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# Ideals Should Not Be Too Ideal: Identity and Public Good Contribution

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# Ideals should not be too ideal: Identity and public good contribution

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**Abstract**

This paper incorporates identity into a model of voluntary public good contribution. An ideal of contributing to public goods divides players to different social categories: Players who identify with the ideal become insiders, obtaining identity utility but incurring disutility if their contributions depart from the ideal, while players who do not identify with the ideal remain as outsiders. We show that identity could increase public good contribution; the ideal that best resolves the free-riding problem in the public good game equals either the contribution level of the most altruistic player in the absence of the identity, or a level that makes the least altruistic player indifferent between becoming an insider and not, depending on the size of the group. These results have implications for social policymaking.

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# 1 Introduction

People in the society divide themselves into different social categories. Different social categories entail different norms. Social categorization and the associated norms influence behavior. Taking the issue of climate change for example, there are so-called climate alarmists and climate skeptists (or climate denialists). The former group accepts the existence of anthropogenic climate change while the latter group denies it. While people skeptical of climate change refuse to take actions on it, people who believe in anthropogenic climate change have started to engage in an emerging lifestyle called low carbon living in an attempt to curb the climate change. Kotchen and Moore (2008) show that environmentalists are more likely to voluntarily restrain their consumption of goods and services that generate negative externalities. Kahn (2007) find that those who vote for "green policies" and register for liberal/environmentalist political parties indeed live a "green" lifestyle by commuting by public transit more often, purchasing more hybrid vehicles, and consuming less gasoline than non-environmentalists. While Costa and Kahn (2010) note that liberals and environmentalists are more energy efficient than conservatives, which makes it harder for them to further reduce energy consumption, in a recent paper, Costa and Kahn (2013) find that popular electricity conservation "nudge" of providing feedback to households on own and peers' home electricity usage is much more effective with political liberals/environmentalists than with conservatives. These two authors provide an identity story to explain this asymmetry: the ideologies that people accept not only affect the policies they vote for, but also influence behavior at the individual level.

Akerlof and Kranton (2000) firstly study the role of identity in economics. Identity means a person's sense of self. In their model, an individual has the sense of belonging to a certain social category; the social category then prescribes what should be done, or *ideals*. These prescriptions or ideals become behavioral targets or goals for people in the social category. In their utility function, Akerlof and Kranton introduce identity utility that depends on which social category the individual identifies with, the prescription of the social category, and the individual's characteristics related to the prescription. They and follow-up studies (e.g. Akerlof and Kranton, 2002, 2005, 2008, 2010, Hiller and Verdier, 2014) use the identity model to analyze behavior in the workplace, the school and the family, to further understandings on discrimination, poverty, labor division, corporate culture, and other topics. In these models, however, the ideals prescribed by social categories are assumed to be fixed.[1]

The evidence discussed above demonstrates that identity plays an important role in issues involving externalities as well. Energy conservation provides a public good to every member in the society in the sense that it reduces Greenhouse Gas emissions to the atmosphere. The fundamental difficulty in a public good problem is that free riding incentives typically cause under-provision of the public good. A question is, is the promotion of the "green" lifestyle conducive to the public good provision? The low carbon movement advocates the "green" lifestyle, exemplified by the Nobel Peace Prize winner Al Gore and his movie *An Inconvenient Truth*. Environmentalists who accept this idea seem to practice it by themselves, as shown by Kahn (2007). However, the fervent environmental campaigns also generate their enemies: the climate denialists heavily and routinely attack the low carbon movement (see, the Climate Depot, a climate denialist website, for instance). Although psychologists and management scientists argue that persuasion strategies or "nudges" may be useful in changing people's behavior (e.g. Thaler and Sunstein 2008, Schultz et al 2007, Goldstein, Cialdini, and Griskevicius, 2008), Costa and Kahn (2013) show that they are useful only for those who identify with the ideology embedded in the nudges. The goals or norms provided by one social category have little impact on people who do not belong to that social category.

In this paper, we develop an economic model to study the role of identity in public good contributions. The questions we investigate include the

[1] Other approaches of modelling identity include oppositional identities (Bisin et al 2011), identity as status (Shayo, 2009), and identity investment when a player has incomplete information on her own type (Bénabou and Tirole, 2011). Costa-i-Font and Cowell (2013) review the related literature. In our paper, we will follow the Akerlof-Kranton tradition in modelling identity.

following. Why does the promotion of certain ideals (prescriptions) have asymmetric effects on different groups of people? How do people sort themselves into different social categories? Is it true that the higher the ideals are, the better? Or are there optimal ideals that best resolve the free riding problem in public good games? Finally and more generally, to what extent would identity help in public good games?

We consider a game of voluntary public good provision. Players are heterogenous in their degrees of altruism. The players first decide on whether to identify with an ideal of contributing to a public good. Those who identify with the ideal become insiders while those who reject the ideal stay as outsiders. By this way, the ideal divides players into two social categories: insiders and outsiders. Being an insider gives the player an identity utility; however, departing from the ideal will entail a utility loss. Insiders and outsiders then privately contribute to the public good.

Our model provides the following answers to the questions above. The ideal of public good contribution only affects the behavior of the insiders, who identify with it. Ideals should not be too high: A very high ideal fails to attract insiders and thus cannot be effective. The ideal that maximizes the expected level of public good contribution is either the level of public good contribution of the most altruistic person in the absence of identity, or the level that makes the least altruistic person indifferent between accepting and rejecting it, depending on the size of the group. In the former case, players who are sufficiently altruistic become insiders while the others stay as outsiders, while in the latter case, all the players identify with the ideal. Overall, identity is helpful in resolving the free-riding problem by increasing the level of public good provision.

