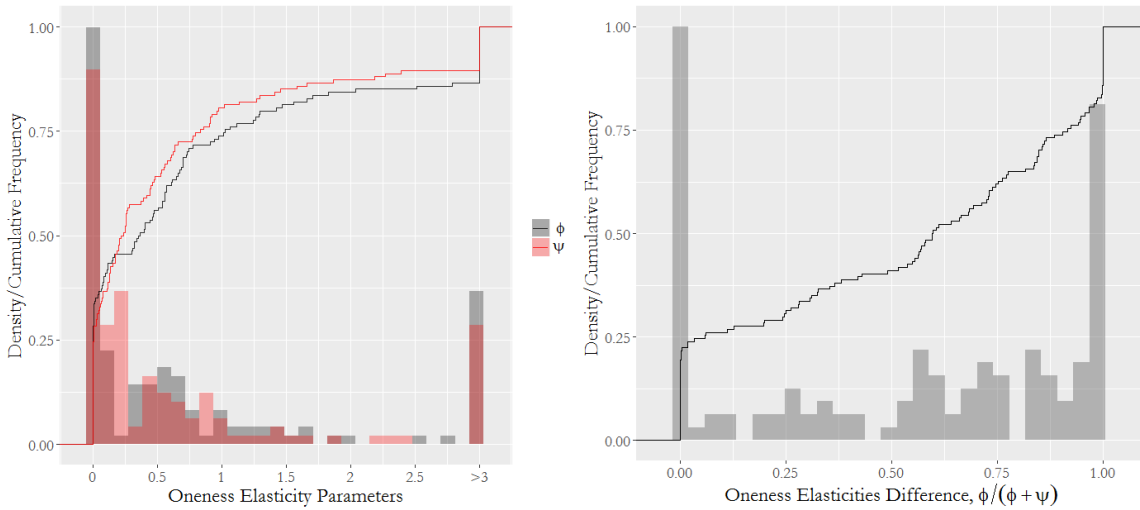
The scatter plot highlights the bivariate distribution of r and α ; splitting the observations into the three clusters: A, B and C. The heterogeneity of preferences is further highlighted here, although patterns do emerge from the clustered results. Those who are the least self-interested (Type A), tend to be the most averse to inequality, while the most self-interested (Type C) tend to be the least. The median r , for Type A, B and C respectively, are 2.029 0.496 and -0.024.

The EDE values are an intuitive measure, which combines the two preferences. If each individual were to consider a society where the payoffs to P1, P2 and P3 were: 10, 1 and 1, then according to their preferences, they would be indifferent between that distribution and an equal distribution of EDE's. Those whose EDE is 10, reflects pure self-interest, an individual's only concern is their own payoff. If $EDE = 1$ then participants are 'Maximin', caring only for the payoff to the worst-off. Those values in-between reflect 'Weighted Prioritarianism' and/or a regard for others. EDE's which are less than 1.2 make up 6.04% of the sample, 29.53% are less than 2 and 63.09% less than 3.33. Those greater than 9.8 make up 2.01%, while 10.07% are greater than 8. The median EDE is 2.90.

4.3.2 Oneness Elasticities

To illustrate the estimated oneness elasticity parameters Figure 8 shows the distribution of ϕ and ψ , in the left panel, and the difference between the two, as the proportion $\phi/(\phi + \psi)$, in the right. Due to lack of variance in elicited oneness levels of a particular individual, 15 individuals are excluded from analysis on oneness elasticity parameters; as no such parameters could be estimated. From the left panel; both ϕ and ψ have similarly right skewed distributions. For ϕ , 33.58% of parameters are less than 0.01, 55.97% are less than 0.5 and 73.88% less than 1. While for ψ , 28.36% are less than 0.01, 64.18% are less than 0.5 and 80.60% less than 1. For the medians: $\phi = 0.36$ and $\psi = 0.23$. As shown by the CDF plot, ψ tends to be lower than ϕ , at the sample level. This observation is confirmed by the right panel, the proportion $\phi/(\phi + \psi)$ shows the difference between the elasticities for each individual. There are 41.04% for whom $\psi > \phi$, with $\psi < \phi$ for 58.96%. Spikes at the extremes imply one elasticity dominates the other for a significant proportion of the population; 22.39% < 0.01 and 17.16% > 0.99 .

Figure 8: Distribution of Oneness Elasticities, ϕ and ψ

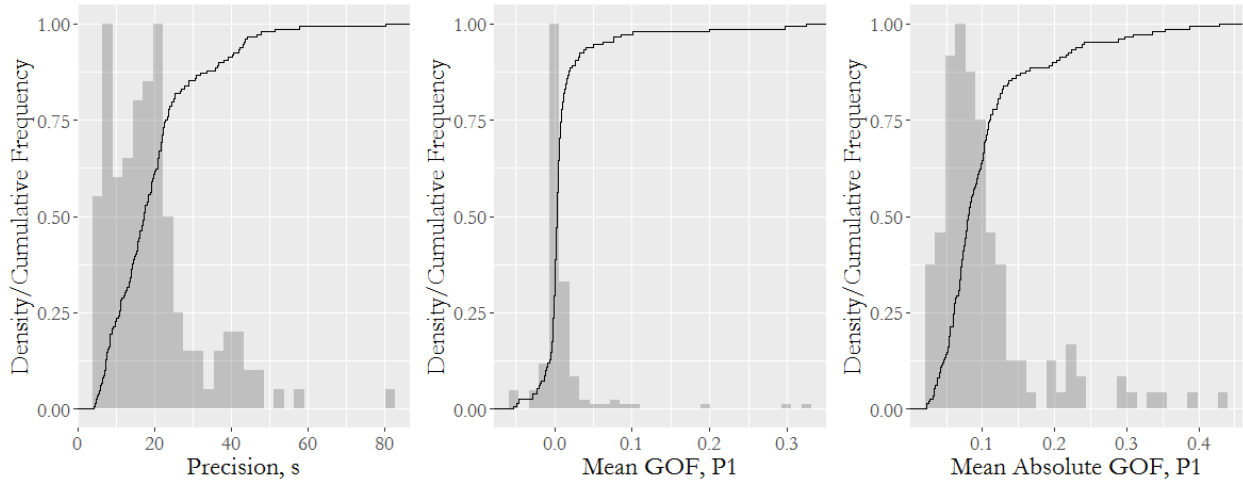


These results reflect, and explain, those results shown in Table 4. On average, the sample is willing to trade-off between the self and others, to a greater extent than between others. This observed trend in the data is because, for the majority of the sample, $\phi > \psi$. Delving further, by identifying the preferences of those individuals belonging to each cluster, we observe the mean $\phi/(\phi + \psi)$ is equal to 0.498, 0.533 and 0.687, for Type A, B and C respectively. This supports the results of Table 5 and 6, as Type A substitute between-others, but not between themselves and others, while Type C predominantly trades-off between themselves and others, but not between-others, with Type B in-between the two.

4.3.3 Precision and Fit

In addition to the estimation of preferences parameters, the ability of the utility function to fit individual behaviour also necessitates consideration. Figure 9 shows the distribution of s in the left panel; s is the precision, which characterises individual level ‘noise’. The higher s the more ‘precise’ decisions are, as illustrated in Figure 4. Those with $s < 7$ make up only 10.07% of the sample, for 40.27% $s < 15$ and for 61.07% $s < 25$. To illustrate how well the model fits the data, the middle and right panel of Figure 9, show the distribution of goodness-of-fit measures for each individual. The measures establish the difference between the *observed* allocations x_1 and *optimal* allocations x_1^* , to Player 1.⁵ The middle panel provides an intuitive measure for bias; the closer to zero the lower the bias in the optimal allocations. The majority of the sample are clustered around zero, 93.29% are within 0.05, 68.46% are within 0.01 and 46.98% are within 0.005. The right panel highlights efficiency, how close the optimal allocations are to the observed in absolute terms; 89.93% have a value less than 0.2, 64.43% are less than 0.1 and 14.09% are less than 0.05.

Figure 9: Distribution of Precision, s , and Goodness of Fit



⁵The mean GOF for P1 = $\sum_{t=1}^{54} \frac{(x_{1t} - x_{1t}^*)}{54}$, while the mean absolute GOF for P1 = $\sum_{t=1}^{54} \frac{|x_{1t} - x_{1t}^*|}{54}$.

4.4 Model Predictions

Once estimated, preference parameters allow for the prediction of behaviour, according to particular environmental factors (i.e. a budget, set of dividers and oneness levels). Rather than relying on the *observed* behaviour, which may be contingent on a particular set of environmental factors, a ‘clean’ ceteris paribus analysis can be undertaken to identify changes in *predicted* behaviour. It provides a meaningful analysis, based on individual level preferences, to reveal how the distribution responses would change in response to a shift in environmental factors.

The below analysis will identify how *predicted* behaviour changes, in response to differing oneness levels. Three different sets of oneness levels have been proposed. Where $\theta = [\theta_2, \theta_3]$, in the first set, A , $\theta = [1, 1]$, in the second, B , $\theta = [7, 1]$ and in the third, C , $\theta = [7, 7]$. Given the estimated individual-level preferences, assuming $\pi = [1, 1, 1]$ and $m = 1$, the optimal payoffs can be established for each individual, in each A , B and C . Both *deterministic*, assuming decisions are optimal, and *stochastic*, accounting for the errors each individual would make, forms of analysis will be conducted; the former showing changes in optimal payoffs, the latter illustrating the sample distribution of payoffs.

4.4.1 Deterministic

To identify changes in behaviour, due solely to a change in oneness, the differences between the proportional payoffs, to a particular player, in A and B ($B - A$), and in A and C ($C - A$) can be compared. The former highlights a behavioural change due to an increased connection to one other, while the latter shows the change due to an increased connection to both others.

