Us and Them: Distributional Preferences in Small and Large Groups*

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Abstract

We experimentally analyze distributional preferences when a decider chooses the provision of a good that benefits herself or a receiver, and creates costs for a group of payers. The treatment variation is the number of payers. We observe that subjects provide the good even if there are many payers so that the costs of provision exceed the benefits by far. This result holds regardless of whether the provision increases the decider's payoff or not. Intriguingly, it is not only selfish or maximin types who provide the good. Rather, we show that a substantial fraction of subjects are "insensitive to group size": they reveal to care about the payoff of all parties, but attach the same weight to small and large groups so that they ignore large provision costs that are dispersed among many payers. Our results have important consequences for the analysis of ethical behavior, medical decision making, charity donations, and the approval of policies with concentrated benefits and large, dispersed costs.

Keywords: Social Preferences, Distribution Games, Concentrated Benefits and Dispersed Costs, Insensitivity to Group Size

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1 Introduction

In many domains, an agent's decisions create both benefits for a small, well-defined group and costs that are dispersed among many individuals. For example, when a politician decides about a policy that is favored by a special interest group, she has to weigh the benefits for this group against the costs that the policy creates for the general public. When a physician determines a patient's treatment, she affects not only the patient's well-being, but also the treatment costs that the insurance company (and hence the group of customers of this company) has to pay. Individuals engaged in illegal behaviors such as tax evasion or corruption typically redistribute income to themselves or their families at the expense of the larger society.

To analyze these behaviors, economists need to know how agents trade off concentrated benefits against dispersed costs. Most theoretical work in economics on political and medical decision making, tax evasion or corruption assumes perfectly selfish agents. However, many economists probably agree that the assumption of pure selfishness is often made mainly for simplicity. There exists substantial evidence that a majority of individuals do not act in a completely selfish manner when making decisions that affect the payoff of others.[1] One robust finding from the lab is that many individuals take into account the welfare of other parties and have a preference for efficient outcomes (Andreoni and Miller 2002, Charness and Rabin 2002, Engelmann and Strobel 2004, Fisman et al. 2007, 2014). Yet, the experimental games in this literature are typically played in small groups of only two or three players. It is unclear what distributional preferences look like when the costs of an action are large but dispersed among many individuals.

What matters is the extent to which decision makers take into account the number of people who are affected by their decision. Consider, e.g., an individual who values the payoff of a single person, but ignores the size of an affected group. This individual may give generously in dictator games, but at the same time redistribute resources from many to herself if her benefit is sufficiently large relative to the costs per person. In contrast, an individual who takes into account the number of affected people may act selfishly in a dictator game, but refrain from redistributing resources from many to herself (and thus behave relatively generously), if the costs of this action for the group are sufficiently large. These examples illustrate that it is difficult to extrapolate behavior in games played in small groups to situations in which decisions affect many as long as we do not know how sensitive or insensitive decision makers are with respect to the size of an affected group. This poses an open empirical question which we address in this paper.

We conduct a laboratory experiment to study distributional preferences in allocation games with concentrated benefits and dispersed costs. In each game, a decider chooses

[1] See, for example, Fehr and Schmidt (2006) for a review of the experimental evidence.

the provision of a good which potentially affects her payoff, the payoff of a single receiver, and the payoff of n payers. Some games are standard *dictator games* (DG) between the decider and the receiver, i.e., the payers' payoff is fixed. In so-called *interested cost dispersion games* (ICDG), the provision of the good increases the decider's payoff while the n payers pay for it, but the receiver's payoff is fixed; in so-called *disinterested cost dispersion games* (DCDG), the provision of the good increases only the receiver's payoff and the n payers pay for it, i.e., the decider's payoff is fixed. Finally, we consider games where both the decider and the receiver benefit, while the n payers pay (*interested cost dispersion games with receiver*, ICDGR). Our treatment variation is the number of payers, with values $n \in \{1, 4, 8, 16, 32\}$. For each game, we keep the costs per payer constant across treatments, so that increasing the number of payers implies increasing costs of provision. This allows us to analyze distributional preferences in situations where eventually the costs of provision by far exceed its benefits.

We generalize Andreoni and Miller's (2002) CES utility function to derive testable predictions for the behavior in the experiment. Our model captures the extent to which an agent takes into account the number of payers n.[2] We say a decider is "sensitive to group size in ICDGs" if she does not provide the good in an ICDG if the number of payers is sufficiently large; in contrast, she is "insensitive to group size in ICDGs" if she provides the good in an ICDG, regardless of the number of payers, whenever the costs per payer are small enough relative to the decider's benefits. Accordingly, we define (in)sensitivity to group size in DCDGs. Purely selfish types are by definition insensitive to group size in ICDGs; and pure maximin types are by definition insensitive to group size in DCDGs. Deciders who do not exhibit the utility function of a pure preference type — we call them "non-pure" types — may be sensitive or insensitive to group size in ICDGs and/or DCDGs.[3]

If all deciders in our experiment with non-pure preferences were sensitive to group size, we should observe in any ICDG that, as the number of payers increases, subjects either stop providing the good, or they provide the maximal amount in case they are purely selfish. Similarly, in any DCDG, we should see that subjects either provide nothing of the good when the number of payers becomes large, or they provide the amount that maximizes the payoff of the least well-off individual in case they are pure maximin types. This is not what we find. In all games and all treatments, the majority

[2]There exist various social preference models that make precise behavioral predictions for allocation games like ours (e.g., Fehr and Schmidt 1999, Bolton and Ockenfels 2000, and Charness and Rabin 2002). In the Appendix, we show that none of these models is able to capture insensitivity to group size in ICDGs and DCDGs for generic values of parameters.

[3]Throughout the paper, "insensitivity to group size" means "insensitivity to group size in ICDGs and/or DCDGs."

of subjects provide significant amounts of the good, thereby reducing the overall group payoff substantially. For example, subjects provide on average 5.72 units (10 is the maximum) in a game in which each unit provided creates benefits of one for both the decider and the receiver, but also costs of one for each of 32 payers. Intriguingly, this result is not exclusively driven by pure (either selfish or maximin) types, but by non-pure types who reveal to care about the payoff of all parties. These subjects do not behave differently in treatments with either a small group or a large group of payers. Also their share does not differ significantly between treatments. This behavioral pattern allows us to provide a conservative lower bound of 37.1 percent on the share of subjects exhibiting insensitivity to group size in ICDGs, and a lower bound of 37.6 percent on the share of subjects exhibiting insensitivity to group size in DCDGs (the estimated correlation is 0.63). These subjects consider the payoffs of all parties, but as they ignore the number of payers (in one way or another), they take decisions that have an detrimental effect on overall welfare.

We also see "reversals in generosity" as described in the illustrating example above: 24 percent of the subjects who give most generously in DGs also take the maximal amount from payers in an ICDG with large, dispersed costs. Importantly, if a subject is concerned with efficiency in dictator games — she gives a lot if the receiver's benefits exceed the costs and little otherwise — this is not informative about her behavior when the costs are sufficiently dispersed. Those with the highest degree of efficiency concerns in DGs just provide as much in a DCDG with large dispersed costs as the rest. These results show that subjects' behavior in situations with concentrated benefits and dispersed costs may be quite different from behavior in classic dictator games.

Together, our theoretical and experimental findings provide a new explanation for a number of important empirical patterns (see Section 6 for a detailed discussion). First, they capture so-called "moral ambiguity." For a decider who is insensitive to group size, both charity donations that benefit clearly specified individuals (say, crime victims) and tax evasion can be optimal at the same time. Second, a physician who is insensitive to group size may have concerns for the patient, but not for the group of insurance payers. Thus, she may recommend an expensive but inessential treatment to patients who are insured, but not to those who pay for themselves. Third, social preferences with insensitivity to group size imply that altruism is fully congestible. Donations benefiting a single victim may be large, but at the same time they may be very small or zero when they are distributed among many recipients. Finally, if people are insensitive to group size, they may approve of political and economic decisions that create benefits for a few but at the same time entail large costs for society (such as, e.g., labor union strikes of small occupation groups). In all of these domains, distributional preferences with insensitivity to group size provide a unified explanation.

The rest of the paper is structured as follows. In the next section, we discuss the most important related literature. In Section 3, we develop a social preference model that captures sensitivity and insensitivity to group size in allocation games. Section 4 describes the experimental setup and Section 5 explains the results. In Section 6, we discuss the key economic implications of our findings. Finally, Section 7 concludes.

2 Related Literature

Our paper is related to different strands in the literature, which we discuss in this section.

Distributional Preferences. Seminal work by Andreoni and Miller (2002) shows that giving in dictator games can be rationalized by economic preferences. They as well as many subsequent papers demonstrate that subjects are heterogeneous with respect to their distributional preferences in allocation games: some are selfish, others maximize the payoff of the least well-off individual, or group welfare.[4] We advance this literature by analyzing the extent to which distributional preferences depend on the size of a group that is affected by a subject's decision. This is important, because in many domains where distribution decisions are made costs are dispersed among many individuals. We show that information about behavior in simple dictator games may not allow us to draw conclusions about distributional preferences in situations with concentrated benefits and dispersed costs. A subject who gives generously in dictator games but ignores the number of payers may act very selfishly when the costs of taking are dispersed among sufficiently many individuals.[5]

Closest to ours is Andreoni (2007) who studies giving in a dictator game with varying numbers of receivers. He finds that the average decider takes into account the number of receivers, although at a decreasing rate. We find that many subjects who are not purely selfish or pure maximin types ignore the number of payers, and that the occurrence of this phenomenon does not depend on whether they benefit from their choices or not. An important difference to Andreoni's (2007) design is that in our experiment each subject is confronted only with one group size. Thus, we can rule out demand effects that may otherwise prompt subjects to react to varying numbers of payers.

Contingent Valuation. Insensitivity to group size is reminiscent of what has been called "extension neglect" in the contingent valuation literature.[6] Kahneman et al. (1999)

[4] See Charness and Rabin (2002), Engelmann and Strobel (2004), Fisman et al. (2007, 2014).

[5] Related to this, there is recent theoretical literature on distributive justice that asks whether the number n should matter if the welfare of one poor person is traded-off against the welfare of n rich individuals, e.g., Fleurbaey and Tundgodden (2010) and Voorhoeve (2014).

[6] Contingent valuation is a method used to estimated the willingness-to-pay for particular public goods, typically from survey data. See Carson (2012) and Hausman (2012) for a recent critical discussion.

define extension neglect as follows: "The attitude to a set of similar objects is often determined by the [...] valuation of a prototypical member of that set. [...] Unless attention is specifically directed to it, the size of the set has little or no influence on its valuation." A classic study is Desvousges et al. (1993) who describe the following hypothetical situation to their subjects: "[2,000, or 20,000, or 200,000] migrating birds die each year by drowning in uncovered oil ponds, which the birds mistake for bodies of water. These deaths could be prevented by covering the oil ponds with nets. How much money would you be willing to pay to provide the needed nets?" Subjects were found to be largely insensitive to the scope of the problem. The average stated willingness to pay was 80 USD, 78 USD and 88 USD, respectively.[7] Our results highlight a phenomenon that appears similar to extension neglect in the context of allocation decisions with dispersed costs. However, the main objective of our paper is fundamentally different from the contingent valuation literature.

First, contingent valuation is primarily interested in the elicitation of passive valuations for a good that respondents will never use and whose valuations cannot be revealed through market choices (Carson 2012). In fact, as Kahneman et al. (1999) write, the main objective of the literature "is far from the core of economic discourse", a view that is also corroborated by the fact that most of the results have not entered the economic debate up to now. In contrast, the key interest of our paper lies exactly in the economic analysis. We study real, incentivized allocation decisions to shed light on economic distributional preferences. Second, Desvousges et al. (1993) and others typically consider very large numbers of beneficiaries (e.g., 2,000 to 200,000). In contrast, the number of payers in our allocation games is at most 32. While the group sizes we consider are relatively large compared to most experimental games analyzed in the economic literature, they are cognitively much less demanding than the numbers encountered in the contingent valuation literature. Our results thus show that insensitivity to group size starts at comparatively small numbers. Third, our paper also has very different applications in mind, all of them being at the core of the economic discourse, e.g., the provision of health care, local public goods, or tax evasion.

Part-Whole Bias. So far, the only experimental paper in economics that draws on findings from the contingent valuation literature is Bateman et al. (1997). The authors document a so-called "part-whole bias" in choices over private goods: the sum of elicited valuations of two complementary private goods is larger when evaluated separately than when evaluated as a bundle, a finding that poses a problem to Hicksean consumer theory. Besides a methodological overlap stemming from the fact that Bateman et al. (1997) also use non-hypothetical decisions with real money at stake, there is no further relationship

[7] See also Frederick and Fischhoff (1998) and Kahneman (2003, 2011).

to the main question and analysis in our paper.

