Consistent Social Choice*

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Abstract

This paper studies when it is possible to link a social planner's preferences across groups of different agents. We propose a preference consistency criterion that relates members of a family of social preferences across domains of different agents; this criterion requires preferences to be identical on domains differing only by adding agents with choice-independent payoffs. We derive additional domain changes for which consistent preferences are invariant, and test adherence to these predictions in an online laboratory experiment. While consistency rates are reasonably high, we document significant differences in consistency across the different types of domain changes. Additionally, we find that participants tend to choose options with higher inequality/lower inefficiency as domain size increases.

1 Introduction

Many individuals make choices that have consequences for others. This paper examines whether social decision-makers make similar choices for different groups of others. Knowing when a social decision-maker's preferences are related across groups can be critical when the decision-maker is chosen through some selection process. Consider the case of a politician running for a higher office. Besides touting their record while serving in lower office, candidates often highlight how they interact with their family, friends, and other members of their community in an effort to convey how they will make choices for all of their constituents. But can we draw inferences about the candidate's behavior on a larger social domain from their choices on a smaller social domain? Such inferences would be useful, but require the presence of a link between preferences on these different social domains.

In this paper, we provide an axiom that characterizes the internal consistency of a family of preference relations across domains of different agents followed by an experimental test of the

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relevance of this condition. This axiom, which we call *joint consistency*, requires preferences to remain the same when agents receiving choice-independent outcomes are added to or removed from the domain of agents the decision-maker chooses for. Combined with the usual axioms of completeness, transitivity, and continuity, joint consistency implies an additively separable utility representation with domain-invariant Bernoulli functions. This representation yields two additional domain changes for which preferences are invariant: 1) changing the level of a choice-independent outcome and 2) adding an agent with an identical choice-dependent outcome for each existing agent with a choice-dependent outcome.

To demonstrate these domain changes more concretely, consider the example in table 1. Dave is the mayor of a small town and is constructing a public park[1]. The facility can include either a dog park or a playground, in addition to the standard park features. In the first choice environment, Dave's decision only affects two other agents—Anne and Betty. In the second environment, a new constituent named Charles moves to town. Charles cares only about the general park and not about whether it has a dog park or playground, so his outcome is independent of which product Dave chooses to construct. In the third environment, the domain of agents is the same as in the second environment; the only difference is Charles experiences a different level of choice-independent outcome. Finally, the fourth environment replaces Charles with two new agents, Evelyn and Fiona. Evelyn experiences the same outcome as Anne while Fiona experiences the same outcome as Betty. In order for Dave's preferences to be jointly consistent, he must choose to build the same project in each of these four choice environments[2].

Joint consistency and its implications are similar to some existing properties, namely the sure-thing principle in Savage (1954) and coordinate independence in Wakker (1988). In the example from table 1, Dave obeys the sure-thing principle if he builds the same project in choice 1 and choice 2, and obeys coordinate independence if he builds the same project in choice 2 and choice 3. Joint consistency is stronger than these existing properties because it requires that neither the level *nor the presence* of an agent's choice-independent outcome affects the planner's decision. In the example from table 1, this results in Dave choosing the same project in each choice environment.

[1]Construction of public goods is a scenario where joint consistency is more likely to arise naturally. Granting new agents access to a public good has a small impact on the experience of previous users, so the choice of which public good to construct should not depend on the presence of people who are indifferent between the different projects.

[2]The planner making the same choice in environment 4 requires an additional assumption of anonymity; that agents who receive the same outcome are viewed the same. This property naturally arises in laboratory settings.

Choice 1	Outcome for Anne	Outcome for Betty		
Dog park	x	w		
Playground	y	z		
Choice 2	Outcome for Anne	Outcome for Betty	Outcome for Charles	
Dog park	x	w	c	
Playground	y	z	c	
Choice 3	Outcome for Anne	Outcome for Betty	Outcome for Charles	
Dog park	x	w	c′	
Playground	y	z	c′	
Choice 4	Outcome for Anne	Outcome for Betty	Outcome for Evelyn	Outcome for Fiona
Dog park	x	w	x	w
Playground	y	z	y	z

Table 1: Four different choices faced by Dave, our social planner. The first two choices differ only by the presence of Charles, whose outcome is independent of the choice Dave makes. The second and third choices differ only by the level of the choice-independent outcome Charles receives. The first and fourth choices differ by the presence of Anne′ and Betty′, who each receive the same outcome as Anne and Betty respectively. We study when Charles selects the same option in each of these choices.

We investigate the empirical relevance of our criterion using an online laboratory experiment with 200 participants. Each participant acts as a social planner making binary decisions for groups of participants, across the various domain types described above[3]. Overall rates of joint consistency are high, including among choices where the planner's outcome is unaffected by their decision. Interpreting joint consistency as a measure of attention, this result indicates that participants often still behave purposefully when their choices only affect other people. Additionally, we find limited differences in consistency across the types of domain changes. Despite this success, we find a few substantive departures from the theory.

First, there is more consistency between choices that differ by exactly one of the three domain changes described in table 1 than between choices differing by compounded domain changes. This suggests inconsistency stems from a cognitive difficulty in parsing the domain changes. Second, we find adding or removing the *planner* results in lower consistency than adding or removing another agent (i.e. there is less consistency among choice 1 and choice 2 when Charles is replaced with Dave). This demonstrates that social planners make systematically different choices depending on their presence in the domain of agents. Additionally, we analyze the direction of inconsistencies and

[3]The example in table 1 involves the decision-maker only choosing for others. We consider both this type of environment, as well as environments where the decision-maker is one of the agents affected by their decision.

find that: 1) inconsistent planners are less inequality averse than consistent planners, especially over more complex domain changes, and 2) inconsistent planners exhibit diminishing inequality aversion as domain size increases. We propose two possible causes for this result: 1) inconsistent preferences over efficiency and inequality of outcomes and 2) cognitive complexity[4]. Our current design limits our ability to distinguish these causes, but we believe this is a productive area for future research.

Many works explore the consistency of decision rules from a theoretical perspective. Polman and Wu (2020) provides a comprehensive overview of the literature on decisions under uncertainty made for oneself and others, and Thomson (2011) offers a thorough overview of which allocation rules adhere to different notions of consistency. While there have many theoretical treatments of preference consistency, there has been very limited empirical work on the topic. Zame et al. (2020) is the only empirical work we are aware of, which focuses on the differences between social and personal preferences in the face of uncertainty. We eliminate uncertainty to focus on the social choice component of these decisions, in addition to investigating choices on different sizes of social domains rather than comparing choices in personal and social domains.

While there is limited empirical work on consistency, there is a vast set of empirical work on social preferences[5]. One difference between our study and much of this literature is that we consider both environments, one where the decision-maker's choices affect their own outcome and one in which they do not. Two important papers in this area are Traub et al. (2009) and Hong et al. (2015), which both find systematic differences in how planners choose between equity and efficiency when their choices affect their own outcome and when they do not. We find this same result in our data, which manifests as much higher consistency within domains that keep the planner's presence constant rather than across those domains.

The rest of the paper is structured as follows. Section 2 provides the theoretical components of this paper. Section 3 provides details on the experimental design. Section 4 shares our main findings from the experiment, and section 5 concludes the paper.

[4]The literature studying when choices may differ from underlying preferences due to mistakes contains recent work by Esponda and Vespa (2023), Nielsen and Rehbeck (2022), Oprea (2020), Oprea (2023), and Enke et al. (2023).

[5]Harsanyi (1961) pioneered this literature introducing the ultimatum game, which Kahneman et al. (1986), Forsythe et al. (1994), and Andreoni and Miller (2002) refined into the modified dictator game. See Engel (2011) for a comprehensive review of dictator game literature.

2 Theory

Let $\mathcal{N} = \{1, ..., n\}$ be the set of all agents a social planner makes decisions for. Then $A \in \mathcal{P}(\mathcal{N})$ and $B \in \mathcal{P}(\mathcal{N})$ are two domains that contain some of the agents from $\mathcal{N}$, where $\mathcal{P}(\mathcal{N})$ refers to the power set of $\mathcal{N}$. For each domain $A \in \mathcal{P}(\mathcal{N})$, $x_A \in \mathbb{R}^{|A|}$ refers to a social allocation in A. The social planner has a preference relation $\succeq_A$ over such social allocations that satisfies the following standard axioms:

2.1 Axioms and Definitions

Axiom 1. *A preference relation $\succeq_A$ is complete if for all $x_A, y_A \in \mathbb{R}^{|A|}$, either $x_A \succeq_A y_A$ or $y_A \succeq_A x_A$.*

Axiom 2. *A preference relation $\succeq_A$ is transitive if for all $x_A, y_A, z_A \in \mathbb{R}^{|A|}$, if $x_A \succeq_A y_A$ and $y_A \succeq_A z_A$, then $x_A \succeq_A z_A$.*

Axiom 3. *A preference relation $\succeq_A$ is continuous if both $E = \{x_A | x_A \succeq_A y_A\}$ and $F = \{x_A | y_A \succeq_A x_A\}$ are closed for all $y_A \in \mathbb{R}^{|A|}$.*

Given that Euclidean space is complete and separable, these axioms imply the existence of a real-valued utility function that represents $\succeq_A$ (Debreu (1954)).

For $A \in \mathcal{P}(\mathcal{N})$ and $B \in \mathcal{P}(\mathcal{N})$, s.t. $A \subset B$, by $(x_A; c_{B\setminus A})$ we denote a collection of payments $x \in \mathbb{R}^{|A|}$ to ordered agents in A, and a collection of payments $c \in \mathbb{R}^{|B|-|A|}$ to ordered agents that are in B, but not in A.

When it is clear from the context which domain we are referring to, we will drop the subscripts and write x, instead of x_A. Additional notation: for $x \in \mathbb{R}^n$ and $c \in \mathbb{R}$, we would denote by $(x_{-i}c_i)$ an n-dimensional vector x, whose i-th component was replaced by c.

An additional aspect of social preferences is how the decision-maker treats different agents receiving the same payment profiles. We define the following pair of anonymity conditions, which require (most) agents receiving the same payoff to be treated equally. In the second anonymity condition, we acknowledge the possibility that the decision-maker treats themselves differently from others but requires that they treat the rest equally when they receive the same payoff[6]. These

[6]By construction, both anonymity axioms are equivalent whenever the decision-maker is not receiving a direct payment.

axioms are not necessary for the main theoretical result, but they naturally arise in our experimental setting and provide a direct method for extending the domain of preferences.