Brekke, Kverndokk and Nyborg (2003) consider moral motivation in public good provision, where the moral goal originates from individuals' introspection based on some absolute laws in the sense of Immanuel Kant. In our paper, as in Akerlof and Kranton (2000), the ideal is more of a social norm derived from outside, rather than a moral norm; depending on whether people identify with it or not, people sort themselves into different social categories. Andreoni (1990) and Holländer (1990) consider warm glow and social approval, respectively, as byproducts of contributing to a public good. There is no social categorization in these studies. Rege (2004) endogenizes the strength of social approvals by studying the interactions among contributors and non-contributors.

There is accumulated empirical evidence that demonstrates the role of identity in public good provision. For instances, Burlando and Hey (1997), Benjamin, Choi and Fisher (2010), Solow and Kirkwood (2002), and Croson, Marks and Snyder (2003) find the effects of national, religious, social and gender identities on public good contribution. Our paper, to our knowledge, is the first theoretical economic study on identity in a public good contribution game.

The rest of this paper is organized as follows. Section 2 develops the model, Section 3 derives the ideal that maximizes the expected level of public good contribution, while Section 4 concludes. The Appendix contains proofs.

# 2 The model

Consider a group of $N$ players. We will assume that the group is sufficiently large in Inequality (8) below. Each player makes voluntary contribution to a public good, which can be interpreted as emission abatement in the application of environmental protection. Let $a_i$ denote player $i$'s contribution, for any $i \in \{1, 2, ..., N\}$. The marginal benefit of the public good to each player is normalized to 1. The private cost of providing $a_i$ is $\frac{c}{2}a_i^2$, for each player. From the social point of view, the efficient provision of the public good would entail, $N = ca_i$, where the social marginal benefit equals the private marginal cost of contributing to the public good, implying each player contributing $\frac{N}{c}$.

Hammond (1987) characterizes altruism and discusses its relevance in public good provision. In our model, players are altruistic in the sense that they partially internalize the benefit of their own contribution to others. Player $i$ has an altruism parameter $\delta_i$ in the objective function, which captures the relative weight of others' benefit compared to her own benefit from her contribution. We assume that $\delta_i$ follows a uniform distribution between

$\left[0,\overline{\delta}\right]$, where $0<\overline{\delta}<1$.

Let $n\equiv N-1$, the number of other players. In a baseline model without identity, any player $i$ chooses $a_i$ to maximize the following:

$$\left(1+\delta_i n\right)a_i-\frac{c}{2}a_i^2. \tag{1}$$

With the inverse U-shaped quadratic objective function, the First Order Condition gives the solution to this problem:

$$\begin{aligned} 1+\delta_i n &= ca_i \\ \Rightarrow a_i^b\left(\delta_i\right) &= \frac{1+\delta_i n}{c}\equiv\frac{A_i}{c}, \end{aligned} \tag{2}$$

where superscript $b$ indicates the baseline case, and we define $A_i\equiv 1+\delta_i n$. Equation (2) implies that $a_i^b$ increases in $\delta_i$ and $n$, and decreases in $c$.

## 2.1 The Model with Identity

This subsection considers the model with identity. Identity originates from an *ideal* level of contributing to the public good, denoted by $a^*$.[2] Whether or not players identify with this ideal sorts players into two social categories: insiders and outsiders. Insiders identify with the ideal while outsiders reject it. Following Akerlof and Kranton (2002), we assume that an insider obtains an identity utility (of being an insider) $V$, but incurs a utility loss of $\frac{\theta}{2}\left(a_i-a^*\right)^2$ by deviating her contribution from the ideal.[3] An outsider does not change her preference with the ideal.

Being an insider gives a player a sense of belonging and a feeling of affections. We condense these psychological effects into one measure, the utility gain from identity. Implicitly, we have normalized the identity utility of be-

[2]Different societies have different mechanisms in selecting ideals. In this section, we will not investigate the ideal generation process, but will have a comparative static analysis on how the ideal affects the sorting of players and the public good contributions of players in different social categories. Section 3 discusses the choice of the ideal.

[3]Akerlof and Kranton's education model (2002) also introduces a utility loss if a student's *looks* depart from the prescription of her social category. We do not have this item in our model, because appearances, or *looks*, are not important in our context of public good provision.

ing an outsider to 0. Alternatively, $V$ can be interpreted as the difference in identity utilities between an insider and an outsider. We further assume that $V$ is sufficiently large:

$$V \geq \frac{\theta}{2c\,(c+\theta)}. \tag{3}$$

Identification with the ideal makes an insider feel bad, if her contribution deviates from the ideal. This utility loss is increasing in the gap between her own contribution and the ideal behavior, and the marginal disutility is also increasing in the absolute value of this gap.[4] The parameter $\theta > 0$ captures how an insider is concerned about the deviation of her contribution from the ideal, given the gap between her contribution and the ideal. We will say it measures the "insider concern".

The game proceeds as follows.

- In stage 1, each player decides on whether to identify with the ideal $a^*$ (and become an insider) or not.
- In stage 2, each player (either an insider or an outsider) decides on her public good contribution.

As usual, we will solve the game backwards.

#### 2.1.1 Public good contribution game

We start with stage 2. Since identity does not affect the preference of an outsider, an outsider $j$ with $\delta_j$ contributes to the public good following Equation (2), i.e. $a_j^o = a_j^b$, where the superscript $o$ indicates outsiders. An insider with $\delta_i$ solves the following problem.

$$\max_{a_i} \left(1+\delta_i n\right) a_i - \frac{c}{2} a_i^2 - \frac{\theta}{2}\left(a_i - a^*\right)^2 + V.$$

[4] We adopt Akerlof and Kranton's (2002) assumption that this utility loss is a quadratic function of the distance between the individual's action and the ideal. Monin, Sawyer, and Marquez (2008) provide experimental evidence that people resent those who do the right thing because their positive self-image is threatened. Bénabou and Tirole (2011) endogenize the ostracism towards the more virtuous ("do-gooders"). These studies may explain the utility loss of an insider if her contribution is higher than the ideal.