Psychic Numbing. The psychological literature on "psychic numbing" is related to our paper. The term "psychic numbing" is due to Lifton (1967) and describes a human tendency to ignore or withdraw attention from certain negative experiences or future consequences. Most of the original work has focused on human or natural disasters, such as the Hiroshima bombing in World War II, and the association with post-traumatic stress disorders. While the basic tendency to ignore or act insensitively with respect to large scale effects may well be relevant in other settings (see Slovic 2007), the main focus and contribution of the literature is again quite different from our paper. Similar to contingent valuation, most of the cases and arguments consider very large numbers of individuals who are affected (e.g., whole populations). In contrast, numbers in our setup are much smaller and easier to handle cognitively. Further, the objective of this literature is not to integrate or formalize the notion of psychic numbing in an economic model. Again, writers see the phenomenon as something that is rather outside the classic economic framework. In contrast, our contribution is to develop and analyze an economic utility model that helps improve our understanding of distributional preferences in important real-world situations with concentrated benefits and dispersed costs.

Third-Party Neglect. A number of papers find that when two parties interact strategically, the welfare of a third party may be neglected. Güth and van Damme (1998) study bargaining games in which the proposer suggests a split between himself, a receiver who has to approve the allocation, and a passive bystander. They show that the passive bystander usually gets very little in this setting. Okada and Riedl (2005) analyze bargaining games in which the proposer first chooses the number of receivers (either one or two) and then how to distribute the endowment within the group. The proposal is implemented if all chosen receivers accept. Proposers correctly anticipate that with two receivers they would have to share a larger fraction to get acceptance. Thus, a majority opts for one receiver only, leaving the other receiver with the value of the outside option. In both papers, the observed "third-party neglect" is a result of strategic interaction. In contrast, strategic concerns are absent in our setup. The resulting phenomenon is entirely driven by subjects' revealed distributional preferences.

Group Size Effects in Public Goods Provision. Finally, there exists an experimental literature on group size effects in public goods games; see, e.g., Isaac and Walker (1988) and Isaac et al. (1994). The main motivation is to test Olson's (1965) conjecture that small groups are more successful in establishing mutual cooperation than large groups. As in the literature on third-party neglect, the main focus is on strategic concerns. These papers examine repeated interaction between group members so that reputation concerns additionally come into play. In consequence, their results do not allow us to draw conclusions about the shape of distributional preferences in situations with concentrated benefits and dispersed costs.

3 A Theory of Distributional Preferences in Small and Large Groups

This section develops a formal framework to analyze a decision maker's (in)sensitivity to group size in a class of allocation games. These games involve three parties: a decider, a receiver, and n payers. In each game, the decider chooses the provision $x \in [0, \bar{x}]$ of a good. The decider's payoff is $\pi_D(x) = W_D + ax$, the receiver's payoff is $\pi_R(x) = W_R + bx$, and each payer's payoff is $\pi_P(x) = W_P - cx$. Hence, each game is characterized by the parameters (a, b, c) and the number of payers n. Games with $a < 0$, $b > 0$ and $c = 0$ are *dictator games* (DG); games with $a > 0$, $b = 0$ and $c > 0$ are called *interested cost dispersion games* (ICDG); games with $a = 0$, $b > 0$ and $c > 0$ are called *disinterested cost dispersion games* (DCDG); and games with $a > 0$, $b > 0$ and $c > 0$ are called *interested cost dispersion games with receiver* (ICDGR). Throughout, we assume $W_D = W_P > W_R$.

3.1 Behavior in Dictator Games

A robust finding in DGs is that subjects' behavior is heterogeneous. Andreoni and Miller (2002) capture this heterogeneity in the CES utility function[8]

$$U^{AM}(\pi_D, \pi_R) = \left(\alpha \pi_D^\rho + (1-\alpha)\pi_R^\rho\right)^{1/\rho}. \tag{1}$$

The parameter α represents the weight of the own payoff relative to the payoff of the other person; the parameter ρ defines the convexity of the utility function. This CES utility function captures the three "pure" social preference types: the purely selfish type has $\alpha = 1$; the pure welfare type has $\alpha = 0.5$ and $\rho = 1$; and the pure maximin type has $\alpha = 0.5$ and $\rho \to -\infty$.

Define $\theta = (1-\alpha)/\alpha$. In a DG, a subject whose preferences can be described by U^{AM} will provide $x \in (0, \bar{x})$ units if the marginal rate of substitution between the decider's and the receiver's payoff (MRS_{DR}) at x equals the inverse "price of giving",

$$MRS_{DR}(x) \equiv \frac{1}{\theta}\left(\frac{\pi_R(x)}{\pi_D(x)}\right)^{1-\rho} = -\frac{b}{a}. \tag{2}$$

She does not provide anything if $MRS_{DR}(0) \geq -b/a$, and the maximal amount if $MRS_{DR}(\bar{x}) \leq -b/a$. How would this subject behave in our cost dispersion games? The answer depends on the extent to which the subject takes into account the number of payers. To capture the various possibilities, we have to extend U^{AM}.

[8] See also Andreoni (2007), Cox et al. (2007), Fisman et al. (2007), Cox and Sadiraj (2012).

3.2 Behavior in Cost Dispersion Games

We generalize Andreoni and Miller's (2002) utility function by including another party, the payers, and by letting the utility weights of the receiver's and the payers' payoff depend on the number of payers n. The CES utility function then becomes

$$U(\pi_D, \pi_R, \pi_P, n) = (\pi_D^\rho + g(n)\pi_R^\rho + f(n)\pi_P^\rho)^{\frac{1}{\rho}} \,. \tag{3}$$

The function $g(n)$ captures the weight of the receiver's payoff when there are n payers affected by the decider's action. Similarly, $f(n)$ is the weight of a payer's payoff as a function of the number of payers. Both functions are needed to describe behavior in cost dispersion games. We normalize $g(0) = \theta$ and $f(0) = 0$ so that for DGs the utility function collapses to U^{AM}. For future reference we define $h(n) = f(n)/g(n)$ whenever this ratio exists.

Our CES utility function again captures the three pure preference types.[9] Note that both the purely selfish type with utility function $U(\pi_D, \pi_R, \pi_P, n) = \pi_D$ and the pure maximin type with utility function $U(\pi_D, \pi_R, \pi_P, n) = \min\{\pi_D, \pi_R, \pi_P\}$ ignore the number n of payers. The pure welfare type with utility function $U(\pi_D, \pi_R, \pi_P, n) = \pi_D + \pi_R + n\pi_P$ takes the number of payers into account. We say that an agent has "non-pure" social preferences if she does not belong to the class of pure preference types. In the following, we assume that agents with non-pure preferences value the payoff of each party, and the weight attached to a group of payers does not strictly decrease in the size of the group. Formally, this is the case if $1 > \rho > -\infty$, $f(n)$ and $h(n)$ weakly increase in n, and $\theta, h(1) > 0$.

The value $g(0) = \theta$ defines the marginal rate of substitution between the decider's and the receiver's payoff in DGs. Thus, the first-order condition in (2) again characterizes behavior in DGs. The utility weight $f(n)$ defines the marginal rate of substitution between the decider's and the payers' payoff. In an ICDG, an individual whose preferences can be described by U will provide $x \in (0, \bar{x})$ units if

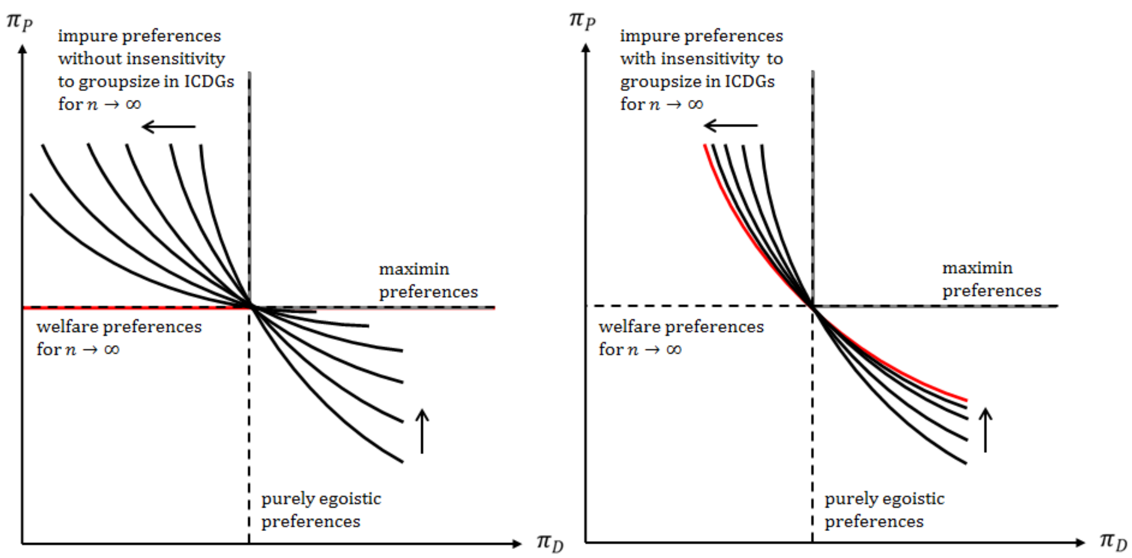
$$MRS_{DP}(x) \equiv \frac{1}{f(n)} \left(\frac{\pi_P(x)}{\pi_D(x)} \right)^{1-\rho} = \frac{c}{a}. \tag{4}$$

She does not provide anything of the good if $MRS_{DP}(0) \leq c/a$, and the maximal amount if $MRS_{DP}(\bar{x}) \geq c/a$. The provision of the good decreases in $f(n)$. Consider Figure 1 below. If a decider with non-pure social preferences always takes into account the number of payers, the indifference curves in the $\pi_D - \pi_P$ space become flat as $n \to \infty$ (as in the left graph). In this case, $f(n) \to \infty$ for $n \to \infty$. Intuitively, this means that the

[9]The purely selfish type has $\theta = g(n) = f(n) = 0$ for all n; the pure welfare type has $\rho = 1$, $\theta = g(n) = 1$ and $f(n) = n$ for all n; and the pure maximin type has $\rho \to -\infty$, $\theta = g(n) = 1$ and $f(n) = 1$ for all $n \geq 1$.

decider's own payoff π_D becomes unimportant relative to a payer's payoff π_P when there are more and more payers. However, if a decider with non-pure preferences does not fully take into account the number of payers, i.e., $f'(n) \to 0$ for $n \to \infty$, then for any payoff combination the slope of the indifference curves remains above some positive level (as in the right graph). The decider then provides some of the good when the ratio c/a is close enough to zero, regardless of the number of payers.

Figure 1: Indifference curves in the $\pi_D - \pi_P$ space



Notes: The dotted vertical line shows an indifference curve of purely selfish types. The dotted horizontal line shows an indifference curve of pure welfare types when $n \to \infty$. The grey curve shows an indifference curve of pure maximin types. The black curves show a sequence of indifference curves of non-pure types (with sensitivity to group size in ICDGs on the left, and with insensitivity to group size in ICDGs on the right) when $n \to \infty$. The red curve represents the limit.

Similarly, the utility weight $h(n)$ defines the marginal rate of substitution between the receiver's and the payers' payoff. In a DCDG, an individual with utility function U will provide $x \in (0, \bar{x})$ if

$$MRS_{RP}(x) \equiv \frac{1}{h(n)} \left(\frac{\pi_P(x)}{\pi_R(x)} \right)^{1-\rho} = \frac{c}{b}. \tag{5}$$

She does not provide anything of the good if $MRS_{RP}(0) \leq c/b$, and the maximal amount if $MRS_{RP}(\bar{x}) \geq c/b$. The provision of the good decreases in $h(n)$. If $h(n)$ is sufficiently large, the decider will not provide the good in the DCDG. However, if she does not fully take into account to the number of payers, i.e., $h'(n) \to 0$ for $n \to \infty$, she provides the good when the ratio c/b is close enough to zero, regardless of how many payers there are.

The following definition makes precise what it means than an individual either takes into account or does not not take into account the number of payers.

Definition 1 *A decider with non-pure social preferences is called sensitive to group size in ICDGs (DCDGs) if* $\lim_{n\to\infty} f'(n) > 0 \;\; (\lim_{\mathrm{n}\to\infty} \mathrm{h}'(\mathrm{n}) > 0)$. *In this case, her provision of the good converges to zero in each ICDG (DCDG) as the number of payers grows large. A decider is called insensitive to group size in ICDGs (DCDGs) if* $\lim_{n\to\infty} f'(n) = 0 \;\; (\lim_{\mathrm{n}\to\infty} \mathrm{h}'(\mathrm{n}) = 0)$. *Then, there exists an ICDG (DCDG) in which she provides at least* $x > 0$ *of the good, regardless of the number of payers.*

An individual may be both insensitive to group size in ICDGs and sensitive to group size in DCDGs, or vice versa. Thus, our framework for example allows for deciders who make rather selfish choices in DGs and ICDGs but do not provide the good in a DCDG if the number of payers is sufficiently large.[10]

We can now characterize behavior in ICDGRs. In an ICDGR, there are two reasons to provide the good: to increase one's own payoff and to redistribute payoffs from the payers to the receiver. An individual whose preferences can be described by U will provide $x \in (0, \bar{x})$ in an ICDGR if

$$MRS_{DRP}(x) \equiv \frac{1}{f(n)} \left(\frac{\pi_P(x)}{\pi_D(x)}\right)^{1-\rho} + \frac{1}{h(n)} \left(\frac{\pi_P(x)}{\pi_R(x)}\right)^{1-\rho} \frac{b}{a} = \frac{c}{a}. \tag{6}$$

She does not provide anything of the good if $MRS_{DRP}(0) \leq c/a$ and the maximal amount if $MRS_{DRP}(\bar{x}) \geq c/a$. Note that in an ICDGR the ratio b/a is positive. Hence, the decider provides a positive amount of the good, regardless of the number of payers, if she exhibits insensitivity to group size in ICDGs *or* DCDGs and the ratio c/a is close enough to zero.