Axiom 4. *A preference relation $\succeq$ that has an additively separable utility representation $U(x) = \sum_i u_i(x_i)$ satisfies anonymity among everyone if $x_i = x_j \implies u_i(x_i) = u_j(x_j)$.*

Axiom 5. *A preference relation $\succeq$ that has an additively separable utility representation $U(x) = u_{dm}(x_{dm}) + \sum_{i \neq dm} u_i(x_i)$ satisfies anonymity among others if $x_i = x_j, i, j \neq dm \implies u_i(x_i) = u_j(x_j)$.*

The final piece of background that we require before introducing our consistency condition is *coordinate independence*, which states that an alternative is preferred to another if and only if changing the level of one choice-independent component by the same amount in both alternatives does not change the preference ranking. Wakker (1988) shows that a preference relation admits an additively separable utility function if and only if it satisfies coordinate independence, axioms 1-3, and some mild regularity conditions. We will use this property to construct the utility representation for our consistency property.

Definition 1. A preference relation $\succeq$ satisfies coordinate independence, if for all $x, y \in \mathbb{R}^n,\ 1 \leq i \leq n,\ c, d \in \mathbb{R}$, we have $(x_{-i}c_i) \succeq (y_{-i}c_i) \iff (x_{-i}d_i) \succeq (y_{-i}d_i)$.

We now present the main definition of consistency which we develop in this paper. Intuitively, this condition says that if an alternative is preferred on a smaller domain, then it should still be preferred when we expand the domain by adding additional agents whose outcome is independent of the decision-maker's choice.

Definition 2. For $A \in \mathcal{P}(\mathcal{N})$ and $B \in \mathcal{P}(\mathcal{N})$, s.t. $A \subset B$, a pair of preference relations $\succeq_A$ and $\succeq_B$ satisfies *pair-wise consistency* if $\forall c \in \mathbb{R}^{|B|-|A|}; \forall x, y \in \mathbb{R}^{|A|}$ we have $x \succeq_A y \iff (x_A; c_{B \setminus A}) \succeq_B (y_A; c_{B \setminus A})$.

Definition 3. A family of preference relations $\{\succeq_A\}_{A \in \mathcal{P}(\mathcal{N})}$, satisfies *joint consistency* if $\forall A, B \in \mathcal{P}(\mathcal{N}) : A \subset B;\quad \succeq_A$ and $\succeq_B$ satisfy pairwise consistency.

While similar to coordinate independence, joint consistency refers to how different preference rankings relate to each other when adding an agent with a choice-independent outcome. Coordinate independence only deals with how a single preference ranking behaves when an agent's choice-independent outcome changes, not with the relationship between preferences over different sets of agents.

2.2 Examples of Jointly Consistent Preferences

One example of jointly consistent preferences is a variation of Rawlsian preferences, which we call *Rawlsian lexicographic preferences* and denote by $\succeq_{RL}$. Standard Rawlsian preferences aim to make the lowest agent's payoff as high as possible, and are mathematically given by $x \succeq_R y \iff \min_j x_j \geq \min_j y_j$. These preferences are not jointly consistent; if $\min_j x_j \neq min_j y_j$, then either $x_j \succ y_j$ or $y_j \succ x_j$, but if $c < \min\{\min_j x_j, \min_j y_j\}$ then $(x_j, c) \sim_R (y_j, c)$. In other words, a Rawlsian planner is indifferent between all options when we add an agent with a choice-independent payoff lower than the previous minimum payoff. A planner with Rawlsian Lexicographic preferences aims to make the *lowest choice-dependent payment* as high as possible. Mathematically, these preferences are described by: $x \succeq_{RL} y \iff x_{(m)} > y_{(m)}$ where $m = \min k$ such that $x_{(k)} \neq y_{(k)}$, and $x_{(k)}$ is the kth order statistic of the allocation x. Like standard lexicographic preferences, Rawlsian lexicographic preferences are not continuous and do not admit a utility representation. Our next example, however, admits a familiar utility representation.

A second example of jointly consistent preferences is *consistent utilitarian preferences*, which we denote by $\succeq_{CU}$. A planner with such preferences maximizes a weighted sum of agent-domain-specific individual utilities where the marginal rate of substitution between any two agents is the same on any domain containing both agents. Mathematically, $x \succeq_{CU} y \iff \sum_{i \in A} u_{A,i}(x_i) \geq \sum_{i \in A} u_{A,i}(y_i)$ and $\frac{u'_{B,j}}{u'_{B,i}} = \frac{u'_{A,j}}{u'_{A,i}}$ whenever $i, j \in A \cap B$. The restriction that the marginal rate of substitution between agents is the same across domains prevents arbitrary changes in the Bernoulli function between domains, which is critical for joint consistency. Equivalently, we could instead require that the Bernoulli functions be unique up to a *jointly cardinal transformation* (the multiplication of every utility index by the same positive constant). We provide this alternative characterization because we can then suppress the choice domain in the notion: $x \succeq_{CU} y \iff \sum_{i \in A} u_{A,i}(x_i) \geq \sum_{i \in A} u_{A,i}(y_i) \forall A \in \mathcal{P}(\mathcal{N})$ where the u_i are unique up to jointly cardinal transformation. It is reassuring that there are utilitarian preferences that are jointly consistent, given their importance in many economics models and empirical applications.

2.3 Theoretical Results

Under some mild regularity conditions, joint consistency has remarkable implications for the utility formulation of families of social preferences:

Proposition 1. $\{\succeq_A\}_{A\in\mathcal{P}(\mathcal{N})}$ *is jointly consistent and each* $\succeq_A$ *satisfies completeness, transitivity, and continuity, if and only if* $\{\succeq_A\}_{A\in\mathcal{P}(\mathcal{N})}$ *has a consistent additively separable representation:* $U_A(x) = \sum_{i\in A} u_{A,i}(x_i)$ *for all* $A \in \mathcal{P}(\mathcal{N})$*, where* u_i *are unique up to a jointly cardinal transformation.*

Proof. The 'if' direction is straightforward. To show the 'only if' direction, we first show that joint consistency implies coordinate independence for all $A \in \mathcal{P}(\mathcal{N})$.

First, choose any $A, B \in \mathcal{P}(\mathcal{N})$, in such a way that $A \subset B$, $|B| = |A| + 1$. Choose arbitrary vectors $(x_A; c_{B\setminus A}), (y_A; c_{B\setminus A}) \in \mathbb{R}^{|B|}$, and assume without loss of generality that $(x_A; c_{B\setminus A}) \succeq_B (y_A; c_{B\setminus A})$.

Consider the $|A|-$dimensional vectors x_A and y_A. Since $\succeq_A$ is complete, either $x_A \succeq_A y_A$ or $y_A \succeq_A x_A$. If $y_A \succeq_A x_A$, then by pairwise consistency it must be the case that $(y_A; c_{B\setminus A}) \succeq_B (x_A; c_{B\setminus A})$; $\forall c \in \mathbb{R}$. This is only possible when both options are indifferent. so we must have $(y_A; c_{B\setminus A}) \succeq_B (x_A; c_{B\setminus A})$. Alternatively, $x_A \succeq_A y_A$, which by pairwise consistency implies that $(x_A; c_{B\setminus A}) \succeq_B (y_A; c_{B\setminus A})$; $\quad \forall c \in \mathbb{R}$.

We have demonstrated that $(x_A; c_{B\setminus A}) \succeq_B (y_A; c_{B\setminus A})$ implies $(x_A; d_{B\setminus A}) \succeq_B (y_A; d_{B\setminus A})$, which proves that joint consistency implies coordinate independence of each $\succeq_A$. Using a theorem from Wakker (1988), each preference relation $\succeq_A$ then has an additively separable utility representation that is unique up to a jointly cardinal transformation. Now, consider an additively separable representation for $\succeq_\mathcal{N}$, $U(x) = \sum_{i\in\mathcal{N}} u_{A,i}(x_i)$. Because $\succeq_A$ is a jointly consistent family, for any $A \in \mathcal{P}(\mathcal{N})$ and any $i, j \in A$ we must then have $\frac{u'_{\mathcal{N},j}}{u'_{\mathcal{N},i}} = \frac{u'_{A,j}}{u'_{A,i}}$. □

An alternative framing is that consistent utilitarian preferences are the unique preference that satisfying the decomposition in the following propositions and corollary, which demonstrate explicitly how to relate utility representations across domains.

Proposition 2. *If* $\{\succeq_A\}_{A\in\mathcal{P}(\mathcal{N})}$ *is jointly consistent and each* $\succeq_A$ *satisfies completeness, transitivity, and continuity;* $\forall B \in \mathcal{P}(\mathcal{N})$ *such that* $B = i \cup k$*, there exists* U_i*,* U_j*,* U_B*, that respectively* *represent $\succeq_i, \succeq_j$, and $\succeq_B$, such that $U_B = U_i + U_j$.*

Proof. By the previous theorem, there exist u_i and u_j that represent $\succeq_i$ and $\succeq_j$. Additionally, there exists some function U_B that represents $\succeq_B$ and is additively separable. Therefore, $U_B = f(u_i) + g(u_j)$ for some increasing functions f and g.

Define $U_i = f(u_i)$ and $U_j = g(u_j)$; therefore $U_B = U_i + U_j$ where U_i, U_j, and U_B respectively represent $\succeq_i, \succeq_j$, and $\succeq_B$ $\square$

Proposition 3. *If $\{\succeq_A\}_{A\in\mathcal{P}(\mathcal{N})}$ is jointly consistent and each $\succeq_A$ satisfies completeness, transitivity, and continuity; $\forall A \subset B \in \mathcal{P}(\mathcal{N})$ such that $B = A \cup \{k\}$, there exists U_A, U_B, U_k, that respectively represent $\succeq_A, \succeq_B$, and $\succeq_k$, such that $U_B = U_A + U_k$.*

Proof. Fix $i \in A$ and $k \in B \setminus A$, and define $C = i \cup k$. By proposition 1, $\succeq_C$ has an additively separable representation $U_C = u_i + u_k$ (note that u_k also represents $\succeq_k$ by proposition 2).

By proposition 1, there exists an additively separable function $U_A = u_i + \sum_{j\neq i\in A} u_j$ that represents $\succeq_A$ where u_i is the same in both U_A and U_C. Define $U_B = u_i + \sum_{j\neq i\in A} u_j + u_k = u_A + u_k$.