Again, the objective function is inverse U-shaped quadratic, so the First Order Condition is sufficient for the solution:

$$\begin{aligned}(1+\delta_i n) - ca_i - \theta\,(a_i - a^*) &= 0 \\ \Rightarrow a_i^i = \frac{1+\delta_i n + \theta a^*}{c+\theta} &= \frac{A_i + \theta a^*}{c+\theta},\end{aligned} \tag{4}$$

where the superscript $i$ indicates insiders. We observe that $a_i^i$ is increasing in $\delta_i$, $n$, and the ideal $a^*$, while decreasing in $c$. Less obvious is its relation with $\theta$:

$$\frac{da_i^i}{d\theta} = \frac{a^* c - A_i}{(c+\theta)^2} > 0 \text{ if and only if } a^* > \frac{A_i}{c} = a_i^b, \tag{5}$$

implying that the insider concern increases an insider's public good contribution if and only if the ideal is higher than the insider's public good contribution in the absence of identity.

Define $\Delta\,(A_i) = a_i^i - a_i^b$, the change of public good contribution after a player becomes an insider. Thus,

$$\begin{aligned}\Delta\,(A_i) &= \frac{A_i + \theta a^*}{c+\theta} - \frac{A_i}{c} \\ &= \frac{\theta\,(ca^* - A_i)}{c\,(c+\theta)}.\end{aligned} \tag{6}$$

We have the following lemma, showing that an insider makes more public good contribution than that in the absence of identity, if and only if the ideal is higher than the insider's public good contribution in the absence of identity.

**Lemma 1** $\Delta\,(A_i) > 0$ *if and only if* $a^* > \frac{A_i}{c} = a_i^b$.

This result is directly derived from Equation (6).

### 2.1.2 Identity game

We now move back to stage 1, the identity game. For player $i$, the utility of staying as an outsider is, the benefit of public good contribution from others, which is exogenous (and fixed) to the player, plus the following,

$$\begin{aligned} u_i^o &= A_i a_j^o - \frac{c}{2} a_j^{o2} \\ &= A_i \frac{A_i}{c} - \frac{c}{2}\left(\frac{A_i}{c}\right)^2 \\ &= \frac{1}{2}\frac{A_i^2}{c}, \end{aligned}$$

while the utility of becoming an insider is, the exogenous benefit of public good contribution from others, plus

$$\begin{aligned} u_i^i &= A_i a_i^i - \frac{c}{2} a_i^{i2} - \frac{\theta}{2}\left(a_i^i - a^*\right)^2 + V \\ &= A_i \frac{A_i + \theta a^*}{c+\theta} - \frac{c}{2}\left(\frac{A_i + \theta a^*}{c+\theta}\right)^2 - \frac{\theta}{2}\left(\frac{A_i + \theta a^*}{c+\theta} - a^*\right)^2 + V \\ &= \frac{1}{2}\frac{A_i\left(A_i + 2\theta a^*\right) - \theta c a^{*2}}{c+\theta} + V. \end{aligned}$$

We have

$$\begin{aligned} & u_i^i \geq u_i^o \\ \Leftrightarrow\ & \frac{-1 + ca^* - \left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}}{n} \leq \delta_i \leq \frac{-1 + ca^* + \left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}}{n} \\ \Leftrightarrow\ & \frac{-1 + ca^* - B}{n} \leq \delta_i \leq \frac{-1 + ca^* + B}{n}, \end{aligned} \tag{7}$$

where $B \equiv \left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}$. The appendix shows the derivation of the equivalence in (7). Let

$$\delta^-\left(a^*\right) \equiv \frac{-1 + ca^* - B}{n},$$

and

$$\delta^+\left(a^*\right) \equiv \frac{-1 + ca^* + B}{n}.$$

Taking into account the constraint $0 \leq \delta_i \leq \overline{\delta}$, and by the tie-breaking assumption that a player being indifferent would choose to be an insider, we have the following lemma regarding the condition under which players choose to be insiders.

**Lemma 2** *Players with*

$$\delta_i \in \left[\max\left(\delta^-(a^*), 0\right), \min\left(\delta^+(a^*), \overline{\delta}\right)\right]$$

*choose to be insiders, while the other players choose to be outsiders.*

Inequality (3) implies that $B > 1$. This guarantees that, for any $a^* > 0$, $\delta^+(a^*) > 0$.[5] We further assume that

$$B < n = N - 1. \tag{8}$$

We now discuss the implication of Lemma 2, by considering two possibilities: (I) a sufficiently large group, $n \geq \frac{2}{\overline{\delta}}B$, and (II) a small enough group, $n < \frac{2}{\overline{\delta}}B$.

(I) When $n \geq \frac{2}{\overline{\delta}}B$, then $\delta^+(a^*) - \delta^-(a^*) \leq \overline{\delta}$, implying that the interval $[\delta^-(a^*), \delta^+(a^*)]$ is not longer than the interval $\left[0, \overline{\delta}\right]$. Depending on the value of $a^*$, Lemma 2 implies the following cases in Table 1.I.

| Case | $a^*$ | $\delta^-(a^*), \delta^+(a^*)$ | $\delta_i$ being insiders |
|---|---|---|---|
| I.i | $a^* < \frac{1+B}{c} \Rightarrow$ | $\delta^-(a^*) < 0 < \delta^+(a^*) < \overline{\delta}$ | $[0, \delta^+(a^*)]$ |
| II.ii | $\frac{1+B}{c} \leq a^* < \frac{1-B+n\overline{\delta}}{c} \Rightarrow$ | $0 \leq \delta^-(a^*) < \delta^+(a^*) < \overline{\delta}$ | $[\delta^-(a^*), \delta^+(a^*)]$ |
| I.iii | $\frac{1-B+n\overline{\delta}}{c} \leq a^* \leq \frac{1+B+n\overline{\delta}}{c} \Rightarrow$ | $0 < \delta^-(a^*) \leq \overline{\delta} \leq \delta^+(a^*)$ | $\left[\delta^-(a^*), \overline{\delta}\right]$ |
| I.iv | $a^* > \frac{1+B+n\overline{\delta}}{c} \Rightarrow$ | $\delta^-(a^*) > \overline{\delta}$ | None |

