Rational Choice and Moral Monotonicity

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Acknowledgement of Coauthors

Today's lecture uses content from:

J.C. Cox and V. Sadiraj (2010). "A Theory of Dictators' Revealed Preferences"

J.C. Cox, J.A. List, M. Price, V. Sadiraj & A. Samek (2017). "Moral Costs and Rational Choice: Theory and Experimental Evidence"

J.C. Cox, V. Sadiraj & S. Tang (2018). "Rational Choice in Games with Externalities and Contractions"

Two Well-Known Anomalies

- Andreoni (1995): subjects are more cooperative in a public good game than in a common pool game <u>with the same feasible set of payoffs</u>

- Bardsley (2008) and List (2007): adding take opportunities to a give-only dictator game changes behavior

- First Question: what are the implications of these anomalies for:
    - Preference theory?
    - Rational choice theory?

Preference Theory and Rational Choice Theory

- Convex Preference Theory
  - Indifference curves
  - Axioms of a preference ordering
  - Utility function
  - Generalized Axiom of Revealed Preference (GARP)

- Rational Choice Theory
  - Choice function
  - Contraction Consistency Axiom (CCA), a.k.a. Property α Sen (1971)

Foundations for the Discussion

- GARP $\leftrightarrow$ utility function that represents revealed preferences

- CCA $\leftrightarrow$ complete and transitive ordering of choices (for singleton choice sets)

Convex preference theory is a special case of rational choice theory.

Definitions

GARP: *if* $p^i \cdot x^i \geq p^i \cdot x^j$, $p^j \cdot x^j \geq p^j \cdot x^r$, …, $p^s \cdot x^s \geq p^s \cdot x^k$

then $p^k \cdot x^k \leq p^k \cdot x^i$, for all i, j, r, …,s, k.

"If x^i is revealed preferred to x^k then x^k is <u>not</u> strictly directly revealed to x^i."

CCA: For any feasible sets F and G and choice sets $C(F)$ and $C(G)$:

$$[x \in C(F) \text{ and } x \in G \subseteq F] \Rightarrow x \in C(G)$$

"An allocation, x that is chosen from F is also chosen from any subset G of F that contains x." (a.k.a. "independence of irrelevant alternatives")

Basic Distinction

- Abstract theory of preferences or choice for commodities
- Interpretation of "commodity"
- Example: indifference curves for commodity X and commodity Y
- What are the commodities?
  - **my** hamburgers and **my** hotdogs

  OR
  - **my** hamburgers and **your** hamburgers

Data from Andreoni (1995) and Many Subsequent Authors

- Choices in a public good game and a common pool game with the same feasible set are significantly different:
  - Subjects allocate more to the public account (less to their private accounts) in the public good game

* This robust finding is inconsistent with CCA because any set is a subset of itself; hence, from CCA:

$$[x \in C(F) \text{ and } x \in G \subseteq F] \Rightarrow x \in C(G)$$

$$[x \in C(G) \text{ and } x \in F \subseteq G] \Rightarrow x \in C(F)$$

Bardsley (2008), List (2007), Cappelen, et al. (2013)

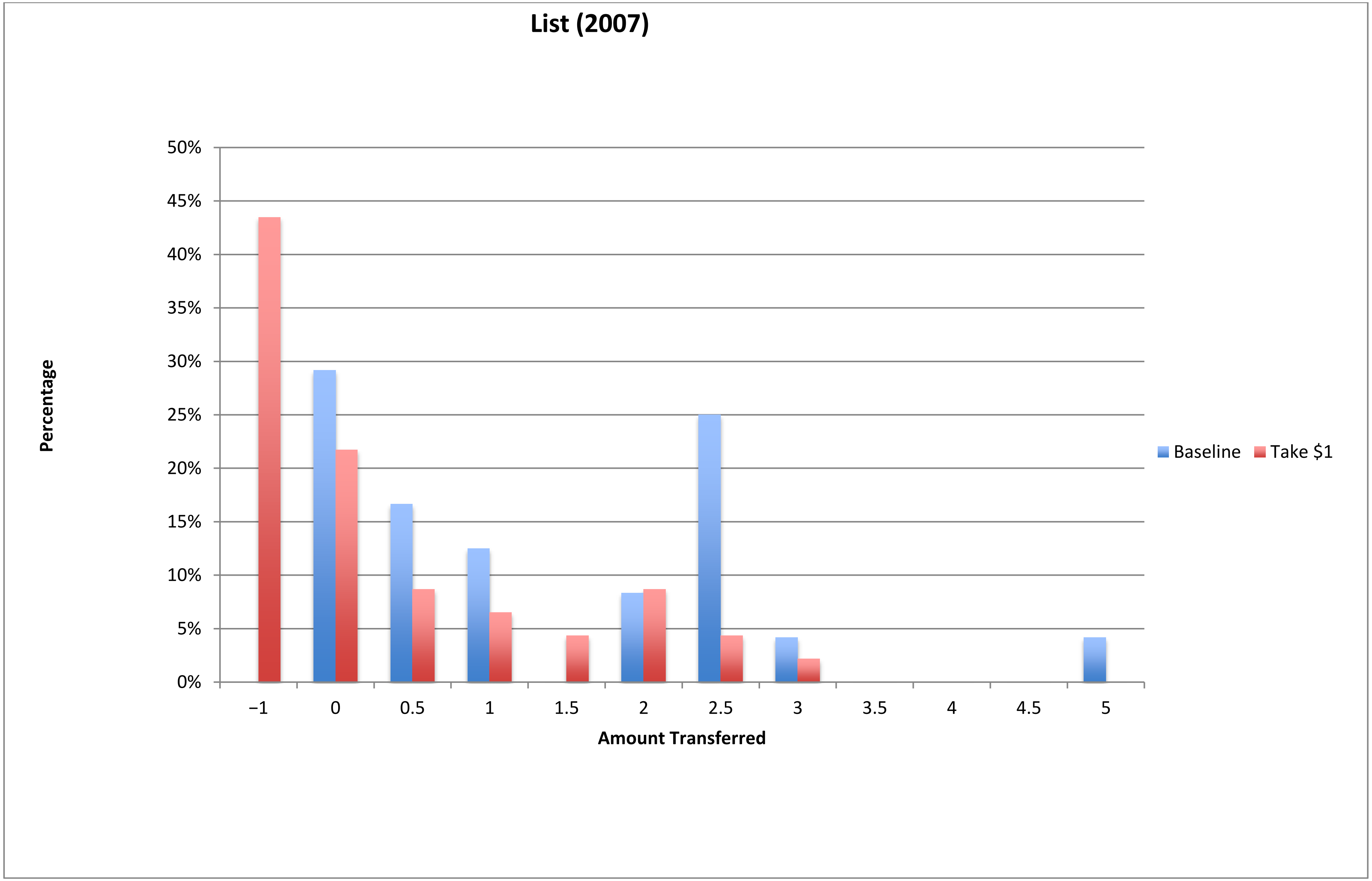
- Dictators change their allocations when presented a chance to take as well as to give to others.