The above U_B is additively separable and is jointly consistent because $\frac{u'_{B,i}}{u'_{B,j}} = \frac{u'_{A,i}}{u'_{A,j}}$ for all $i, j \in A$ and $\frac{u'_{B,i}}{u'_{B,k}} = \frac{u'_{C,i}}{u'_{C,k}}$ (by construction we also have $\frac{u'_{B,j}}{u'_{B,k}} = \frac{u'_{D,j}}{u'_{D,k}}$ such that $j, k \in D$). U_B therefore also represents $\succeq_B$.

$\square$

By repeated application proposition 3, we obtain the following corollary.

Corollary 1. *If $\{\succeq_A\}_{A\in\mathcal{P}(\mathcal{N})}$ is jointly consistent and each $\succeq_A$ satisfies completeness, transitivity, and continuity; $\forall A \subset B \in \mathcal{P}(\mathcal{N})$, there exists U_A, U_B, $U_{B\setminus A}$, that respectively represent $\succeq_A, \succeq_B$, and $\succeq_{B\setminus A}$, such that $U_B = U_A + U_{B\setminus A}$.*

In addition, if preferences satisfy either anonymity condition we can extend $\{\succeq_A\}$ to include additional agents not in $\mathcal{N}$ as long as the new agent's payoff profile is identical to an agent already in the domain.

Proposition 4. *Suppose that $\{\succeq_A\}_{A\in\mathcal{P}(\mathcal{N})}$ are jointly consistent, anonymous, continuous, transitive, and complete. Suppose that agent $k \notin \mathcal{N}$ but there exists some agent $j \in \mathcal{N}$ such that $x_k = x_j$ for all options x. Then the family of preferences$\{\succeq_B\}$ for $B \in \mathcal{P}(\mathcal{N}\cup k)$ described by*

$u_{B,\mathcal{N}\cup\{k\}} = u_{B,\mathcal{N}}$ *for* $B \in \mathcal{P}(\mathcal{N}) \cap \{k\}^c$ *and* $u_{B,\mathcal{N}\cup\{k\}} = u_{B,\mathcal{N}} + u_j$ *for* B *in* $\mathcal{P}(\mathcal{N} \cup k)$ *where* j *satisfies* $x_k = x_j$ *for all* x *is a jointly consistent family of preferences over* $\mathcal{P}(\mathcal{N} \cup k)$

2.4 Commentary

There are two important implications of these results. First, they inform the experimental design we describe in the following section. Second, they demonstrate how important consistency (or the lack of it) is for empirical applications. Joint consistency implies external validity of preference measurements—that the measurement of a planner's preferences do not depend on the particular domain of agents included in the measurement. In particular, the failure of joint consistency has strong implications for the class of planners with additively separable utility representations. Joint consistency guarantees that measured Bernoulli functions do not vary (with the possible exception of a common scale factor) with the domain of measurement. Any measured Bernoulli functions for an inconsistent planner are specific only to the domain of measurement, and carry no information about the planner's preferences on other domains. This limits the value of such preference measurement for conducting welfare analysis, policy, analysis, etc.

3 Experimental Design

We recruited 200 participants using Prolific.com for an online laboratory experiment to test for joint consistency of preferences. Each participant made decisions for 31 binary choices over allocations to themselves and to other people, resulting in 31,400 pairs of decisions[7]. Each participant received \$2.50 for their participation; 10% received an additional bonus based on a decision selected at random. The median completion time was 10 minutes, and the average payment with the bonus was \$4, yielding an average hourly wage of[8] \$24.

Questions were presented in two blocks: one where the participant makes decisions that affect their payment and the payments of others, and a second where they only make decisions that affect the payments of others[9]. The order of the blocks and the order of questions within the blocks were

[7] Due to a coding error, we are only able to use 26 of the 31 decisions for the first 60 of our participants.

[8] We find no evidence that the time a participant takes to complete the study affects joint consistency. On average, participants taking an additional minute to complete the study had a lower joint consistency rate of 0.15%. We fail to reject the null hypothesis that this effect is 0, with a p-value for the t-test of 0.528.

[9] The role of the other players was assigned to other different participants in the study at random each round, so at no point did any participant know exactly who was receiving the payments they were allocating to other people.

randomized[10].

Choice 1	Payment to Player 1	Payment to Player 2
option 1	\$5	\$25
option 2	\$10	\$15

Table 2: The most basic choice our participants made. There are three variants; the decision-maker could be player 1 (receiving the lower payment profile), player 2 (receiving the higher payment profile), or not a player and receive no payment from this decision.

3.1 The Basic Choices

There were three 'basic' choices our participants made, which involved only the choice of allocating \$5 to person 1 and \$25 to person 2, or allocating \$10 to person 1 and \$15 to person[11] 2. The difference between these three choices is the payment to the decision-maker. In one variant of the choice, they are not receiving either of the payments they are allocating. In the other two variants, they are receiving one of the payments they are allocating (either the poorer payment profile or the richer payment profile). Table 2 provides a description of these decision environments. While none of the decisions made in these basic choices are comparable to each other to test for joint consistency, every other decision our participants made is comparable to the decision in one of these three choices.

3.2 Additional Terminology

We refer to option 1 in all of the choices as 'inefficiency averse', and option 2 as 'inequality averse'[12]. We refer to the profile receiving \$5 or \$10 as the 'poorer' profile, and the profile receiving either \$25 or \$15 as the 'richer' profile. When the decision-maker is making choices involving their own monetary payments, we refer to the option that provides them with the higher monetary payment as either the 'selfish' option or the individually payment-maximizing option (i.e. option 2 is selfish when the decision-maker is poorer, but option 1 is selfish when the decision-maker is

[10]The order of the blocks was not randomized for the first 60 participants. Because of this and the aforementioned coding error, we repeat all of our analysis dropping these individuals in section 4.5 and we find largely the same results.

[11]These numbers were selected to generate a tradeoff between efficiency and equality; we use multiples of \$5 to make the choices clear for participants to understand and minimize rounding.

[12]We randomly presented the options to participants; we have standardized the order here for clarity of exposition.

Choice 1	Payment to Player 1	Payment to Player 2		
option 1	\$5	\$25		
option 2	\$10	\$15		
Choice 2	Payment to Player 1	Payment to Player 2	Payment to Player 3	
option 1	\$5	\$25	\$c	
option 2	\$10	\$15	\$c	
Choice 3	Payment to Player 1	Payment to Player 2	Payment to Player 3	Payment to Player 4
option 1	\$5	\$25	\$c	\$$\hat{c}$
option 2	\$10	\$15	\$c	\$$\hat{c}$

Table 3: Comparison of choices that differ by the addition of adding agents with a choice-independent outcome. The decision-maker faces multiple variants where they are either player 1, player 2, player 3, or are not one of the players and receive no payment, and variants where the value of c varies between 5, 18, and 25.

richer)[13].

3.3 Simple Change 1: Addition of Players with Choice-Independent Outcomes

For each of the three basic decisions, we change the domain of choices by adding agents who receive a choice-independent outcome to each option. Under the assumption of joint consistency, a decision-maker chooses the same option in both choices under such a domain transformation. Table 3 illustrates this comparison explicitly; choice 1 is a basic decision, choice 2 adds an additional agent receiving a choice-independent outcome, and choice 3 adds two additional agents receiving choice-independent outcomes. A decision-maker who is jointly consistent chooses option 1 in one choice if and only if they choose option 1 in all choices.

3.4 Simple Change 2: Changing the level of a choice-independent outcome

Besides changing the set of agents in the choice domain, we can change the outcomes the agents receive. Table 3 again illustrates these changes. A decision-maker who is jointly consistent chooses option 1 in choice 2 for one level of c if and only if they choose option 1 in choice 2 for any level of c.

[13]These attributions are not theoretical predictions but are useful for describing the direction of inconsistencies.

Choice 1	Payment to Player 1	Payment to Player 2				
option 1	$5	$25				
option 2	$10	$15				
Choice 2	Payment to Player 1	Payment to Player 2	Payment to Player 3	Payment to Player 4		
option 1	$5	$25	$5	$25		
option 2	$10	$15	$10	$15		
Choice 3	Payment to Player 1	Payment to Player 2	Payment to Player 3	Payment to Player 4	Payment to Player 5	Payment to Player 6
option 1	$5	$25	$5	$25	$5	$25
option 2	$10	$15	$10	$15	$10	$15

Table 4: Comparison of choices that differ only by duplication of agents with variable payments. The decision-maker is not one of the players receiving payment here, as that would violate anonymity.

3.5 Simple Change 3: Duplications

In addition to changing the domain by adding agents receiving a choice-independent outcome, we test for joint consistency by duplicating all choice-dependent outcome profiles and assigning them to new agents. Table 4 compares a basic choice to a choice with one duplication and a to a choice with two duplications. A decision-maker who is jointly consistent and satisfies anonymity chooses option 1 in one choice if and only if they choose option 1 in all choices[14].

3.6 Combining the Domain Changes and Testable Predictions

Joint consistency of preferences implies that decisions are invariant under each of the domain expansions described above and under the composition of these changes. Table 5 demonstrates several environments formed by the combination of these domain changes. Joint consistency implies that the decision-maker chooses option 1 in one choice in table 5 if and only if they choose option 1 in all choices in that table.

In our experiment, this means there are three categories of choices based on the individual outcome experienced by the decision-maker: the poorer payment profile, the richer payment profile, or a choice-independent profile (this includes when the decision-maker receives no payment). Each participant made 7 choices where they received the richer payment profile (generating 21 pairs of comparable decisions), 7 choices when they received the poorer payment profile, and 17 choices where their outcome was independent of their choice (generating 136 pairs of comparable

[14]Our experimental design enforces anonymity among others, so we can test for joint consistency using duplications whenever the decision-maker is not one of the agents receiving a choice-dependent outcome profile. We, therefore, design our experiment to have duplications only when the decision-maker is not one of the agents receiving a choice-dependent outcome profile.

Choice 1	Payment to Player 1	Payment to Player 2				
option 1	\$5	\$25				
option 2	\$10	\$15				
Choice 2	Payment to Player 1	Payment to Player 2	Payment to Player 3			
option 1	\$5	\$25	\$c			
option 2	\$10	\$15	\$c			
Choice 3	Payment to Player 1	Payment to Player 2	Payment to Player 3	Payment to Player 4		
option 1	\$5	\$25	\$5	\$25		
option 2	\$10	\$15	\$10	\$15		
Choice 4	Payment to Player 1	Payment to Player 2	Payment to Player 3	Payment to Player 4	Payment to Player 5	
option 1	\$5	\$25	\$5	\$25	\$c	
option 2	\$10	\$15	\$10	\$15	\$c	
Choice 5	Payment to Player 1	Payment to Player 2	Payment to Player 3	Payment to Player 4	Payment to Player 5	Payment to Player 6
option 1	\$5	\$25	\$5	\$25	\$c	\$$\hat{c}$
option 2	\$10	\$15	\$10	\$15	\$c	\$$\hat{c}$

Table 5: Comparison of choices that can differ by both the addition of agents with choice-independent payments or the duplication of the choice-dependent payment profiles. The decision-maker faces variants where they are either player 6 or not one of the players and receive no payment, and where c varies between 5, 18, and 25.

decisions[15]). This results in 178 pairs of decisions per participant.