Table 1.I: The range of $\delta_i$ for becoming insiders, with $n \geq \frac{2}{\overline{\delta}}B$

The domain of $a^*$ in the second column of Table 1.I implies the relative magnitudes of $\delta^-(a^*)$, $\delta^+(a^*)$, 0, and $\overline{\delta}$ in the third column, while the last column indicates the corresponding range of $\delta_i$ for which players choose to be insiders. Table 1.I shows that when the group is sufficiently large ($n \geq \frac{2}{\overline{\delta}}B$), with a low $a^*$, less altruistic players identify with $a^*$ but more altruistic players choose to be outsiders; with an intermediate $a^*$, players with moderate

[5]If Inequality (3) does not hold, then $\delta^+(a^*)$ may be negative, in which case no player becomes an insider and the ideal has no effect at all.

degree of altruism choose to be insiders while players with low or high degree of altruism stay out; with an even higher $a^*$, only sufficiently altruistic players choose to be insiders; if $a^*$ is too high, however, every player stays out and the ideal is not effective.

(II) When $n < \frac{2}{\overline{\delta}}B$, then $\delta^+(a^*) - \delta^-(a^*) > \overline{\delta}$, implying that the interval $[\delta^-(a^*), \delta^+(a^*)]$ is longer than the interval $\left[0, \overline{\delta}\right]$. Depending on the value of $a^*$, Lemma 2 implies the following cases in Table 1.II.

| Case | $a^*$ | $\delta^-(a^*), \delta^+(a^*)$ | $\delta_i$ being insiders |
|---|---|---|---|
| II.i | $a^* < \frac{1-B+n\overline{\delta}}{c} \Rightarrow$ | $\delta^-(a^*) < 0 < \delta^+(a^*) < \overline{\delta}$ | $[0, \delta^+(a^*)]$ |
| II.ii | $\frac{1-B+n\overline{\delta}}{c} \leq a^* \leq \frac{1+B}{c} \Rightarrow$ | $\delta^-(a^*) \leq 0 < \overline{\delta} \leq \delta^+(a^*)$ | $\left[0, \overline{\delta}\right]$ |
| II.iii | $\frac{1+B}{c} < a^* \leq \frac{1+B+n\overline{\delta}}{c} \Rightarrow$ | $0 < \delta^-(a^*) \leq \overline{\delta} < \delta^+(a^*)$ | $\left[\delta^-(a^*), \overline{\delta}\right]$ |
| II.iv | $a^* > \frac{1+B+n\overline{\delta}}{c} \Rightarrow$ | $\delta^-(a^*) > \overline{\delta}$ | None |

Table 1.II: The range of $\delta_i$ for becoming insiders, with $n < \frac{2}{\overline{\delta}}B$

Table 1.II shows that when the group size is small enough ($n < \frac{2}{\overline{\delta}}B$), with a low $a^*$, more altruistic players choose to be outsiders; with an intermediate $a^*$, every player identifies with it; with an even higher $a^*$, only sufficiently altruistic players choose to be insiders; but if $a^*$ is too high, no player wants to be an insider.

Overall, the ideal $a^*$ affects which of the players would become insiders, and the contribution levels of insiders. We will analyze how the choice of $a^*$ affects total public good contribution in the next section.

# 3 Discussion

In this section, we discuss the choice of the ideal, $a^*$. Suppose that there is a social manager who wants to resolve the free-riding problem and alleviate the underprovision of the public good. The social manager could be a politician, an educator, or a religious leader. Through some mechanisms (e.g. media, school, church), the social manager is able to influence or control $a^*$. Then the question is, how would the social manager choose $a^*$?

To answer this question, we add a prior stage, stage 0, to the above game, in which the social manager chooses $a^*$. We assume that for any $i$, $j \in \{1, 2, ..., N\}$, $\delta_i$ and $\delta_j$ are independently and identically distributed, and that the $\delta_i$'s (for any $i \in \{1, 2, ..., N\}$) are not realized until stage 1, so the social manager only knows the distribution of $\delta_i$ during her decision-making.

- In stage 0, a social manager decides on $a^*$ to maximize the expected level of public good contribution.

From the standpoint of stage 0, denote the expected effect of $a^*$ on the public good contribution of a player by $g(a^*)$. Recall that the ideal will have no impact on outsiders. Therefore, we have

$$g(a^*) = E_{\delta_i}\Delta(A_i|Insider, a^*) \times \Pr(Insider|a^*),$$

where $\Pr(Insider|a^*)$ is the probability of the player becoming an insider given $a^*$ and $E_{\delta_i}\Delta(\delta_i|Insider, a^*)$ is the expectation of $\Delta(A_i)$ conditional on the player being an insider and $a^*$. The function $g(a^*)$ thus measures, by expectation, to what extent $a^*$ would increase public good contribution for a player. We first have the following lemma.