Figure 10: Distribution of Changes in Predicted Optimal Proportional Payoffs; Differing Oneness

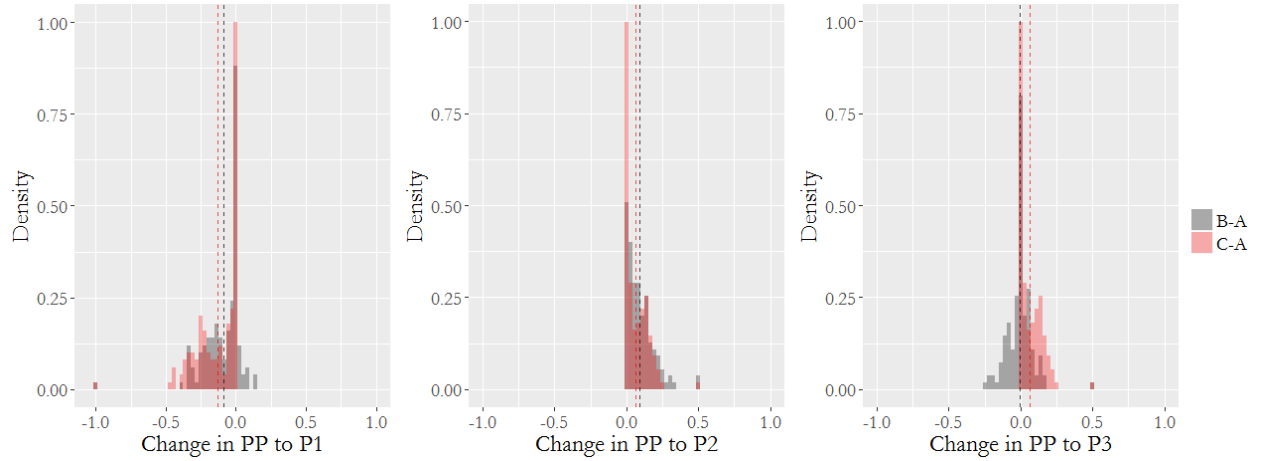


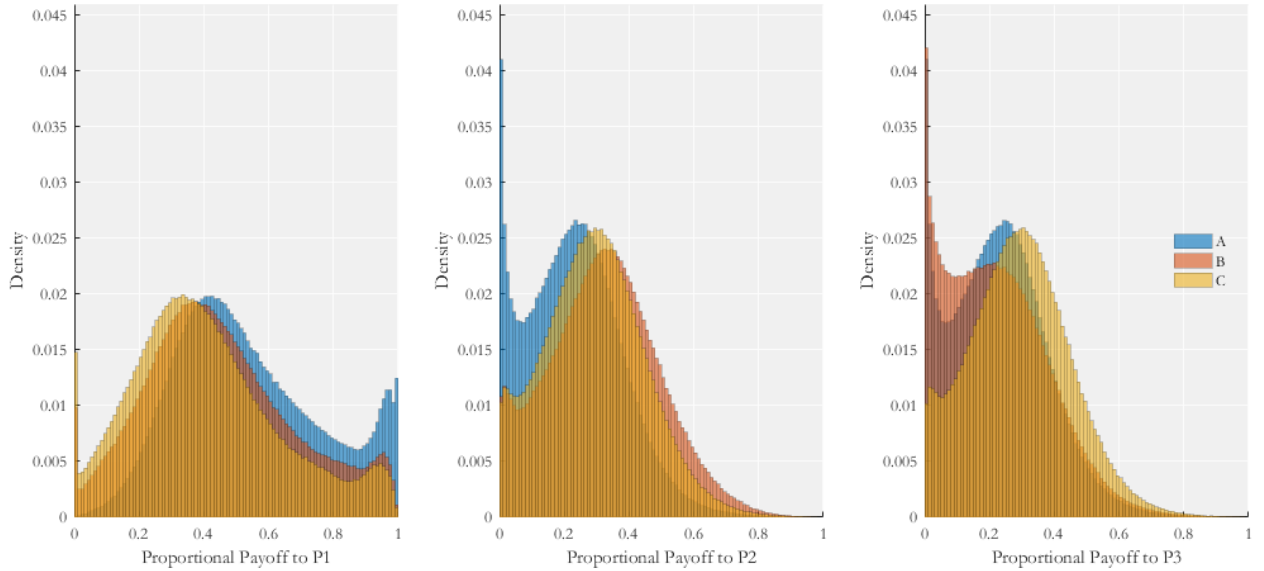
Figure 10 shows the distribution of these changes, where the magnitude and sign of the individual change depends on the preferences of that particular individual. A negative change shows a decrease in the proportional payoff, to that respective player, when moving from A to B (or C), while a positive change shows the opposite. The closer to zero, the less that change has been. Looking at $C - A$ we observe that as the closeness to both players increases, less is given to $P1$ while more is given to $P2$ and $P3$. On average, the PP to $P1$ decreases by $-13.02pp$, while the

PP to P2 and P3 both increase by $6.51pp$. Considering $B - A$, the behavioural changes due to an increase in the oneness to P2, only, can be observed. The change in PP to P2 is as expected, each individual increases the PP to P2 and the magnitude is greater than in $C - A$; $9.40pp$ on average. For majority of the sample, 76.87%, there is a decrease in the PP to P1, however, the remaining minority do actually increase the PP to P1. When considering the PP to P3 a split occurs, 52.24% decrease that to P3, while the remainder, perhaps counter-intuitively, increase the PP to P3; the mean is only slightly negative, $-0.51pp$. This split will be more thoroughly discussed in Section 5.1. These results, similar on average in magnitude and sign to those in Table 4, reveal how individual's *optimal* behaviour is shaped by a change in oneness to those to whom they are giving.

4.4.2 Stochastic

While the above shows how the sample *optimally* responds to changes oneness levels; it neglects the *noise* in individual decision making. By combining both utility function and error model a more representative distribution of decision making can be made. Figure 11 utilises individual level preferences and precision parameters to predict the distribution of proportional payoffs, according to differing oneness levels. The three sets of oneness levels (A, B and C) are used as above, but the distribution of proportional payoffs, rather than the changes, are plotted. By using a monte-carlo simulation, taking 10,000 random draws each individual level probability density function, the plots reflect an ‘asymptotic’ distribution of *predicted* decisions.

Figure 11: Distribution of Predicted Proportional Payoffs; Differing Oneness



The first observation is that A reflects an ‘objective’ distribution, where participants have no connection to others. The mean proportional payoffs are $[0.539, 0.230, 0.230]$, for P1, P2 and P3, respectively. As oneness increases the distribution of PP to P1 shifts left, reflected by the decrease in the average to 0.450 and 0.409 for B and C, respectively. For the PP to P2, an increase is observed in both cases, as the plots shift right, however, the shift to B is greater than that of C; with means of 0.324 and 0.295, respectively. For the PP to P3, a decrease is shown, when moving

to B, while an increase occurs to C; with means of 0.225 and 0.296, respectively. Of most note are the changes at the extremes. Those observations for which the PP to P1 is greater than 0.98, is 2.28%, 0.44% and 0.33%, for A, B and C respectively. While those observations, for which the PP to P3 is less than or equal to 0.01 is 4.11%, 4.21% and 1.02%, for A, B and C respectively.

5 Discussion

5.1 Oneness Peculiarities

Predictions from the utility function, in Section 4.4.1, have two apparently peculiar tendencies. Both occur when identifying the change in optimal allocations from a situation where $\theta_2 = \theta_3 = 1$ to that where $\theta_2 = 7, \theta_3 = 1$; when, ceteris paribus, the oneness to P2 increases. As expected, x_2^* always increases, and for the majority of individuals, x_1^* and x_3^* decrease. There are, however, two peculiarities, first, with regards to an increase in x_1^* and, second, with an increase to x_3^* .

The former occurs only when $r > 0$ and ϕ/ψ is *sufficiently low*. If $\psi > \phi$, individuals place a higher weight on substituting *between-others*, than on *self-other* trade-offs. If ψ is sufficiently high, then as θ_2 increases relative to θ_3 , $\omega_3 \rightarrow 0$. When ϕ is low, ω_1 only decreases relatively little. As a result, as $\omega_1, \omega_2 \gg 0$ and $\omega_3 \rightarrow 0$; individuals consider the problem as one of distributing between P1 and P2 only. As individuals are inequality averse, $r > 0$, they share between P1 and P2; the increase to P2 is greater, but x_1^* does actually increase. Intuitively, this peculiarity makes sense, when faced with a situation where the individual is disconnected to both P2 and P3, they decide to share between all three (especially as $r > 0$). A change in absolute terms of oneness, as described above, leads to a relative reduction in the connection to P3, as the individual is willing to substitute between-others, $\omega_3 \rightarrow 0$, but as they are not very willing to trade-off between themselves and others, ω_1 does not. Then, they consider the problem of distributing between themselves and one other, they then give more to P2 but also more to themselves.

The latter occurs when ϕ/ψ is *sufficiently high*. When $\phi > \psi$, individuals place a higher weight on *self-other* trade-offs, than substituting *between-others*. The reason for this is that, in the model, as θ_i increases, $\forall i > 1$, ω_1 decreases; as a result $1 - \omega_1$ increases. If ψ is sufficiently small, little substitution occurs between ω_2 and ω_3 , and therefore both ω_2 and ω_3 increase. Intuitively, this could be due to the relative amounts given to P2 and P3. If, due to an increase in θ_2 , x_2^* increases, it could lead to an increased generosity to P3. Being close to one other makes me consider that I would want to share with others, rather than giving all to myself; as I now consider sharing more, I will actually give more to P3, even though my closeness to them has not increased.

5.2 Comparability

5.2.1 Giving and Social Distance

Engel (2011) conducts a meta-analysis on dictator games from 129 papers, calculating a 'grand mean' of 0.717, as the proportion kept by the dictator. Our results show a 'grand mean' of 0.505, significantly lower than that calculated by Engel. Two factors may explain this heightened generosity; both of which are stated in Engel's conclusion: that dictators give more 'when they come from a developing country' and 'if there are multiple recipients'.

In support of the latter, Andreoni (2007) finds that as the number of recipients increases dictators give themselves less, however, the rate at which they give is *congested*. For the representative agent a ‘gift that results in one person receiving x is equivalent to one in which n people receive x/n ’^{0.68}. A back-of-the-envelope calculation shows that (all else being equal) the equivalent mean PP to P1, from our experiment, would be 0.603, in a 2-player dictator game. Fisman, Kariv, and Markovits (2007) observe a similar trend, as their mean PP to P1 is 0.75, in the three-player variant, and 0.79 in the two.

In the *social distance* literature dictator games usually have two-players. Considering the most similar treatment in Leider et al. (2009), when the exchange rate is 1:1, the PP to P1 0.761 and 0.875 for the most and least connected respectively. From lab-in-the-field experiments in ‘developing economics’, when matched with a stranger and a friend, respectively, dictators took 0.636 and 0.5573 on average in Binzel and D. Fehr (2013). In Ligon and Schechter (2012), when the recipient was chosen the average to the self was 0.637, while when they were random it was 0.615. The level of giving is somewhat lower in the later two, giving support to the findings by Engel (2011). While not directly comparable to other papers, combining the unilateral effects above provides an explanation for the difference in the levels of giving.

Aside from the difference in levels, the results appear consistent with those in the *social distance* literature. Giving is shown to increase with *oneness*; the predicted mean PP to P1 is 0.539, when there is the least connection to both others, and 0.408 with the most. Due to the three-player design, this work is able to tease out *between-other*, alongside *self-other*, trade-offs when closeness to others differs. Combining this with the the proposed utility function and error model, we observe a great deal of heterogeneity in preferences, as found in Fisman, Kariv, and Markovits (2007). By accounting for this heterogeneity, and incorporating *oneness* considerations, the average effects of changes in *oneness* can be explained by the distribution of individual behaviour.