3.3 Reversal in Behavior

(In)sensitivity to group size generates an important behavioral phenomenon: depending on whether an individual is sensitive or insensitive to group size, we may observe decisions that at first sight seem contradictory. We call this "reversal in behavior."

Reversal in generosity. Does generous or non-generous behavior in dictator games translate into similar behavior in situations with concentrated benefits and dispersed

[10] To see this, consider a DG and an ICDG with parameters $(a, b, 0)$ and $(a', 0, c')$, respectively. Let $f(n) = \theta$ for all n and $\theta > 0$ be small enough so that the decider behaves selfishly in both games. If $g(n) = \theta/n$ for all $n \geq 1$ so that $h(n) = n$, then for any given DCDG, she provides nothing of the good if n is sufficiently large; see the first-order condition in (5).

costs? The answer to this question depends on an individual's sensitivity to group size. A decider who is insensitive to group size in ICDGs can at the same time be willing to share in a DG, and take from many others in an ICDG $(a, 0, c)$ if the ratio c/a is close enough to zero. In contrast, a decider who is sensitive to group size in ICDGs and gives nothing in the DG will take nothing from the payers in the ICDG — and thus behave relatively generously — if the number of payers is sufficiently large. Both statements follow from the first-order conditions in (2) and (4).

Reversal in welfare and maximin concerns. Similarly, a decider may be concerned with welfare in dictator games: she gives a lot if the provision of the good increases the total payoff $(-a < b)$ and provides little otherwise $(-a > b)$. Another decider may be concerned with the equality of the receiver's and her own payoff, such that for given provision costs a she gives more when the receiver's marginal return b decreases. To what extent do these motives carry over to games with concentrated benefits and dispersed costs? If the decider with welfare concerns is insensitive to group size in DCDGs, she provides the good in a DCDG $(0, b, c)$, regardless of the number of payers, if the ratio c/b is sufficiently close to zero. Thus, when total costs are large but dispersed among many payers, she makes choices that actually reduce group welfare. In contrast, if the decider with maximin concerns is sensitive to group size in DCDGs, then in any given DCDG she will not provide the good if there are too many payers. She then accepts the inequality between the receiver's and the payers' payoff in order not to damage group welfare. Both statements can be derived from the first-order conditions in (2) and (5).

4 Experimental Design

We now come to our experiment. The goal of the experiment is to provide an empirical analysis of distributional preferences in situations with concentrated benefits and dispersed costs. In particular, we are interested in whether or not subjects take into account the number of individuals affected by their decisions.

Basic Setup. Subjects play a number of allocation games. In each game, the decider's and the payers' endowment is $W_D = W_P = 15$ tokens, while the receiver's endowment is $W_R = 5$ tokens. The decider chooses the provision $x \in \{0, 1, \ldots, 10\}$ of the good. We keep the framing constant across games. Our treatment manipulation is the number of payers n; in each treatment, the number of payers is fixed. We consider five different treatments with n equal to 1, 4, 8, 16, and 32. We call these treatments $P1$, $P4$, $P8$, $P16$ and $P32$, respectively. Table 1 displays the parameter values (a, b, c) of all allocation games played in the experiment as well as the actions that a pure preference type would choose: x_i^s is the selfish action in game i, x_i^w is the action that maximizes the group payoff (for treatments with eight or more payers), and x_i^m is the action that maximizes the payoff of the least well-off individual of the group.

[Insert Table 1 about here]

The first three games are DGs with fixed marginal costs a for the decider and varying values of the receiver's marginal benefit b; the next six games are ICDGs in which we both vary the decider's marginal benefit a and the payers' marginal costs c; the next six games are DCDGs in which we both vary the receiver's marginal benefit b and the payers' marginal costs c; finally, the last three games are ICDGRs, again with varying values of b.[11]

In each treatment with n payers, subjects are paired up randomly into groups of size $n + 2$. Each subject chooses the provision of the good x in all games. After the experiment, we randomly pick one game for each group that is implemented. We also randomly select one subject from each group who takes on the role of the decider and one subject who takes on the role of the receiver. The other subjects of the group take on the role of payers. The decider's action in the chosen game then determines the payoffs of all group members. Hence, subjects' decisions can only affect their own payoff when they are chosen to be the decider, not when they are in the role of the receiver or of a payer. This is explicitly communicated to all subjects.

Subjects get no feedback about the actions of others except through their payment after the experiment. When making their decision, they receive detailed information about the potential consequences of their action on the decision screen: their own payoff, the receiver's payoff, the payoff of each payer, and the group payoff. Thus, the group payoff is as salient as any individual payoff.

Control Treatments. Our experimental design implies that the probability with which a particular decision becomes effective varies between treatments. The realization probability equals $1/18 \times 1/(n + 2)$ in a treatment with n payers. This variation may affect behavior, for example, through subjects' attention to the task or via demand effects (subjects in treatments with lower realization probability may behave more generously as their decisions are less likely to become effective). We therefore implement two control treatments, P16-17 and P32-9. These treatments differ in the number of payers (16 in P16-17 and 32 in P32-9), but the realization probability is exactly the same, because in P16-17 subjects play 17 games while in P32-9 subjects play only 9 games. Any difference between these two treatments cannot be attributed to the variation in the realization probability, but only to the variation in the number of payers. Moreover, by comparing behavior in the two treatments P32-9 and P32 we can check whether the realization

[11] Parameters in the ICDGs and DCDGs are chosen such that we also are able to analyze how the provision of the good changes when constant total costs are distributed over more and more payers. We do this in the Online Appendix.

probability matters for subjects' decisions, as the probability in the former treatment is twice as large as in the latter treatment.[12]

Experimental Procedures. The experiment was conducted online over the internet and administered by CentERdata, Tilburg University. On the first screens of the experiment, participants answered several survey questions on demographic variables. We then carefully explained the design using a number of numerical examples. Subjects could participate in the experiment only if they correctly answered two control questions. We recruited subjects through ORSEE (Greiner 2015) from the University of Munich. Our main motivation for conducting the experiment online was two-fold: First, many of the economic situations we have in mind (e.g., tax evasion) involve a high degree of anonymity between the decider and the group of payers. The online experiment, in which subjects decide without the other parties being physically present, mimics this important feature. Second, by running the experiment over the internet we also keep the degree of anonymity constant across treatments. This would not be possible in a classic lab environment, where the degree of anonymity may vary with the number of subjects who are present. To check whether our choice of an online experiment influences behavior, we recruited additional subjects who participated in our study in an experimental lab. We do not find any behavioral differences and therefore pool the data from both sources.[13] All data was obtained in anonymized form, which was made clear to the participants in the invitation and also on the first screen of the experiment. In total, 502 participants completed the experiment over the internet, and 79 participants in the experimental lab; 75 participants were allocated to treatment P1, 78 to treatment P4, 69 to treatment P8, 71 to treatment P16, 99 to treatment P32, 89 to treatment P16-17, and 100 to treatment P32-9.[14] A participant's final payoff of π tokens was converted into 0.65π Euros. Average earnings in the experiment (which include a 4 EUR show-up fee) were 11.80 Euros.

5 Experimental Results

In the results section, we proceed as follows. We first analyze behavior in the dictator games to see whether behavior in our experiment is consistent with previous results in the literature (Section 5.1). Then we consider the cost dispersion games. We start by investigating average behavior in ICDGRs (Section 5.2) as these are at the core of our

[12]In treatment P16-17 subjects play all games except DCDG 13. In treatment P32-9, subjects play DG 1, 2, 3, ICDG 4, 5, 6, and DCDG 10, 11, 12.

[13]See the Online Appendix for details on procedures and results.

[14]We ensured the necessary number of $n+2$ players in each treatment by filling up incomplete groups with participants who did not answer the control questions correctly (they were assigned the roles of receivers or payers).

interest in view of economic applications: both the decider and the receiver benefit, while the payers pay. Subsequently, we go into details by analyzing average as well as the heterogeneity of individual behavior in ICDGs (Section 5.3) and DCDGs (Section 5.4). Finally, we examine potential reversals in behavior (Section 5.5).

Table 2 summarizes behavior in all treatments and games. We report the average (and standard deviation) of the units of the good provided by all subjects, the share of subjects who provide ten (i.e., the maximum amount) as well as the share of subjects who provide zero. Moreover, we report the share and the average behavior of several subgroups further defined below. The data from treatments P16 and P16-17 are pooled under the label P16, as we observe no difference between these two treatments (this also applies to all graphs and regressions below). The same holds for treatments P32 and P32-9 (see below), which are pooled under P32. We continuously refer to the numbers reported in Table 2 in this section.

[**Insert Table 2 about here**]

5.1 Behavior in Dictator Games (DGs)

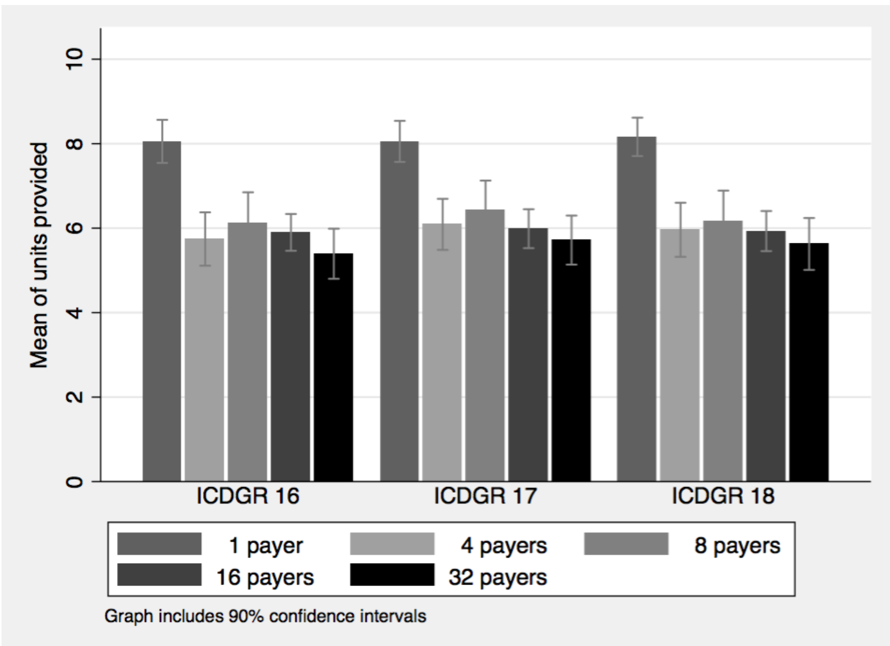
The data from the DGs allow us to check whether subjects' behavior is comparable to that in previous studies on dictator game giving. This is important in order to rule out that our results in the experiment are caused by subject pool effects. Note that the only difference between the DGs played in the different treatments is the realization probability with which a subject's decision is implemented. The variation in this probability could in principle affect behavior, either via subjects' attention to the decision task or via demand effects. In the Online Appendix, we show that the realization probability has no significant effect on subjects' behavior. On average, subjects provide the same amount in the DGs, regardless of whether there is only one player (so that the realization probability equals 1/54) or 32 payers (so that the realization probability is 1/612). We also find no significant differences in behavior between the treatments P32 and P32-9 or between P16-17 and P32-9 for any other type of game. We therefore pool the data from all treatments.

In DG 1 ($a = -1.0$, $b = 1.5$), the average provision of the good is 2.19 units; in DG 2 ($a = -1.0$, $b = 1.0$), it is 2.01 units; in DG 3 ($a = -1.0$, $b = 0.5$), it is 1.78 units. The share of subjects who provide zero in all DGs is 35.1 percent. These numbers are very close to previous results in the literature. In his meta-study, Engel (2011) reports that the share of participants in dictator games who do not give anything to the receiver is 36.1 percent. In Andreoni and Miller (2002), average giving is equal to 16.9 to 24.3 percent (in our data 20.1 percent) when the price of giving is 1, and 20.7 to 21.2 percent (in our data 17.8 percent) when the price of giving is 2. Moreover, we find a similar gender effect as Andreoni and Vesterlund (2001). Men provide more of the good than women if the provision of the good increases the group payoff, and less if it decreases the group payoff (see the Online Appendix for details). We thus conclude that the results from our DGs are in line with those in previous studies.