- In the typical dictator game:
  - The experiment is framed such that "giving nothing" is the least generous act, and
  - Substantial sums of money are given away (Engel, 2011).

- But if subjects are allowed to take as well as give money then they give much less to the other player on average.

*** So What?**

Data from List (2007)



Theoretical Interpretation of List (2007) Data

- In order for the data to be consistent with convex preference theory:
  - The height of the blue bar at 0 must equal the sum of the heights of the red bars at -1 and 0
  - The heights of the blue and red bars must be the same at all other transfer numbers

- In order for the data to be consistent with rational choice theory:
  - No red bar to the right of -1 can be taller than the corresponding blue bar

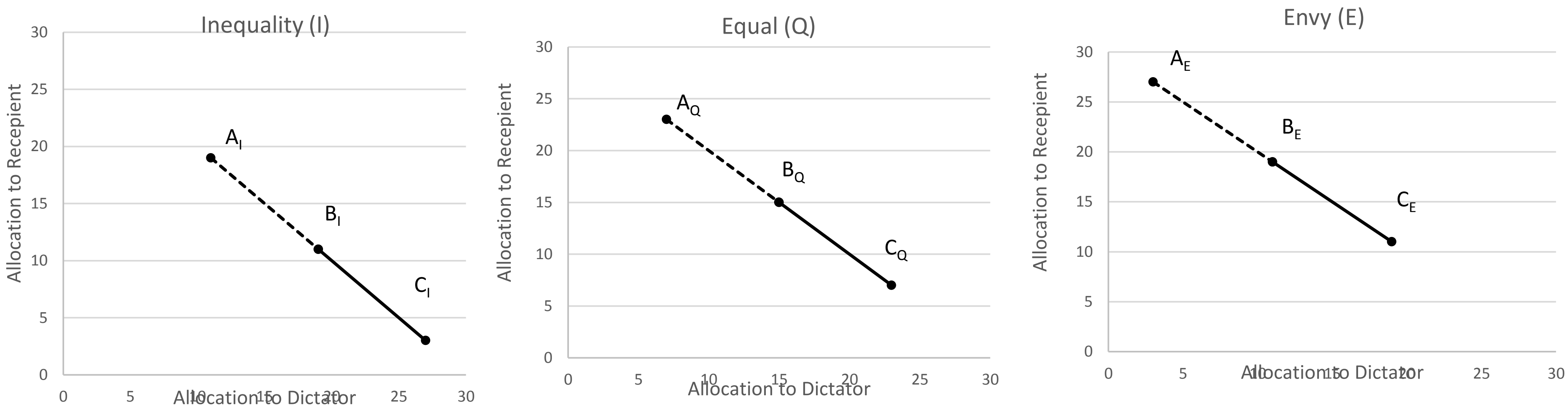
List (2007), Bardsley (2008), Cappelen, et al. (2013)

- Data from these experiments are:
  - **Inconsistent** with convex preference theory (including "social preferences" models)
  - **Consistent** (almost completely) with rational choice theory

- These experiments:
  - Stress-test convex preference theory
  - Endowments and action sets are **not** well suited to stress-test rational choice theory

Our Dictator Experiment

Feasible Sets: [B, C] for Give or Take, [A, C] for Symmetric



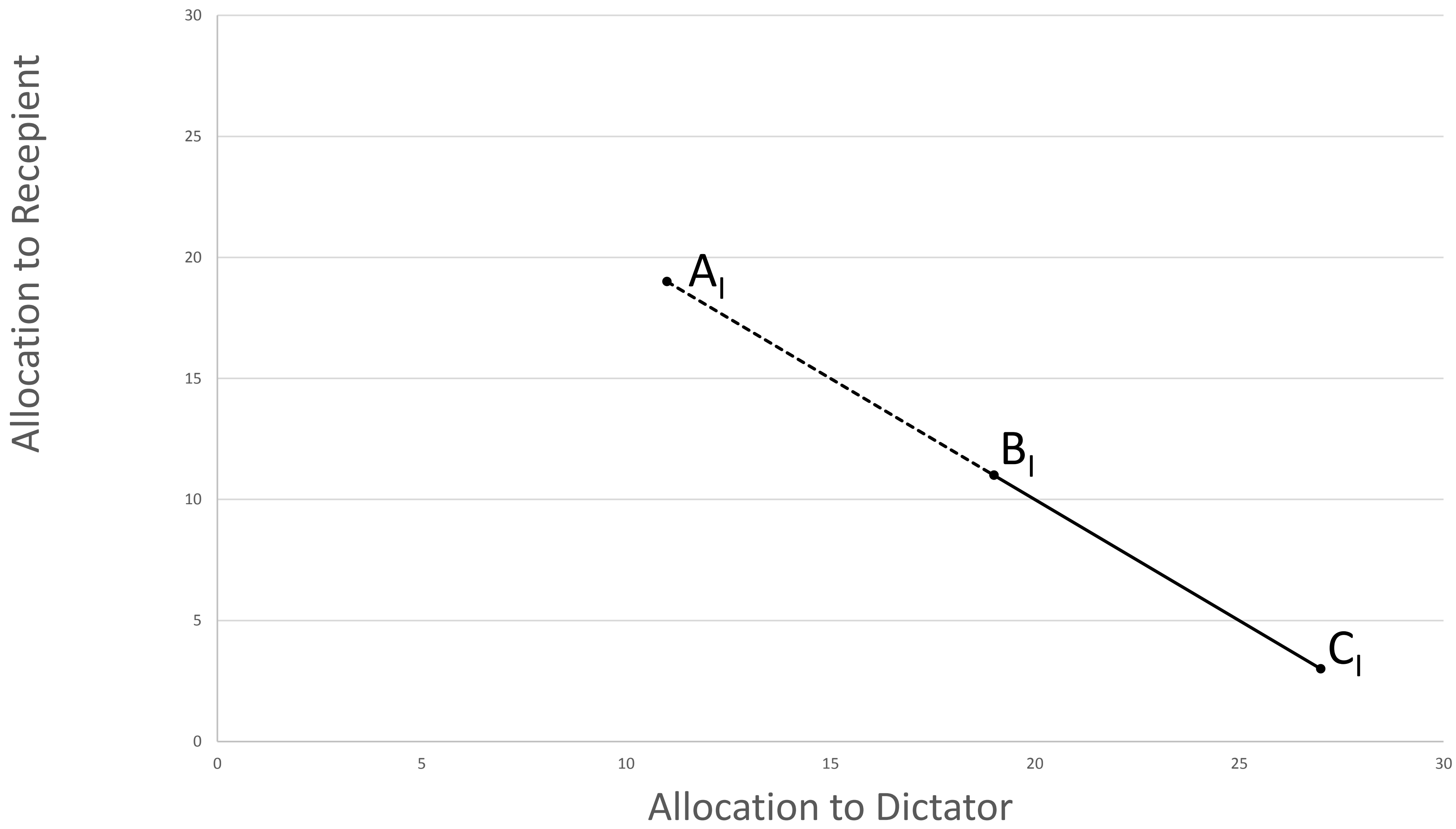
This figure portrays the feasible allocations for each treatment and action set.