5.2.2 Error Models

The random behavioural model proposed here diverges from that which is most common. Usually random behavioural models assume that an individual has some optimal payoff, according to their preferences and the decision problem, say y_i^* . The individual then makes some error calculating, or choosing, y_i , meaning the *observed* decisions are $y_i^* + \epsilon_i$, where ϵ_i is normally distributed with mean zero. The issue is that with some probability, $y_i^* + \epsilon_i$ will exceed the bounds of the problem (i.e. 0 and 1, in the case of the share to the self). As a result, censoring must ensue, usually in the form of a tobit model; as in Andreoni and Miller (2002) and Fisman, Kariv, and Markovits (2007). With greater dimensions, a further issue may arise due to the i.i.d nature of the errors; in the three player case (assume $y_3 = (m - y_1^* + \epsilon_1 + y_2^* + \epsilon_2)$), if ϵ_1 and ϵ_2 are sufficiently large, y_3 could be negative.

An alternative is that suggested here, where *observed* decisions are said to be drawn from the Dirichlet distribution, which is bounded between 0 and 1, where the expectation of the distribution is y^* and the sum of *observed* decisions will always equal 1 (or m if scaled). On an individual level, this is perhaps a more natural distribution to assume; the flexibility of the distribution, intuition of its formulation and generalisability to n dimensions are useful in these bounded decision problems. While the Dirichlet distribution could potentially provide a more intuitive fit for individuals, at the aggregate level the normal error model could provide a better fit, the distribution of round decisions in Figure 5, for instance, has responses clustered at the upper bound.

5.2.3 Incentives

One point of divergence in this paper, from others in the literature, is the incentive structure. Within both Andreoni and Miller (2002) and Fisman, Kariv, and Markovits (2007), participants receive the payoffs they gave to themselves plus the payoffs other participants gave to them; in effect getting two (or three) sets of payoffs. In this paper, the decisions from only one dictator from each ‘group’ was carried out, meaning individuals would only get one set of payoffs. In the former incentive mechanism (henceforth (1)), the total experimental payoffs received included their own payoff to themselves plus what the others gave them; and they knew that others had the same payoff structure. Whereas, in the incentive mechanism used here (henceforth (2)) participants knew that, if they were chosen as dictator, then the payoffs they distributed would be the only experimental payoffs that each member of the group would receive.

This subtle difference could lead to a substantial divergence in decision making (if a consequentialist approach is taken). Imagine an individual who is an *egalitarian*; they wish everyone to leave the room with an equal payoff. In (2), individuals would allocate equally, while in (1) more strategic considerations are necessary. If they believe that everyone in the room is an *egalitarian*, then they would share equally, but if they believe everyone else is an *egoist* (who keeps all for themselves) then they would take everything for themselves. Interpreting the behaviour in the latter case would lead to the conclusion that the *egalitarian* was an *egoist*, due to a difference in the beliefs of the behaviour of the others in the room.

A further consideration, relates to the construct of the *impartial spectator* (Smith, 1759). The perspective of the spectator can be considered by putting oneself in the situation of the other; imagining how one’s behaviour would be viewed from the standpoint of all members of society. When considering this perspective, behaviour is likely to reflect a greater degree of prosociality.⁶ In (1) it is arguably less likely that this perspective would be considered. Participants know that the payoffs they distribute are certain, but that an additional uncertain amount will be added to those payoffs, by others. Participants would consult their beliefs about what others would give when making their decision, but still consider the problem from their individual perspective. In (2) the participant has the same chance of being the recipient, as the others in the room. Moreover, if they are chosen to be the dictator, the payoffs they distribute will be the only experimental payoffs to each player. As participants know this it is easier to imagine the situation of the other (when that other is a recipient of their giving), knowing that the other would receive the exact experimental payoff chosen by the participant. Imagining receiving *only* the payoff given to the other could, then, led to an increase in generosity.⁷

Due to these two observations, a divergence in observed behaviour could occur. For the former, results from (1) could be biased towards more ‘apparently’ self-interested decisions, while for the latter, results from (2) could be biased toward more equal distributions, than individuals would otherwise have done. This difference could perhaps further explain the differences in average giving (see Section 5.2.1) and is, perhaps, an interesting area for further inquiry.

⁶Smith writes of the *social passions*: ‘all the social and benevolent affections’. Arguing that to the spectator, the social passions are the most agreeable, as ‘we enter into the satisfaction both of the person who feels them, and of the person who is the object of them’ (Smith, 1759). Given this, by taking the perspective of the spectator our behaviour should strive to satisfy these passions.

⁷Indeed, it may be easier to imagine the situation of an other to whom you are more closely connected to. If being better able to consider their situation leads to increased giving, this could partially explain why we observe an increase in giving, when oneness increases.

6 Conclusion

To conclude, distributional preferences are an integral component in explaining heterogeneity in prosocial behaviour. Through intertwining distributional preferences with considerations of *oneness*, the impact that *social distance* has on distributional decision making can be further explored and understood. This paper has formulated a model which incorporates both elements; estimating individual-level preferences to explain behaviour from a lab-in-the-field experiment. Results show that participants tend to favour reducing inequality, as opposed to reducing inefficiencies, and exhibit a substantial regard for others. On average, there is a greater willingness to trade-off between the self and others, when the closeness to others increases, than there is to substitute between-others, when relative oneness levels change.

Heterogeneity in behaviour, is however, the most notable aspect of these findings. There is not a consensus on how to share, nor how to trade-off between equality and efficiency, nor how to redistribute to those who are close. Differences in prosocial behaviour have been shown to depend both upon distributional preferences of individuals and the closeness of connection to others. Accounting for both would, therefore, seem necessary in order to better understand prosocial behaviour.

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A Appendices

A.1 Experimental Design

An incentivised lab-in-the-field experiment, with an accompanying survey, was run in Mbale, Uganda. On each experimental day, two parallel sessions were ran with groups of six participants. The first group partook in the *experimental session*, and then the *survey*, while the second group did the survey followed by the experimental session. The experimental session began with the *script*, moved onto the *interactive tutorial* (one-on-one with enumerators with questions to check understanding), then the *budget treatment*. This was followed by the *oneness script*, the *oneness questionnaire*, finishing with the *oneness treatment*. The survey began with a *group discussion*, then the *survey*, one-on-one with an enumerator. The whole experiment lasted between 3 and 5 hours, depending on the speed of the participants. At least six enumerators were present throughout the experiments. Figure 12 shows how the experiment was set-up.

Figure 12: Photographs of Experiment Set-Up ⁸



⁸Photos clockwise from top-left: (1) Experiment set-up, each participant had a Linx Tablet, with Z-Tree software, to make their decisions, tables were numbered from 1 to 6. (2) Chairs set up for General, Part 1 and Part 2 of the script. Semi-circle to ensure equal distance, with A2 posters showing screenshots of the experiment. (3) Survey set-up, one enumerator per participant. Using Asus tablets with Survey Solutions software to conduct the survey. (4) Chairs set up to encourage group discussion for Group 2, before the survey, and a waiting room for those not doing the survey, throughout.

A.1.1 Scripts

Participants were firstly given instructions in the form of a verbal script, a transcript of which can be found in Appendix A.5. The script was split into two parts, the *general* script and *oneness* script; the former of which was given when participants entered the experimental session, the later between Part 1 and Part 2. The general script explained all the necessary precursors to the experiment, explained the payoffs, the decisions they would be making and what Part 1 entailed. Throughout the script visual aids were used to enhance the understanding of the participants; a Linux tablet, the round selection bag and a poster. The poster showed a screenshot of the Z-Tree interface, which was used to show the layout of the screen and exactly which decisions they would be required to make. There were no distribution of payoffs, or allocations, shown to avoid any anchoring effects. The oneness script was delivered after the break, before the oneness treatment, where both the oneness decisions and Part 2 were explained. Another poster was used to explain the oneness decisions to be made, and references were made to the previous poster for Part 2. The scripts were delivered by two of the enumerators; Zam the General Script and Isaac the Oneness Script.

A.1.2 Tutorial

To further ensure that participants understood the decisions they were making after the general script they went through an extensive on-screen tutorial. Each participant went through the tutorial one-on-one with an enumerator.⁹ The tutorial was split into three parts. The first was a simplified version, with one player (rather than three) which built up each element step-by-step and was led by the enumerator. Starting with only the allocations, then adding the payoffs, alongside differing dividers. The three methods were taught in turn, *slider*, *arrow keys*, then *written input*, before all three could be used. After the first part, the participants had to answer six questions to check their understanding. Enumerators recorded if they had answered correctly, or not, from the first time the participant understood the question. If they got the answer wrong the enumerators explained the correct answer. Once the questions were complete they moved onto a tutorial with the entire interface. Participants then made the decisions, with no input from the enumerators, who were still there to check they understood the decisions they had made. Two practice rounds were given, one where the dividers were $[1, 1, 1]$, the second $[1, 2, 3]$. Once participants were confident with the interface, then the enumerators left the participants to make their decisions for real, in private. A script of the wording of the on-screen tutorial, questions, and instructions to enumerators (in []) can be found in Appendix A.6.

A.1.3 Survey

Alongside the experiment an in-depth survey was ran. The surveys were implemented with Asus touchscreen tablet and ran one-on-one; where one enumerator went through the survey with one participant. The survey was split into four sections: *individual characteristics*; *household characteristics*; *assets, wealth and MPI*; and *preferences*. The *individual characteristics* section comprised predominately of demographic questions, about the participant's: gender, date of birth, religion, tribe, occupation, level of education, hours of work/study, income, height and weight. *Household*

⁹The exact enumerator was recorded to test for enumerator effects.

characteristics asked questions regarding each member of their household: gender, age, relation to the participant, level of education, school attendance and literacy. Alongside this more general household level questions were asked: child mortality, food shortages, bank accounts, health insurance, social insurance, healthcare and unemployment. *Assets, wealth and MPI*, asked questions about their household: household type; housing arrangement; bedrooms; floor, roof and external wall materials; water source and distance; toilet; lighting; cooking fuel and rubbish collection. Further questions on ownership of livestock, vehicles and household assets were made. The final section, *preferences*, asked participants to allocate hypothetical tokens between three pots which denoted the health, education and household assets, of the household. They were asked to allocate the tokens to denote how much importance these three elements had to them.

A.1.4 Group Discussion

In order to test whether having group discussion had an effect on the oneness scores, or the behaviour of participants in the experiment, a group discussion was part of the design. The second group, who did the survey first and experiment second, were firstly sat down to partake in a group discussion. This was informal, and led by the enumerators, but allowed the chance to talk amongst themselves. Further to this, before the experiment, they had lunch together to further any group dynamics, or individual relationships, which could have emerged throughout that time. In contrast, the first group did the experiment as soon as all members of their group arrived.