4 Results

4.1 Descriptive Statistics

The average proportion of consistent choices is 0.8141, and the median proportion of consistent pairs among participants is 0.8764. We find no difference in consistency from gender, age, employment status, length of time spent on the experiment, or survey experience[16]. We include the sample-balance results in table 11 in the appendix. We next examine the proportion of consistent choice pairs across different types of domain changes and present the results in table 6. There are two primary results.

Result 1 Adding an agent with a choice-independent outcome and changing the level of a choice-independent outcome have the same proportion of consistent choices

Our first result is consistent with the theory—that the different types of domain changes should be associated with the same rate of consistency. While it appears that combined changes and duplications have lower consistency rates, there are additional experimental parameters that

[15] The coding error for 60 of our participants resulted in only 12 choices from this block appearing correctly, so this set of participants only has 66 comparable pairs.

[16] Survey experience has a statistically significant but economically insignificant effect on consistency. A participant would need to complete an additional 100,000 surveys to have a 1.59% increase in their consistency percentage. The maximum number of surveys completed in our sample was 7,063.

condition	proportion consistent
Adding 1 choice-independent outcome	0.8672 (0.0040)
Changing level of 1 choice independent outcome	0.8662 (0.0051)
Duplication	0.8284 (.0094)
combined change	0.7789 (.0031)

Table 6: Table featuring the proportion of consistent decision pairs by different choice environments, with the more consistent option displayed on the left along with stars to indicate statistically significant differences in consistency. * is significant at 90%, ** is significant at 95%, *** is significant at 99%, **** is significant at 99.99%.

may be driving these results.

4.2 Regression Results

We next build upon the results of table 6 using a linear probability model (LPM) and a logit model. We present the result in table 7. The regressions contain indicator variables for each domain change analyzed in 6, utilize both fixed effects and standard error clustering at the participant level, and include controls for addition parameters of the experimental design.

Result 2 There is less consistency among choices involving a combination of changes, but consistency among choices involving duplication is the same as the other simple changes when controlling for additional experimental parameters.

Choices involving duplications were more likely to have the decision-maker receiving payment on one choice but on the other, which has a significant negative effect on consistency. Additionally, choices where the decision-maker has a choice-dependent outcome only occur when duplications are not present. When controlling for these factors, duplications have the same effect on consistency as the other two basic types of domain changes. However, combining changes still has a significant negative effect on consistency. Additionally, the effects of the controls provide insight on the effect of an additional change.

Result 3 There are no differences in consistency when the decision-maker receives a choice-independent payment on both choices when that payment is positive or when it is 0. However, there is a significant decrease in consistency when comparing choices where the decision-maker receives a choice-independent positive outcome in one choice and 0 in another choice.

Our participants view adding themselves to a domain differently than adding another agent

	LPM	LPM	Logit	Logit	LPM	LPM	Logit	Logit
adding choice-independent outcome	.0009 (.0061)	.0006 (.0063)	.0087 (.0545)	.0053 (.0613)	-.0035 (.0059)	-.0036 (.0060)	-.0330 (.0529)	-.0383 (.0624)
duplication	-.0379 (.0133)***	-.0358 (.0133)***	-.2937 (.0966)***	-.3316 (.1163)***	.0065 (.0115)	.0087 (.0115)	.0357 (.0825)	.0651 (.0996)
combined change	-.0873 (.0120)***	-.0826 (.0114)***	-.6086 (.0774)***	-.6990 (.0871)***	-.0181 (.0071)**	-.0157 (.0070)**	-.1316 (.0531)**	-.1376 (.0632)**
DM paid on one only					-.0454 (.0128)***	-.0494 (.0129)***	-.2613 (.0783)***	-.3691 (.0966)***
DM paid on both					.0045 (.0199)	-.0038 (.0189)	.0290 (.1301)	-.0373 (.1517)
DM richer					.0611 (.0193)***	.0623 (.0192)***	.4801 (.1549)***	.5817 (.1799)***
DM poorer					.1020 (.0171)***	.1033 (.0170)***	.9410 (.1719)***	1.0978 (.1906)***
Regression constant	.8663 (.0106)	.8635 (.0075)	1.8681 (.0913)		.8185 (.0171)	.8219 (.0112)	1.5171 (.1146)	
Log Likelihood			-14,981.969	-11,071.051			-14,692.688	-10,843.016
(pseudo) R^2	.0116	.0116	.0125	.0178	.0226	.0226	.0257	.0380
N	31,400	31,400	31,400	23,010	31,400	31,400	31,400	23,010
# Clusters	200	200	200	145	200	200	200	145
Participant FE	No	Yes	No	Yes	No	Yes	No	Yes

Table 7: Multiple specifications comparing effect of domain changes on consistency. The baseline is changing only the level of a choice-independent outcome when the decision-maker is not paid. All regressions computed with standard errors clustered at the participant level, along with participant-level fixed effects and additional controls where indicated. * is significant at 90%, ** is significant at 95%, *** is significant at 99%.

to the domain. This is inconsistent with the theory; joint consistency requires that adding an additional agent with a choice-independent payoff does not change preferences regardless of the identity of the added agent. While this indicates that participants make systematically different choices depending on their inclusion in the domain, they make consistent choices within the regime.

4.3 Directions of Inconsistencies

One conclusion we drew from the results in table 6 was that our participants made systematically different choices in different environments. To further support this conclusion, we compare the likelihood of selecting the inequality-averse choices on different environments between participants who are fully consistent and those who are not. We present the results of this analysis in table 8, which compares the proportions between these different groups for a variety of decision environments.

Result 4 Individuals who are not fully consistent display significantly lower levels of inequality aversion than individuals who are fully consistent.

Inconsistent individuals overwhelmingly exhibit lower inequality aversion than consistent individuals. Additionally, inconsistent individuals appear to choose the inequality-averse option less frequently as domain size increases.

Environment	Consistent	Inconsistent, Smaller	Inconsistent, Larger
Aggregate	.7383 (.0056)	.6009 (.0037)****	.5692 (.0038)****
Adding choice-independent outcome	.6648 (.0106)	.5735 (.0068)****	.5706 (.0069)****
Duplication	.7655 (.0203)	.6186 (.0141)****	.5781 (.0143)****
combined change	.7733 (.0067)	.6124(.0047)****	.5675 (.0048)****
DM choice-dependent outcome, aggregate	.6182 (.0120)	.5662 (.0075)***	.5501 (.0075)****
DM choice-dependent outcome, adding choice-independent outcome	.6182 (.0134)	.5629 (.0084)***	.5506 (.0084)****
DM choice-dependent outcome, combined change	.6182 (.0267)	.5793 (.0167)***	.5483 (.0169)**
DM choice-dependent outcome, richer, aggregate	.3272 (.0163)	.2497 (.0093)****	.2331 (.0091)****
DM choice-dependent outcome, richer, adding choice-independent outcome	.3273 (.0183)	.2483 (.0104)****	.2339 (.0101)****
DM choice-dependent outcome, richer, combined change	.3273 (.0365)	.2552 (.0209)*	.2299 (.0202)**
DM choice-dependent outcome, poorer, aggregate	.9091 (.0100)	.8828 (.0067)**	.8671 (.0073)***
DM choice-dependent outcome, poorer, adding choice-independent outcome	.9091 (.0112)	.8776 (.0079)**	.8672 (.0081)***
DM choice-dependent outcome, poorer, combined change	.9090 (.0223)	.9034 (.0142)	.8667 (.0163)***
DM choice-independent outcome, aggregate	.7816 (.0061)	.6127 (.0043)****	.5757 (.0044)****
DM choice-independent outcome, adding choice-independent outcome	.7588 (.0167)	.5943 (.0117)****	.6101 (.0116)****
DM choice-independent outcome, duplication	.7655 (.0203)	.6186 (.0141)****	.5781 (.0143)****
DM choice-independent outcome, combined change	.7880 (.0069)	.6153 (.0049)****	.5692 (.0050)****
DM paid on one domain, aggregate	.7838 (.0084)	.6127 (.0060)****	.5759 (.0061)****
DM paid on one domain, adding choice-independent outcome	.7702 (.0274)	.5985 (.0193)****	.6047 (.0193)****
DM paid on one domain, combined change	.7853 (.0089)	.6143 (.0063)****	.5727 (.0064)****
DM paid on both domains, aggregate	.6706 (.0089)	.5837 (.0057)****	.5640 (.0058)
DM paid on both domains, adding choice-independent outcome	.6363 (.0123)	.5658 (.0078)****	.5554 (.0078)****
DM paid on both domains, duplication	.7455 (.0240)	.6230 (.0164)****	.5724 (.0168)****
DM paid on both domains, combined change	.7005 (.0150)	.5991 (.0099)****	.5752 (.0010)****
DM paid on neither domain, aggregate	.8158 (.0118)	.6167 (.0086)***	.5675 (.0088)****
DM paid on neither domain, adding choice-independent outcome	.76 (.0302)	.6019 (.0211)***	.6444 (.0206)***
DM paid on neither domain, duplication	.8286 (.0368)	.6063 (.0275)****	.5937 (.0277)****
DM paid on neither domain, combined change	.8286 (.0133)	.6216 (.0101)****	.5459 (.0104)****

Table 8: This table details the proportion of decision pairs where participants selected the inequality-averse choice, broken down by different choice environments. The left column is the proportion among individuals who are fully consistent in the sample, the middle and right columns are the proportion among individuals who are not fully consistent. The left and middle columns are the proportion where individuals selected the inequality-averse option on the choice with a smaller domain (regardless of their choice on the larger domain), and the left and right columns are the proportion where individuals selected the inequality-averse option on the choice with a larger domain (regardless of their choice on the smaller domain). Stars indicate significant differences against the left column. * is significant at 90%, ** is significant at 95%, *** is significant at 99%, **** is significant at 99.99%.