Participants in the Give or Take action sets can choose from [B, C]

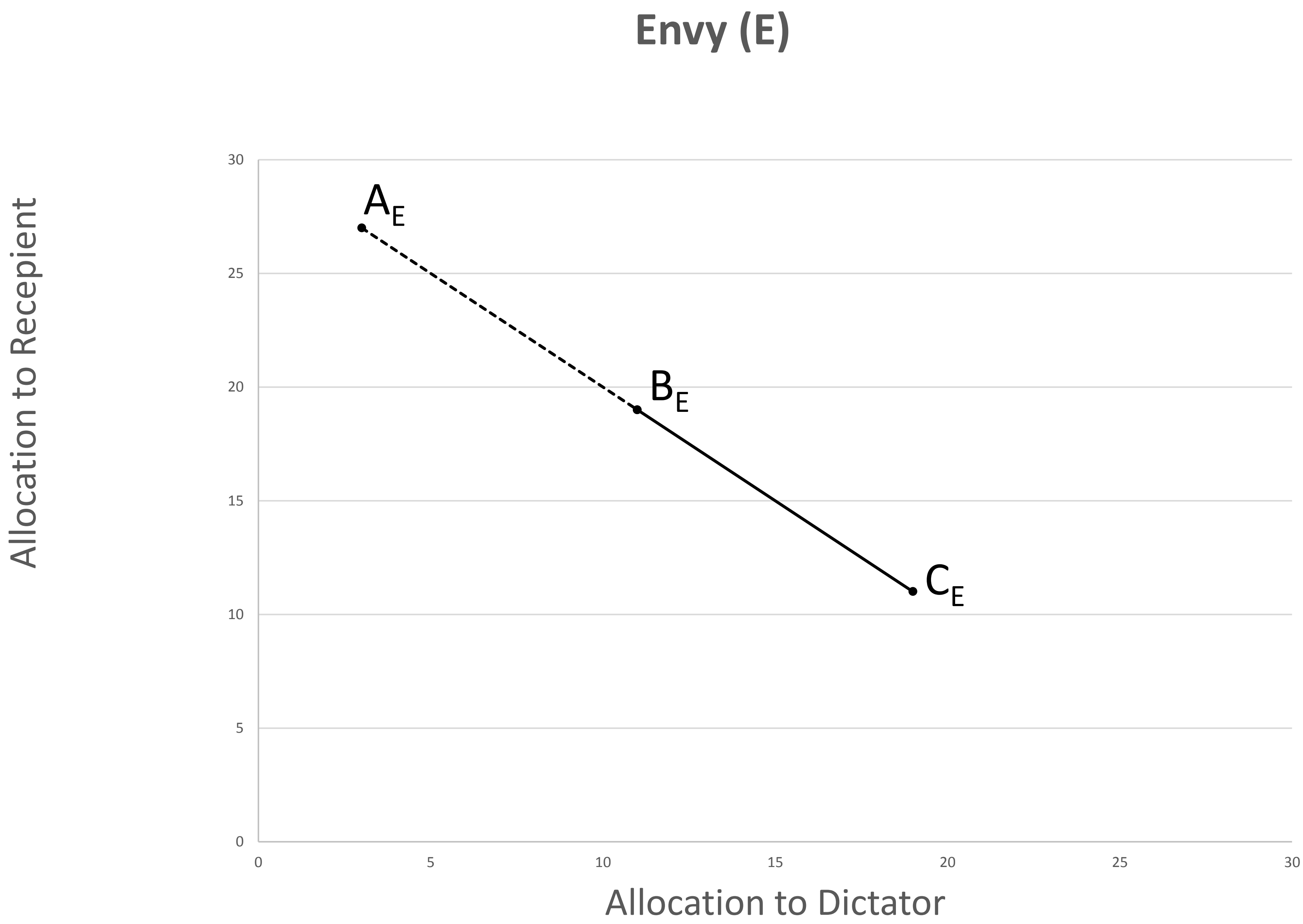
Participants in the Symmetric action set can choose from [A, C].

Actual feasible choices are ordered pairs of integers on the line segments.

Inequality (I)



Equal (Q)
Allocation to Recepient
Allocation to Dictator
A_Q
B_Q
C_Q
0
5
10
15
20
25
30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Some Results from Our Give, Take, and Symmetric Dictator Treatments for Extant Theory

- Data are **inconsistent** with rational choice theory **(CCA)**

- Hence, data are **inconsistent** with convex preference theory, including several social preferences models:
  - Inequality aversion (Fehr & Schmidt1999; Bolton & Ockenfells 2000)
  - Quasi-maxmin (Charness & Rabin 2002)
  - Egocentric altruism (Cox & Sadiraj 2007)

- Data are **inconsistent** with:

  Reference Dependent Model (Koszegi and Rabin 2006)

The High Priest Questions the Faith

For decades A.K. Sen was central to development of rational choice theory. But in a 1993 *Econometrica* article he wrote:

“Internal consistency of choice has been a central concept in demand theory, social choice theory, decision theory, behavioral economics, and related fields. It is argued here that this idea is essentially confused, and there is no way of determining whether a choice function is consistent or not without referring to something external to choice behavior (such as objectives, values, or norms).”