A.1.5 Pilot Experiments

Prior to the main experiment two pilot sessions were ran. The first, a preliminary paper version was ran with 23 participants in September 2015. The second, was a first run through of the final experiment, ran with 12 participants at UCU, Mbale, in June 2016. The major changes relate to timing, firstly that paper based methods were too time consuming, hence the move to touchscreen tablets, and secondly that only one session could be ran each day, rather than two. Other changes included simplification, ensuring dividers had were equal for each Player, ensuring privacy of decisions was paramount and minor tweaks to the script to enhance understanding.

A.2 Sampling

Two sampling frames were created in order to conduct the experiments. The first, from a general population in the Mbale District, the second, from student records from the Ugandan Christian University (UCU), Mbale. The majority of the sample, 108, were from the general population, the remainder, 48, from the student population.

A.2.1 General Population

In order to create the sampling frame for the general population, mobilizers were employed to gather information for each individual, within each household, within their Cell.¹⁰ There were 9 Cells selected, within two Divisions. From the Industrial Division the cells selected were: Bumasa (n=169), Pallisa (n=255), Malawa (n=241), Butaleja (n=127), Bugwere (n=248) and Wanyera (n=185). Within the Northern Division the cells were: Mugisu (n=289), Gudoi (n=305) and Nkokonjeru (n=282).¹¹ A total sampling frame size of $n = 2101$, where there were 51.5% women and a mean overall age of 26.15.

The characteristics recorded were household ID, gender, age and the relationship to the household head for every member of the cell. For those individuals who were between the age of 18 and 45 further information was taken: if they had a good level of English; if they were in secondary school; if they would be willing to participate in the experiment; their phone number; and the answers to three selected questions. The three questions were: Q1: Do you own a touch-screen phone? Q2: Would you be comfortable using a touch-screen gadget in a study? Q3: Do you regularly use a personal computer?

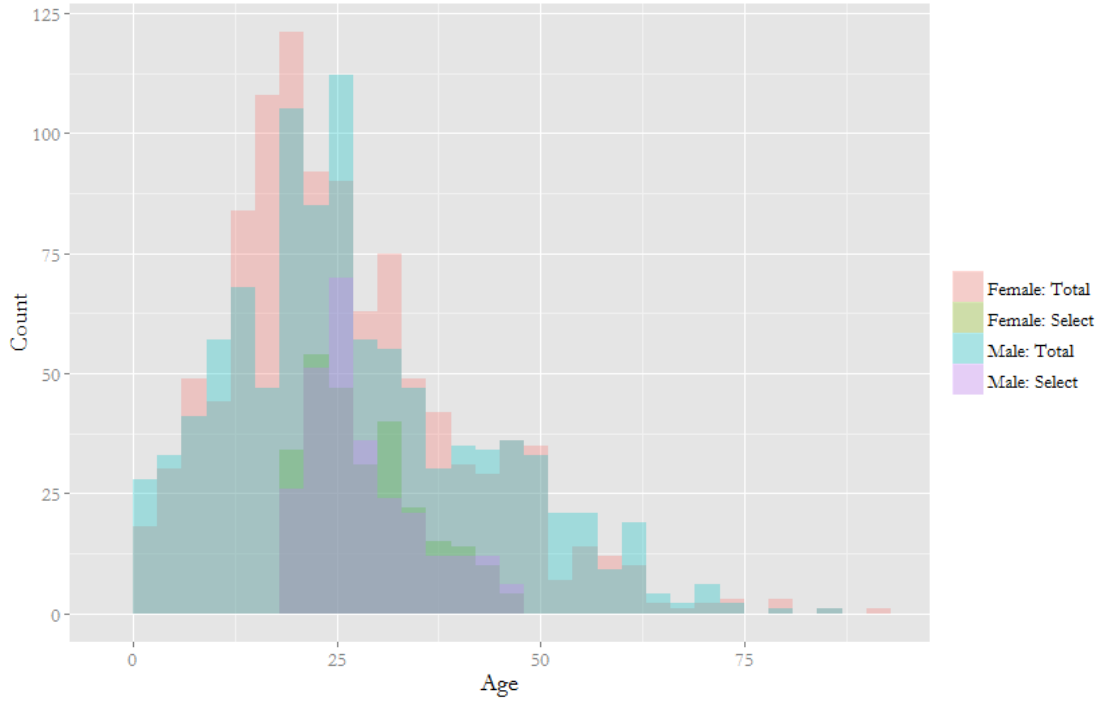
In order to select a sample from the sampling frame individuals had to meet certain characteristics. They had to: be between 18 and 45; have a good level spoken and written English, not be in secondary school, be willing to participate; and have answered yes to two or more of the three questions. Those who met such requirements numbered 541. Gender characteristic remained similar with 50.01% being female; while the age was censored there was a mean age of 27.96. This criteria was necessary to ensure that participants would be able to participate within the study. With such criteria a bias is indeed created within the sample, while as many steps were made to ensure the sample was random and as unbiased as possible, the claim being made here is not that the sample is representative. A trade-off did have to be made, however, between representativeness and ability to be able to make informed decisions with the tablets provided. Figure 13 shows the composition of age and sex for both the "total" sampling frame and the "select" sampling frame. The histogram highlights the age cut-off points and the reduced sample frame size, alongside the population's general age and gender characteristics.

Once the sampling frame was created, and the eligible participants identified, random sampling was conducted to invite participants to the experiment. Two groups of six were selected, from

¹⁰A cell is a geographical area which is smaller than a Division, which is smaller than a District. They are the urban equivalent of a rural village.

¹¹There were issues with the sampling frame. The general consensus from the Mobilisers was that they had recorded 70-80% of participants within the cell. Reasons given for the lack of coverage included: Suspicion that the information was being collected for taxation purposes, as the study was going to be in UCU individuals were worried that the aim was to convert them to being born again Christians, some people identify the mobilisers with a particular political party and claim they were tired of government programmes because they only register people but never deliver their promises.

Figure 13: Composition of Age and Sex: Total and Selected Cells



each cell, for each day; alongside a backup list of the next randomly selected participants. Mobilizers were given the information of the first 12 participants there were to invite and bring to the experiment and if difficulties arrived in getting participants then they were replaced by the next participant. Replacements were common, and on average the experiments began an hour late, due to mobilization issues.¹²

A.2.2 Student Population

The student sampling frame was somewhat easier. The Dean of Students, at UCU Mbale, was approached to provide a list of students who were registered. A list of 640 students was acquired and random sampling was carried out to invite the 48 participants to the experiment. A postgraduate student at UCU, was recruited to mobilize the participants.

¹²Further issues concerned the gender bias. Although the ratio of men to women, who were randomly selected, was approximately equal, the drops outs were far more often women. To attempt to resolve this issue, when selecting replacements women's names were prioritised.

A.3 Sample Characteristics

Between experimental days there were two separate samples, the general population (n=108) and the student population (n=48). Of these 156, 7 participants were excluded from the analysis: ID 1_11, 6_11 and 8_01 had a clear lack of comprehension (where enumerators had to assist decision making); concerns of contamination between sessions led to the exclusion of 9_03 and 9_08; 1_05 was as an outlier; and data for 3_09 was lost due to a tablet crashing.

Table 8 shows the characteristics for the remaining 149, within the two samples. In both samples there are fewer women, 43% on average, than the 51.5% collected from the sampling frame. In both samples the modal age group is 22 – 25, but the student population has significantly less over 25 year old participants. Both samples are relatively well educated, 56.4% of the general population are educated to the bachelors level. Every member of the general population have completed at least primary school, but there is a significant proportion who have either not completed secondary, or have only completed secondary. Every participant identified themselves as being religious, not one was agnostic or atheist as is common in western samples. The majority are Christian, with the largest proportion of these being Anglican’s in both samples. There is a substantial minority of Muslims within the general population, but not in the student population; as they were sampled from, the Ugandan Christian University. It is important to note that the general population is *not representative*, due to the necessary selection criteria.

Table 8: Sample Characteristics

	Sample					
	General		Student		Total	
	No.	%	No.	%	No.	%
Gender						
Male	59	58.4%	26	54.2%	85	57.0%
Female	42	41.6%	22	45.8%	64	43.0%
Age						
18-21	16	15.8%	10	20.8%	26	17.4%
22-25	37	36.6%	33	68.8%	70	47.0%
26-30	18	17.8%	2	4.2%	20	13.4%
31+	30	29.7%	3	6.3%	33	22.1%
Religion						
Catholic	25	24.8%	12	25.0%	37	24.8%
Anglican	37	36.6%	21	43.8%	58	38.9%
Muslim	16	15.8%	0	0.0%	16	10.7%
Seventh Day Adventists	0	0.0%	1	2.1%	1	0.7%
Born Again	23	22.8%	14	29.2%	37	24.8%
Highest Level of Education						
Secondary: Incomplete	11	10.9%	0	0.0%	11	7.4%
Secondary: Complete	14	13.9%	0	0.0%	14	9.4%
Tertiary: College	19	18.8%	0	0.0%	19	12.8%
Tertiary: Bachelors	56	55.4%	48	100.0%	104	69.8%
Tertiary: Masters	1	1.0%	0	0.0%	1	0.7%
Total	101	100.0%	48	100.0%	149	100.0%

A.4 Wealth and Multidimensional Poverty Indices

A.4.1 Wealth Index

Alongside the experiment an in-depth survey was run. Part of this survey contained variables to assess the wealth of the individual participants. Rather than using income data, which are notoriously unreliable in developing countries, or consumption data, which are very time consuming to collect, a focus upon assets was made. An extensive list of variables has been collected, in order to calculate a relative wealth index; using methods standard to the literature.

Data were collected for 57 variables to be included within the Wealth Index. Dummy variables were established for: access to electricity; material of the floor, roof and exterior walls; water source; toilet type; shared toilet; lighting; cooking fuel and rubbish collection. Numerical values were established for number of bedrooms; distance to water source (mins); livestock; vehicles; and household assets. Each of these variables, split into subcategories, are shown in Table 9. The mean value shows either the proportion of the populace who own that asset, for dummy variables, or the mean number owned by the population. The standard error shows the variance of ownership between individuals.

In order to establish the Wealth Index the methods set out in Vyas and Kumaranayake (2006) have been followed. Whereby Principal Components Analysis is ran, on the variable list, then the weights from the first component are used to form the base of the wealth index. These weights, shown in Table 9, are used to weight each observation for each participant, to provide a single index. This index is then normalised for the sample, providing an index between 0 and 1, where 0 is the least wealthy and 1 is the most wealthy, in relative terms.

