

Optimal altruism in public good provision

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October 2014

Social preferences now play important role in economic analysis

This paper: **Social preferences in public good provision**

- 1 Welfare impact of unselfish behaviour
 - Players altruistically-minded yet rational
 - Tension between altruism & crowding-out effects
- 2 Preferences & incentives \implies “**Optimal altruism**”
- 3 Range of applications—focus on global climate policy

Recent climate policy initiatives

Recent **unilateral climate initiatives** at local, national & regional levels

- EU to reduce GHG emissions by 20% until 2020
- UK aims to cut carbon emissions by 80% by 2050
- Australia & New Zealand, US (California, RGGI), China, others

Increasing **use of social cost of carbon** in regulatory decision-making

- Several EU countries (Netherlands, Finland, Italy, UK) apply SCC
- US has developed measure of SCC & applied to selected regulations

No binding global agreement to jointly reduce carbon emissions

- Many countries unwilling to go beyond “business-as-usual”

Evidence that for some unilateral policies, **domestic benefits** < **costs**

- **European Union's "20/20/2020" package**

CBA suggests (benefits/costs) < 1 for range of scenarios

- **United Kingdom's 2008 Climate Change Act**

Impact Assessment: "Benefits of UK action will be distributed across the globe" ... "Economic case for the UK continuing to act alone where global action cannot be achieved would be weak" (DECC)

Difficult to reconcile such policies with central tenet of self-interest...

⇒ **Role for "unselfish" objectives** that go beyond national welfare

This paper: *How is altruism optimally reflected in abatement policies?*

Three main results:

- 1 More altruistic behaviour by a player often *reduces* social welfare
- 2 *Almost* always optimal to act more selfishly than true preference
- 3 Optimal altruism often “*low*”—even when strongly altruistic

⇒ Difficult to infer social preferences from observed behaviour

Overview of the talk

- Benchmark model & key properties
- Welfare impact of small altruistic commitments
- Optimal altruistic commitments
- Robustness of the main results
- Implications for climate policy

Setup of the benchmark model

Two players i and j contribute to a public good ($k = i, j$)

- **National welfare** $\Pi_k = B_k(X_i + X_j) - C_k(X_k)$
 - Standard assumptions $B'_k > 0$, $B''_k < 0$ and $C'_k > 0$, $C''_k > 0$
- **Global welfare** $W = \Pi_i + \Pi_j$

Modelling players' degrees of altruism:

- **True objective** $S_k = (1 - \theta_k)\Pi_k + \theta_k W$
 - $\theta_k \in [0, 1]$ is true preference for altruism
- **Strategic objective** $\Omega_k = (1 - \lambda_k)\Pi_k + \lambda_k S_k$
 - $\lambda_k \in [0, 1]$ reflects strategic preference

\implies Welfare impact of altruistic behaviour & optimal altruism $\lambda_k^*(\theta_i, \theta_j)$

Key properties of the model

Interpretation: Delegation of policy decisions

Model timing:

- 1 Countries endowed with $B_k(\cdot), C_k(\cdot)$, and true altruism θ_k ($k = i, j$)
- 2 Citizens choose commitment λ_k to maximize true objective S_k
- 3 Politicians choose contribution X_k to maximize strategic objective Ω_k

\implies Subgame-perfect Nash equilibrium $\implies X_k^*(\lambda_i, \lambda_j)$ at Date 3

Key properties:

- 1 Stronger commitment increases contribution, $dX_i^*/d\lambda_i > 0$
- 2 Higher contribution leads to "leakage", $L_i \equiv (-dX_j^*/dX_i) \in (0, 1)$
 - Players' efforts are *strategic substitutes*

Other applications of the model

- Environmental policy
- Problems of the commons
- Defense spending
- Economics of the family
- Corporate joint ventures

Proposition

The impact of a small unilateral commitment $d\lambda_i$ by player i on her equilibrium true objective satisfies

$$\left. \frac{dS_i^*}{d\lambda_i} \right|_{\lambda_i=\lambda_j=0} = \left[(\theta_i B'_j - B'_i L_i) \frac{dX_i^*}{d\lambda_i} \right]_{\lambda_i=\lambda_j=0}$$

Commitment $\implies dX_i^* > 0$ but $\implies dX_j^* < 0$ (crowding-out)

- **Two direct effects** on own net benefits are zero (envelope theorem)
- **Two strategic effects** are positive and negative:
 - 1 Player j gains from free-riding by $B'_j dX_i^* > 0$ (weight $\theta_j \in [0, 1]$)
 - 2 Player i loses from leakage by $B'_i dX_j^* = -B'_i L_i dX_i^* < 0$ (full weight)