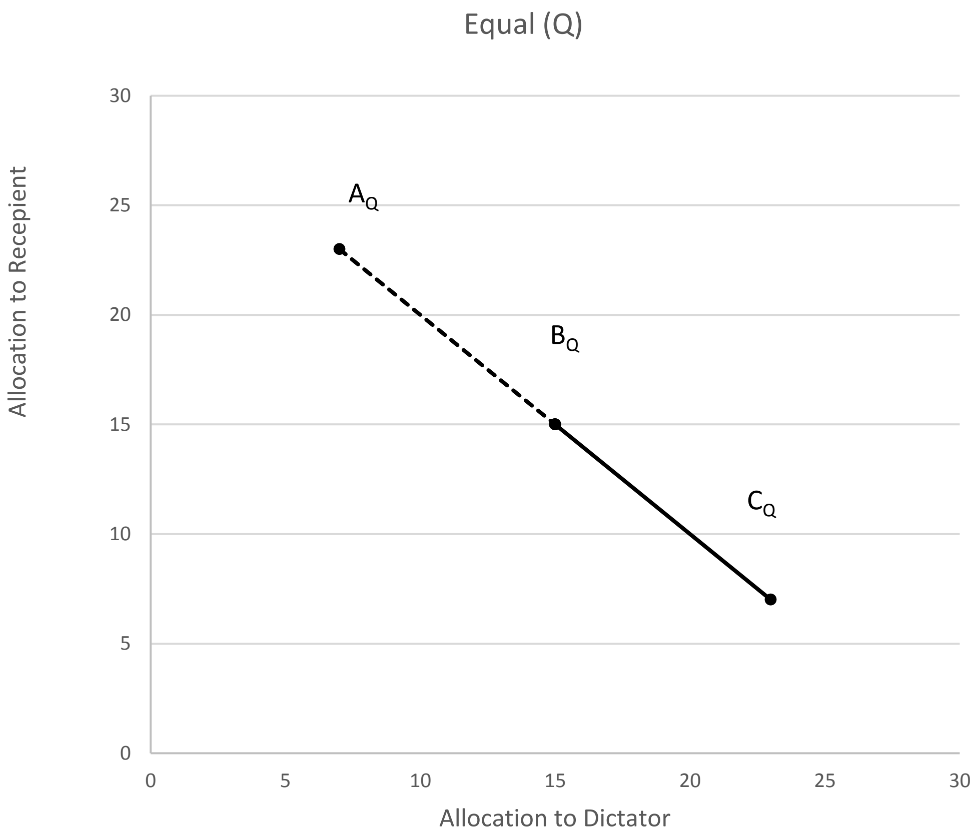
But Don’t Throw Out the Baby with the Bath Water

Our challenge is how to extend the theory, as called for by Sen, while preserving the central feature that makes it empirically testable: **objective restrictions on observable choices**.

We respond by defining **moral reference points** that are **observable features** of feasible sets. Moral Monotonicity Axiom (**MMA)** is an extension of **CCA** that incorporates these observable moral reference points.

We Incorporate Two Intuitions into Rational Ch. Th.

- My moral constraints on interacting with you depend on
  - The minimum payoff each of us can receive in “the game”
  - My property rights in “the game”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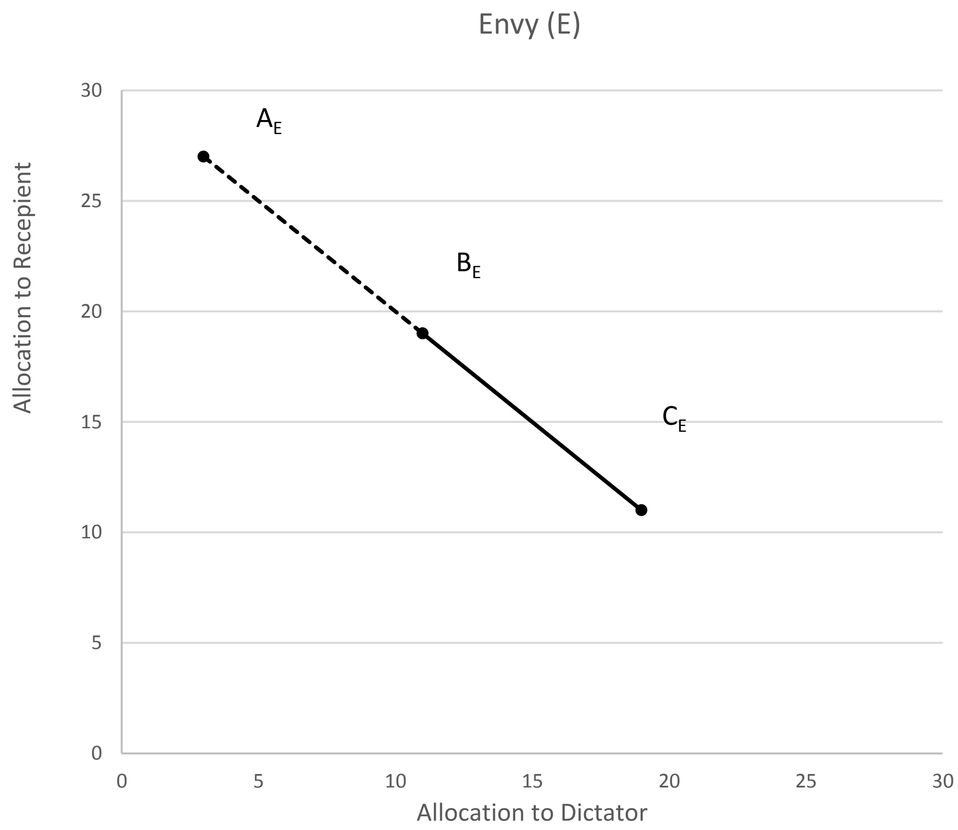
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An Illustrative Example of Moral Reference Points

- Consider the N = 2 case of dictator games in the give vs. take literature:
  - Let (m,y) denote an ordered pair of money payoffs for the dictator m = "my payoff" and the recipient y = "your payoff"
  - Let F denote the dictator's compact feasible set
  - Let m^o and y^o denote maximum feasible payoffs:

$$m^o(F) = \max\{m \mid (m,y) \in F\} \text{ and } y^o(F) = \max\{y \mid (m,y) \in F\}$$

Illustrative Example (cont.)

- We assume an agent's moral reference point is a function of the minimal expectations point, M, defined by:

$$m_*(F) = \max\{m \mid (m, y^o(F)) \in F\} \text{ and } y_*(F) = \max\{y \mid (m^o(F), y) \in F\}$$