**Lemma 3** *$g(a^*) \leq 0$ if $a^* < \frac{1-B+n\bar{\delta}}{c}$, and $g(a^*) = 0$ if $a^* > \frac{1+B+n\bar{\delta}}{c}$.*

The proofs of Lemma 3 and the proposition below are relegated to the Appendix. Lemma 3 demonstrates that when $a^* \leq \frac{1-B+n\bar{\delta}}{c}$ (corresponding to cases (I.i), (I.ii) and (II.i) in Tables 1.I and 1.II), the ideal has a non-positive effect on the expected level of public good contribution, and when $a^* > \frac{1+B+n\bar{\delta}}{c}$ (corresponding to Cases (I.iv) and (II.iv) in Tables 1.I and 1.II), the ideal has a zero effect on the expected level of public good contribution. The intuitions are as follows. When the ideal is low, it backfires as it discourages (at least some) insiders from public good contribution. When $a^*$ is very high, it fails to attract any insiders, so it has no impact on public good contribution.

Lemma 3 implies that the social manager would choose an ideal that is reasonably high but not too high. Given this, the ideal level that maximizes public good contribution depends on the following tradeoff: A higher ideal encourages insiders to contribute more (i.e., increases the intensive margin) but attracts less insiders (i.e. decreases the extensive margin). We then have the following proposition.

**Proposition 1** *(i)* $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c}$ *maximizes* $g\left(a^*\right)$*; (ii) when* $n\overline{\delta} < B$, $g\left(\frac{1+B}{c}\right) = \frac{\theta\left(B-\frac{1}{2}n\overline{\delta}\right)}{c(c+\theta)}$*, and when* $n\overline{\delta} \geq B$, $g\left(\frac{1+n\overline{\delta}}{c}\right) = \frac{V}{n\overline{\delta}}$.

When $B \geq n\overline{\delta}$, $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c} = \frac{1+B}{c}$, which falls into the Case (II.ii) in Table 1.II, where it makes $\delta^-\left(a^*\right) = 0$. By Inequality (7), $\delta^-\left(a^*\right) = 0$ means that a player with $\delta_i = 0$ is indifferent between becoming an insider and remaining outside.[6] In this case, every player in the group chooses to be an insider. When $B < n\overline{\delta}$, $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c} = \frac{1+n\overline{\delta}}{c} = a_i^b\left(\overline{\delta}\right)\left(> \frac{1+B}{c}\right)$, which falls into Cases (I.iii) and (II.iii) in Tables 1.I and 1.II, where player $i$ chooses to be an insider if and only if $\delta_i \geq \delta^-\left(\frac{1+n\overline{\delta}}{c}\right) = \overline{\delta} - \frac{B}{n}$.

Therefore, Proposition 1 implies that when the group is sufficiently small ($n \leq \frac{B}{\overline{\delta}}$), the concern on the extensive margin dominates, and the ideal that maximizes expected public good contribution makes the least altruistic player indifferent between being an insider and an outsider, so that all players choose to be insiders, and the ideal increases expected contribution to the public good by $\frac{\theta\left(B-\frac{1}{2}n\overline{\delta}\right)}{c(c+\theta)}$ per player. When the group is large enough ($n > \frac{B}{\overline{\delta}}$), the concern on the intensive margin dominates, and the ideal that maximizes public good contribution equals the contribution of the most altruistic player in the absence of identity, to encourage contribution from insiders; with this ideal, only sufficiently altruistic players become insiders, and the ideal increases expected contribution to the public good by $\frac{V}{n\overline{\delta}}$ per player.

Note that $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c}$ brings a Pareto improvement to the case without identity. We have $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c} \geq \frac{A_i}{c} = a^b\left(\delta_i\right)$, for any $\delta_i$. Then by Lemma 1, this ideal increases the public good contribution of every insider compared to the baseline case without identity. Compared to the baseline case, outsiders are better off because they enjoy more benefits from the higher contributions of insiders, while they do not change their own contributions.

[6] We can verify this by observing that $u_i^o = \frac{1}{2c} = u_i^i$ when $\delta_i = 0$ and $a = \frac{1+B}{c}$.

Insiders are (at least weakly) better off from identifying with the ideal than being an outsider, since they could have stayed outside. Given the fact that outsiders are better off than in the baseline case, insiders are thus also better off compared to the baseline case. Overall, both insiders and outsiders are better off from $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c}$ than in the baseline case without identity.

Meanwhile, the ideal in Proposition 1 does not cause overprovision of the public good, from the purely economic (materialistic) point of view. Recall that when $a_i = \frac{N}{c}$, the social marginal (material) benefit of public good provision, $N$, equals the private marginal cost, $ca_i$. With the ideal $a^* = \frac{1+\max\left(n\overline{\delta},B\right)}{c}$, any insider's contribution to the public good is still lower than $\frac{N}{c}$, because by Equation (4),

$$
\begin{aligned}
a_i^i = \frac{A_i + \theta a^*}{c+\theta} &\le \frac{1 + n\overline{\delta} + \theta \frac{1+\max\left(n\overline{\delta},B\right)}{c}}{c+\theta} \\
&= \begin{cases} \frac{1+n\overline{\delta}+\theta\frac{1+n\overline{\delta}}{c}}{c+\theta} \text{ if } B \le n\overline{\delta} \\ \frac{1+n\overline{\delta}+\theta\frac{1+B}{c}}{c+\theta} \text{ if } B > n\overline{\delta} \end{cases} \\
&= \begin{cases} \frac{1+n\overline{\delta}}{c} \text{ if } B \le n\overline{\delta} \\ \frac{c\left(1+n\overline{\delta}\right)+\theta(1+B)}{c(c+\theta)} \text{ if } B > n\overline{\delta} \end{cases} \\
&\le \begin{cases} \frac{N}{c} \text{ if } B \le n\overline{\delta} \\ \frac{Nc+N\theta}{c(c+\theta)} = \frac{N}{c} \text{ if } B > n\overline{\delta} \end{cases},
\end{aligned}
$$

where in the last step we make use of $\overline{\delta} < 1$ and $B < n = N - 1$.