What this method reveals is the impact that owning a particular asset has upon the wealth of the individual. The direction and magnitude of the weight implies a relationship between a particular asset and the expected wealth. For instance, having electricity shows that individuals are more wealthy. As do more bedrooms, closer water, rubbish collection, the number of vehicles (apart from bicycles) and the number of household assets (with the exception of handmills). Delving into particular materials it can be observed that the higher quality materials lead to higher wealth. For floor, there is a high positive weight for cement, while dung and earth/sand have negative weight, the former being the higher weight of the two. This can be seen throughout each category: tiled roofs, brick/cement walls, private piped water sources, flush toilets, electric lighting and gas/electric cooking fuel all relate to a higher wealth. On the opposite scale, thatch/straw roofs, mud/pole walls, boreholes as a source of water, pit latrines, paraffin/gas lighting and wood for cooking fuel all lead to lower wealth levels. Interestingly, we observe that owning livestock, apart from hens, leads to lower wealth. This is likely explained by the urban nature of the sample, those who owned large animals are more likely to be rural, and possibly poorer than their urban counterparts, in terms of the other assets mentioned. Hens within a city are more feasible, and owning them is, perhaps, a sign of wealth. The ownership of vehicles increases wealth, with the exception of a bicycle as perhaps the someone with more wealth may dispense with the bicycle in favour of a car. While owning all assets, with the exception of a handmill (a traditional pestle and mortar, predominately owned by rural or poorer individuals who do not have more modern electric blenders) also increased wealth.

In order to split the population into socio-economic groups two methods are common in the literature; an arbitrary split, into quintiles for example, or through cluster analysis. Here the later

Table 9: Wealth Index Construction; PCA

	(1) Weights	Mean	Std. Err.		(1) Weights	Mean	Std. Err.
Electricity	0.2453	0.846	(0.363)	Cooking Fuel			
Number of Bedrooms	0.0424	2.309	(1.456)	- Gas/Electric	0.0666	0.074	(0.262)
Floor Material				- Charcoal/Coal	0.1718	0.725	(0.448)
- Earth/Sand	-0.0769	0.020	(0.141)	- Wood	-0.2640	0.161	(0.369)
- Dung	-0.2402	0.101	(0.302)	No Food Cooked	0.0148	0.040	(0.197)
- Cement	0.1199	0.698	(0.461)				
- Ceramic Tiles	0.0587	0.067	(0.251)	Rubbish Collected	0.1394	0.416	(0.495)
- Vinyl/Carpet	0.0419	0.114	(0.319)	Number of Livestock			
Roof Material				- Heifer/Cow	-0.1149	0.624	(2.042)
- Thatch/Straw	-0.1333	0.020	(0.141)	- Bull/Oxen	-0.0890	0.148	(0.608)
- Iron Sheets	0.0015	0.872	(0.335)	- Calves	-0.0959	0.114	(0.458)
- Asbestos	0.0028	0.034	(0.181)	- Donkey	-0.0699	0.007	(0.082)
- Tiles	0.0513	0.047	(0.212)	- Goats	-0.0951	0.732	(1.814)
- Cement	0.0424	0.027	(0.162)	- Sheep	-0.0131	0.376	(4.109)
Exterior Wall Material				- Pigs	-0.0599	0.040	(0.305)
- Mud/Poles	-0.2384	0.101	(0.302)	- Hens	0.0236	1.295	(8.339)
- Brick/Mud	-0.0490	0.040	(0.197)	Number of Vehicles			
- Brick/Cement	0.2003	0.805	(0.397)	- Bicycles	-0.0503	0.342	(0.655)
- Cement	0.0091	0.054	(0.226)	- Motorcycles	0.0245	0.208	(0.424)
Water Source				- Cars	0.1076	0.275	(0.624)
- Private Pipe/Bottled	0.2147	0.617	(0.488)	- Vans	0.0409	0.020	(0.141)
- Public Taps	-0.0328	0.215	(0.412)	- Trucks	0.0564	0.134	(1.239)
- Protected Well	-0.1698	0.067	(0.251)	- Tractors	0.0491	0.013	(0.115)
- Borehole	-0.1608	0.101	(0.302)	Household Assets			
Water Distance (mins)	-0.2438	6.544	(14.194)	- Sofas	0.1395	0.893	(0.617)
Toilet				- Radios	0.0642	1.000	(0.678)
- Flush	0.1804	0.503	(0.502)	- Tables	0.1100	1.034	(0.911)
- VI Pit Latrine	0.0298	0.282	(0.451)	- Fridges	0.1672	0.362	(0.548)
- Pit Latrine	-0.2524	0.215	(0.412)	- Televisions	0.1934	0.926	(0.679)
Shared Toilet	-0.0149	0.315	(0.466)	- Computers	0.1344	0.564	(0.738)
Lighting				- Clocks	0.1103	0.913	(0.830)
- Electric	0.2556	0.826	(0.381)	- Jewellery	0.1066	2.027	(2.043)
- Paraffin/Gas	-0.2283	0.107	(0.311)	- Mobile Phones	0.0974	4.148	(2.675)
- Solar	-0.1053	0.067	(0.251)	- Handmills	-0.0094	0.336	(0.565)
Observations	149			Observations	149		

approach has been taken, using K-means with three degrees of freedom to create three cluster: Low, Middle and High. Figure 14 shows the overall distribution of wealth, split into these three clusters. Table 10 shows the percentage of the population who fall into these three clusters, the mean Wealth Index and the standard deviation. From these results the largest proportion, 51.01%, of the population lies within the high wealth category. The lowest socio-economic group is the smallest cluster, while the middle is in-between.

To provide comparability between this study and potential others a further wealth index was calculated, the International Wealth Index (IWI). The index was proposed by Smits and Steendijk (2015) as a way in which to compare between studies, due to the relative nature of typical wealth indices. The index is made up of a subset of the variables used above: floor material, toilet facility, number of rooms, access to electricity, water source. Alongside dummies for consumer durables: television, refrigerator, phone, car, bicycle, cheap utensils and expensive utensils. The

Figure 14: Wealth Index Distribution

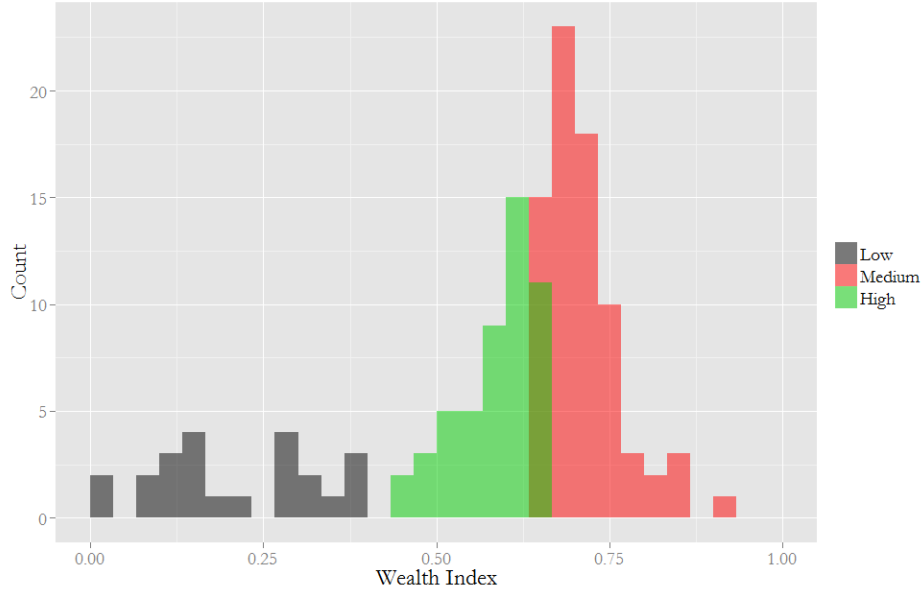


Table 10: Wealth Index Categories

	%	Mean WI	Std. Dev.
Low	15.44%	0.209	(0.115)
Middle	33.56%	0.586	(0.0561)
High	51.01%	0.714	(0.061)

only divergence which was necessary, was that phone had to include only mobile phones and that number of rooms had to be number of bedrooms, due to data limitations.

The mean IWI was 66.308, with a minimum of 12.003, a maximum of 100 and a standard deviation of 20.871. In terms of headcount cut-offs the IWI-30 poverty line is 8.05% and the IWI-50 poverty line is 19.46%; which most closely correlates to the \$1.25 and \$2.00 poverty cutoff lines, respectively. The IWI and Wealth Index are highly correlated, with a Pearson's Correlation Coefficient of 0.8750.

A.4.2 Multidimensional Poverty Index

The Multidimensional Poverty Index (MPI) is a poverty index, which accounts for severe deprivations in Health, Education and Living Standards. An absolute measure of poverty which considers the necessary capabilities that individuals need in order not to be in poverty. It follows the Alkire and Foster Methodology (Alkire and J. Foster, 2011); where individual households are assessed on nine indicators. The intensity of poverty is calculated by summing the weighted indicators, where each of the dimensions: *health*, *education* and *living standards*; are equally weighted. Education contains two indicators: years of schooling and child school attendance. Health is equally split

between child mortality and nutrition. Living standards contains five indicators: electricity, improved sanitation, safe drinking water, adequate flooring, cooking fuel and asset ownership. Data are usually gathered from sources such as DHS, MICS and WHS surveys which provide large scale, cross-country, datasets. The indicators have been chosen to maximise the sensitivity and usefulness of the index, alongside avoiding issues of missing data.

An alternative, Extended MPI (EMPI) has also been calculated. This makes use of the extensive survey data collected, avoiding issues of missing data that may have limited the number of indicators previously. Adding to the education dimension are the indicators: schooling gap and adult education. Food shortage and health care have been added to the health dimension. While, external wall and roofing have been included within living standards. In addition, a further dimension, *urban*, has been added to account for particular urban characteristics of the sample. Within this dimension the indicators are: overcrowding, unemployment, underemployment, bank account and rubbish collection. These additional dimensions have stemmed from a combination of recent additions to the literature and Mbale specific issues. Other extended indices include the MPI-LA (Santos and Villatoro, 2016), the Mexican MPI (J. E. Foster, 2007), the Colombian MPI (Angulo, Díaz, and Pardo, 2016), and Bhutan’s Gross National Happiness Index (Ura et al., 2012); alongside MPI’s in Chile and Ecuador. Specific indicators to Mbale, which could also be widespread issues, include the government clinic access and underemployment issues the town has.

Table 11 shows each of the dimensions and indicators. Showing the cutoff thresholds for the cut-off points, alongside the weights for the standard and extended MPI. The weights for the EMPI have been calculated according to similar principles, each dimension has an equal weight, and given a dimension indicator has an equal weight, within. Although the surveys were extensive, they were conducted on an individual level. As a result two indicators, nutrition and underemployment, can only consider the individual rather than the household this may lead to an under-measurement of poverty for both indicators.