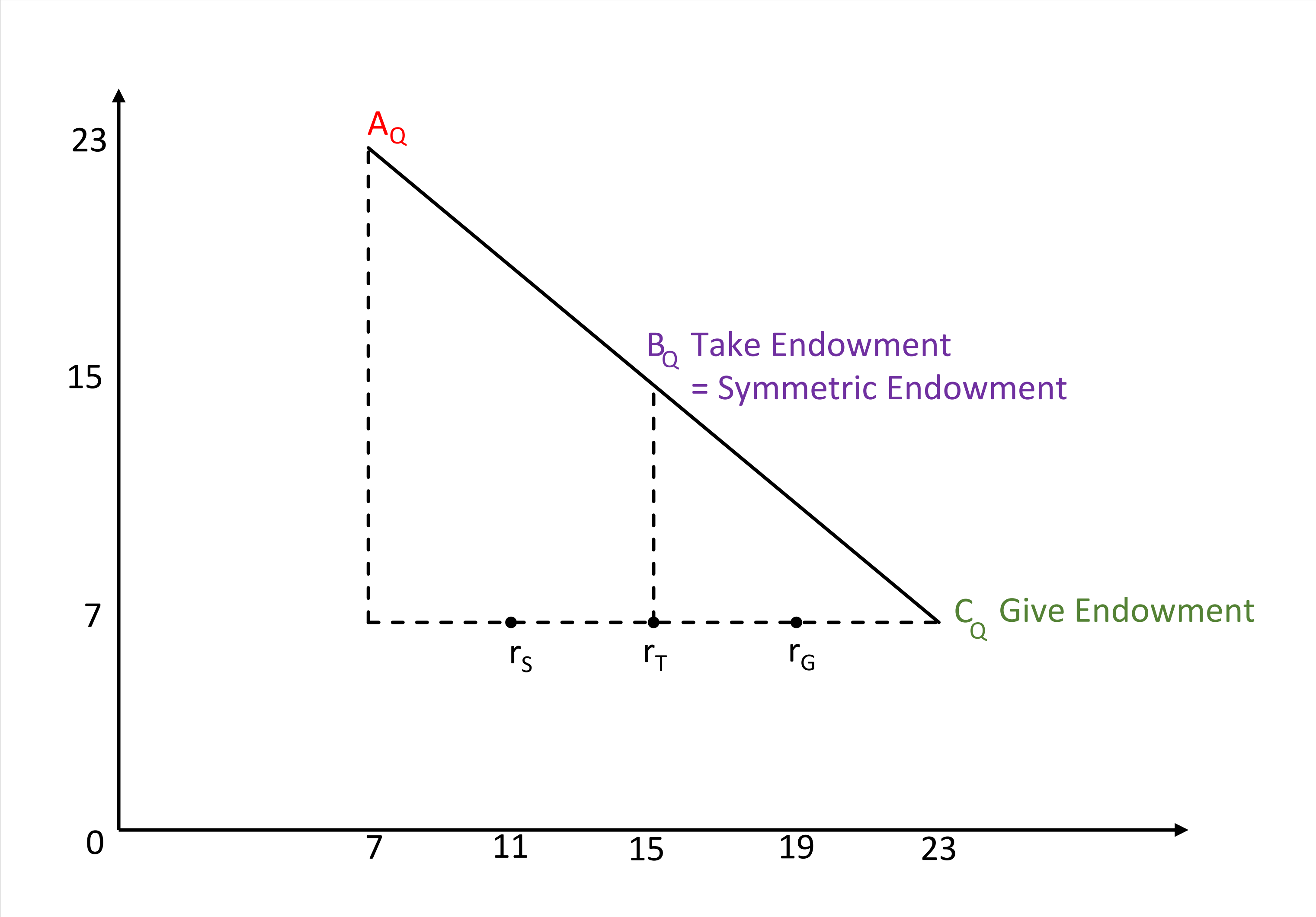
Illustrative Example (cont.)

- Moral reference point also depends on payoff entitlement from the decision maker's endowment.

- We propose as a moral reference point an ordered pair that
  - Agrees with the minimal expectations point on the second (recipient's) payoff dimension and
  - Is a convex combination of the minimal expectations point and the initial endowment e_m on the first (dictator's) payoff dimension.
  - For dictator game feasible sets, the moral reference points are given by:

$$f^r = ((\tfrac{1}{2} m_*(F) + \tfrac{1}{2} e_m), y_*(F))$$

Moral Reference Points in Treatment Q



Moral Reference Point for $n \geq 2$

Let x_{ij}^{o} be the maximum payoff player i gets when

player j gets her maximum, for all $j \neq i$

Define $i_*(S) = \min_{j \neq i} x_{ij}^{o}$

The minimal expectations point is the vector

$$(1_*(S), 2_*(S), ..., n_*(S))$$

Player 1's, moral reference point is

$$s_1^r = (\tfrac{1}{2}(1_*(S) + e_1), 2_*(S), ..., n_*(S))$$

when her endowment is e_1

Moral Monotonicity Axiom (MMA)

Let $\gtreqless$ denote "weakly larger" **or** "weakly smaller". One has:

$$\textbf{MMA:}\ \text{If } G \subseteq F,\ g_i^r \gtreqless f_i^r \text{ and } \boldsymbol{g}_{-i}^r = \boldsymbol{f}_{-i}^r \text{ then } x \in C(F) \cap G$$

$$\Rightarrow y_i \gtreqless x_i, \forall y \in C(G)$$

In words:

- Suppose that G is a subset of F that contains some choice x from F.

- Suppose also that the moral reference points of F and G differ from each other only with respect to the value of dimension i.

- Then if the moral reference point in G is weakly **more** favorable to individual i then no choice from G allocates him **less** than x.

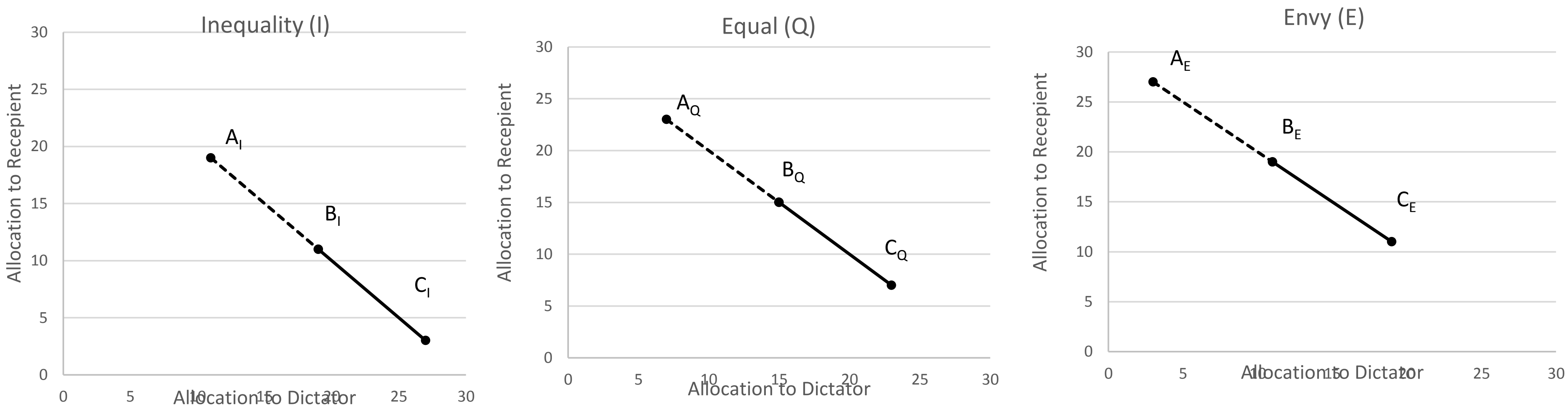
- Similarly, if the moral reference point in G is weakly **less** favorable to individual i then no choice from G allocates him **more** than x.

MMA Compared to CCA

* Note that if *F* and *G* have the same moral reference point then MMA is equivalent to CCA.