Environment	# Observations	Proportion Inequality ↓
Aggregate	4,450	.5611 (.0074)****
Adding choice-independent outcome	959	.5078 (.0161)
Duplication	278	.5863 (.0295)***
combined change	3213	.5749 (.0087)****
DM choice-dependent outcome, aggregate	604	.5779 (.0202)***
DM choice-dependent outcome, adding choice-independent outcome	473	.5454 (.0229)**
DM choice-dependent outcome, combined change	131	.6031 (.0427)**
DM choice-dependent outcome, richer, aggregate	362	.5497 (.0261)*
DM choice-dependent outcome, richer, adding choice-independent outcome	285	.5439 (.0295)
DM choice-dependent outcome, richer, combined change	77	.5715 (.0563)
DM choice-dependent outcome, poorer, aggregate	242	.5702 (.0318)**
DM choice-dependent outcome, poorer, adding choice-independent outcome	188	.5479 (.0363)
DM choice-dependent outcome, poorer, combined change	54	.6481 (.0650)**
DM choice-independent outcome, aggregate	3846	.5616 (.0080)****
DM choice-independent outcome, adding choice-independent outcome	486	.4712 (.0226)
DM choice-independent outcome, duplication	278	.5863 (.0295)***
DM choice-independent outcome, combined change	3082	.5736 (.0089)****
DM paid on one domain, aggregate	2235	.5545 (.0105)****
DM paid on one domain, adding choice-independent outcome	220	.4909 (.0337)
DM paid on one domain, combined change	2015	.5613 (.0111)****
DM paid on both domains, aggregate	769	.5488 (.0179)****
DM paid on both domains, adding choice-independent outcome	125	.4960 (.0447)
DM paid on both domains, duplication	224	.5982 (.0328)***
DM paid on both domains, combined change	420	.5381 (.0233)
DM paid on neither domain, aggregate	842	.5926 (.0169)****
DM paid on neither domain, adding choice-independent outcome	141	.4184 (.0415)*
DM paid on neither domain, duplication	54	.5370 (.0678)
DM paid on neither domain, combined change	647	.6352 (.0189)****
Duplication without choice-independent outcomes	54	.5370 (.0678)

Table 9: Proportion Inequality ↓ is the proportion of choice pairs where we see decreasing inequality aversion as size increases; that is, where the decision-maker selected the inequality-averse option on the smaller domain but not on the larger domain. ** is significant at 95%, *** is significant at 99% (significance is in terms of difference from 50%, which would indicate no trending direction).

4.4 Direction of Inconsistencies as Size Changes

To further investigate changes in inequality aversion with domain size, we report the proportion of choices where the participants selected the inequality-averse choice on the smaller domain but not on the larger domain. We perform this analysis for each choice category investigated above, and report the results in table 9.

Result 5 When the domain changes through duplication or combined changes, inconsistencies are associated with decreasing inequality aversion. When the domain changes through adding choice-independent outcomes, there is no trend in the direction of inconsistencies.

Inconsistencies are systematic, which provides some insight into the mechanisms behind them. One possible explanation is mechanical; participants may have inconsistent preferences that are decreasing in both inefficiency and inequality. We attempt to test this using choices from the category "duplication without choice-independent outcomes". Many standard inequality measures are *identical* under these types of choice comparisons[17]. The absolute efficiency loss (the difference between total payments received by all players in a choice from choosing the inequality-averse option), however, is higher in the inequality-averse option on the duplicated economy. A participant with decreasing preferences over efficiency loss and inequality measured by some index would therefore exhibit decreasing inequality aversion as the domain size increased in this choice category. While our observed probability is consistent with this explanation, our sample size is far too small to draw a firm conclusion about this hypothesis[18].

A second explanation centers on the complexity of the decision environments. Inconsistencies under duplication or combined changes appear to be systematic, while inconsistencies when adding choice-independent outcomes appear random. Duplication and combined changes are fundamentally more complex domain transformations than adding an agent with a choice-independent outcome, since the former entails adding and/or changing more than 2 numbers in each choice while the latter only adds 2 numbers to each choice. Additionally, it is far easier to determine which option pays a larger sum to all participants than to calculate an inequality index for each option. A decision-maker who experiences differential difficulty across these factors would be more likely to choose more efficient/higher inequality options as domain size increases.

Unfortunately, our current data and design are not well-equipped to completely disentangle these two explanations, nor the complexity costs of changing domain size versus composition. We believe, however, that this would be a productive area for future research.

4.5 Direction of Inconsistencies When Size Does Not Change

There are two types of domain changes that do not change size—a simple change in the level of a choice-independent payoff, or a combined change that adds and removes different agents. There are four components of the domain that can change—the number of agents receiving a choice-

[17]Examples of measures that are identical under duplication without adding choice-independent outcomes include but are not limited to: Gini index, Thiel index, Hoover index, Atkinson index, Palma ratio, variance, and average absolute difference. These measures depend only on the *distribution* of each payment profile within a choice; duplicating all payment profiles changes only the count of each payment profile without changing the distribution of profiles.

[18]Given the number of violations and proportion of each direction in this data set, we estimate we would need to recruit around 3,500 participants to effectively test this hypothesis using our current design.

	#Obs	Prop Inequality Av	Condition
total inconsistencies, same size	1,388		
Changing choice-independent level only	591		
Changing choice-independent only, replacing $25 with $18	173	.5607 (.0377)	more $18
Changing choice-independent only, replacing $25 with $5	175	.5371 (.0377)	more $5
Changing choice-independent only, replacing $18 with $5	243	.4733 (.0322)	more $5
combined change	797		
combined change, swapping DM without changing profiles	191	.4764 (.0361)	DM paid
combined change, swapping DM and $18 for $25	154	.6234 (.0390)***	more $18
combined change, swapping DM and$5 for $25	121	.6363 (.0437)***	more $5
combined change, swapping DM and $5 for $18	141	.5745 (.0416)*	more $5
combined change, swapping $18 for duplication	62	.5645 (.0629)	more dup
combined change, swapping $5 for duplication	45	.5556 (.0741)	more dup
combined change, swapping $18 and $25 for duplication	41	.5853 (.0769)	more dup
combined change, swapping $18 and $25 for $5	42	.5476 (.0769)	more $5
combined change, swapping DM aggregate	607	.4530 (.0202)**	DM paid
combined change, swapping DM without changing profiles	191	.4764 (.0361)	DM paid
combined change, swapping DM and $18 for $25	154	.3636 (.0387)***	DM paid
combined change, swapping DM and$5 for $25	121	.4711 (.0454)	DM paid
combined change, swapping DM and $5 for $18	141	.5035 (.0421)	DM paid

Table 10: Prop Inequality Av is the proportion of choice pairs where the inequality averse choice is selected only after the indicated replacement is made. * is significant at 90%, ** is significant at 95%, *** is significant at 99% (significance is in terms of difference from 50%, which would indicate no trending direction).

independent payment of $5, the number of agents receiving a choice-independent payment of $18, the number of agents receiving a choice-independent payment of $25, and the number of duplications of the choice-dependent payment profiles. Table 10 depicts the direction of inconsistencies for all possible change categories.

Result 6 There is no trend in the direction of inconsistencies when changing only the level of a choice-independent outcome or when changing choice-independent outcomes to duplications. When the decision-maker receives a positive choice-independent outcome on one domain but a choice-independent 0 on the other, inequality aversion decreases as the level of choice-independent payments increases.

The first part of this finding agrees with our previous finding—that inconsistencies for simpler changes are less systematic than inconsistencies for complex changes. The second part of the result also agrees with our earlier finding that participants made systematically different choices depending on their inclusion in the domain. Ultimately, this result says that systematic inconsistencies remain when domain size does not change. If issues with cognitive complexity drive observed inconsistencies, this suggests complexity does not come solely from differences in the number of components the decision-maker has to evaluate.

4.6 Robustness Checks

4.6.1 Robustness of Including All Participants

We mentioned earlier that 60 of our participants had a slightly different experimental experience; they did not see the blocks of questions in a random order, and they did not see five of the choices displayed correctly. Since there may be concern about spillovers between the choices or other systematic differences between these participants and the others in our study, we repeat all of the analysis from section 4 dropping these participants from the sample. We present the results in the appendix. The results are qualitatively unchanged; while many of the numerical estimates of coefficients and proportions change slightly, none of the conclusions we drew above were due to this particular subset of participants.

4.6.2 Robustness Against Random Choice and Indifference

Joint consistency is a strong condition—choice data either satisfies or does not satisfy it, leaving no room to incorporate random choice or errors in decision-making. Since we are dealing with social choice data, it is also possible that some of our participants are choosing randomly because of indifference between options. The presence of any of these phenomena would bias our measures of inconsistency upwards, since any of them could cause inconsistent choices without inconsistent preferences. This section addresses these concerns.

Since joint consistency and anonymity imply an additively separable utility representation, one approach to dealing with the above ideas would be to make functional form assumptions on the Bernoulli functions and estimate a random utility model. Finding parameter values that reasonably fit the data would indicate participants follow a random variant of joint consistency rather than the deterministic version presented in section 2. However, we believe such a model is insufficiently parsimonious to yield a meaningful rejection of a random utility variant of joint consistency.

Instead, we propose a simple alternative random choice model. Suppose the decision-maker only chooses their preferred choice with probability $p \in [0.5, 1]$; with probability $1 - p$ the decision-maker instead selects their less preferred choice. When $p = 1$, the decision-maker's behavior is fully deterministic, and we can verify whether they are consistent or not. When $p = 0.5$, the decision-maker's choices are made uniformly at random and provide no information about their underlying preferences. Equivalently, a decision-maker with $p = 0.5$ can be thought of as someone who is indifferent between all options[19]. Because this interval is continuous, we can interpret a p estimate closer to 0.5 as providing less meaningful information about underlying preferences than a p estimate closer to 1. We use this model to analyze the 17 choices where participants' decisions have no impact on their own payment[20].

We can estimate what value of p is most likely to generate the distribution of consistency rates (percentage of consistent choices) observed in the data. In the appendix, we derive the following equation that relates p, the probability of random choice being in line with deterministic choice, to the expected consistency rate: $E[\text{consistency rate}] = 1 - 2p + 2p^2$. On the subset of choices where the participants are receiving a choice-independent payment (including no payment), our average consistency rate is 0.7897 with a standard deviation[21] of 0.0144. This consistency rate data and the above equation then provide an estimated choice probability value of $p = 0.8805$ with a standard deviation of 0.0189; the associated 95% confidence interval for p is then [0.8407.0.9183]. This estimate is substantially closer to 1 than to 0.5, indicating that there is indeed much we can learn about the consistency of underlying preferences despite potential randomness/errors of choice. Combined with trends in the direction of inconsistencies, this indicates that simple random choice is not responsible for most of our inconsistencies.