We have shown that the ideal level in Proposition 1 maximizes the expected contribution to public goods, leads to a Pareto improvement, and does not cause overprovision of public goods. Proposition 1 has important implications on how should the social manager set an ideal to enhance public good contribution. It is not the case that the higher the ideal is, the better it is. A higher ideal motivates an insider to contribute more to the public good (by Equation (4)), but discourages players from becoming an insider. Note that the ideal level in Proposition 1 is also lower than $\frac{N}{c}$ (the contribution level where the social marginal material benefit of public good provision equals the private marginal cost), because

$$\frac{N}{c} = \frac{1+n}{c} > \frac{1+\max\left(n\overline{\delta}, B\right)}{c},$$

by $\overline{\delta} < 1$ and Inequality (8). Proposition 1 implies that setting a very high ideal at $\frac{N}{c}$ would actually reduce the expected level of public good contribution. In other words, *ideals should not be too ideal.*

This result is in line with everyday observations. In well-functioning organizations, managers do not set unreal ideals. Instead, they may set an ideal that most (if not all) of the members find realistic enough and would like to accept, or may just take the best real-world exemplars as the ideal.[7] Proposition 1 fits these observations. Moreover, in the climate change application, our result implies that if the advocates of low carbon movements set up a very high target on "green living", many people would turn to be climate skeptists or even denialists.

The following remark presents some results of comparative statics.

**Remark 1** *(i) If* $n < \frac{B}{\overline{\delta}}$*, the ideal maximizing expected contribution to public goods,* $a^* = \frac{1+B}{c} = \frac{1+\left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}}{c}$*, is increasing in* $V$ *and decreasing in* $c$ *and* $\theta$*. (ii) If* $n \geq \frac{B}{\overline{\delta}}$*, the ideal maximizing expected public good contribution,* $a^* = \frac{1+n\overline{\delta}}{c}$*, is increasing in* $n$ *and* $\overline{\delta}$*, and decreasing in* $c$*; under this ideal, players with* $\delta_i \geq \overline{\delta} - \frac{B}{n}$ *become insiders, so the expected proportion of insiders is* $\frac{B}{n\overline{\delta}} = \frac{\left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}}{n\overline{\delta}}$*, which increases in* $V$*,* $c$*, and decreases in* $\theta$*,* $\overline{\delta}$ *and* $n$*.*

A higher marginal cost of contribution requires a lower ideal to counterbalance, so the ideal maximizing public good contribution is lower with a higher $c$; as a result, when the group size is so large that only sufficiently altruistic players become insiders, the expected proportion of insiders becomes larger with a higher $c$, since the ideal goes down. Parameters $V$ and $\theta$ represent the benefit (identity utility) and cost (identity concern) of accepting the

[7] In reality, many awards (including the prestigious Nobel Peace Prize) are given to people who are considered most altruistic, sacrifice themselves for the public welfare, or make selfless contribution to common goods. These people then become ideals.

ideal respectively. Therefore, the ideal maximizing contribution is increasing in $V$ and decreasing in $\theta$ when the group size is small, and the expected proportion of players accepting the ideal is increasing in $V$ and decreasing in $\theta$ when the group size is large. When the group size is large enough such that less altruistic players choose to be outsiders, an increase in the average level of altruism $(\frac{\overline{\delta}}{2})$ or the group size (representing the extent of positive externality from the public good) increases the ideal that maximizes contribution, which eventually causes a smaller expected proportion of insiders. Consequently, the expected increase of per player public good contribution from the ideal, compared to the baseline case, is lower with larger $n\overline{\delta}$, as implied by part (ii) of Proposition 1.

Finally, the following remark shows how identity changes the disparity in public good contribution among players.

**Remark 2** *(i) For any $a^*$ and any $\delta_j > \delta_i$, $a^b(\delta_j) - a^b(\delta_i) > a^i(\delta_j) - a^i(\delta_i)$. (ii) If $n \geq \frac{B}{\overline{\delta}}$, under the ideal in Proposition 1, for any $\delta_j > \delta^-(a^*) > \delta_i$, $a^b(\delta_j) - a^b(\delta_i) < a^i(\delta_j) - a^o(\delta_i)$.*

Part (i) of Remark 2 is straightforward from Equations (2) and (4). It suggests that identity reduces the gap in public good contribution for insiders. If $n \geq \frac{B}{\overline{\delta}}$, under the ideal that maximizes public good contribution $a^* = \frac{1+n\overline{\delta}}{c}$, players with $\delta_j \geq \delta^-(a^*)$ become insiders while players with $\delta_i < \delta^-(a^*)$ stay outside. In this case, Part (ii) of the remark suggests that identity increases the gap in public good contribution between insiders and outsiders. This is directly from the fact that every player identifying with the ideal increases her contribution, while outsiders choose the same level of contribution as that without identity. This result is also in line with the asymmetric effects of energy conservation "nudges" on different social categories, as reported by Costa and Kahn (2013). The "nudges" are useful only with insiders (political liberals/environmentalists) but not outsiders (political conservatives), as the latter group does not identify with the ideology embedded in the nudges; as a result, such "nudges" enlarge the gap in energy use between the two groups of people.

# 4 Conclusion

With free riding incentives, voluntary contribution to public goods typically falls short of efficiency. In this paper we study how identity can be used to influence voluntary public good contribution. There exists ideal behavior regarding contribution to public goods. Depending on whether to identify with this ideal, players become insiders or outsiders. Insiders obtain identity utility from being insiders, but incur utility loss if their contributions deviate from the ideal. Identity thus affects the public good contribution of insiders.

Although the society has a complicated process, through different mechanisms, in generating the ideal, social managers, politicians, teachers, and religious leaders may influence the ideal, through public policies, media, school, and church. We derive the ideal level that maximizes the expected level of public good contribution: it equals either the contribution level of the most altruistic player in the absence of identity, or the level that makes the least altruistic player indifferent between accepting the ideal and not, depending on which level is higher. We show that this ideal is a Pareto improvement; it increases the expected level of public good contribution to the largest extent but does not cause overcontribution. Therefore, the ideal level is optimal in view of resolving the free-riding problem in voluntary public good contributions. We also find that identity increases the gap in public good contribution between insiders and outsiders, but reduces the gap within insiders.