5.2 Behavior in Interested Cost Dispersion Games with Receiver (ICDGRs)

Figure 2 displays the average provision of the good in the three ICDGRs for all treatments (see also Table 2). The main observation is startling. While subjects on average provide eight units if there is only one payer, they provide about six units on average if the number of payers is larger than one, *independent* of whether the number of payers is 4, 8, 16, or 32. In all three games, the average provision is significantly larger in treatment P1 than in P4 ($p-value < 0.001$), but there is no significant difference between treatments P4 to P32 ($p-value > 0.591$).[15] This behavior has detrimental consequences on overall group welfare. For example, in ICDGR 18 of treatment P32, the average provision implies an increase of 5.63 tokens in the decider's payoff and an increase of 2.82 tokens in the receiver's payoff, at a total cost of 180.16 tokens for the group of payers.

Figure 2: Average provision in ICDGRs (all subjects)



[15]Throughout the paper, $p-values$ come from linear regressions (see the Online Appendix for ICDGRs).

Result 1 *Subjects provide substantial amounts of the good in ICDGRs. While the average provision is significantly lower when the number of payers increases from 1 to 4, there is no significant difference when the number of payers increases from 4 to 8, 16, or 32.*

According to our model, there are three potential explanations for this result: first, pure selfish types provide the good to maximize their own payoff; second, pure maximin types provide the good to equalize the receiver's and a payer's payoff; finally, subjects with non-pure social preferences, who are insensitive to group size in either ICDGs or DCDGs, care for the payoff of all parties but do not fully take into account the number of payers. For them, some provision of the good can then be optimal. In the following, we examine the relevance of each of these explanations by analyzing the size and the behavior of these subgroups using data from the ICDGs and DCDGs.

5.3 Behavior in Interested Cost Dispersion Games (ICDGs)

In an ICDG, providing the good entails benefits for the decider and costs for all payers. There is no additional redistribution motive towards the receiver. Figure 3 shows how the average provision of the good varies across the six ICDGs and across treatments. Overall, the provision of the good slightly decreases in the number of payers, but the changes are small relative to the corresponding increase in provision costs. The implied damage for the group payoff is again substantial. For example, in ICDG 6 of treatment P32, the average provision increases the decider's payoff by 2.10 tokens at a cost of 134.08 tokens for the payers. Despite this, subjects reveal to "care" for efficiency: their provision of the good significantly increases in their own marginal payoff a, and decreases in a payer's marginal cost c (see specification 1 and 2 of Table 3).

Since each subject is confronted with only one group size, we cannot determine directly whether a particular individual is insensitive to group size in ICDGs or not. Nevertheless, the data allow us to provide a conservative estimate of the share of these subjects. If all subjects with non-pure preferences are sensitive to group size in ICDGs, we should observe that their provision of the good converges to zero as the number of payers grows large. However, if a subject with non-pure preferences in insensitive to group size in ICDGs, her provision in a ICDG converges to a strictly positive value.

We use this to analyze the data. First, we identify and exclude all subjects who act like pure selfish or pure maximin types in the DGs. We call them "selfish types" and "maximin types", respectively. Overall, 35.1 percent of our subjects are selfish types and 8.0 percent are maximin types; see Table 2 for the respective shares in each treatment.[16]

[16] In the Online Appendix, we do the same analysis allowing for errors of maximin types.

Figure 3: Average provision in ICDGs (all subjects)

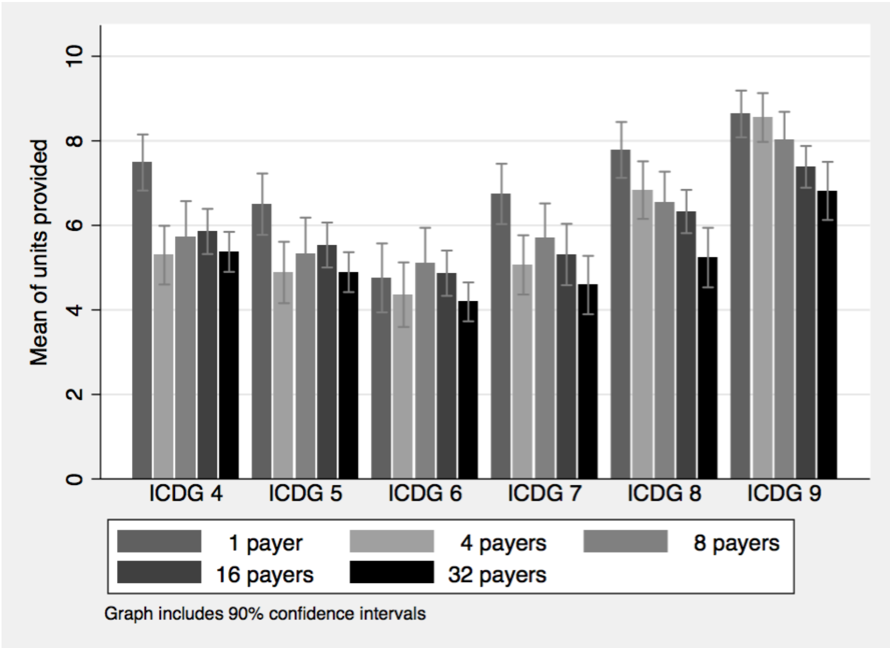
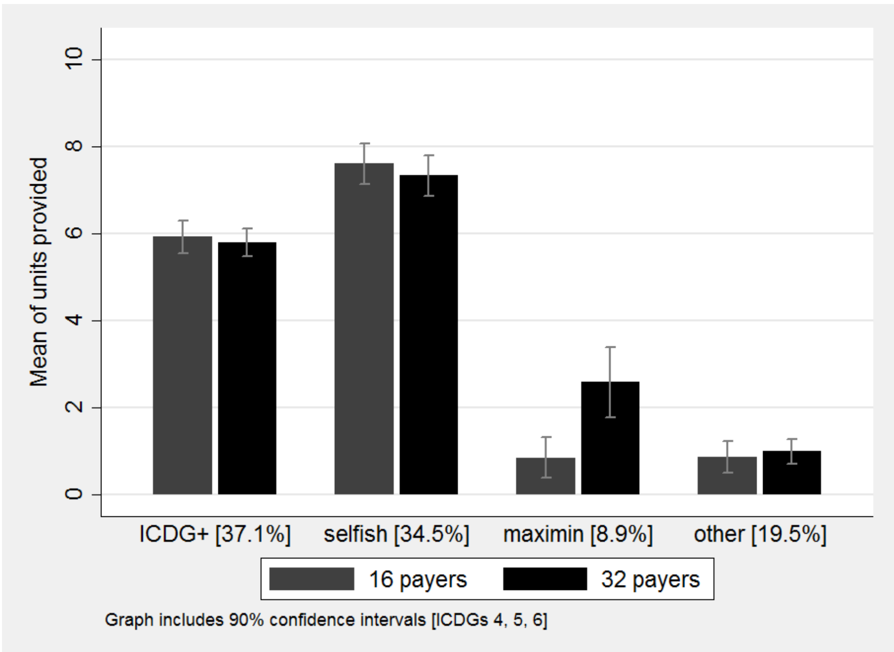


Figure 4: Average provision of different types (ICDGs 4 to 6)



Next, from all remaining subjects we consider those who provide positive amounts in all of the first three ICDGs.[17] We call them "ICDG+ types." We then analyze to what extent the average provision and the share of these subjects varies across treatments in the ICDGs. In particular, we are interested in their behavior in the limit when the number of payers becomes large. If both values remain constant across the treatments P16 and P32 (which is indeed what we find), their share in these treatments is a good estimate for the fraction of subjects who are insensitive to group size in ICDGs.[18]

ICDG+ types provide substantial amounts of the good in all ICDGs and treatments, see Table 2 and Figure 4. A regression analysis shows that their behavior in the ICDGs does not vary significantly between the treatments P8, P16 and P32 (see specifications 4 and 5 of Table 3). On average ICDG+ types take the welfare of all parties into account: their provision increases in their own marginal payoff a, and decreases in a payer's marginal cost c. The share of ICDG+ types does not vary significantly between the treatments P8 to P32 (see specification 3 of Table 3), and the shares are rather close to each other in P16 and P32 (38.8 and 35.7 percent, respectively; $p - value = 0.542$). The average share of ICDG+ types in these treatments is 37.1 percent, which constitutes our conservative estimate of the share of subjects who exhibit insensitivity to group size in ICDGs.

[**Insert Table 3 about here**]

To see what types create the huge welfare losses, we compare in Figure 4 the behavior of the different subgroups in the first three ICDGs 4 to 6 of the treatments P16 and P32. ICDG+ types provide on average 5.85 units in these games when there are 16 or 32 payers. Unsurprisingly, selfish types provide the most, on average 7.46 units. Considering all ICDGs and all treatments, we see a slight, mostly insignificant downward trend in their provision as the number of payers increases (see specification 6 of Table 3). Maximin types provide on average only 1.84 units in ICDGs 4 to 6 with either 16 or 32 payers. Figure 4 shows that their provision is in fact higher in P32 than in P16, but a regression analysis including all ICDGs and treatments reveals no significant differences (see specification 7 of Table 3). Finally, subjects who do not belong to any of these types provide on average only 0.95 units; these subjects mostly reduce their provision as the

[17] We use these games as they were played by all subjects in both the main and the control treatments.

[18] We consider this estimate to be a conservative lower bound. First, subjects who are classified as selfish or maximin types might also have non-pure preferences and exhibit insensitivity to group size. Second, subjects who provide zero in the first three ICDGs might provide positive amounts regardless of the number of payers when the costs per payer are smaller than the values chosen in our experiment. In the Online Appendix, we therefore consider a stricter classification of selfish and maximin types and thus provide a less conservative lower bound.

number of payers increases (see specification 8 of Table 3). In sum, we find that both selfishness and insensitivity to group size in ICDGs contribute equally to the inefficient provision of the good in ICDGs when there are many payers.

Result 2 *Subjects provide substantial amounts in ICDGs and the average provision decreases only slightly in the numbers of payers. Selfishness and insensitivity to group size in ICDGs provide key explanations for this observation. When there are 16 or 32 payers, subjects who act like purely selfish types in the DGs (34.5 percent of subjects) on average provide 7.46 units in the first three ICDGs; subjects who provide positive amounts in the ICDGs but who according to their choices in the DGs are not purely selfish or pure maximin types (37.1 percent of subjects), on average provide 5.85 units in the first three ICDGs. Since neither the behavior nor the share of the latter group differs significantly when there are 16 or 32 payers, their share provides a conservative estimate of the share of subjects who are insensitive to group size in ICDGs.*

5.4 Behavior in the Disinterested Cost Dispersion Games

In a DCDG, the provision of the good redistributes payoffs from the payers to the receiver but does not benefit the decider. Thus, it is costless for subjects to make choices that maximize group welfare. Figure 5 shows the average provision of the good in the six DCDGs for all treatments. Subjects' behavior in the DCDGs appears even less responsive to the number of payers compared to the ICDGs above. The provision remains largely constant, regardless of whether there are 4, 8, 16 or 32 payers, which again implies substantial welfare losses. For example, in DCDG 12 of treatment P32, the average decision is to provide 3.35 units, which increases the receivers' payoff by 1.68 tokens but reduces the payers' total payoff by 107.20 tokens. Nevertheless, subjects do take into account the costs per payer: the provision of the good significantly decreases in the marginal costs per payer c (see specification 1 and 2 of Table 4).

The data again allow us to provide a conservative estimate of the share of subjects who are insensitive to group size in DCDGs. As before, we exclude all subjects who act like pure selfish or pure maximin types in the DGs. From the remaining subjects we consider those who provide positive amounts in all of the first three DCDGs and call them "DCDG+ types." Then we examine to what extent their share and behavior varies across treatments in the DCDGs.

DCDG+ types provide substantial amounts of the good in all games and treatments, see Table 2 and Figure 6. Their average provision hardly varies between the treatments P8, P16 and P32 (see specifications 4 and 5 of Table 4). The average reaction of DCDG+ types to the receiver's marginal payoff b is significantly negative ($p-value < 0.1$), which indicates that on average they care more about equality than efficiency in DCDGs.