A further index, the Preference MPI (PMPI), is calculated; incorporating the *preference* survey responses. In the above MPI calculations the weights between dimensions are chosen to be equal. The choice of weights is, however, open to debate. Is education of equal importance as health and living standards when assessing the intensity of poverty, or do different weights better capture poverty? Alternative weightings could be used, and by using them the resulting indices would differ. An alternative approach, which could be used is to identify the weights that the individuals in question would give to each dimension. The Preference MPI illustrates how this could be done. Using the elicited weightings for health, education and living standards, from the survey data, to calculate the index.

Once the Dimension, Indicators and Weights have been decided upon the statistics relating to the MPI, EMPI and PMPI can be calculated. Figure 15 shows the distribution of the uncensored intensity (the proportion of simultaneous deprivations experienced). The average uncensored intensity is 0.126, 0.178 and 0.105, for MPI, EMPI and PMPI, respectively. A percentage of the population classed as MPI, EMPI and PMPI Poor: 6.04%, 10.07% and 5.37% respectively. These *incidence* rates are rather low in comparison to elsewhere in Uganda, where (in 2011) the average across Uganda was 69.9% and the Urban average is 29.2% (OPHI, 2017).

Two main observations emerge from these results. The first, that the EMPI reveals a higher level of multidimensional poverty than the MPI. Two factors could explain this: (1) the EMPI is a richer index and, therefore, better identifies poverty, implying MPI measures of poverty are biased downward. (2) The thresholds in the additional indicators in the EMPI are ‘too low’, biasing the

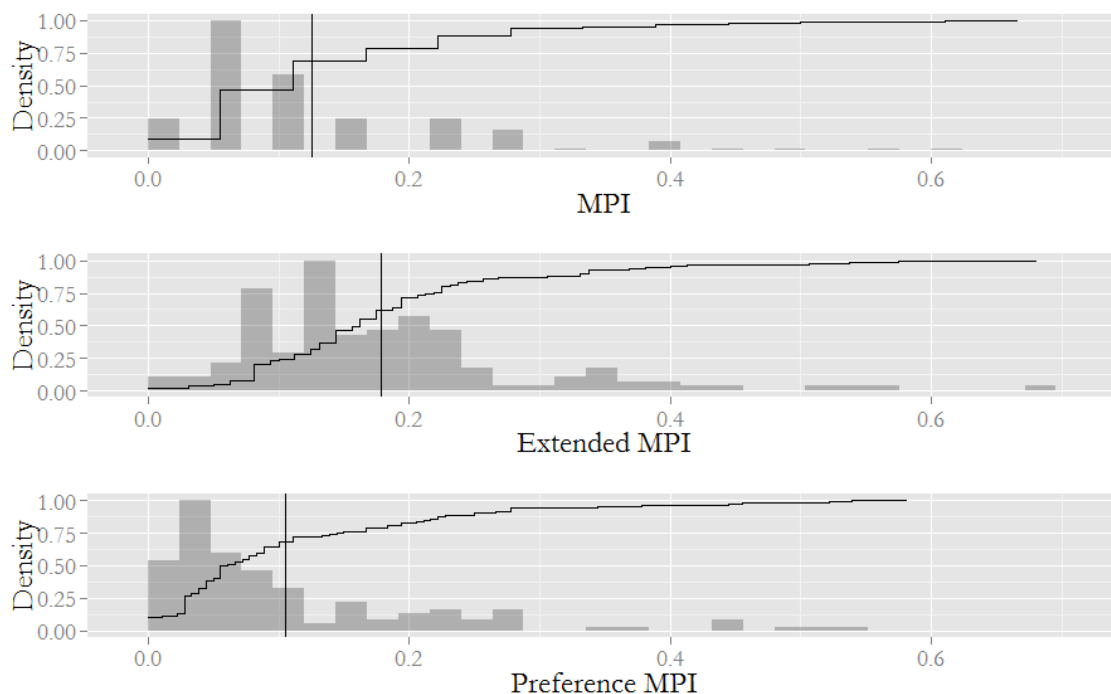
Table 11: MPI Dimensions, Indicators, Deprivation Thresholds and Relative Weights

Dimension	Indicator	Deprived if...	Weight	
			Std.	Ext.
Education	Years of Schooling	No household member has completed five years of schooling.	$\frac{1}{6}$	$\frac{1}{16}$
	Child School Attendance	Any school-aged child is not attending school up to class 8.	$\frac{1}{6}$	$\frac{1}{16}$
	Schooling Gap	Any child is over two years delayed with respect to their school grade for age.	.	$\frac{1}{16}$
	Adult Education	Any adult in the household can not read and write, or have not completed secondary school.	.	$\frac{1}{16}$
Health	Child Mortality	Any child has died in the family	$\frac{1}{6}$	$\frac{1}{16}$
	Nutrition	The participant is malnourished, $BMI \leq 18.5$	$\frac{1}{6}$	$\frac{1}{16}$
	Food Shortage	The household has suffered a food shortage in the last Month	.	$\frac{1}{16}$
	Health Care	The household only has access to a Government Clinic and has no Health Insurance	.	$\frac{1}{16}$
Living Standard	Improved Sanitation	The household's sanitation facility is not "improved", or shared.	$\frac{1}{18}$	$\frac{1}{32}$
	Electricity	The household has no access to electricity.	$\frac{1}{18}$	$\frac{1}{32}$
	Drinking Water	The household does not have access to safe drinking water or it is at least a 30-minute roundtrip away.	$\frac{1}{18}$	$\frac{1}{32}$
	Flooring	The household has a dirt, sand or dung floor.	$\frac{1}{18}$	$\frac{1}{32}$
	External Wall	The household has external walls made from thatch, straw or mud and poles.	.	$\frac{1}{32}$
	Roofing	The household has a roof made from thatch, straw or banana fibres.	.	$\frac{1}{32}$
	Cooking Fuel	The household cooks with dung, wood or charcoal.	$\frac{1}{18}$	$\frac{1}{32}$
	Assets Ownership	The household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck.	$\frac{1}{18}$	$\frac{1}{32}$
Urban	Overcrowding	The household has three or more people per bedroom.	.	$\frac{1}{20}$
	Unemployment	Any household member is long term unemployed and noone receives Social Insurance.	.	$\frac{1}{20}$
	Underemployment	Participant works four hours or less daily.	.	$\frac{1}{20}$
	Bank Account	No household member has access to any form of bank account.	.	$\frac{1}{20}$
	Rubbish Collection	Rubbish is not collected from the household.	.	$\frac{1}{20}$

EMPI upwards. The second, is that the PMPI reveals a lower level of multidimensional poverty than the MPI. Again two, possible, factors could explain this: (1) As active agents, individual's preferences shape their priorities over dimensions of poverty. As particular dimensions are weighted

higher, household resources are directed towards reducing poverty in that dimension, and poverty is therefore reduced. (2) Poverty shapes preferences, households weight lower those dimensions in which they are deprived. Here, these two observations cannot be further investigated, but highlight a potentially interesting area of investigation.

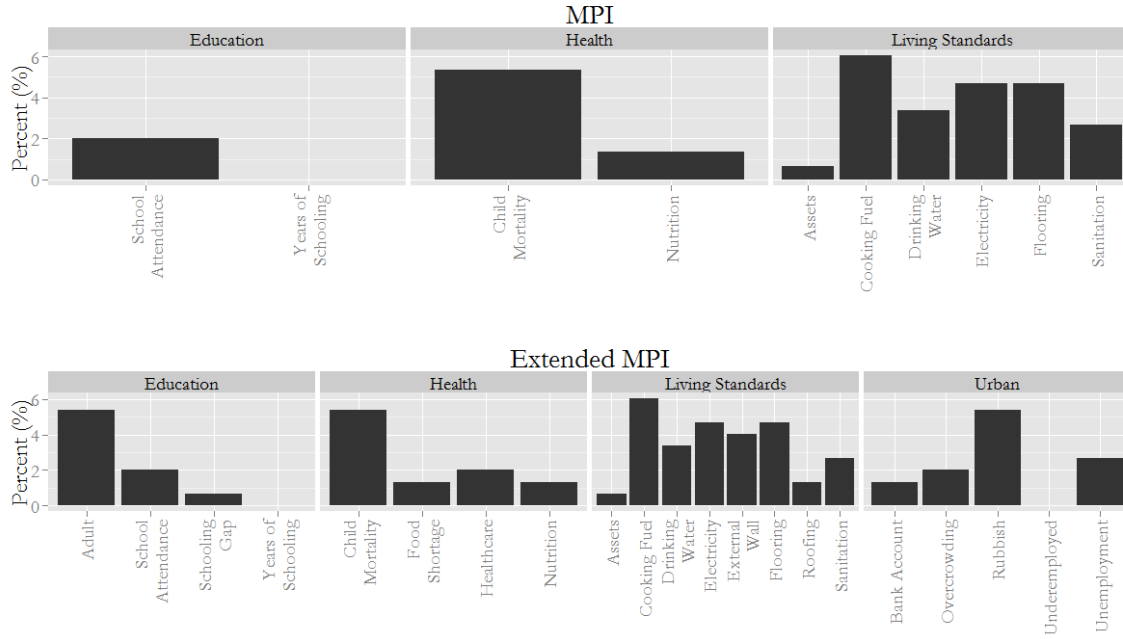
Figure 15: Distribution of Uncensored Intensity for MPI, Extended MPI and Preference MPI



Analysing specific indicators reveal the dimensions in which are deprived in. Censored Headcounts, show the proportion of the sample who are classed as MPI Poor and deprived in that particular indicator. Firstly, considering the MPI, the censored headcount in education is low (1.01%), health the next lowest (3.36%), followed by living standards (3.69%). Years of schooling is particularly low (0%), as every member of the survey had had at least 5 years of schooling themselves, so are not deprived in that measure. Child mortality (5.37%) is somewhat higher than nutrition (1.34%), but this is perhaps affected by the individual level nature of the measure. Households are typically not deprived in assets (0.67%), but indicators such as cooking fuel (6.04%), electricity (4.70%) and flooring (4.70%) score relatively high.

The Extended MPI shows the censored headcounts in each dimension are: education: 2.01%, health: 2.52%, living standards: 3.44% and urban: 2.28%. Adult education is high 5.37%, school attendance is 2.01%, the schooling gap is 0.67% and years of schooling remains at zero. Food shortage (1.34%), nutrition (1.34%) and healthcare (2.01%) are similar to one another, with child mortality (5.37%) remaining high. The external wall (4.03%) appears similar to the other house related indicators, but roofing deprivations (1.34%) occur less often. The greatest contributor to the urban dimension is rubbish (5.37%), with unemployment (2.68%) followed by overcrowding (2.01%), then bank account (1.34%). Underemployed has a zero incident rate. To reduce multidimensional poverty, the main considerations are, therefore, the levels of child mortality, cooking fuel, housing

Figure 16: Percentage of the Population who are MPI Poor and Deprived in each Indicator



materials and drinking water. Alongside these, rubbish collection and unemployment appear the worst within the additional urban dimension.