# A Appendix

**Derivation of Expression (7)**

$$
\begin{aligned}
& u_i^i \geq u_i^o \\
& \Leftrightarrow \frac{1}{2}\frac{A_i\left(A_i+2\theta a^*\right)-\theta c a^{*2}}{c+\theta}+V \geq \frac{1}{2}\frac{A_i^2}{c} \\
& \Leftrightarrow cA_i\left(A_i+2\theta a^*\right)-\theta c^2 a^{*2}+2Vc\left(c+\theta\right) \geq A_i^2\left(c+\theta\right) \\
& \Leftrightarrow 2Vc\left(c+\theta\right) \geq \theta A_i^2-2\theta a^* c A_i+\theta c^2 a^{*2} \\
& \Leftrightarrow \frac{2Vc\left(c+\theta\right)}{\theta} \geq \left(A_i-ca^*\right)^2 \\
& \Leftrightarrow -\left(\frac{2Vc\left(c+\theta\right)}{\theta}\right)^{1/2} \leq A_i-ca^* \leq \left(\frac{2Vc\left(c+\theta\right)}{\theta}\right)^{1/2} \\
& \Leftrightarrow -\left(\frac{2Vc\left(c+\theta\right)}{\theta}\right)^{1/2} \leq 1+\delta_i n-ca^* \leq \left(\frac{2Vc\left(c+\theta\right)}{\theta}\right)^{1/2} \\
& \Leftrightarrow \frac{-1+ca^*-\left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}}{n} \leq \delta_i \leq \frac{-1+ca^*+\left(\frac{2Vc(c+\theta)}{\theta}\right)^{1/2}}{n}.
\end{aligned}
$$

**Proof.** (Lemma 3) Again, we consider the two cases, (I) $n \geq \frac{2}{\overline{\delta}}B$, and (II) $n < \frac{2}{\overline{\delta}}B$, respectively, following Tables 1.I and 1.II in Subsection 2.1.2. Recall Equation (6) and the fact that $\delta_i$ follows a uniform distribution in $\left[0,\overline{\delta}\right]$.

Case (I): $n \geq \frac{2}{\bar{\delta}}B$. We have

$$g\left(a^*\right)^I = \begin{cases} E\left(\frac{\theta(ca^*-A_i)}{c(c+\theta)}|\delta_i \leq \frac{-1+ca^*+B}{n}\right) \times \frac{-1+ca^*+B}{n\bar{\delta}} \text{ if } a^* < \frac{1+B}{c} \\ E\left(\frac{\theta(ca^*-A_i)}{c(c+\theta)}|\delta_i \in \left[\frac{-1+ca^*-B}{n}, \frac{-1+ca^*+B}{n}\right]\right) \times \frac{2B}{n\bar{\delta}} \text{ if } \frac{1+B}{c} \leq a^* < \frac{1-B+n\bar{\delta}}{c} \\ E\left(\frac{\theta(ca^*-A_i)}{c(c+\theta)}|\delta_i \geq \frac{-1+ca^*-B}{n}\right) \times \left(1 - \frac{-1+ca^*-B}{n\bar{\delta}}\right) \text{ if } \frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B+n\bar{\delta}}{c} \\ 0 \text{ if } a^* > \frac{1+B+n\bar{\delta}}{c} \end{cases} \Rightarrow \tag{9}$$

$$\frac{c\left(c+\theta\right)g\left(a^*\right)^I}{\theta} = \begin{cases} \left[ca^* - \left(1 + \frac{-1+ca^*+B}{2}\right)\right] \times \frac{-1+ca^*+B}{n\bar{\delta}} \text{ if } a^* < \frac{1+B}{c} \\ \left[ca^* - \left(1 - 1 + ca^*\right)\right] \times \frac{2B}{n\bar{\delta}} \text{ if } \frac{1+B}{c} \leq a^* < \frac{1-B+n\bar{\delta}}{c} \\ \left[ca^* - \left(1 + \frac{-1+ca^*-B+n\bar{\delta}}{2}\right)\right]\left(1 - \frac{-1+ca^*-B}{n\bar{\delta}}\right) \text{ if } \frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B+n\bar{\delta}}{c} \\ 0 \text{ if } a^* > \frac{1+B+n\bar{\delta}}{c} \end{cases}$$

$$= \begin{cases} \frac{(ca^*-1-B)(ca^*-1+B)}{2n\bar{\delta}} \text{ if } a^* < \frac{1+B}{c} \\ 0 \text{ if } \frac{1+B}{c} \leq a^* < \frac{1-B+n\bar{\delta}}{c} \\ \frac{\left(ca^*-1+B-n\bar{\delta}\right)\left(-ca^*+1+B+n\bar{\delta}\right)}{2n\bar{\delta}} \text{ if } \frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B+n\bar{\delta}}{c} \\ 0 \text{ if } a^* > \frac{1+B+n\bar{\delta}}{c} \end{cases},$$

where the superscript $I$ denotes case (I).

When $a^* < \frac{1+B}{c}$, Equation (9) becomes

$$\begin{aligned} g\left(a^*\right)^I &= \frac{\theta}{c\left(c+\theta\right)}\frac{\left(ca^*-1-B\right)\left(ca^*-1+B\right)}{2n\bar{\delta}} \\ &= \frac{\theta}{c\left(c+\theta\right)}\frac{\left(ca^*-1\right)^2-B^2}{2n\bar{\delta}} \\ &< 0, \end{aligned} \tag{10}$$

where the inequality comes from $-B < -1 < ca^* - 1 < (1+B) - 1 = B$, by $B > 1$ and $a^* < \frac{1+B}{c}$.