Figure 5: Provision of the good in DCDGs (all subjects)

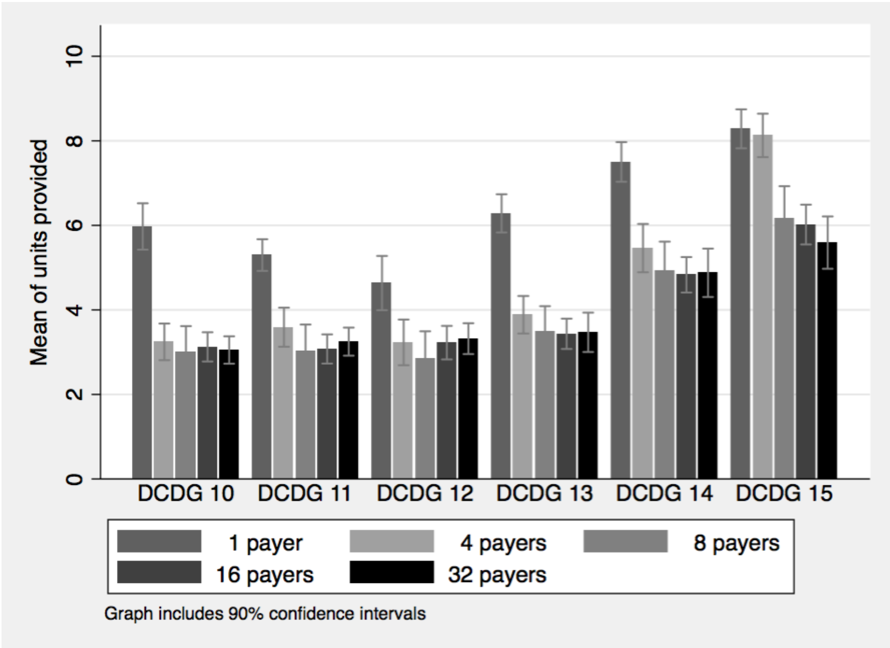
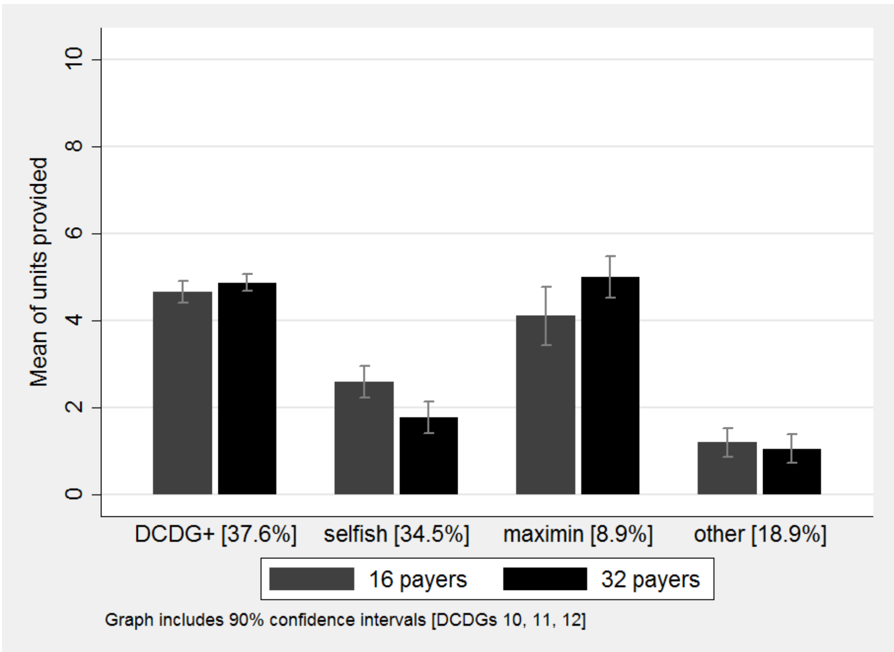


Figure 6: Average provision of different types (DCDGs 10 to 12)



However, only 1.4 percent of the DCDG+ types choose the maximin action in at least two DCDGs and none chooses the maximin action in more than two DCDGs. The share of DCDG+ types does not systematically vary in the number of payers (see specification 3 of Table 4). The only significant difference is in P8, but the mean share of DCDG+ types in P8 is lower, not higher than in P32. In particular, the shares of DCDG+ types in the treatments P16 and P32 are not significantly different from each other (33.8 and 40.7 percent, respectively; $p - value = 0.168$); the average share in these treatments is 37.6 percent, which thus constitutes our estimate of the share of subjects who exhibit insensitivity to group size in DCDGs. There is a positive correlation between the probability of being an ICDG+ type and an DCDG+ type. Pooling the data from the P16 and P32 treatments, the estimated correlation is 0.63.

[**Insert Table 4 about here**]

As before, Figure 6 compares the behavior of the different subgroups in the first three DCDGs 10 to 12 when there are 16 or 32 payers. While DCDG+ types provide on average 4.78 units, selfish types on average provide only 2.19 units. Moreover, they significantly lower the provision of the good as the number of payers increases (see specification 6 of Table 4, including all DCDGs and treatments). Maximin types provide on average 4.64 units, and consistent with their behavioral motivation, their provision does not vary significantly across treatments (see specification 7 of Table 4). Subjects who belong to neither of these groups provide on average only 1.11 units. As the share of maximin types is small, the main reason for the inefficient provision of the good in DCDGs are thus subjects who are insensitive to group size in DCDGs.

Result 3 *Subjects again provide substantial amounts in the DCDGs and the average provision remains constant when there are 4, 8, 16 or 32 payers. Insensitivity to group size in DCDGs is the main driver of this observation. When there are 16 or 32 payers, subjects who provide positive amounts in the DCDGs but who according to their choices in the DGs are not purely selfish or pure maximin types (37.6 percent of subjects), on average provide 4.78 units. Since neither their behavior nor their share differs significantly when there are 16 or 32 payers, their share provides a conservative estimate of the share of subjects who are insensitive to group size in DCDGs. The correlation between being insensitive in DCDGs and being insensitive in ICDGs is 0.63.*

5.5 Results on Reversals in Behavior

So far, our analysis shows that group size insensitivity in both ICDGs and DCDGs is the main explanation (together with pure selfishness in ICDGs) for the observed behavior and inefficiency in our experiment. We now analyze whether the observed (in)sensitivity also leads to "reversal in behavior" as discussed in Section 3.3.

We focus on two games where costs per payer are small but total costs are large: ICDG 9 ($a = 1.0$, $c = 0.2$) and DCDG 16 ($b = 1.0$, $c = 0.2$) in treatment P32. In both games, one additional unit for the receiver creates costs of 6.4 units for the group of payers. In the ICDG, generous behavior means to provide little or nothing of the good, while selfish behavior means to provide the maximal amount. Similarly, in the DCDG, welfare maximizing behavior implies to provide nothing, while the action that maximizes the welfare of the least well-off individual is to provide nine units of the good. To identify reversals in behavior, we first create behavioral measures for generosity, welfare, and maximin concerns in the three DGs and rank subjects according to these measures. We then compare the behavior of subject groups from the extremes of the distribution. A subject's generosity in the DGs is defined as $gen = \frac{1}{3}\sum_{i=1}^{3} x_i^2$. With regard to welfare and maximin concerns, we consider the squared distance to the actions of the pure preference types, i.e., $wel = \frac{1}{3}\sum_{i=1}^{3}(x_i^w - x_i)^2$ and $max = \frac{1}{3}\sum_{i=1}^{3}(x_i^m - x_i)^2$.[19]

[Insert Table 5 about here]

Reversal in generosity. Consider ICDG 9. In the top left panel of Table 5 we compare behavior of the least generous subjects in the DGs (those who give zero; 29.3 percent in P32) with that of the remaining subjects. As can be seen, only very few of the selfish subjects (7 percent) provide nothing of the good in ICDG 9, compared to 20 percent of the non-selfish subjects. At the same time, 86 percent choose the maximum amount, compared to 43 percent of the others. Thus, the behavior of selfish subjects seems very consistent across games. The situation looks different when we consider the most generous quarter of subjects in the DGs ($gen > 20.33$) and compare their behavior with that of the remaining population, see the top right panel of Table 5. While on average the top generous quarter provide less than the bottom 75 percent (3.93 versus 8.04 units, $p - value < 0.001$) and also more frequently provide zero (34 percent versus 9 percent, $p - value < 0.001$), 24 percent of them do provide the maximum amount. These subjects give very generously in DGs and at the same time take selfishly from many others when the costs per individual are small.

Reversal in welfare and maximin concerns. We first compare the behavior of the quarter whose actions are closest to those of the pure welfare type ($wel < 26.5$) with that of the remaining subjects, see the bottom panel of Table 5. While on average, the provision of the good does not differ between these groups (5.52 versus 5.62 units,

[19] Note that the two latter measures capture the degree to which these concerns do *not* play a role in subjects' behavior in the DGs.

$p - value = 0.455$) and similar shares give zero, 11 percent of the top welfare quarter choose the maximin action (i.e., provide 9 units), compared to zero percent of the others; and 20 percent of them provide 9 or 10 units. These subjects thus behave as if they care for welfare in DGs, but at the same time redistribute payoffs when costs are dispersed, thereby creating a substantial loss in welfare. Looking at maximin concerns, we find little evidence for reversal in behavior. Subjects in the top quarter with respect to maximin concerns ($max < 2.50$) provide significantly more in the DCDG than the rest (7.66 versus 4.72 units, $p - value < 0.001$), and not a single one of them chooses to provide zero. Note that similar to selfish subjects in the ICDG, a potential reversal of behavior of maximin types in this game would be caused by group size sensitivity, which is not what we see. Instead, all reversals we do observe (generosity and welfare) are based on group size insensitivity.

6 Implications

The theoretical and empirical findings in our paper have important implications for economic policy. We discuss four different domains where group size insensitivity can explain a number of behavioral patterns: ethical behavior, medical decision making, charitable giving, and the approval of public policies with large, dispersed costs. In each domain, alternative interpretations may exist, but our results provide a unified explanation for all of these phenomena.

Moral ambiguity. Non-pure social preferences with insensitivity to group size imply that both pro- and anti-social decisions can be optimal at the same time. Take, for example, donations $x \geq 0$ to a clearly specified, needy receiver and tax evasion $z \geq 0$. The decider maximizes utility from both activities, possibly at different points in time and with a different mindset, but with the same distributional preferences. A donation is a transfer of x from the decider to the receiver. The monetary gain from tax evasion for the decider is z and the costs of tax evasion per (tax-)payer are z/n, where n is the number of individuals who are negatively affected by tax evasion. If the decider is altruistic towards the receiver, she donates a positive amount. If additionally she is insensitive to group size in ICDGs and n is sufficiently large, she also evades taxes.[20] Thus, optimal levels of x and z can be strictly positive at the same time.[21] In the experiment, we have seen that such behavior is not infrequent: 24 percent of the most generous quarter of subjects in the DGs also take the maximal amount from payers when the costs of taking are dispersed.

[20] See the first-order conditions in (2) and (4).

[21] Of course, individuals may also be influenced by norms which work as a constraint on behavior (e.g., the norm "not to betray society" may constrain the extent of tax evasion).

Also empirically, we observe that both charity donations and dishonest behaviors such as insurance fraud and tax evasion — criminal activities where there are many victims who suffer small losses — are substantial. In 2009, total philanthropy in the United States amounted to 300 billion USD (227 billion USD from individuals). At the same time, the magnitude of fraud in the US property and casualty insurance industry is estimated to be around 32 billion USD every year (around 10 percent of claims);[22] and the estimated difference between tax liability and paid taxes exceeds 300 billion USD.[23] Naturally, there exist no good data about how many individuals are engaged in philanthropy and fraud at the same time. However, the pervasiveness of both phenomena and evidence of dishonest behavior even among respected members of society (e.g., Mazar et al. 2008) suggests that this number is sizable.

Concerns for the patient, not for insurance holders. The idea that physicians have concerns for the patient is well-established in the health economics literature (e.g., McGuire 2000, Chapter 6). Several papers assume that physicians' utility function is given by $U(\pi_D, \pi_R)$, where π_D is their own income and π_R the patient's welfare. In contrast, there are no concerns for the welfare of insurance payers.

Non-pure social preferences with insensitivity to group size qualify this assumption. A decider with such preferences takes the welfare of all parties into account, but gives very little weight to costs that are dispersed among many individuals. One consequence of this is that insurance protection changes physicians' behavior. Consider a physician who decides whether a treatment should take place ($x = 1$) or not ($x = 0$). The treatment benefits the patient, but it is not essential for her recovery. The patient fully relies on the physician's recommendations. The physician's remuneration is ax, the patient's net benefit (in monetary terms) bx, and the total costs are Cx, where $a, b, C > 0$. Either the patient or her insurance company pays for the costs of treatment. Suppose that the treatment is inefficient in the sense that $a + b << C$.

Assume first that the physician is motivated only by economic self-interest. She will then choose the treatment, regardless of whether the patient or an insurance company pays for it. Insurance protection creates no additional costs. Next, assume that the physician exhibits non-pure social preferences with insensitivity to group size. She will then not choose the treatment in case of no insurance protection, if she sufficiently cares about the patient's welfare. However, she will choose the treatment if the costs are dispersed among sufficiently many customers of the insurance company. Insurance protection then decreases welfare by $C - a - b >> 0$.

Note that these costs of insurance are different from those created by moral hazard.

[22] See iii.org/issue-update/insurance-fraud (accessed on 09/15/2015).

[23] Estimate by the IRS for 2006 at irs.gov (accessed on 09/15/2015).

Moral hazard causes costs because the insurance holder (or the physician) exploits a situation of asymmetric information. Our costs of insurance occur because one party (the physician) weighs differently the welfare of a single individual (the patient) and the welfare of a party that consists of many individuals (insurance holders).