A.4.3 Comparison of Poverty Indices

The five poverty indices (MPI, EMPI, PMPI, WI and IWI) are different in their construction, but can be compared to identify how correlated they are. Table 12 shows a pairwise correlation matrix between each of the indices. Each pairwise relationship is statistically significant at the 0.01% level. The strongest relationships are between the similar indices, MPI, EMPI and PMPI; and IWI and WI, which is to be expected. Strong relationships do also emerge between the wealth and multidimensional poverty indices.

Table 12: Pairwise Correlation Matrix of Wealth Indices

	MPI	EMPI	PMPI	IWI	WI
MPI	1.0000				
EMPI	0.7255***	1.0000			
PMPI	0.9275***	0.6523***	1.0000		
IWI	-0.5741***	-0.6628***	-0.4713***	1.0000	
WI	-0.6341***	-0.6812***	-0.5344***	0.8750***	1.0000

A.5 Script

A.5.1 General

Welcome. Thank you for taking the time to come today. My name is and I am working with researchers from the EXEC laboratory at the University of York. This University is found in the UK. We have invited you here, today, because we want to learn about how people in this area make decisions. We are conducting both this study and a survey, and you will be required to take part in both. This section is the study where you are going to be asked to make decisions that will earn you some money. The money that results from your decisions will be yours to keep.

What you need to do will be explained fully in a few minutes. But first, there are three things I would like to explain to you clearly and you should consider them as very important. First of all, this is not our money. As I told you before, we work for a university and this money has been given to us by that university for this research. Participation is voluntary. You may still choose not to participate in the study. We also have to make clear that this is research about your decisions. Therefore I will not allow you to talk with anyone else during the study. This is very important. I'm afraid that if I find you talking with someone else during the study I will kindly ask you to go back home and what this means is that you will not earn any money. If you have any questions, please ask any of us.

Do you have a mobile phone? **[If yes]** Can I please ask you to switch it off? Make sure that you listen carefully. You could earn a good amount of money today, and it is important that you follow my instructions. There are no right or wrong decisions here, we are interested in exactly what decisions you want to make. But think seriously about your decisions as it will possibly affect how much money you will take home. In this study you will be making decisions about the distribution of money between yourself and other participants in this room. How this is done will be explained to you shortly. You will get an attendance fee of shs5000 in addition to the money you will earn from the study as a result of the decisions that are made.

In order to make your decisions you will be using tablets that we shall provide. This is what they look like **[Show Tablet]**. The decisions you make will be made by interacting with the screen. These tablets are touch screen similar to the smart phones that some of you use. They are easy to use. Do not get worried if you are not familiar with using them because before making your decisions we shall guide on how to use them.

In this study we shall have two parts. Part 1 and Part 2. In Part 1 there will be 27 rounds and in Part 2, there will also be 27 rounds. So in total, there will be 54 rounds. In order to determine your final payment. Out of the 54 rounds, one shall randomly be chosen by asking one of you to pick a number of out this bag **[Show the Round Selection Bag]**. This bag has 54 tokens which represent the 54 rounds. One token will be selected like this **[Pick One Token]** and this will be the round that will determine the final payment that all participants receive. This means that every round has an equal chance of determining your final payment, so consider each decision you make carefully. Everyone will finish at the same time, as you need to wait for every participant to finish before the payments can be determined. The decisions that you make will involve distributing money amongst a group of three participants; yourself and two others in the room. In each round you will be randomly linked to the two other people.

Now listen carefully, I will explain how the distribution of the money works. Do not worry, it is easy to understand, but it is important that you remember it. The money you have to Allocate

amongst the group will come from a Budget. You must decide how to Allocate all of the money from the Budget. The Allocations that you make will then be divided by a Divider to give the Payoff that a player will get in a particular round. This will be done by dividing the Allocation you make by the number referred to as the Divider. The Payoff can be thought of as the final amount of money that everyone gets in that round.

The decisions you make in each round will determine the Payoffs for yourself and the other two people in your group would receive. Each of you will make your decisions independently of one another, but only the decision of one person will be selected, randomly, to determine the final Payoffs for all the people in the group. You will not know whose decision has been chosen and will receive your Payoff, individually, at the end. This means that every decision you make is entirely anonymous. Importantly, there are no right or wrong answers, the decisions you make are entirely up to you.

To make your decisions you will be using the tablets, the screen you will see will look like this **[Show Tablet Poster]**. You will always be Player 1, the player on the left **[Point to Player 1]**. Player 2, in the middle **[Point to Player 2]** and Player 3 on the right **[Point to Player 3]** will be the other two participants who you are linked to.

You will be given a budget to allocate among the three of you. This is shown on the left **[Point to Budget Remaining]**, and in this example is shs60,000. You must spend the entire budget in each of the rounds. This means the Remaining Budget must be zero. You will be able to make the allocations in three ways. The first is with the sliders **[Point to the Sliders]**; you can drag the sliders to any allocation that you want, for each of the players **[Pretend to Drag the Sliders]**. The second is with the arrow keys **[Point and Pretend to Press the Arrow Keys]**. They allow you to make small increases and decreases in your allocations to each player. The third is the written input **[Point to Written Input]**; you can click in each of the boxes, type your desired allocations to each player with the keyboard and click update **[Point to each Box and then to Update]**.

Within each of the rounds there will be different dividers for each player **[Point to the Dividers at the Top]**. The actual payoff that each player will get will be the allocation you give, divided by the divider **[Point to the Payoff at the Top]**. These dividers are important as they change every round. It is the payoff which will be given to each participant so it is important to consider the distribution of payoffs. The payoffs will be always be in shillings and will be shown by the height of the orange bars, the orange numbers beside them and by the numbers at the top of the screen, which you will see later in the tutorial.

You will also see the Sum of Payoffs **[Point to the Sum of Payoffs]** and the Gap Between Payoffs **[Point to the Gap Between Payoffs]**. The Sum of Payoffs is the Payoffs of Player 1, 2 and 3 added together. The Gap Between Payoffs is the highest Payoff minus the lowest Payoff. Notice how these change when making your decisions. You must make a decision in every round, and then click Next or Finish to confirm your decision **[Point to Next/Finish]**.

A.5.2 Part 1

In Part 1, the budget you have to allocate will change. The others, Player 2 and Player 3, will always be random and anonymous participants in the room. As earlier mentioned, there will be 27 rounds. After Part 1, you will have a short break, before we explain Part 2. Now we shall guide you on how to use the tablets, and how to participate in the study. One of us will be there with

you to guide you. The first tutorial you will see is not the whole picture, it will just explain to you how to use the tablets. The second tutorial will show you the interface which is on the poster here **[Point to Poster]**, and explain in more detail. If you have any questions now, or throughout the study, please raise your hand and we will help as best we can. There will be at least two of us in the room at all times.

A.5.3 Part 2

[Do Not Read Part 2 Until After the Break]. In this part, we shall start by asking you a question on how connected you are to each of the other people in this room in real life. By this we mean how close you are to the other people in everyday life. You will be shown seven diagrams which look like this **[Show Oneness Poster]**. You will find these diagrams on the tablets that you used in Part 1. In each diagram there are two circles, the one on the left denotes yourself **[Point to One Circle on the Left]** and the one on the right show another person in the room **[Point to One Circle on the Right]**. Each diagram represents the degree of closeness between you. If we start at diagram A **[Point to A]** where the circles are very far apart, we see a very distant connection. As we move to G **[Move from A through G]** we see the circles moving closer, representing closer connections, with G as the closest connection.

You will be asked to select the diagram which best represents your connectedness with each person in the room. You will know who the 'other' person is as it will be denoted by their desk number. You will have a sheet of paper on your desk which shows the layout of the desks by number. There is also a number on your desk and each of the other participant's desks which you can see if you look around the room. You should look around to see exactly who is sat at each desk, when making your decisions. In order to select the diagram click on it, it will be highlighted, then you can click on Next in the bottom right corner to move to the next question, about another person.

When you have finished these questions for all 5 other people in the room you will move onto Part 2. Part 2 is similar to Part 1, but in this case you will know the players in the group by their desk number. The layout and interaction with the tablet will be the same as before **[Point to Tablet Poster]**. However, you will now get to know who Player 2 and Player 3 are **[Point to Player 2 and Player 3]** by their Desk Number. Remember to look at exactly who are sat at the desks you are distributing between. As before the decisions and payoffs will remain anonymous and so the other players will not know the decisions you make and you will not know the decisions of others.

A.6 Tutorial Script

A.6.1 Tutorial 1 – One Player

[Enumerators are here to Guide Them One-on-One, Let Them Read the Instructions Themselves, but Carry Out the Instructions in this Script]

Screen 0 - Welcome to the Tutorial. During this tutorial your decisions do not affect your payoffs. They are only to help you learn the experiment. You can click Next and Back in the bottom right corner to move between Tutorials **[Click on Next, then Click Back]**. Follow the instructions to work through the tutorial. Now click Next.

Screen 1 - This is the Allocation Slider. It allows you to distribute the Budget amongst each player. Click the Slider and Drag it upwards. Notice the higher you drag the slider the higher the allocation is, and the lower the Remaining Budget. **[Drag the Slider to Several Points, Each Time Show How the Allocation Increases and the Remaining Budget Decreases, Then Let Them Try]**. When you have done so, click Next.

Screen 2 - Now you have some more information move the Slider again. Notice the Orange Bar, and orange number, these represent the Payoffs. **[Drag the Slider, Pointing Out the Allocation and the Payoffs, both the Numbers and the Heights, Let them Drag the Slider]**. The Payoff is the Allocation divided by the Divider. The Divider is shown at the top, and is 1 in this round. **[Point to the Divider]**. That means that the Allocation and Payoffs are the same. **[Highlight this with an Example]**. When you are finished click Next.

Screen 3 - In each round the Divider will change for each Player. Now the Divider has been increased to 2. **[Point to the Divider]**. Move the Slider and notice the difference to the Payoff. **[Drag the Slider to Several Points, Show Them the Link Between Allocation and Payoff, Emphasize the Payoff is Important, Let Them Drag the Slider]**. It is now always the Allocation divided by 2. When you are finished click Next.

Screen 4 - Alongside the Slider you can also click the Arrow Keys to change the Allocation by small amounts. The Dark Grey arrows change the allocation by 10. The Light Grey arrows change the allocation by 1. Click each of the arrows to see how they change the Allocations. **[Show Them How to Click Up and Down On Both Arrows, Showing How the Allocation/Payoff is Changing]**. Once you have done this, click Next.