Our Dictator Experiment

Feasible Sets: [B, C] for Give or Take, [A, C] for Symmetric



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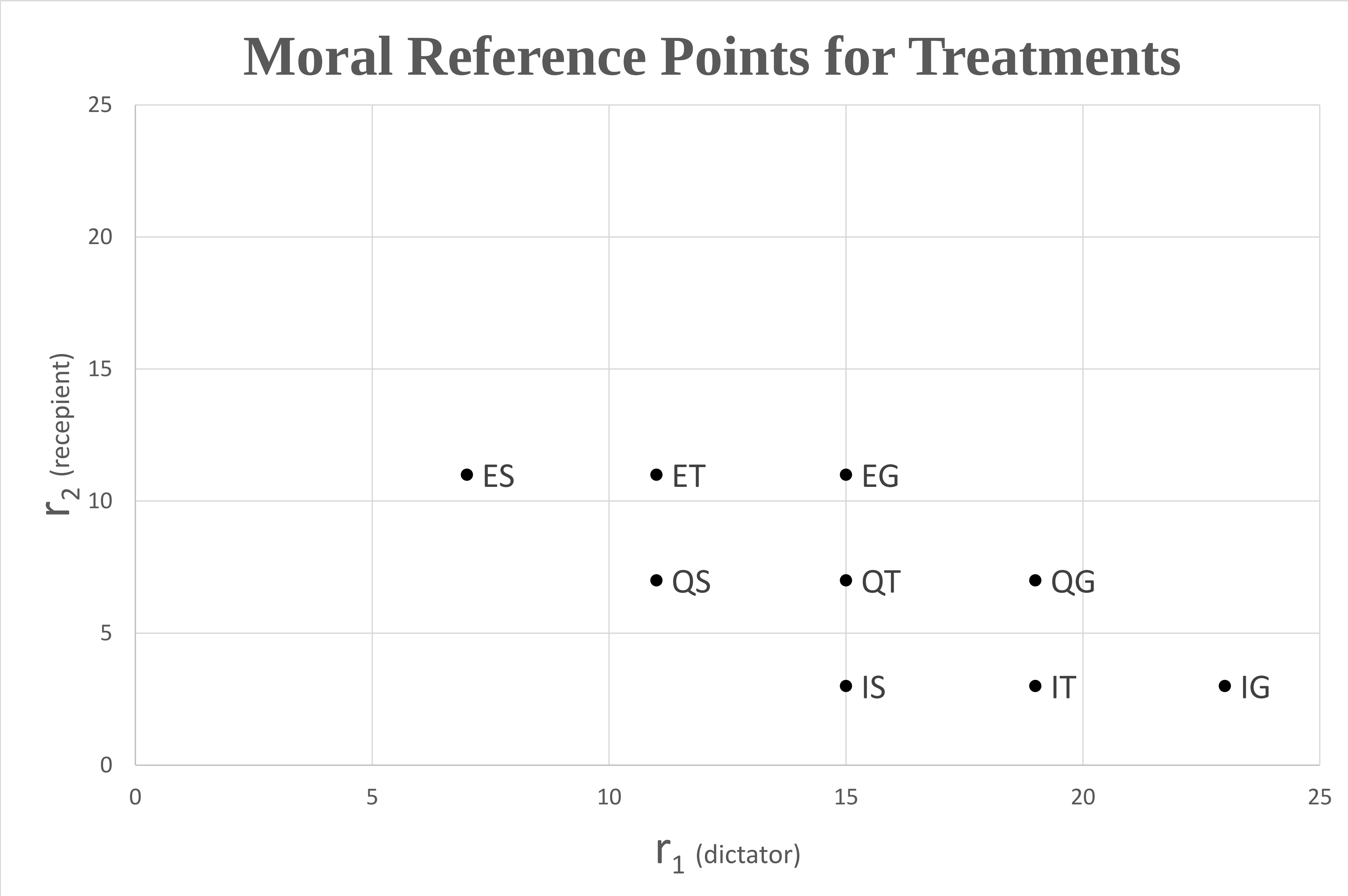

Moral Reference Points for Treatments
r_2 (recepient)
r_1 (dictator)
0
5
10
15
20
25
ES
ET
EG
QS
QT
QG
IS
IT
IG

Predictions for r_2 Effects on Recipient's Payoff

- Predicted effect of r_2 on dictator's choice of recipient's payoff:
  - Contraction Consistency Axiom: no effect
  - Moral Monotonicity Axiom: positive effect

Tests for r_2 Effects on Recipient's Payoff

Recipient's Final Payoff	$r_1 = 15$		$r_1 = 19$		$r_1 = 11$	
r_2 **[+]**	0.674***	0.668***	0.415*	0.391*	0.330**	0.328**
	(0.187)	(0.186)	(0.215)	(0.221)	(0.155)	(0.151)
Constant	6.145***	6.955***	6.435***	5.616***	8.620***	9.341***
	(1.548)	(2.417)	(1.143)	(1.895)	(1.480)	(1.797)
Demo-graphics	no	yes	no	yes	no	yes
Observations	207	207	147	147	131	131
Log-likelihood	-261.3	-258.3	-224.8	-221.4	-225.9	-219.4

Notes: Entries are Tobit estimated coefficients. MMA predicted sign in square brackets. Demographics include gender, race, GPA, religion, major and study year. Standard errors in parentheses. *** p<0.001, **p<0.05, p*<0.1

Predictions for r_1 and r_2 Effects on Transfers

- Marginal Effect of r_1
  - Contraction Consistency Axiom: No effect
  - Moral Monotonicity Axiom: Negative Effect

- Marginal Effect of r_2
  - Contraction Consistency Axiom: Effect equals -1
  - Moral Monotonicity Axiom: Effect is between -1 and 0