Also ambiguous impact on *global* welfare, $dW^*/d\lambda_i \geq 0$ (just set $\theta_i = 1$)

\implies *May not be good idea to go ahead with a commitment...*

- **Generalized impact** of unilateral commitment by player i :

$$\begin{aligned}
 dS_i^* = & \underbrace{\left[\begin{array}{l} \text{direct effect} \\ \text{on player } i \text{ (} \leq 0 \text{)} \end{array} + \begin{array}{l} \text{strategic effect} \\ \text{on player } i \text{ (} < 0 \text{)} \end{array} \right]}_{=d\Pi_i^* < 0} \\
 & + \text{true altruism} \\
 & \text{of player } i \text{ (} \theta_i \in [0, 1] \text{)} \times \\
 & \underbrace{\left[\begin{array}{l} \text{direct effect} \\ \text{on player } j \text{ (} \geq 0 \text{)} \end{array} + \begin{array}{l} \text{strategic effect} \\ \text{on player } j \text{ (} > 0 \text{)} \end{array} \right]}_{=d\Pi_j^* > 0}.
 \end{aligned}$$

\implies Equilibrium impact & sign $\left(\frac{dS_i^*}{d\lambda_j} \right)$ depend on relative magnitudes

A full commitment is almost never optimal

Proposition

Players' optimal commitments $\lambda_i^ = 1$ and $\lambda_j^* = 1$ if and only if their true preferences are entirely altruistic, $\theta_i = \theta_j = 1$*

First-best efforts \iff both players entirely unselfish

- No incentive to unilaterally deviate from bilateral full commitment

Example: If $\theta_i = 1$ but $\theta_j < 1$, then $\lambda_i^* < 1$ (and also $\lambda_j^* < 1$)

\implies Delegate to politicians with preferences closer to national self-interest

- *Player who genuinely cares about global welfare does best by being at least somewhat selfish. Why?*
 - 1 Small decrease in own effort \implies 2nd order loss in global welfare
 - 2 Induced rise in other's effort \implies 1st order gain (“**Reverse leakage**”)

A zero/low commitment is often best

Proposition

- (a) If the ratio of marginal benefits B'_i/B'_j is sufficiently large (and $\theta_i < 1$ or $\theta_j < 1$), then player i 's optimal commitment $\lambda_i^* = 0$;
- (b) If θ_i and θ_j are positive but sufficiently small, then $\lambda_i^* = \lambda_j^* = 0$.

Part (a) \implies Policy of full commitment (e.g., global social cost of carbon) may be welfare-dominated by zero commitment

- Let $(\theta_i, \theta_j) = (1, 0)$. For B'_i/B'_j sufficiently large, global welfare W^* higher with $(\lambda_i, \lambda_j) = (0, 0)$ than $(\lambda_i, \lambda_j) = (\ell, 0)$ for *any* $\ell \leq 1$

Part (b) = For “sufficiently small” altruism, positive free-riding effect swamped by leakage \implies Both players do best by acting entirely selfishly

- Let $B_i(\cdot) = B_j(\cdot)$ and $\theta_k < L_k$ ($k = i, j$). Then $(\lambda_i^*, \lambda_j^*) = (0, 0)$

Proposition

In an interior equilibrium with $(\lambda_i^*, \lambda_j^*) \in (0, 1)^2$,

$$\lambda_i^* = \frac{\left[\theta_i(1 - L_i L_j) - (1 - \theta_i \theta_j) (B_i' / B_j') L_i \right]}{\theta_i (1 - \theta_i \theta_j L_i L_j)} \in (0, 1),$$

where equilibrium rates of leakage

$$L_i = \frac{\left[1 + \lambda_j^* \theta_j (B_i'' / B_j'') \right]}{\left[1 + (C_j'' / |B_j''|) + \lambda_j^* \theta_j (B_i'' / B_j'') \right]} \in (0, 1),$$

and player i 's equilibrium effort satisfies $X_i^* = C_i'^{-1} \left(B_i' + \lambda_i^* \theta_i B_j' \right) > 0$.

- **Informational requirement:** B_i' / B_j' & B_i'' / B_j'' , $C_k'' / |B_k''|$ & θ_k

Inferring players' levels of altruism

Suppose it is observed/estimated that i 's effort is selfish ($\lambda_i^* \theta_i = 0$)

- Does *not* follow that true preference $\theta_i = 0$ since maybe $\lambda_i^* = 0$
 - Statement “No unilateral climate action \implies being selfish” easily false

Proposition

- (a) For $0 < \theta_i = \theta_j < 1$, optimal commitments may satisfy $\lambda_i^* \theta_i \neq \lambda_j^* \theta_j$;
- (b) For $0 < \theta_j < \theta_i$, optimal commitments may satisfy $\lambda_j^* \theta_j > \lambda_i^* \theta_i$;
- (c) If $0 < \theta_j < \theta_i$, optimal commitments in interior equilibrium satisfy $(\lambda_i^* \theta_i - \lambda_j^* \theta_j) < (\theta_i - \theta_j)$ if $B_i' \geq B_j'$ & $L_i \geq L_j$.