Screen 5 - The final way of changing the Allocations is through the Written Input. Click the light blue box, then type an Allocation using the keyboard. Once you have done this, click Update. **[Show Them How to Use the Written Input, Showing How the Allocation/Payoff is Changing]**. After trying the Written Input, click Next.

Screen 6 - Now try and change the Allocations with all three methods. When you finish Allocate all of the remaining Budget and click Finish to end this part of the Tutorial.

A.6.2 Questions

[Enumerators are here to Ensure they Answer Every Question Correctly the First Time they answer, so long as they understand the question. If They Do Not Answer Correctly, Explain Until They Understand, If They are Struggling Go Back to Tutorial]

- Q1.** Point to the numbers representing the Allocation, Divider and Payoff, on this screen. Then to which of the Slider and Orange Bar represents the Allocation and Payoff.
- Q2.** What are the three methods of Allocating the Budget?
- Q3.** If an Allocation is \$20,000 and the Divider is 1, as on the screen, what is the Payoff?
- Q4.** If an Allocation is \$20,000 and the Divider is 2, as on the screen, what is the Payoff?
- Q5.** If the Remaining Budget is \$5000 can you proceed to the next Round? Explain why.
- Q6.** If, in one round, the Allocation is \$45,000, the Divider is 3 and the Payoff is \$15000, to yourself, what is the Final Amount of Money you will get from that round?

A.6.3 Tutorial 2 – Three Players

[Enumerators are now here to Answer any Questions One-on-One, Let Them Read the Instructions Themselves, and Make any Allocations Themselves].

Screen 1 - Three Person Tutorial. Throughout the experiment you will be allocating between three players, one of which is yourself. You will always be Player 1. While Player 2 and Player 3 will be random anonymous other people in the room. You must allocate all of the budget between the three players. Use the sliders, arrows and written input, as before. This Tutorial round is still a practice round and is not for real. Click Next to proceed. **[Do Not Do Any of the Allocations for Them, Let Them Do it, But be There to Help if They Need].**

Screen 2 - Three Person Tutorial. Now try when the Dividers are different. Notice to the Sum of Payoffs and Gap Between Payoffs, to the right hand side. The Gap Between Payoffs is the difference between the highest payoff and the lowest payoff. **[Point to Sum of Payoffs and Gap Between Payoffs; Do Not Do Any of the Allocations for Them, Let Them Do it, But be There to Help if They Need].**

Screen 3 - Three Person Tutorial. You have finished the tutorial. Now every decision you make will be for real. So take care each round, as it is equally likely to be the actual payoff for yourself and the others in the group. **[Leave Them to Do the Experiment].**

A.7 Sensitivity of Treatment Selection

Within the main analysis one particular assumption is made concerning how participants view *oneness* when others are anonymous. Anonymity here, means that the ‘dictator’ knows that Player 2 and 3 are others in the experimental session, but does not know their identity. It is assumed that distributional decisions may be affected by how closely connected the ‘dictator’ is to the others in the group, as a whole; meaning that ‘dictators’ may be more generous when they are (randomly placed) in a group with whom they feel close. To account for this, the *oneness levels*, which enter into the utility function in the *budget* treatment, are assumed to be the expected value of the elicited oneness levels for the group.

The main analysis incorporates this assumption, so that *oneness* can be incorporated in decision problems where the ‘recipients’ are anonymous; as is most common in the literature. It could prove to be an interesting area of investigation, for giving in other dictator games.¹³ Yet, objections could be made to this assumption. To circumvent this assumption, preference parameters can be estimated using data only from the *oneness* treatment, where the identity of the other players is *known*. Below sensitivity analysis shows the comparison of estimated preferences from the *both* treatments (54 rounds) and the *oneness* treatment (27 rounds).

Figure 17: Sensitivity of Treatment Selection: r , α , ϕ and ψ

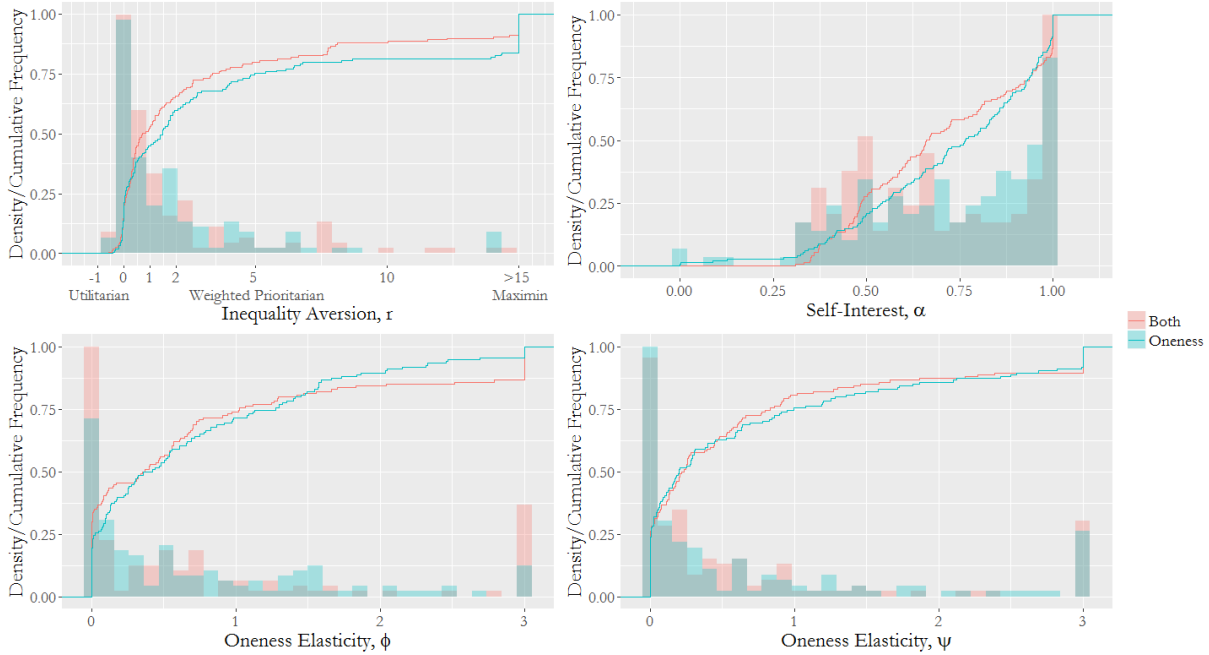


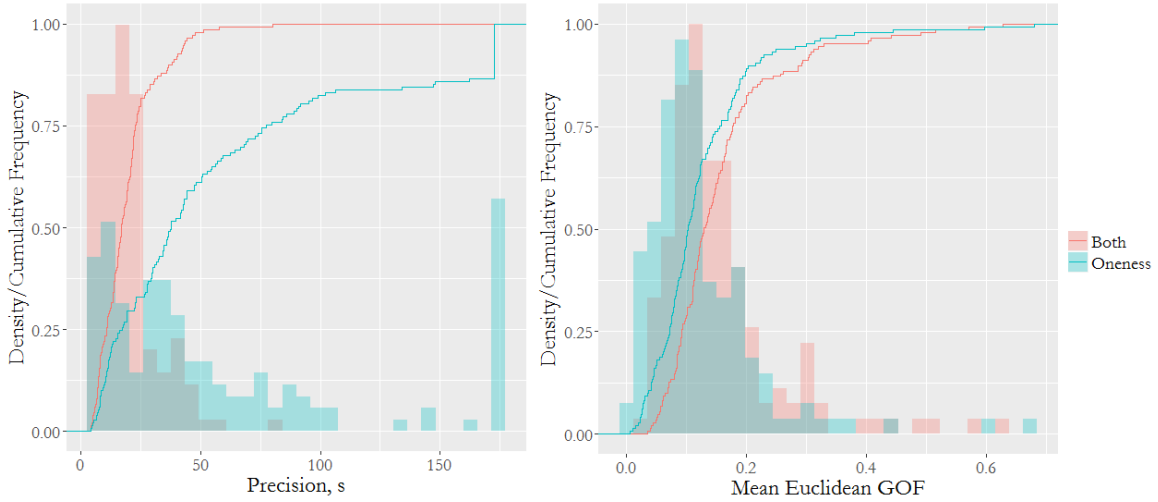
Figure 17 shows the distribution r , α , ϕ and ψ ; estimated using data from *both* and *oneness* treatments. The comparisons imply that, on average, estimates of inequality aversion and self-interest are higher; when using only the *oneness* treatment data. Oneness magnitude parameters, ϕ and ψ appear very similar, but less extreme values of ψ are estimated using *oneness* treatment data.

¹³For example, as the number of participants within a given experimental session increase, and are selected from a more disperse sample, it is likely that average *oneness* will decrease. This predicted decrease could be an interesting source of variation in behaviour, and using this model could address that variation.

Kolmogorov-Smirnov corrected test-statistics (non-parametric tests used to identify differences in two arbitrary distributions) show that α distributions are significantly different ($p = 0.081$), while r ($p = 0.144$), ϕ ($p = 0.190$) and ψ ($p = 0.960$) distributions are not significantly different. When accounting for the matched nature of the data, the Wilcoxon signed-rank test examines the null hypothesis both distributions are the same. Results show the null cannot be rejected (at 10%) for either α , ϕ or ψ ; for r the null can be rejected at 10%, but not at 5%.

Figure 18 shows the distribution of the s and the mean Euclidean goodness-of-fit; estimated using data from *both* and *oneness* treatments.¹⁴ Precision, s , estimates are higher and mean Euclidean GOF measures appear lower, when estimated using *oneness* treatment data. However, Kolmogorov-Smirnov corrected test statistics and Wilcoxon signed-rank test statistics reveal that only the distribution of s is significantly different ($p < 0.000$).

Figure 18: Sensitivity of Treatment Selection: s and GOF



The sensitivity analysis results are reassuring. The preference parameters estimated from the *oneness* treatment alone are similar to those estimated from *both* treatments. When considering that the data are matched pairs, neither α , ϕ nor ψ distributions are significantly different. Only the unmatched distribution of α and matched r , are significantly different, and this only at the 10% level. Higher precision parameters are estimated for the *oneness* treatment, but the mean Euclidean GOF measures are not significantly different. These results imply that the estimation of preference parameters is relatively insensitive to inclusion of treatments where ‘recipients’ are *known* and *anonymous*. Precision parameters are somewhat higher, but the ability of the model to fit behaviour is similar in both treatments.

¹⁴The *mean Euclidean GOF* $= \frac{1}{T} \sum_{t=1}^T \left(\sum_{i=1}^N (x_{it} - x_{it}^*)^2 \right)^{-2}$, where: T is the number of rounds in a treatment. It is a measure of goodness-of-fit which incorporates differences in optimal (x_{it}^*) and actual (x_{it}) allocations for Player 1, 2 and 3. The value is less intuitive, than that used in Section 4.3.3, but for the purposes of comparison encompasses more dimensions.

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