The empirical evidence on physician choices suggests that patients with better insurance coverage are indeed more likely to receive high-cost treatments compared to those with less extensive coverage. Mort et al. (1996) elicit a large number of hypothetical treatment decisions in a nationally representative survey of physicians. They randomly vary patient attributes and therefore can identify the influence of insurance status on treatment decisions. McKinlay et al. (1996) use a videotape study to analyze the influence of several socio-economic variables on physicians' decisions. They find that in the subsample of old patients, insured patients were more likely to get a cardiac diagnosis for chest pain, which creates greater subsequent costs than the gastrointestinal or psychogenic alternatives. Movsas et al. (2012) analyze U.S. administrative data and show that Caesarian sections are more likely to be performed on privately insured mothers than on those without insurance. Rischatsch et al. (2013) find that brand-name drugs are less often substituted by generic drugs for patients with lower co-payments for branded drugs in Switzerland. These studies imply that physicians show a greater concern for an individual patient's financial situation than for the cost borne by an insurance company or the tax-payer. This may also be an important reason for why the extension of health insurance through Medicare has increased medical spending dramatically in the U.S. (Finkelstein 2007).

Congestible altruism. Non-pure social preferences with insensitivity to group size imply that charity donations to a single individual can exceed those to a large group. If a donation x is distributed among n individuals and n is large, it is worth less to the decider than a donation of x to a single individual. Hence, to maximize a giver's propensity to donate it is important for charity organizations to highlight the fate of one specific recipient that depends on the giver's benevolence. In fact, many organizations advertise their request by promoting the stories of individual recipients.

There is some previous experimental evidence that altruism depends on the number of recipients. Kogut and Ritov (2005) find that contributions for a single victim exceed those for a group of eight victims when these two situations are judged separately. Andreoni (2007) studies how donations depend on the number of receivers. He finds partial congestion: when the number of receivers doubles (and each receiver gets a constant amount per unit provided), the value of a donation to the giver increases by a factor less than two. Specifically, he estimates that one person receiving x is equivalent to n persons receiving x/n^{β} where $\beta = 0.68$. This means that if we keep constant the marginal effect of a donation to a single recipient, donations increase in n, but at a decreasing rate.

In our ICDGs (where the provision of the good is the exact opposite of donating to a number of recipients), we observe almost no reaction to the number of payers. In particular, a large share of subjects provides the same positive amount, regardless of the number of payers. For these subjects the β in ICDGs would be rather close to zero, i.e., there is full congestion.

Approval of public policies with large but dispersed costs. Several economic or political decisions create benefits for a small group of individuals at relatively large costs for society. For instance, labor union strikes are sometimes not only very costly for employers, but also for the rest of the society when the industry that sees strike action has a large set of customers or is important for other sectors of the economy. Nevertheless, people often do not judge such actions as inappropriate or unethical.

A prominent example is the German labor union for locomotive drivers (GDL), which went on strikes nationwide eight times between 2007 and 2015, sometimes for a number of subsequent days. The GDL represents around 34.000 employees, which equals 0.08 percent of all employees in Germany. A strike by the GDL severely impairs the carriage of passengers and the transportation of goods. It is estimated that a day on strike produces economic losses of around 100 million Euros, which corresponds to 1.2 percent of Germany's daily GDP. Nevertheless, there is surprisingly little public resistance against these strikes and a significant fraction of the population even regard them as justified. Surveys conducted in 2011 and 2015 reveal that 73 and 46 percent of respondents, respectively, approve of the GDL's strikes.[24] One explanation for this observation is that insensitivity to group size causes people to underweight large costs that are imposed on society relative to the (potential) gains of a small group that has some moral entitlement to these gains.

7 Conclusion

We study distributional preferences in games with concentrated benefits and dispersed costs. In these games, it does not only matter to what extent the decider cares about the welfare of others, but also whether she takes into account the number of individuals affected by her decision. We formally define two ways in which deciders with non-pure distributional preferences may ignore this number. If a decider is insensitive to group size in ICDGs, she redistributes resources from payers to herself, regardless of the number of payers, as soon as the costs per payer are sufficiently small relative to her benefits. If

[24]For the economic costs on strikes, see the estimates for the strike of 2015 on statista.com (accessed on 09/15/2015), or for earlier strikes in Kemfert and Kooths (2008). For the approval of these strikes, see statista.com on the survey question (in German) "Do you approve of the locomotive drivers' strike?" (accessed on 09/15/2015).

she is insensitive to group size in DCDGs, she redistributes resources from payers to a needy receiver, regardless of the number of payers, when the costs per payer are small enough relative to the receiver's benefits. Our experimental data reveal that a significant fraction of subjects exhibits insensitivity to group size: at least 37 percent are insensitive to group size in ICDGs and the same holds for DCDGs. These subjects take the welfare of all parties into account, but large groups of payers just receive the same weight as small groups. Consequently, the degree of redistribution we observe in our allocation games is substantial even if the costs of redistribution by far exceeded its benefits. The combination of non-pure social preferences and group size insensitivity can explain a number of empirical patterns such as the co-existence of pro-social actions (like charity donations) as well as welfare-damaging behavior (like tax evasion or insurance fraud), the effect of insurance protection on medical decision making, congestible altruism, and the approval of public policies with small benefits and large, dispersed costs.

Future research may address several issues that we do not consider in this paper. For example, the number of payers we have in our experiment is still relatively small compared to the number of individuals who are affected in many real-world applications, such as the number of insurance holders or tax payers. It would be interesting to extend our analysis to field settings that allow for even larger numbers of payers.

Next, an important question is *why* many individuals ignore the number of affected individuals. Some psychologists argue that forming impressions of individuals and groups are two distinct processes (Hamilton and Sherman 1996, Susskind et al. 1999). Unlike a group of individuals, a single individual is viewed as a psychologically coherent unit. Therefore, perceptually distinct processes may give rise to different behavioral tendencies toward individuals and groups. Providing detailed information about the identity of individual payers (or other framing manipulations), might be a promising direction for future research to influence and analyze the extent to which subjects are insensitive to group size, and to discover potential underlying causes of the insensitivity.

Finally, research may explore the evolutionary forces that support (in)sensitivity to group size. Most human interactions in the private and social sphere take place in bilateral relations or small groups, with frequent encounters and many opportunities to monitor or sanction misbehavior. In contrast, interactions between an individual and a large group are far less common, and the role of monitoring and sanctioning misbehavior in situations with concentrated benefits and dispersed costs is less clear. This discrepancy might cause individuals to develop both altruistic preferences and a tendency to neglect the scale of costs that are dispersed among many others.

References

Andreoni, James, and Lise Vesterlund (2001): "Which is the Fair Sex? Gender Differences in Altruism," *Quarterly Journal of Economics*, 116(1), 293-312.

Andreoni, James, and John Miller (2002): "Giving According to GARP: An Experimental Test of the Consistency of Preferences for Altruism," *Econometrica*, 70(2), 737-753.

Andreoni, James (2007): "Giving Gifts to Groups: How Altruism Depends on the Number of Recipients," *Journal of Public Economics*, 91(9), 1731-1749.

Bateman, Ian, Alistair Munro, Bruce Rhodes, Chris Starmer, and Robert Sugden (1997): "Does Part-Whole Bias Exist? An Experimental Investigation," *Economic Journal*, 107(441), 322-332.

Bolton, Gary, and Axel Ockenfels (2000): "ERC: A Theory of Equity, Reciprocity, and Competition," *American Economic Review*, 90(1), 166-193.

Carson, Richard (2012): "Contingent Valuation: A Practical Alternative when Prices Aren't Available," *Journal of Economic Perspectives*, 26(4), 27-42.

Charness, Garry, and Matthew Rabin (2002): "Understanding Social Preferences with Simple Tests," *Quarterly Journal of Economics*, 117(3), 817-869.

Cox, James, Daniel Friedman, and Steven Gjerstad (2007): "A tractable model of reciprocity and fairness," *Games and Economic Behavior*, 59(1), 17-45.

Cox, James, and Vjollca Sadiraj (2012): "Direct Tests Of Individual Preferences For Efficiency And Equity," *Economic Inquiry*, 50(4), 920-931.

Desvousges, William, F. Reed Johnson, Richard Dunford, Sara Hudson, Nichole Wilson, and Kevin Boyle (1993): "Measuring Natural Resource Damages with Contingent Valuation: Tests of Validity and Reliability," In: Jerry A. Hausman (Ed.): Contingent valuation: A critical assessment. Amsterdam: North-Holland, 91-164, 1993.

Engel, Christoph (2011): "Dictator games: a meta study," *Experimental Economics*, 14(4), 583–610.

Engelmann, Dirk, and Martin Strobel (2004): "Inequality Aversion, Efficiency, and Maximin Preferences in Simple Distribution Experiments," *American Economic Review*, 94(4), 857-869.

Fehr, Ernst, and Klaus Schmidt (1999): "A Theory of Fairness, Competition and Cooperation," *Quarterly Journal of Economics*, 114(3), 817-868.

Fehr, Ernst, and Klaus Schmidt (2006): "The Economics of Fairness, Reciprocity and Altruism - Experimental Evidence and New Theories," In: Serge-Christophe Kolm, Jean Mercier Ythier (Eds.): Handbook on the Economics of Giving, Reciprocity and Altruism, Elsevier, Amsterdam.

Finkelstein, Amy (2007): "The Aggregate Effects of Health Insurance: Evidence from the Introduction of Medicare," *Quarterly Journal of Economics*, 122(1), 1-37.

Fisman, Raymond, Shachar Kariv, and Daniel Markovits (2007): "Individual Preferences for Giving," *American Economic Review*, 97(5), 1858-1877.

Fisman, Raymond, Pamela Jakiela, and Shachar Kariv (2014): "The Distributional Preferences of Americans," NBER Working Paper No. 20145.

Fleurbaey, Marc, and Bertil Tungodden (2010): "The Tyranny of Non-Aggregation versus the Tyranny of Aggregation in Social Cchoices: A Real Dilemma," *Economic Theory*, 44(3), 399-414.

Frederick, Shane, and Baruch Fischhoff (1998): "Scope (in)sensitivity in Elicited Valuations," *Risk, Decision, and Policy*, 3(2), 109-123.

Greiner, Ben (2015): "Subject Pool Recruitment Procedures: Organizing Experiments with ORSEE," *Journal of the Economic Science Association*, 1(1), 114-125.

Güth, Werner, and Eric van Damme (1998): "Information, Strategic Behavior, and Fairness in Ultimatum Bargaining: An Experimental Study," *Journal of Mathematical Psychology*, 42(2-3), 227-247.

Hamilton, David, and Steven Sherman (1996): "Perceiving Persons and Groups," *Psychological Review*, 103(2), 336-355.

Hausman, Jerry (2012): "Contingent Valuation: From Dubious to Hopeless," *Journal of Economic Perspectives*, 26(4), 43-56.

Isaac, Mark, and James Walker (1988): "Group Size Effects in Public Goods Provision: The Voluntary Contributions Mechanism," *Quarterly Journal of Economics*, 103(1), 179-199.

Isaac, Mark, James Walker, and Arlington Williams (1994): "Group size and the voluntary provision of public goods: Experimental evidence utilizing large groups," *Journal of Public Economics*, 54(1), 1-36.

Kahneman, Daniel, Ilana Ritov, and David Schkade (1999): “Economic Preferences or Attitude Expressions?: An Analysis of Dollar Responses to Public Issues,” *Journal of Risk and Uncertainty*, 19(1), 203-235.

Kahneman, Daniel (2003): “Maps of Bounded Rationality: Psychology for Behavioral Economics,” *American Economic Review*, 93(5), 1449-1475.

Kahneman, Daniel (2011): *Thinking, Fast and Slow*, Farrar, Straus and Giroux, New York.

Kemfert, Claudia, and Stefan Kooths (2008): “Die wirtschaftlichen Folgen von Bahnstreiks,” *DIW Wochenbericht*, 75(3), 25-29.

Kogut, Tehila, and Ilana Ritov (2005): “The Singularity Effect of Identified Victims in Separate and Joint Evaluations,” *Organizational Behavior and Human Decision Processes*, 97(2), 106-116.

Lifton, Robert (1967): *Death in Life: Survivors of Hiroshima*, Random House, New York.

Mazar, Nina, On Amir, and Dan Ariely (2008): “The Dishonesty of Honest People: A Theory of Self-Concept Maintenance,” *Journal of Marketing Research*, 45(6), 633-644.

McGuire, Thomas (2000): “Physician Agency.” In: Anthony Cuyler, Joseph Newhouse (Eds.): Handbook of Health Economics, Vol. 1A, Amsterdam, North-Holland.

McKinlay, John, Deborah Potter, and Henry Feldman (1996): “Non-Medical Influences on Medical Decision-Making,” *Social Science and Medicine*, 42(5), 769-776.