\implies Caution required in inferring altruism from observed behaviour & making cross-country comparisons

Specification of strategic objective

- Main results robust to functional form of Ω_k

Definition of “global welfare”

- Could instead let $W = S_i + S_j$ *directly* feature altruism

Pure vs impure public goods

- Benefits could depend on players' *weighted* efforts

Generalization to $n \geq 3$ players (“one bad apple”)

- Contributions made in “aggregative game” \implies Player-specific leakage rates $L_{ij} \equiv [-dX_j/dX_i] > 0$
 \implies Overall leakage rate $L_i \equiv [-\sum_{j \neq i} dX_j/dX_i] \in (0, 1)$

Cross-country cost spillovers (“two-edged sword”)

- More abatement reduces other country's costs (learning-curve effects; technology spillovers) \implies Let $C_i(X_i, X_j)$ such that $L_i \in (0, 1)$

Other altruistic objectives (“warm glow”)

- Let true objective function $S_i = \Pi_i + \hat{\theta}_i \Phi_i$ where $\hat{\theta}_i \in [0, 1]$
 - $\Phi_i(X_i, X_j)$ is altruistic (overstates benefits; understates costs)
 - “Warm glow” with $\Phi_i(\cdot) = g_i(X_i)$

How does altruistic behaviour affect leakage rates?

Proposition

- (a) If $B_j''' \leq 0$ and $C_j''' \leq 0$, leakage satisfies $L_i|_{\lambda_j^* > 0} > L_i|_{\lambda_j^* = 0}$
- (b) If $B_j''' = 0$, $C_j''' = 0$, B_i'' / B_j'' constant, leakage satisfies $\partial L_i / \partial \lambda_j > 0$

- Unselfish component of j 's effort choice has 100% leakage rate:
 $\partial \Pi_i / \partial X_j = B_i'(X_i + X_j)$ constant $\iff dX_j = -dX_i$
 - High rates of carbon leakage *because* countries are altruistic!

\implies Altruistic behaviour often worsens free-riding problem at the margin

Proposition

(a) Suppose that B'_i / B'_j is constant. Player i 's optimal commitment varies with player j 's commitment according to

$$\text{sign} \left\{ \frac{d\lambda_i^*}{d\lambda_j} \right\} = \text{sign} \left\{ \frac{1}{\eta_{ij}} - \left(\frac{1 - \lambda_j^* \theta_i \theta_j}{\lambda_j^* \theta_i \theta_j} \right) \right\}$$

where $\eta_{ij} \equiv [(dL_i / L_i) / (d\lambda_j / \lambda_j)]_{\lambda_k = \lambda_k^*}$.

(b) Suppose that B'_i / B'_j , B''_i / C''_j and B''_i / B''_j are all constant.

Then $\eta_{ij} \in (0, 1)$, and so $d\lambda_i^* / d\lambda_j > 0$ if $\lambda_j^* \theta_i \theta_j \geq \frac{1}{2}$ while $d\lambda_i^* / d\lambda_j < 0$ if $\lambda_j^* \theta_i \theta_j$ is sufficiently small.

- **Strategic substitutes** if $\eta_i > 0$ and $\lambda_j \theta_i \theta_j$ ("joint altruism") small
- **Strategic complements** if $\eta_i \leq 0$ or $\lambda_j \theta_i \theta_j$ large

\implies Strategic properties of commitments differ from contributions

Social preferences can explain any outcome \in [self-interest, first-best]

\implies Recent unilateral policy *might* be driven by altruistic preferences

Equilibrium analysis yields sharper conclusions:

- 1 Suboptimal for any subset of countries to unilaterally employ SCC
 - Limited project use of SCC broadly consistent with our results
- 2 Sometimes little or no action by altruistically-minded players
- 3 Caution required in trying to infer countries' degrees of altruism

Optimal altruism in public good provision

- Altruistic-yet-rational players account for incentive effects
 - Leakage \implies Optimal altruism $<$ true preference

What could lead to more favourable outcomes?

- 1 Moving towards a more *cooperative setup*
 - Unilateral climate policy “in the shadow” of cooperative talks
- 2 Public good problems with *negative leakage*
 - Relatively little theoretical/empirical backing...
- 3 Players making *conditional commitments*
 - Committing to do more if others also do more