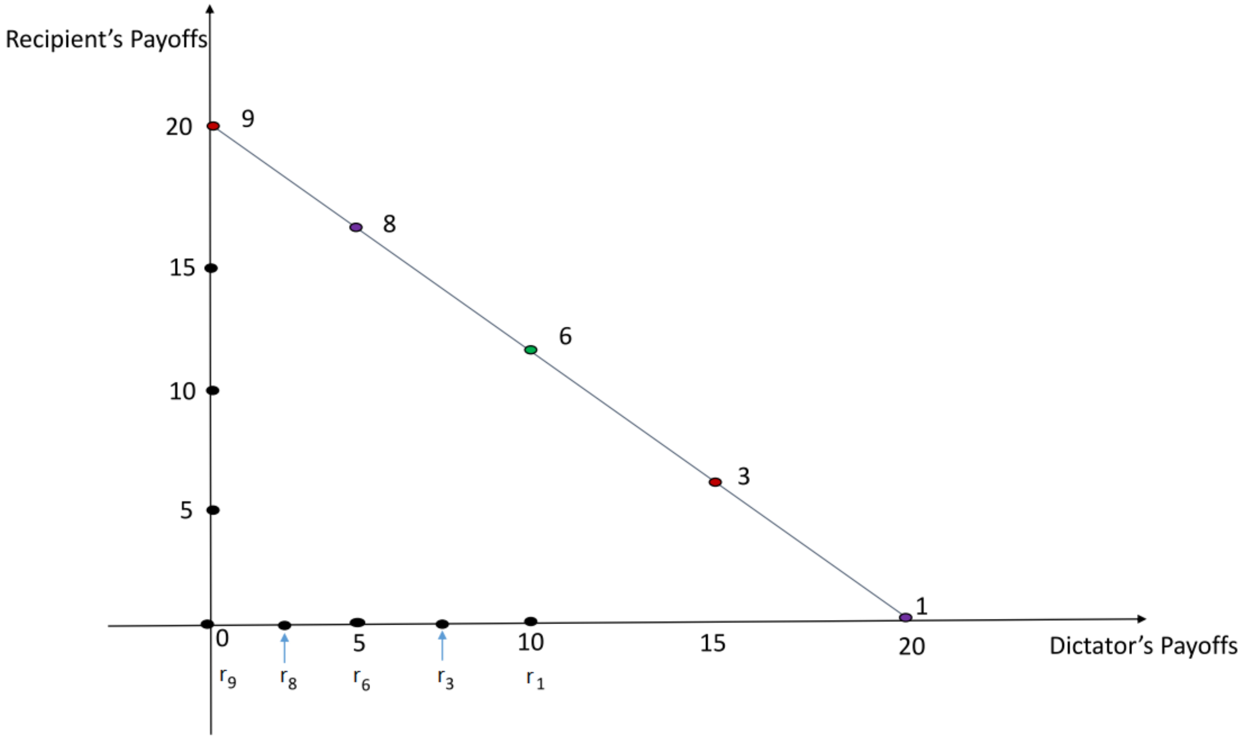
Tests for r_1 and r_2 Effects on Transfers

Dep. Variable	Hurdle Model		Tobit Model	
Transfer	(1)	(2)	(1)	(2)
r_1	-0.058**	-0.055**	-0.098**	-0.104**
	(0.027)	(0.027)	(0.047)	(0.047)
r_2	-0.319***	-0.314***	-0.497***	-0.487***
	(0.047)	(0.047)	(0.091)	(0.090)
Demographics	no	yes	no	yes
Observations	612	612	612	612

Summary Results from Our Give, Take, and Symmetric Dictator Treatments

- CCA is **rejected in favor** of MMA.

Application to Experiment in Korenok et al. (2014)



Endowments are at points 1, 3, 6, 8 and 9

CCA implies choice is invariant to the endowment

MMA implies allocation to the recipient varies inversely with dictator's endowment because $r_1 > r_2 > \cdots > r_9$

Application to Experiment in Korenok et al. (cont.)

Data from their experiment is

- Inconsistent with
  - CCA, hence GARP and social preferences models
  - Warm glow model in Korenok et al. (2013)

- Consistent with MMA

Cox, Sadiraj, and Tang (2018)

EXPERIMENT

- Payoff equivalent public good (PG), common pool (CP), and mixed games (MG)
  - Within-subjects and between-subjects design
  - Endogenous contractions of feasible sets

THEORETICAL RESULTS

- CCA implies play is invariant
  - Across PG, CP, and MG
  - To non-binding contractions of feasible sets
- MMA implies contributions to the public account are
  - Ordered as PG > MG > CP
  - Increasing in the lower bound, *b* of non-binding contractions of feasible sets

Choices in the Experiment

Use *t*-test for allocations and Pearson chi2 test for free riding.

Choices of subjects in our experiment are characterized by:

(i) Larger public account (*g*) allocations (one-sided p-value=0.063) and less free-riding (one-sided p-value=0.002) in provision than appropriation game data

(ii) Larger public account (*g*) allocations (one-sided p-value=0.08) but similar free-riding (one-sided p-value=0.124) in provision than mixed game data

(iii) Similar public account (*g*) allocations (one-sided p-values=0.424) but less free-riding (one-sided p-value=0.038) in mixed than appropriation game data.

Best Response *g* Allocations (no contraction, tobit, random effects)

Dep.Variable: *g* allocation	(1)	(2)	(3)	(4)
Guessed Other's allocation	1.005***	1.014***	1.022***	1.024***
	(0.079)	(0.079)	(0.079)	(0.079)
g^{o} (Initial allocation)	-0.131**	-0.141**	-0.132**	-0.146**
	(0.065)	(0.066)	(0.065)	(0.065)
Demographics	no	yes	yes	yes
Self Image	no	no	yes	yes
Image of Others	no	no	no	yes
Constant	-0.662	-0.989	-1.203	-0.831
	(0.550)	(0.763)	(0.787)	(0.798)
Observations	554	554	554	554
Log. Likelihood	-1019	-1018	-1014	-1012

Best Response *g* Allocations (with contractions, tobit, random effects)

	Provision Game		Appropriation Game	
Dep.Var: *g* Allocation	(1)	(2)	(1)	(2)
Guessed Other's allocation	0.694***	0.711***	0.661***	0.656***
	(0.093)	(0.093)	(0.130)	(0.128)
Contraction (lower bound)	0.769***	0.784***	0.767***	0.774***
	(0.168)	(0.161)	(0.232)	(0.226)
Demographics	no	yes	no	yes
Constant	-0.626	-1.309*	-2.371***	-3.927***
	(0.571)	(0.765)	(0.903)	(1.502)
Observations	240	240	240	240
Nr of Subjects	80		80	
(left-, un-,right-) censored	(70,129,41)		(87, 123,30)	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Data are Generally Inconsistent with CCA but Consistent with MMA

Result 1. Public good game elicits higher avg. allocation to the public account; common pool game elicits more free-riding (allocations of 0 or 1).

Result 2. Allocation to the public account **decreases** with the initial endowment of the public account.

Result 3. Non-binding lower bounds on public account allocations induce higher average allocations to the public account, conditional on other's allocation.

Some Additional Applications of MMA to Data in the Literature

MMA is **consistent with** Andreoni & Miller (2002) data

MMA is **consistent with** both dictator data and elicited norms in the bully game (Krupka and Weber 2013)

MMA is **consistent with** data from sharing and sorting experiment (Lazear et al. 2012)

MMA is **consistent with** data from strategic games with contractions:

Moonlighting (Abbink et al.) and investment games (Berg, et al. 1995)

Carrot, stick, and carrot/stick games (Andreoni et al. 2003)

Conclusion

MMA provides an extension of rational choice theory that rationalizes otherwise anomalous data from many experiments

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Sen's Two Properties for Non-singleton Choice Sets