In addition to estimating a sample-wide choice probability, we estimate individual choice probabilities to identify which participants might not be choosing purposefully. To do this, we simulate the distribution of consistency rates for $p = 0.5$ and identify which participants have consistency rates that fall close to the center of this distribution. A comparison of these distributions is presented in figure 1. Only about 30% of our population have consistency rates that lie in the lower 98% of the distribution generated if our population was choosing uniformly at random. The remaining participants have consistency rates unlikely to come from such choice patterns. We then repeat

[19] Our experimental interface randomizes the order of the questions and the order of the options presented. Therefore, a decision-maker who is indifferent between the options but is not actively choosing uniformly at random will appear to be choosing uniformly at random.

[20] We focus on these choices since we believe they are most likely to generate upward bias in inconsistency measures.

[21] The standard deviation is estimated via bootstrap.

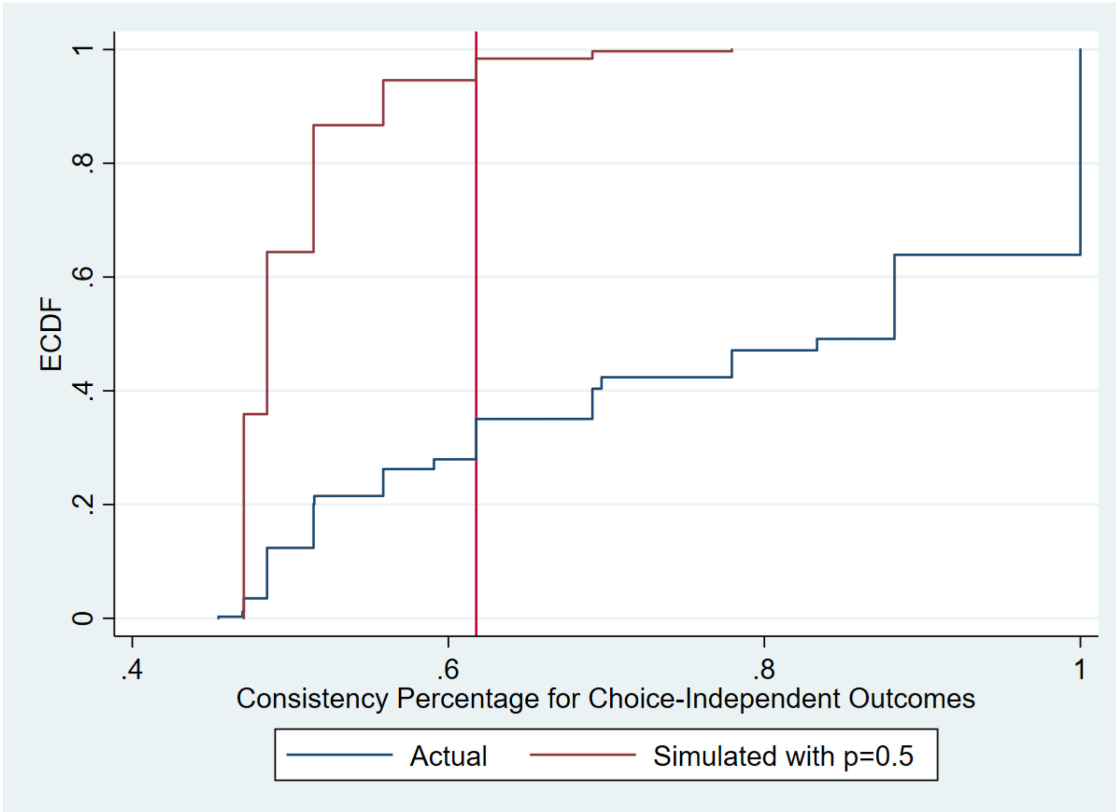


Figure 1: Differences in the distribution of consistency rate between our data and simulated data with $p = 0.5$. Only about 30% of our participants have a consistency rate that falls in the lower 98% of the simulated distribution.

the analysis of section 4 including an additional control for agents we identify as not choosing purposefully, and present the results in section 7.2.3. Our primary results remain: compound changes are associated with lower consistency, inconsistent decision-makers are less inequality averse, and decision-makers become less inequality averse/more inefficiency averse as domain size increases. Our main conclusions are not driven by participants with low consistency rates, but rather by the participants who behave purposefully. Additionally, the fact that trends in the direction of inconsistencies remain after removing many noisy observations further indicates our conclusions are not driven by simple random choice. Instead, there are systematic reasons for observed inconsistencies which require further research to understand fully.

5 Conclusion

In this paper, we proposed a criterion that relates families of social preferences across domains of different sizes and compositions. Combined with standard regularity assumptions, this criterion produces an additively separable utilitarian representation with domain-invariant Bernoulli functions. A planner following the criterion has invariant preferences under three types of domain changes, in addition to any combination or composition of these changes.

We then examine the empirical relevance of this criterion using an online laboratory experiment. While rates of joint consistency were generally high, there were systematic differences across types of domain changes. Importantly, participants were more consistent between domains differing by a single simple domain change than a combination or composition of changes, suggesting that the difficulty of decisions may play a role in inconsistent behavior. We also observe higher rates of consistency when the decision-maker's presence in the domain is constant between choices, indicating participants make systematically different choices depending on their inclusion. In addition, we document that inconsistent individuals are less inequality-averse than consistent individuals and that inequality aversion decreases as domain size increases. These trends indicate that inconsistencies are systematic, and again may be due to choice complexity rather than an accurate reflection of underlying preferences.

One promising direction for future research is a more thorough investigation of the mechanisms driving our observations. We provide suggestive evidence that cognitive limitations play a substantial role in our observed inconsistencies, but this requires more experiments with different designs to confirm this hypothesis. Additionally, understanding precisely where cognitive limitations may enter the decision process may be critical for understanding choice more broadly. Recent work by Oprea (2023) and Enke et al. (2023) suggest that classical behavioral anomalies in many settings may come from similar cognitive limitations rather than a disparate set of non-standard preferences. If our results are also driven by cognitive limitations, disentangling how much is unique to our particular setting and how much could be generalized to other choice environments would further support this emerging literature.

References

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

Debreu, G. (1954). Representation of a preference ordering by a numerical function. *Decision processes 3*, 159–165.

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

Enke, B., T. Graeber, and R. Oprea (2023). Complexity and time. *Working Paper*.

Esponda, I. and E. Vespa (2023). Contingent thinking and the sure-thing principle: Revisiting classic anomalies in the laboratory. *Review of Economic Studies (Forthcoming)*.

Forsythe, R., J. L. Horowitz, N. E. Savin, and M. Sefton (1994). Fairness in simple bargaining experiments. *Games and Economic Behavior 6*, 347–369.

Harsanyi, J. C. (1961). On the rationality postulates underlying the theory of cooperative games. *Journal of Conflict Resolution 5*, 179–196.

Hong, H., J. Ding, and Y. Yao (2015). Individual social welfare preferences: An experimental study. *Journal of Behavioral and Experimental Economics 57*, 89–97.

Kahneman, D., J. L. Knetsch, and R. H. Thaler (1986). Fairness and the assumptions of economics. *Journal of Business 59*, S285–S300.

Nielsen, K. and J. Rehbeck (2022). When choice are mistakes. *American Economic Review 102.7*, 2237–2268.

Oprea, R. (2020). What makes a rule complex? *American Economic Review 110.2*, 3913–3951.

Oprea, R. (2023). Simplicity equivalents. *Working Paper*.

Polman, E. and K. Wu (2020). Decision making for others involving risk: A review and meta-analysis. *Journal of Economic Psychology 77*, 200–218.

Savage, L. J. (1954). Foundations of statistics. *John Wiley & Sons*.

Thomson, W. (2011). Consistency and its converse: an introduction. *Review of Economic Design 15*, 257–291.

Traub, S., C. Seidl, and U. Schmidt (2009). An experimental study on individual choice, social welfare, and social preferences. *European Economic Review 53*, 385–400.

Wakker, P. (1988). The algebraic versus the topological approach to additive representations. *Journal of Mathematical Psychology 32*, 421–435.

Zame, W. R., B. Tungodden, E. Sørensen, S. Kariv, and A. W. Cappelen (2020). Linking social and personal preferences: Theory and experiment. *Working Paper*.

6 Appendix A: Sample-balance Table

Dependent Variable	Effect
male	-.0377 (.0552)
female	-.0499 (.0577)
age	-.0007 (.0010)
employed	-.0156 (.0246)
# of surveys completed	.0000164 (.00000769)**
time spent on experiment	-.00003 (.00004)
regression constant	.8720 (.0618)
R^2	.0310

Table 11: Linear regression of the effect of different demographic variables on consistency percentage of the decision-maker, with standard errors clustered at the participant level. * is significant at 90%, ** is significant at 95%, *** is significant at 99%. We fail to reject the null hypothesis that the male and female coefficients are identical, with the F-test producing a p-value of 0.6427.

7 Appendix B: Robustness Checks

7.1 Results from Section 4.6.1

This section repeats the analysis in section four but without the first 60 participants who saw 5 incorrect questions which were dropped from the analysis, and did not see the blocks in a random order. There are no qualitative changes to any of our results.