Mort, Elizabeth, Jennifer Edwards, David Emmons, Karen Convery, and David Blumenthal (1996): “Physician Response to Patient Insurance Status in Ambulatory Care Clinical Decision-Making: Implications for Quality Care,” *Medical Care*, 34(8), 783-797.

Movsas, Tammy, Eden Wells, Ann Mongoven, and Violanda Grigorescu (2012): “Does Medical Insurance Type (Private vs Public) Influence the Physician’s Decision to Perform Caesarean Delivery?,” *Journal of Medical Ethics*, 38(8), 470-473.

Okada, Akira, and Arno Riedl (2005): “Inefficiency and social exclusion in a coalition formation game: experimental evidence,” *Games and Economic Behavior*, 50(2), 278-311.

Olson, Mancur (1965): *The Logic of Collective Action: Public Goods and the Theory of Groups*, Harvard University Press.

Rischatsch, Maurus, Maria Trottmann, and Peter Zweifel (2013): "Generic Substitution, Financial Interests, and Imperfect Agency," *International Journal of Health Care Finance and Economics*, 13(2), 115-138.

Slovic, Paul (2007): "If I look at the mass I will never act: Psychic numbing and genocide," *Judgment and Decision Making*, 2(2), 79-95.

Susskind, Joshua, Kristin Maurer, Vinia Thakkar, and David Sherman (1999): "Perceiving individuals and groups: Expectancies, dispositional inferences, and causal attributions," *Journal of Personality and Social Psychology*, 76(2), 181-191.

Voorhoeve, Alex (2014): "How Should We Aggregate Competing Claims?," *Ethics*, 125, 64-87.

Tables and Figures

TABLE 1 — Payoff Parameters

Game	Label	a	b	c	x_i^s	x_i^w	x_i^m
1	DG	-1.0	1.5	0.0	0	10	4
2	DG	-1.0	1.0	0.0	0	any	5
3	DG	-1.0	0.5	0.0	0	0	6,7
4	ICDG	1.5	0.0	1.0	10	0	any
5	ICDG	1.0	0.0	1.0	10	0	any
6	ICDG	0.5	0.0	1.0	10	0	any
7	ICDG	1.0	0.0	0.8	10	0	any
8	ICDG	1.0	0.0	0.4	10	0	any
9	ICDG	1.0	0.0	0.2	10	0	any
10	DCDG	0.0	1.5	1.0	any	0	4
11	DCDG	0.0	1.0	1.0	any	0	5
12	DCDG	0.0	0.5	1.0	any	0	6,7
13	DCDG	0.0	1.0	0.8	any	0	6
14	DCDG	0.0	1.0	0.4	any	0	7
15	DCDG	0.0	1.0	0.2	any	0	9
16	ICDGR	1.0	1.5	1.0	10	0	4
17	ICDGR	1.0	1.0	1.0	10	0	5
18	ICDGR	1.0	0.5	1.0	10	0	6,7

TABLE 2 — Average behavior in all games

Game	Label	mean (sd)	share ten	share zero	mean ICDG+	mean DCDG+	mean selfish	mean maximin
[share]					[0.43]	[0.49]	[0.31]	[0.05]
P1.1	DG	2.63 (2.97)	0.08	0.39	3.25	3.05	0.00	4.00
P1.2	DG	1.92 (2.20)	0.00	0.47	2.41	2.68	0.00	5.00
P1.3	DG	1.40 (2.15)	0.00	0.60	1.84	2.05	0.00	6.25
P1.4	ICDG	7.49 (3.43)	0.54	0.07	7.81	6.67	9.74	2.75
P1.5	ICDG	6.50 (3.75)	0.41	0.14	6.94	5.92	8.74	2.75
P1.6	ICDG	4.76 (4.21)	0.31	0.31	5.87	4.92	7.30	0.50
P1.7	ICDG	6.74 (3.68)	0.45	0.08	7.03	5.89	8.83	3.00
P1.8	ICDG	7.78 (3.41)	0.64	0.08	8.55	7.36	9.04	2.75
P1.9	ICDG	8.64 (2.86)	0.74	0.04	9.29	8.42	9.61	3.00
P1.10	DCDG	5.97 (2.83)	0.27	0.03	5.58	5.28	6.57	4.25
P1.11	DCDG	5.30 (1.94)	0.09	0.04	5.39	5.33	5.70	6.25
P1.12	DCDG	4.64 (3.31)	0.11	0.26	5.65	5.64	5.17	5.25
P1.13	DCDG	6.28 (2.33)	0.19	0.03	6.19	5.94	6.39	5.75
P1.14	DCDG	7.50 (2.42)	0.34	0.04	7.45	7.33	6.91	7.75
P1.15	DCDG	8.28 (2.38)	0.47	0.04	8.13	8.19	7.74	8.75
P1.16	ICDGR	8.05 (2.64)	0.59	0.00	7.29	6.81	10.00	5.75
P1.17	ICDGR	8.05 (2.51)	0.54	0.00	7.35	6.89	9.96	5.50
P1.18	ICDGR	8.16 (2.35)	0.53	0.00	7.94	7.31	9.96	5.50
[share]					[0.33]	[0.37]	[0.36]	[0.06]
P4.1	DG	2.00 (2.28)	0.03	0.44	2.65	3.10	0.00	4.00
P4.2	DG	1.24 (2.28)	0.00	0.42	2.77	3.03	0.00	5.00
P4.3	DG	1.65 (2.28)	0.00	0.60	2.35	2.59	0.00	6.00
P4.4	ICDG	5.29 (3.68)	0.29	0.18	5.27	4.45	8.32	2.20
P4.5	ICDG	4.88 (3.85)	0.28	0.23	5.31	4.10	7.71	2.80
P4.6	ICDG	4.36 (4.05)	0.27	0.31	5.08	4.14	6.96	2.40
P4.7	ICDG	5.06 (3.72)	0.28	0.18	5.27	4.31	7.79	3.00
P4.8	ICDG	6.83 (3.61)	0.45	0.08	6.77	5.72	8.96	4.20
P4.9	ICDG	8.55 (3.06)	0.77	0.05	8.42	7.69	9.71	5.60
P4.10	DCDG	3.24 (2.30)	0.04	0.22	4.19	4.31	2.68	4.00
P4.11	DCDG	3.59 (2.45)	0.03	0.23	4.42	4.66	3.07	5.00
P4.12	DCDG	3.23 (2.86)	0.01	0.36	4.50	5.10	2.50	5.60
P4.13	DCDG	3.88 (2.36)	0.03	0.18	4.58	4.66	2.93	5.40
P4.14	DCDG	5.46 (3.03)	0.08	0.15	6.08	6.07	4.21	6.20
P4.15	DCDG	8.13 (2.73)	0.47	0.06	7.88	8.34	7.68	7.20
P4.16	ICDGR	5.74 (3.35)	0.31	0.10	5.35	5.45	7.86	4.20
P4.17	ICDGR	6.09 (3.21)	0.32	0.08	5.88	5.90	8.00	5.20
P4.18	ICDGR	5.96 (3.40)	0.32	0.10	5.88	5.79	7.32	6.20

TABLE 2 (continuation) — Average behavior in all games

Game	Label	mean (sd)	share ten	share zero	mean ICDG+	mean DCDG+	mean selfish	mean maximin
[share]					[0.26]	[0.23]	[0.42]	[0.09]
P8.1	DG	2.03 (2.62)	0.04	0.51	2.39	2.81	0.00	4.00
P8.2	DG	2.20 (2.49)	0.01	0.46	2.89	3.69	0.00	5.00
P8.3	DG	1.90 (2.61)	0.01	0.54	2.94	3.00	0.00	6.33
P8.4	ICDG	5.72 (4.22)	0.42	0.23	6.17	5.00	8.69	4.33
P8.5	ICDG	5.33 (4.23)	0.36	0.26	4.89	4.50	8.52	4.33
P8.6	ICDG	5.10 (4.19)	0.33	0.26	5.39	4.81	7.76	2.33
P8.7	ICDG	5.70 (4.10)	0.39	0.17	5.17	5.69	8.45	2.67
P8.8	ICDG	6.64 (3.65)	0.42	0.12	5.83	5.56	9.14	5.67
P8.9	ICDG	8.03 (3.27)	0.64	0.09	7.83	7.31	9.79	6.33
P8.10	DCDG	3.01 (3.00)	0.09	0.39	4.06	5.44	2.21	5.00
P8.11	DCDG	3.03 (3.11)	0.07	0.41	3.83	5.65	2.41	4.67
P8.12	DCDG	2.84 (3.25)	0.07	0.46	3.67	5.13	2.31	6.00
P8.13	DCDG	3.49 (2.96)	0.07	0.28	4.11	5.44	2.79	6.00
P8.14	DCDG	4.93 (3.42)	0.12	0.26	6.44	7.19	4.03	7.50
P8.15	DCDG	6.17 (3.75)	0.28	0.20	7.28	7.50	5.00	9.00
P8.16	ICDGR	6.12 (3.65)	0.39	4.67	0.38	5.69	8.69	4.17
P8.17	ICDGR	6.42 (3.52)	0.39	5.44	0.39	6.63	8.59	5.83
P8.18	ICDGR	6.16 (3.64)	0.38	4.50	0.39	5.56	8.93	5.83
[share]					[0.39]	[0.34]	[0.39]	[0.08]
P16.1	DG	1.85 (2.29)	0.03	0.48	2.26	2.67	0.00	4.00
P16.2	DG	1.83 (2.10)	0.00	0.49	2.44	2.72	0.00	5.00
P16.3	DG	1.89 (2.40)	0.00	0.51	2.94	2.96	0.00	6.38
P16.4	ICDG	5.86 (4.07)	0.41	0.19	6.52	5.20	7.92	0.92
P16.5	ICDG	4.53 (4.05)	0.37	0.19	5.98	4.67	7.82	0.85
P16.6	ICDG	4.87 (4.08)	0.31	0.24	5.26	4.04	7.07	0.77
P16.7	ICDG	5.31 (3.67)	0.28	0.15	5.86	4.90	7.68	1.25
P16.8	ICDG	6.33 (3.90)	0.44	0.16	7.02	5.63	8.26	1.46
P16.9	ICDG	7.38 (3.76)	0.59	0.12	8.23	7.02	8.93	1.92
P16.10	DCDG	3.13 (2.64)	0.06	0.28	3.73	4.44	2.71	3.31
P16.11	DCDG	3.08 (2.64)	0.02	0.33	3.73	4.78	2.50	4.00
P16.12	DCDG	3.23 (3.03)	0.03	0.36	3.68	4.76	2.56	5.00
P16.13	DCDG	3.43 (2.73)	0.03	0.28	4.40	5.07	2.70	4.00
P16.14	DCDG	4.83 (3.20)	0.09	0.19	5.81	6.39	3.70	6.00
P16.15	DCDG	6.02 (3.59)	0.19	0.18	7.05	7.44	4.92	7.31
P16.16	ICDGR	5.90 (3.33)	0.31	0.08	5.61	5.07	7.82	3.77
P16.17	ICDGR	5.99 (3.53)	0.35	0.12	5.85	5.52	7.68	4.08
P16.18	ICDGR	5.93 (3.63)	0.34	0.13	5.44	5.17	7.79	4.08

TABLE 2 (continuation) — Average behavior in all games

Game	Label	mean (sd)	share ten	share zero	mean ICDG+	mean DCDG+	mean selfish	mean maximin
[share]					[0.36]	[0.41]	[0.31]	[0.10]
P32.1	DG	2.43 (2.63)	0.05	0.40	2.94	3.19	0.00	4.00
P32.2	DG	2.16 (2.18)	0.00	0.40	2.61	3.06	0.00	5.00
P32.3	DG	1.96 (2.45)	0.01	0.51	2.35	2.79	0.00	6.26
P32.4	ICDG	5.37 (4.01)	0.36	0.20	6.49	5.15	7.93	3.26
P32.5	ICDG	4.89 (3.99)	0.29	0.25	5.87	4.52	7.51	2.22
P32.6	ICDG	4.19 (3.89)	0.23	0.30	5.03	3.92	6.56	2.22
P32.7	ICDG	4.59 (4.10)	0.26	0.27	6.33	4.32	7.39	2.09
P32.8	ICDG	5.24 (4.18)	0.33	0.27	7.20	5.27	7.86	2.36
P32.9	ICDG	6.81 (4.08)	0.56	0.16	8.60	6.70	8.93	3.64
P32.10	DCDG	3.05 (2.75)	0.06	0.32	4.10	4.61	1.69	4.21
P32.11	DCDG	3.25 (2.82)	0.05	0.32	4.33	4.94	1.79	5.05
P32.12	DCDG	3.32 (3.10)	0.04	0.38	4.80	5.06	1.85	5.74
P32.13	DCDG	3.47 (2.77)	0.02	0.31	4.17	5.08	2.43	5.08
P32.14	DCDG	4.88 (3.41)	0.09	0.26	5.90	6.76	2.57	6.58
P32.15	DCDG	5.59 (3.69)	0.13	0.23	6.77	7.35	2.93	8.17
P32.16	ICDGR	5.39 (3.55)	0.28	0.13	6.33	5.43	7.52	3.75
P32.17	ICDGR	5.72 (3.48)	0.29	0.14	6.87	5.84	7.72	4.42
P32.18	ICDGR	5.63 (3.68)	0.30	0.15	6.60	5.76	7.79	5.08

Note: This table displays the average behavior in all treatments and games. Column 3 shows the mean provision of all subjects (standard deviation in brackets). Column 4 shows the share of subjects who provide the maximum amount (10 units). Column 5 shows the share of subjects who provide nothing. Columns 6 and 7 show the mean provision of those subjects we classify as ICDG+ and DCDG+ types, respectively. Columns 8 and 9 show the mean provision of those subjects we classify as selfish and maximin types, respectively. For each treatment, in the first row, we indicate the share of ICDG+, DCDG+, selfish and maximin types.