Property α: if $G \subseteq F$ then $F^* \cap G \subset G^*$

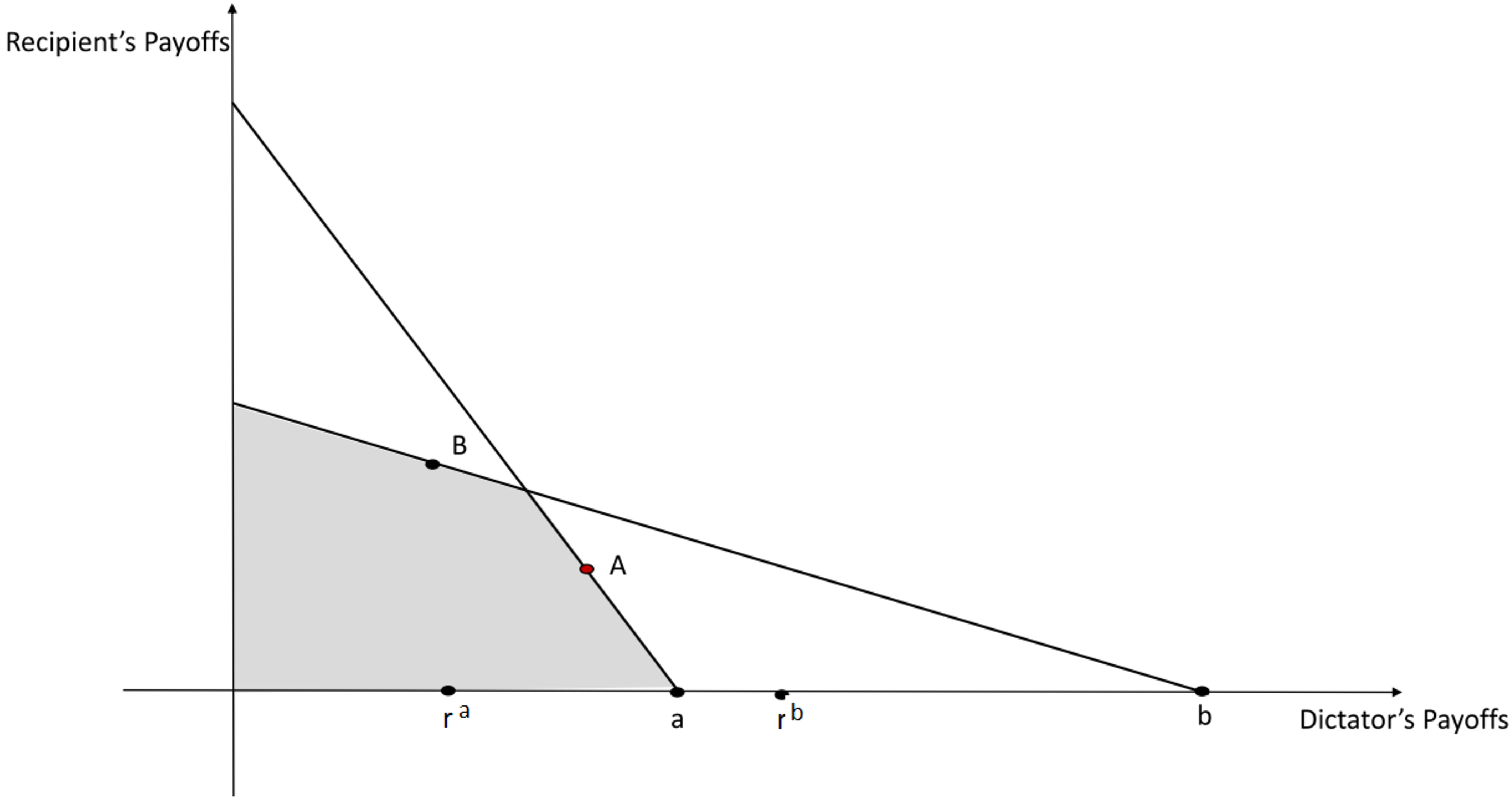
Property β: if $G \subseteq F$ and $G^* \cap F^* \neq \varnothing$ then $G^* \subseteq F^*$

Proof of Proposition 1

Let $\boldsymbol{f}$ belong to both F^* and G. Consider any $\boldsymbol{g}$ from G^*. As G and F have the same moral reference point, $\boldsymbol{r}^g = \boldsymbol{r}^f$, MMA requires that $g_i \geq f_i$ and $g_i \leq f_i$, $\forall i$. These inequalities can be simultaneously satisfied if and only if $\boldsymbol{g} = \boldsymbol{f}$, i.e. f belongs to G^* which concludes the proof for Property α_M. Note, though, that any choice $\boldsymbol{g}$ in G^* must coincide with $\boldsymbol{f}$, an implication of which is G^* must be a singleton. So, if the intersection of F^* and G is not empty then choices satisfy property β_M.

Implications for Andreoni and Miller (2002) Experiment

MMA Implies Tighter Restrictions than WARP for the Andreoni and Miller (2002) Experiment



Rationalizing Data from the Bully Game (Krupka and Weber 2013)

- MMA predicts dictator game choices & social norms elicited by Krupka and Weber
- Moral reference points
  - (5, 0) in the standard dictator game
  - (2.5, 0) in the bully dictator game

- Hence, MMA requires choices in the bully treatment to be drawn from a distribution that is less favorable to the dictator than the distribution of choices in the standard game

- Implies higher amount for the recipient and positive estimate for the bully treatment

- Mean amounts & results of ordered logistic regression support the predictions of MMA

- Reported distribution of elicited norms is also consistent with MMA

Rationalizing Data from Sharing and Sorting Exp. (Lazear et al. 2012)

EXPERIMENT 2

- Random selection of one of several decisions for payoff

- Decision 1: subjects play a distribute \$10 dictator game

- Decision 2: subjects can
  - Sort out of \$10 dictator game, and be paid \$10 (other gets \$0), or
  - Sort in and play the distribute \$10 dictator game

- Other decision tasks:
  - Subjects can sort out of \$$S$ dictator game, and be paid \$10 (other gets \$0), or
  - Sort in and play the distribute \$$S$ dictator game
  - S varied from 10.50 to 20

Rationalizing Data from Sharing and Sorting Exp. (cont.)

- Explaining sorting into a $S > 10$ game and keeping more than 10 is straightforward

- Many sorted out, and got 10, when they could have sorted in & retained more than 10

- MMA model is consistent with the data:
  - Subject has right to choose the ordered pair of payoffs (10,0) by sorting out
  - This provides a (10,0) endowment for the two-step game
  - S_j is the amount that can be allocated in treatment j
  - Dictator's sharing options include 0 and S_j, hence the minimal expectations point for the two-stage game is (0,0)
  - The moral reference point is
    - $(r_1, r_2) = (\frac{1}{2} \times 10, 0) = (5, 0)$ if the player sorts in
    - $(r_1, r_2) = (0, 0) =$ if the player sorts out

Rationalizing Data from Sharing and Sorting Exp. (cont.)

- Let preferences consistent with MMA be represented by a utility function

- Examples show that $u(10, 0),$ from sorting out, can be larger than

  $u(S-y-5, y)$ for $S-y>10,$ from sorting in