7.2 Results from Section 4.6.2

Derivation of Relationship Between Consistency Percentage and Probability of Choice

Suppose that the decision-maker follows the random choice model described in section 4.6.2, and chooses the actual preferred option with probability p and the less preferred option with probability $1-p$. Each choice is a Bernoulli trial with probability p, so a collection of n realizations can then be described as a vector of length-n composed of 0's and 1's. For joint consistency, we are interested in the probability that any two components of this vector are equal. The probability

	LPM	Logit	LPM	Logit
adding choice-independent outcome	.0004 (.0061)	.0044 (.0529)	-.0036 (.0059)	-.0332 (.0529)
duplication	-.0358 (.0134)***	-.2807 (.0983)***	.0087 (.0115)	.0522 (.0824)
combined change	-.0827 (.0114)***	-.5780 (.0751)****	-.0156 (.0070)**	-.1135 (.0527)**
DM paid on one only			-.0494 (.0129)***	-.2901 (.0777)***
DM paid on both			.0038 (.0189)	-.0303 (.1231)
DM richer			.0623 (.0192)***	.4904 (.1547)***
DM poorer			.1032 (.0170)****	.9519 (.1715)****
control for 60 participants	.0412 (.0239)*	.3031 (.1850)	.0356 (.0238)	.2672 (.1860)
regression constant	.8551 (.0129)	1.7928 (.1010)	.8146 (.0180)	1.4889 (.1203)
Log Likelihood		-14,861.112		-14,669.928
(pseudo) R^2	.0134	.0145	.0239	.0272
N	31,400	31,400	31,400	31,400
# Clusters	200	200	200	200

Table 12: This is a version of table 7 which excludes the first 60 participants. The table presents multiple specifications comparing the effect of different choice environments on consistency. All regressions computed with with standard errors clustered at the participant level, and with participant-level fixed effects where indicated. * is significant at 90%, ** is significant at 95%, *** is significant at 99%. All conclusions are the same as in table 7.

that the vector contains k ones and $n-k$ zeroes is:

$$Pr(k \text{ ones and } n-k \text{ zeros}) = p^k \cdot (1-p)^{n-k} \cdot \binom{n}{k}$$

Assuming both n and k are greater than 1, we can calculate the resulting percentage of consistent choices conditional on n and k as:

$$1 - \text{consistency rate} = Pr(1 \text{ one and } 1 \text{ zero}) = 1 - \frac{n-k}{n} \cdot \frac{k}{n-1} \cdot 2$$

Combining the two terms together, we can calculate the total expected consistency rate given probability p to be:

$$\text{Expected consistency rate} = 1 - \sum_{k=0}^{n} p^k (1-p)^{n-k} \cdot \frac{2 \cdot (n-2)!}{(k-1)! \cdot (n-k-1)!} = 1 - 2p + 2p^2$$

Using this equation and the delta method, we can obtain an estimator for p based on the observed sample mean and sample variance (computed via bootstrap) of the consistency percentage.

Environment	Consistent	Inconsistent, Smaller	Inconsistent, Larger
Aggregate	.7966 (.0059)	.5981 (.0041)****	.5624 (.0042)****
Adding choice-independent outcome	.7359 (.0123)	.5717 (.0079)****	.5624 (.0080)***
Duplication	.8286 (.0212)	.6190 (.0158)****	.5757 (.0161)****
combined change	.8188 (.0069)	.6070 (.0051)****	.5610 (.0052)****
DM choice-dependent outcome, aggregate	.6857 (.0143)	.5590 (.0088)****	.5419 (.0089)****
DM choice-dependent outcome, adding choice-independent outcome	.6857 (.0160)	.5560 (.0099)****	.5425 (.0099)****
DM choice-dependent outcome, combined change	.6857 (.0320)	.5714 (.0197)	.5397 (.0199)***
DM choice-dependent outcome, richer, aggregate	.4000 (.0213)	.2304 (.0106)****	.2229 (.0105)****
DM choice-dependent outcome, richer, adding choice-independent outcome	.4000 (.0239)	.2286 (.0118)****	.2230 (.0117)****
DM choice-dependent outcome, richer, combined change	.4000 (.0478)	.2381 (.0240)***	.2222 (.0234)***
DM choice-dependent outcome, poorer, aggregate	.9714 (.0073)	.8876 (.0080)****	.8610 (.0087)****
DM choice-dependent outcome, poorer, adding choice-independent outcome	.9714 (.0081)	.8833 (.0089)****	.8619 (.0097)****
DM choice-dependent outcome, poorer, combined change	.9714 (.0162)	.9047 (.0165)**	.8571 (.0197)****
DM choice-independent outcome, aggregate	.8286 (.0062)	.6093 (.0047)****	.5683 (.0047)****
DM choice-independent outcome, adding choice-independent outcome	.8286 (.0177)	.6007 (.0132)****	.5993 (.0133)****
DM choice-independent outcome, duplication	.8286 (.0212)	.6190 (.0158)****	.5757 (.0161)****
DM choice-independent outcome, combined change	.8286 (.0070)	.6096 (.0052)****	.5626 (.0053)****
DM paid on one domain, aggregate	.8286 (.0087)	.6047 (.0065)****	.5702 (.0066)****
DM paid on one domain, adding choice-independent outcome	.8286 (.0285)	.6038 (.0213)****	.6019 (.0214)****
DM paid on one domain, combined change	.8286 (.0091)	.6049 (.0068)****	.5670 (.0069)****
DM paid on both domains, aggregate	.7445 (.0103)	.5795 (.0067)****	.5544 (.0068)****
DM paid on both domains, adding choice-independent outcome	.7061 (.0146)	.5605 (.0092)****	.5463 (.0092)****
DM paid on both domains, duplication	.8286 (.0260)	.6254 (.0193)****	.5667 (.0197)****
DM paid on both domains, combined change	.7782 (.0170)	.5944 (.0116)****	.5636 (.0117)****
DM paid on neither domain, aggregate	.8286 (.0118)	.6183 (.0088)****	.5619 (.0090)****
DM paid on neither domain, adding choice-independent outcome	.8286 (.0319)	.6095 (.0238)****	.6262 (.0236)****
DM paid on neither domain, duplication	.8286 (.0368)	.6063 (.0275)****	.5937 (.0277)****
DM paid on neither domain, combined change	.8286 (.0136)	.6216 (.0101)****	.5459 (.0104)****

Table 13: This is a version of table 8 which excludes the first 60 participants. This table details the proportion of decision pairs where participants selected the inequality-averse choice, broken down by different choice environments. The left column is the proportion among individuals who are fully consistent in the sample, the middle and right columns are the proportion among individuals who are not fully consistent. The left and middle columns are the proportion where individuals selected the inequality-averse option on the choice with a smaller domain (regardless of their choice on the larger domain), and the left and right columns are the proportion where individuals selected the inequality-averse option on the choice with a larger domain (regardless of their choice on the smaller domain). Stars indicate significant differences against the left column. * is significant at 90%, ** is significant at 95%, *** is significant at 99%, **** is significant at 99.99%.

Environment	# Observations	Proportion Inequality ↓
Aggregate	3782	.5664 (.0081)****
Adding choice-independent outcome	722	.5249 (.0186)
Duplication	221	.5928 (.0330)***
combined change	2839	.5749 (.0093)****
DM choice-dependent outcome, aggregate	428	.5631 (.0240)***
DM choice-dependent outcome, adding choice-independent outcome	338	.5503 (.0271)*
DM choice-dependent outcome, combined change	90	.6111 (.0514)**
DM choice-dependent outcome, richer, aggregate	242	.5248 (.0321)
DM choice-dependent outcome, richer, adding choice-independent outcome	193	.5181 (.0360)
DM choice-dependent outcome, richer, combined change	49	.5510 (.0711)
DM choice-dependent outcome, poorer, aggregate	186	.6129 (.0357)***
DM choice-dependent outcome, poorer, adding choice-independent outcome	145	.5931 (.0408)**
DM choice-dependent outcome, poorer, combined change	41	.6829 (.0191)**
DM choice-independent outcome, aggregate	3354	.5668 (.0086)****
DM choice-independent outcome, adding choice-independent outcome	384	.5026 (.0255)
DM choice-independent outcome, duplication	221	.5928 (.0330)***
DM choice-independent outcome, combined change	2749	.5737 (.0094)****
DM paid on one domain, aggregate	1980	.5495 (.0112)
DM paid on one domain, adding choice-independent outcome	185	.5027 (.0368)
DM paid on one domain, combined change	1795	.5543 (.0117)****
DM paid on both domains, aggregate	566	.5767 (.0208)***
DM paid on both domains, adding choice-independent outcome	92	.5435 (.0519)
DM paid on both domains, duplication	167	.6108 (.0377)***
DM paid on both domains, combined change	307	.5570 (.0284)**
DM paid on neither domain, aggregate	808	.6064 (.0172)****
DM paid on neither domain, adding choice-independent outcome	107	.4673 (.0482)
DM paid on neither domain, duplication	54	.5370 (.0678)
DM paid on neither domain, combined change	647	.6253 (.0189)****
Duplication without choice-independent outcomes	54	.5370 (.0679)

Table 14: This is a version of table 9 which excludes the first 60 participants. Proportion Inequality ↓ is the proportion of choice pairs where we see decreasing inequality aversion as size increases; that is, where the decision-maker selected the inequality-averse option on the smaller domain but not on the larger domain. ** is significant at 95%, *** is significant at 99% (significance is in terms of difference from 50%, which would indicate no trending direction).

	LPM	Logit	LPM	Logit
adding choice-independent outcome	.0008 (.0061)	.0076 (.0589)	-.0035 (.0059)	-.0369 (.0595)
duplication	-.0373 (.0135)***	-.3277 (.1108)***	.0072 (.0115)	.0476 (.0945)
combined change	-.0861 (.0115)***	-.6854 (.0832)***	-.0173 (.0070)**	-.1444 (.0597)**
DM paid on one only			-.0467 (.0128)***	-.3163 (.0900)***
DM paid on both			.0019 (.0181)	.0133 (.1361)
DM richer			.0615 (.0192)***	.5458 (.1717)***
DM poorer			.1025 (.0169)****	1.0487 (.1849)****
control for low consistency	-.3075 (.0124)****	-1.8504 (.1071)****	-.3073 (.0124)****	-1.8794 (.1069)****
regression constant	.9511 (.0101)	2.6468 (.1206)	.9051 (.0146)	2.2770 (.1369)****
Log Likelihood		-13,078.505		-12855.812
(pseudo) R^2	.1371	.1327	.1480	.1475
N	31,400	31,400	31,400	31,400
# Clusters	200	200	200	200

Table 15: This is a version of table 7 which accounts for individuals whose consistency is so low they are classified as choosing uniformly at random. Multiple specifications comparing effect of different choice environments. All regressions computed with with standard errors clustered at the participant level, and with participant level fixed effects where indicated. * is significant at 90%, ** is significant at 95%, *** is significant at 99%. All conclusions are the same as in table 7.

7.2.1 Data and Analysis from Section 4.6.2

This section presents the detailed analysis from the above section, which repeats our initial analysis accounting for individuals with sufficiently low consistency rates that they appear to choose uniformly at random. There are no qualitative changes to the conclusions.