TABLE 3 — Behavior in ICDGs

	All Subjects		**Prob. ICDG+**	**ICDG+**		**Selfish**	**Maximin**	**Other**
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
a	1.227***	1.183***		1.252***	1.464***	1.272***	0.901**	1.549***
	[0.112]	[0.173]		[0.173]	[0.254]	[0.186]	[0.357]	[0.304]
c	-2.634***	-1.874***		-2.898***	-3.118***	-1.659***	-1.714***	-4.728***
	[0.192]	[0.462]		[0.266]	[0.600]	[0.291]	[0.575]	[0.435]
P1	1.677***	0.919	0.079	1.110**	0.527	1.169**	-0.253	2.879***
	[0.449]	[0.703]	[0.066]	[0.436]	[0.773]	[0.576]	[1.937]	[0.861]
P4	0.538	2.616***	-0.028	-0.504	1.115	0.571	0.568	0.517
	[0.460]	[0.668]	[0.063]	[0.489]	[0.895]	[0.659]	[1.675]	[0.667]
P8	0.771	2.143***	-0.094	-0.590	-0.549	1.061	1.518	-0.428
	[0.509]	[0.706]	[0.063]	[0.545]	[1.018]	[0.643]	[1.809]	[0.799]
P16	0.623	1.118*	0.031	-0.020	-0.224	0.261	-1.569	1.746**
	[0.400]	[0.644]	[0.050]	[0.422]	[0.834]	[0.585]	[0.979]	[0.826]
Male	0.156	0.155	-0.173***	-0.666*	-0.666*	0.615	-0.291	-0.556
	[0.302]	[0.302]	[0.039]	[0.339]	[0.340]	[0.397]	[1.013]	[0.547]
a * P1		1.547***			0.472			
		[0.474]			[0.622]			
a * P4		-0.247			-1.271***			
		[0.295]			[0.470]			
a * P8		-0.559			-0.686			
		[0.344]			[0.418]			
a * P16		-0.195			-0.206			
		[0.259]			[0.430]			
c * P1		-0.983			0.121			
		[0.630]			[0.821]			
c * P4		-2.404***			-0.506			
		[0.694]			[0.932]			
c * P8		-1.015			0.848			
		[0.656]			[1.067]			
c * P16		-0.311			0.530			
		[0.548]			[0.744]			
Constant	5.938***	5.357***	0.428***	7.601***	7.575***	7.332***	3.213***	5.510***
	[0.359]	[0.534]	[0.038]	[0.386]	[0.634]	[0.577]	[1.182]	[0.773]
Observations	3,069	3,069	581	1,093	1,093	1,071	247	618
R-squared	0.074	0.080	0.040	0.149	0.153	0.066	0.112	0.250

Note: This table shows the results of ordinary least squares regressions using the data from the ICDGs (Games 4 to 9). The dependent variables are the number of units provided for the whole sample in Columns 1 and 2; a dummy that indicates whether a subject is classified as ICDG+ type in Column 3; and the number of units provided for the subsamples of ICDG+ types (Columns 4 and 5), the selfish types (Column 6), the maximin types (Column 7), and everybody who is not part of any of the former groups (Column 8). Independent variables are the parameters a and c, a gender dummy, and dummies for the treatments P1 to P16. The reference treatment is P32. Robust standard errors in brackets, clustering of standard errors by respondent. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. See the Online Appendix for a regression analysis of the behavior of selfish, maximin and other types including interaction terms.

TABLE 4 — Behavior in DCDGs

	All Subjects		**Prob. DCDG+**	**DCDG+**		**Selfish**	**Maximin**	**Other**
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
b	0.074	-0.269		-0.391**	-0.450*	0.163	-1.468***	1.058***
	[0.125]	[0.181]		[0.152]	[0.244]	[0.231]	[0.276]	[0.277]
c	-3.655***	-2.890***		-3.327***	-3.080***	-2.805***	-3.748***	-5.066***
	[0.183]	[0.443]		[0.238]	[0.530]	[0.346]	[0.355]	[0.376]
P1	2.373***	1.415**	0.097	0.642**	0.813	4.067***	0.508	2.421***
	[0.264]	[0.715]	[0.067]	[0.286]	[0.865]	[0.543]	[0.437]	[0.460]
P4	0.559*	2.068***	-0.040	-0.158	0.835	1.460**	-0.410	0.751
	[0.291]	[0.655]	[0.063]	[0.288]	[0.839]	[0.573]	[0.448]	[0.465]
P8	-0.087	0.209	-0.174***	0.390	-0.534	0.730	0.452	-0.417
	[0.375]	[0.769]	[0.062]	[0.395]	[1.118]	[0.641]	[0.927]	[0.654]
P16	-0.057	0.204	-0.069	-0.181	-0.119	0.844*	-0.947	-0.418
	[0.270]	[0.661]	[0.050]	[0.269]	[0.767]	[0.492]	[0.681]	[0.568]
Male	-0.850***	-0.852***	-0.190***	-0.170	-0.174	-0.684*	-0.506	-0.622*
	[0.202]	[0.203]	[0.039]	[0.203]	[0.204]	[0.374]	[0.600]	[0.368]
b * P1		1.607***			0.089			
		[0.580]			[0.527]			
b * P4		0.282			-0.343			
		[0.308]			[0.384]			
b * P8		0.443			0.762			
		[0.343]			[0.536]			
b * P16		0.169			0.135			
		[0.292]			[0.390]			
c * P1		-0.791			-0.320			
		[0.625]			[0.689]			
c * P4		-2.348***			-0.852			
		[0.623]			[0.817]			
c * P8		-0.914			0.254			
		[0.650]			[1.104]			
c * P16		-0.493			-0.236			
		[0.524]			[0.652]			
Constant	6.964***	6.678***	0.485***	8.546***	8.401***	4.597***	10.295***	6.659***
	[0.291]	[0.507]	[0.039]	[0.325]	[0.621]	[0.587]	[0.475]	[0.498]
Observations	3,168	3,168	581	1,161	1,161	1,116	261	669
R-squared	0.207	0.215	0.059	0.231	0.234	0.193	0.315	0.342

Note: This table shows the results of ordinary least squares regressions using the data from the DCDGs (Games 10 to 15). The dependent variables are the number of units provided for the whole sample in Columns 1 and 2; a dummy that indicates whether a subject is classified as ICDG+ type in Column 3; and the number of units provided for the subsamples of DCDG+ types (Columns 4 and 5), the selfish types (Column 6), the maximin types (Column 7), and everybody who is not part of any of the former groups (Column 8). Independent variables are the parameters *a* and *c*, a gender dummy, and dummies for the treatments P1 to P16. The reference treatment is P32. Robust standard errors in brackets, clustering of standard errors by respondent. *** p<0.01, ** p<0.05, * p<0.1. See the Online Appendix for a regression analysis of the behavior of selfish, maximin and other types including interaction terms.

TABLE 5 — Reversal in Behavior

ICDG 9 P32	selfish	non-selfish	t-sig.	top 25 generosity	bottom 75 generosity	t-sig.
	[$\varnothing gen = 0.00$]	[$\varnothing gen = 15.47$]		[$\varnothing gen = 29.45$]	[$\varnothing gen = 4.35$]	
mean (sd)	8.93 (2.84)	5.96 (4.20)	***	3.93 (4.12)	8.04 (3.40)	***
share zero	0.07	0.20	***	0.34	0.09	***
share ten	0.86	0.43	***	0.24	0.69	***

DCDG 15 P32	top 25 welfare	bottom 75 welfare	t-sig.	top 25 maximin	bottom 75 maximin	t-sig.
	[$\varnothing wel = 16.48$]	[$\varnothing wel = 42.80$]		[$\varnothing max = 1.05$]	[$\varnothing max = 23.51$]	
mean (sd)	5.52 (3.71)	5.62 (3.69)	–	7.66 (1.59)	4.72 (3.97)	***
share zero	0.20	0.25	–	0.00	0.33	***
share nine	0.11	0.00	**	0.14	0.06	*

Appendix: Alternative Social Preference Models

We examine the predictions of several prominent social preference models for our allocation games with decider, receiver and n payers. Throughout we assume that the parties' endowments are such that $W_D = W_P > W_R$. We say that a model does not capture insensitivity to group size in ICDGs (DCDGs) if for almost all values of the preference parameters we cannot find an ICDG (DCDG) in which the decider provides positive amounts the good, regardless of the number of payers.

Fehr and Schmidt (1999). If the decider has Fehr and Schmidt (1999) preferences, her utility function is given by

$$\begin{aligned} U^{FS}(\pi_D, \pi_R, \pi_P) &= \pi_D - \alpha\frac{1}{n+1}\max\{0, \pi_R - \pi_D\} - \beta\frac{1}{n+1}\max\{0, \pi_D - \pi_R\} \\ &\quad -\alpha\frac{n}{n+1}\max\{0, \pi_P - \pi_D\} - \beta\frac{n}{n+1}\max\{0, \pi_D - \pi_P\}, \end{aligned}$$

where $\beta \leq \alpha$ and $0 \leq \beta < 1$. Parameter α captures the decider's aversion to disadvantageous inequality, while β captures her aversion to advantageous inequality. In an ICDG, the marginal utility from providing the good equals

$$\frac{\partial U^{FS}}{\partial x} = a - \beta\frac{n}{n+1}(a+c).$$

For generic values of β, the decider provides nothing or the maximal amount of the good. Note that for almost all values of β we can find an ICDG in which the decider provides positive amounts of the good for all numbers of payers. Thus, the model captures insensitivity to group size in ICDGs. In a DCDG, the marginal utility from providing the good (as long as the receiver's payoff does not exceed the decider's payoff) is

$$\frac{\partial U^{FS}}{\partial x} = \beta\frac{1}{n+1}b - \beta\frac{n}{n+1}c.$$

If $\beta > 0$ and the number of payers is sufficiently large, the decider provides nothing of the good. The Fehr and Schmidt (1999) preference model therefore does not capture insensitivity to group size in DCDGs.

Bolton and Ockenfels (2000). If the decider has Bolton and Ockenfels (2000) preferences, her utility function is given by

$$U^{BO}(\pi_D, \pi_R, \pi_P) = V(\pi_D, \sigma) \text{ with } \sigma = \frac{\pi_D}{\pi_D + \pi_R + n\pi_P}.$$

In the model, it is assumed that V is twice differentiable in both arguments and that for given π_D it attains its global maximum at $\sigma = \frac{1}{n+2}$ (i.e., for given π_D the decider's utility is maximal if she gets the average payoff). These properties imply that in any DCDG we have

$$\frac{\partial U^{BO}}{\partial x} = \frac{\partial V(\pi_D, \sigma)}{\partial \sigma} \times \frac{-\pi_D(b - nc)}{(\pi_D + \pi_R + n\pi_P)^2}.$$

If the provision of the good lowers the group payoff, $b - nc < 0$, then for any x the first term is negative (since the provision of the good increases the decider's share in the group payoff), while the second term is positive. It is then optimal for the decider to provide nothing of the good. Hence, the model does not capture insensitivity to group size in DCDGs. Unfortunately, the model does not make any predictions about behavior in ICDGs without further assumptions on V.

Charness and Rabin (2002). If the decider has Charness and Rabin (2002) preferences, her utility function is given by

$$U^{CR}(\pi_D, \pi_R, \pi_P) = (1-\lambda)\pi_D + \lambda[\delta \min\{\pi_D, \pi_R, \pi_P\} + (1-\delta)(\pi_D + \pi_R + n\pi_P)],$$

where the parameters δ, λ take on values in the unit interval. Parameter λ captures concerns for the payoff of others, while δ captures how important the payoff of the least well-off individual is relative to the group payoff. In an ICDG, the marginal utility from providing the good is

$$\frac{\partial U^{CR}}{\partial x} = (1-\lambda)a + \lambda(1-\delta)(a - nc),$$

while in a DCDG, the marginal utility from providing the good is given by

$$\frac{\partial U^{CR}}{\partial x} \leq \lambda[\delta b + (1-\delta)(b - nc)].$$

In both cases, the marginal utility from providing the good is strictly negative if $\lambda > 0$, $\delta < 1$ and the number of payers is sufficiently large. Hence, the model does not capture insensitivity to group size in ICDGs and DCDGs.