Environment	Consistent	Inconsistent, Smaller	Inconsistent, Larger
Aggregate	.7384 (.0056)	.6197 (.0047)****	.5987 (.0048)****
Adding choice-independent outcome	.6648 (.0106)	.5951 (.0086)****	.5855 (.0086)
Duplication	.7655 (.0203)	.6340 (.0178)****	.6245 (.0179)****
combined change	.7733 (.0068)	.6301 (.0059)****	.6023 (.0060)****
DM choice-dependent outcome, aggregate	.6182 (.0120)	.5867 (.0095)**	.5630 (.0095)***
DM choice-dependent outcome, adding choice-independent outcome	.6182 (.0134)	.5833 (.0106)**	.5639 (.0107)***
DM choice-dependent outcome, combined change	.6182 (.0267)	.6000 (.0211)	.5593 (.0214)*
DM choice-dependent outcome, richer, aggregate	.3273 (.0163)	.26 (.0119)***	.2319 (.0115)****
DM choice-dependent outcome, richer, adding choice-independent outcome	.3273 (.0183)	.2583 (.0133)***	.2333 (.0129)****
DM choice-dependent outcome, richer, combined change	.3273 (.0365)	.2667 (.0269)	.2259 (.0255)**
DM choice-dependent outcome, poorer, aggregate	.9091 (.0100)	.9133 (.0077)	.8941 (.0084)
DM choice-dependent outcome, poorer, adding choice-independent outcome	.9091 (.0112)	.9083 (.0088)	.8944 (.0093)
DM choice-dependent outcome, poorer, combined change	.9091 (.0224)	.9333 (.0152)	.8926 (.0188)
DM choice-independent outcome, aggregate	.7817 (.0061)	.6309 (.0054)****	.6108 (.0055)****
DM choice-independent outcome, adding choice-independent outcome	.7588 (.0167)	.6182 (.0147)****	.6283 (.0146)****
DM choice-independent outcome, duplication	.7655 (.0178)	.6340 (.0178)****	.6245 (.0179)****
DM choice-independent outcome, combined change	.7880 (.0069)	.6328 (.0062)****	.6061 (.0063)****
DM paid on one domain, aggregate	.7838 (.0085)	.6311 (.0075)****	.6078 (.0076)****
DM paid on one domain, adding choice-independent outcome	.7702 (.0274)	.6200 (.0243)****	.6250 (.0242)***
DM paid on one domain, combined change	.7853 (.0089)	.6323 (.0079)****	.6060 (.0080)****
DM paid on both domains, aggregate	.6706 (.0089)	.6050 (.0072)****	.5824 (.0073)****
DM paid on both domains, adding choice-independent outcome	.6364 (.0126)	.5877 (.0098)***	.5698 (.0099)****
DM paid on both domains, duplication	.7455 (.0240)	.6370 (.0206)***	.6167 (.0209)****
DM paid on both domains, combined change	.7005 (.0150)	.6222 (.0124)****	.5908 (.0126)****
DM paid on neither domain, aggregate	.8158 (.0118)	.6301 (.0109)****	.6179 (.0110)****
DM paid on neither domain, adding choice-independent outcome	.76 (.0302)	.6209 (.0265)***	.6567 (.0259)****
DM paid on neither domain, duplication	.8286 (.0368)	.6256 (.0347)***	.6462 (.0342)***
DM paid on neither domain, combined change	.8286 (.0136)	.6329 (.0127)****	.6049 (.0129)****

Table 16: This is a version of table 9 which excludes participants with consistency rates so low they are classified as choosing uniformly at random. This table details the proportion of decision pairs where participants selected the inequality-averse choice, broken down by different choice environments. The left column is the proportion among individuals who are fully consistent in the sample, the middle and right columns are the proportion among individuals who are not fully consistent. The left and middle columns are the proportion where individuals selected the inequality-averse option on the choice with a smaller domain (regardless of their choice on the larger domain), and the left and right columns are the proportion where individuals selected the inequality-averse option on the choice with a larger domain (regardless of their choice on the smaller domain). Stars indicate significant differences against the left column. * is significant at 90%, ** is significant at 95%, *** is significant at 99%, **** is significant at 99.99%.

Environment	# Observations	Proportion Inequality ↓
Aggregate	1697	.5657 (.0120)****
Adding choice-independent outcome	423	.5366 (.0242)
Duplication	117	.5299 (.0461)
combined change	1157	.5799 (.0145)****
DM choice-dependent outcome, aggregate	298	.6074 (.0283)***
DM choice-dependent outcome, adding choice-independent outcome	236	.5890 (.0320)***
DM choice-dependent outcome, combined change	62	.6774 (.0594)***
DM choice-dependent outcome, richer, aggregate	202	.5941 (.0346)***
DM choice-dependent outcome, richer, adding choice-independent outcome	159	.5849 (.0391)**
DM choice-dependent outcome, richer, combined change	43	.6279 (.0737)*
DM choice-dependent outcome, poorer, aggregate	96	.6354 (.0491)***
DM choice-dependent outcome, poorer, adding choice-independent outcome	77	.5974 (.0559)*
DM choice-dependent outcome, poorer, combined change	19	.7895 (.0935)**
DM choice-independent outcome, aggregate	1399	.5568 (.0132)***
DM choice-independent outcome, adding choice-independent outcome	187	.4706 (.0365)
DM choice-independent outcome, duplication	117	.5299 (.0461)
DM choice-independent outcome, combined change	1095	.5744 (.0149)****
DM paid on one domain, aggregate	777	.5611 (.0178)***
DM paid on one domain, adding choice-independent outcome	74	.4865 (.0581)
DM paid on one domain, combined change	703	.5690 (.0187)***
DM paid on both domains, aggregate	322	.5621 (.0276)**
DM paid on both domains, adding choice-independent outcome	53	.5283 (.0686)
DM paid on both domains, duplication	91	.5604 (.0520)
DM paid on both domains, combined change	178	.5730 (.0370)*
DM paid on neither domain, aggregate	300	.5400 (.0288)
DM paid on neither domain, adding choice-independent outcome	60	.4000 (.0632)
DM paid on neither domain, duplication	26	.4231 (.0969)
DM paid on neither domain, combined change	214	.5935 (.0336)
Duplication without choice-independent outcomes	26	.4231 (.0969)

Table 17: This is a version of table 9 which excludes the participants with consistency rates so low they are classified as choosing uniformly at random. Proportion Inequality ↓ is the proportion of choice pairs where we see decreasing inequality aversion as size increases; that is, where the decision-maker selected the inequality-averse option on the smaller domain but not on the larger domain. ** is significant at 95%, *** is significant at 99% (significance is in terms of difference from 50%, which would indicate no trending direction).

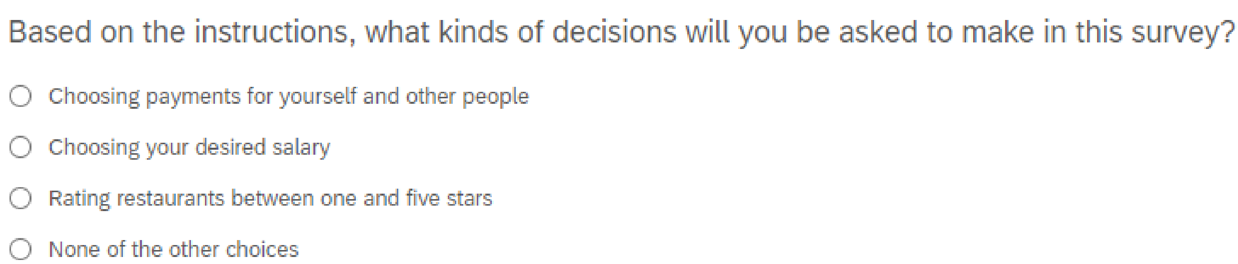
8 Appendix C: Experimental Instructions

8.1 General instructions:

This study examines peoples' decisions about monetary payments received by yourself and other people. You will be presented with a pair of options to be paid out to a randomly generated group of participants of this study, and asked which of the proposed options you would like to see paid out. Once we have collected data from all participants, we will select one decision at random to become the decision-that-counts. We will then randomly select 10% of participants to receive a bonus payment based on the decision-that-counts; this means that your decision-that-counts can affect the payment that you receive or that other people receive. As such, you should answer each question honestly, since your answers can affect your payment and the payments of other people. These bonus payments can range from \$5 to \$25. At no point will you see the choices other participants made for you, nor will any other participants see the choices you made for them.

Your total payment for the study consists of two components: your participation payment of \$2.50, and a 10% chance for a bonus payment ranging from \$5 to \$25 which depends on your choices, the choices of others, and random chance.

Once you have read and understood these instructions, please answer the following brief comprehension check.


Based on the instructions, what kinds of decisions will you be asked to make in this survey?

- Choosing payments for yourself and other people
- Choosing your desired salary
- Rating restaurants between one and five stars
- None of the other choices

Figure 2: Comprehension check

8.2 Treatment 1[22]

This study contains 34 questions, and is split into two parts. For one part of this study, you will be making decisions for some number of other participants in the study. For each decision, a

[22] The other treatment had the subjects first decide on the payoffs including themselves in the sample as player 1, and then decide only on behalf of others.

different set of other participants in the study has been selected at random and paired with you for that decision. A participant you are paired with in a decision is referred to as **"player N"**, where N is a number (i.e. player 1, player 2, player 3, etc). At no point will you learn the identity of any other participants assigned you made decisions for, nor the identity of any participants who made decisions for you.

An example of the decision interface is provided below. Please read the interface; we will then ask two comprehension checks to make sure you understand the interface. **These questions are only examples designed to ensure you understand the interface; the outcome of the following choices will not be paid to anyone.**

	Payment to player 1	Payment to player 2
Option 1	**$26**	**$14.81**
Option 2	**$17**	**$19.40**

Figure 3: Example 1

The middle row describes the payments if you choose option 1, and the bottom row describes the payments earned if you choose option 2. The middle column describes the payments that would be earned by you, and the right column describes the payments that would be earned by player 1.

If you chose option 1 in this decision, and this decision was selected to become the decision-that-counts, what would be player 1's bonus payment from this study?

If you chose option 1 in this decision, and this decision was selected to become the decision-that-counts, what would be the bonus payment to player 2?

You have successfully completed the comprehension check, and may now begin the study. We would like to remind you of three pieces of information.

All decisions you make for the remainder of the study have a chance of becoming the bonus payments paid to you or to other people in the study, so you should answer each question honestly.

There is no right or wrong answer for any of these decisions. We are interested in studying your preferences.

Some decisions may be repeated.

For this part of the study, you will be making decisions for some number of other participants in this study. For each decision, a different set of other participants in the study has been selected at random and paired with you for that decision. A participant you are paired with in a decision is referred to as "player N", where N is a number (i.e. player 1, player 2, player 3, etc). **Remember: all decisions you make in the study have a chance of becoming the bonus payments paid to you or to other people in the study, so you should answer each question honestly.**