When $\frac{1+B}{c} \leq a^* < \frac{1-B+n\bar{\delta}}{c}$ or $a^* > \frac{1+B+n\bar{\delta}}{c}$, $g\left(a^*\right)^I = 0$.

Case (II): $n < \frac{2}{\bar{\delta}}B$. We have

$$g\left(a^*\right)^{II} = \begin{cases} E\left(\frac{\theta(ca^*-A_i)}{c(c+\theta)}|\delta_i \leq \frac{-1+ca^*+B}{n}\right) \times \frac{-1+ca^*+B}{n\bar{\delta}} \text{ if } a^* < \frac{1-B+n\bar{\delta}}{c} \\ E\left(\frac{\theta(ca^*-A_i)}{c(c+\theta)}|\delta_i \in \left[0,\bar{\delta}\right]\right) \times 1 \text{ if } \frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B}{c} \\ E\left(\frac{\theta(ca^*-A_i)}{c(c+\theta)}|\delta_i \geq \frac{-1+ca^*-B}{n}\right) \times \left(1-\frac{-1+ca^*-B}{n\bar{\delta}}\right) \text{ if } \frac{1+B}{c} < a^* \leq \frac{1+B+n\bar{\delta}}{c} \\ 0 \text{ if } a^* > \frac{1+B+n\bar{\delta}}{c} \end{cases} \Rightarrow \tag{11}$$

$$\frac{c\left(c+\theta\right)g\left(a^*\right)^{II}}{\theta} = \begin{cases} \left[ca^* - \left(1+\frac{-1+ca^*+B}{2}\right)\right] \times \frac{-1+ca^*+B}{n\bar{\delta}} \text{ if } a^* < \frac{1-B+n\bar{\delta}}{c} \\ \left[ca^* - \left(1+\frac{n\bar{\delta}}{2}\right)\right] \times 1 \text{ if } \frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B}{c} \\ \left[ca^* - \left(1+\frac{-1+ca^*-B+n\bar{\delta}}{2}\right)\right]\left(1-\frac{-1+ca^*-B}{n\bar{\delta}}\right) \text{ if } \frac{1+B}{c} < a^* \leq \frac{1+B+n\bar{\delta}}{c} \\ 0 \text{ if } a^* > \frac{1+B+n\bar{\delta}}{c} \end{cases}$$

$$= \begin{cases} \frac{(ca^*-1-B)(ca^*-1+B)}{2n\bar{\delta}} \text{ if } a^* < \frac{1-B+n\bar{\delta}}{c} \\ ca^* - \left(1+\frac{n\bar{\delta}}{2}\right) \text{ if } \frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B}{c} \\ \frac{\left(ca^*-1+B-n\bar{\delta}\right)\left(-ca^*+1+B+n\bar{\delta}\right)}{2n\bar{\delta}} \text{ if } \frac{1+B}{c} < a^* \leq \frac{1+B+n\bar{\delta}}{c} \\ 0 \text{ if } a^* > \frac{1+B+n\bar{\delta}}{c} \end{cases},$$

where the superscript $II$ denotes case (II).

When $a^* < \frac{1-B+n\bar{\delta}}{c}$, Equation (11) becomes

$$g\left(a^*\right)^{II} = \frac{\theta}{c\left(c+\theta\right)}\frac{\left(ca^*-1\right)^2 - B^2}{2n\bar{\delta}}. \tag{12}$$

By $a^* < \frac{1-B+n\bar{\delta}}{c}$, we have

$$-B < -1 < ca^* - 1 < -B + n\bar{\delta} < -B + 2B = B,$$

where the third inequality is from $a^* < \frac{1-B+n\bar{\delta}}{c}$, and the last from $n < \frac{2}{\bar{\delta}}B$. Therefore, $g\left(a^*\right)^{II} < 0$ if $a^* < \frac{1-B+n\bar{\delta}}{c}$.

When $a^* > \frac{1+B+n\bar{\delta}}{c}$, then $g\left(a^*\right)^{II} = 0$.

Combining cases (I) and (II), we then have $g\left(a^*\right) \leq 0$ if $a^* < \frac{1-B+n\bar{\delta}}{c}$, and $g\left(a^*\right) = 0$ if $a^* > \frac{1+B+n\bar{\delta}}{c}$. ■

**Proof.** (Proposition 1) Again, we consider the two cases, (I) $n \geq \frac{2}{\bar{\delta}}B$, and (II) $n < \frac{2}{\bar{\delta}}B$.

Case (I): $n \geq \frac{2}{\bar{\delta}}B$. When $\frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B+n\bar{\delta}}{c}$, by Equation (9),

$$\begin{aligned} g\left(a^*\right)^I &= \frac{\theta}{c\left(c+\theta\right)} \frac{\left(ca^* - 1 + B - n\bar{\delta}\right)\left(-ca^* + 1 + B + n\bar{\delta}\right)}{2n\bar{\delta}} \\ &= \frac{\theta}{c\left(c+\theta\right)} \frac{B^2 - \left(ca^* - 1 - n\bar{\delta}\right)^2}{2n\bar{\delta}} \\ &\geq 0 \end{aligned} \tag{13}$$

where the inequality comes from $-B < ca^* - 1 - n\bar{\delta} \leq B$, as implied by $\frac{1-B+n\bar{\delta}}{c} < a^* \leq \frac{1+B+n\bar{\delta}}{c}$. Moreover, (13) is maximized at $a^* = \frac{1+n\bar{\delta}}{c} \in (\frac{1-B+n\bar{\delta}}{c}, \frac{1+B+n\bar{\delta}}{c}]$ and equals

$$\frac{\theta}{c\left(c+\theta\right)} \frac{B^2}{2n\bar{\delta}} > 0. \tag{14}$$

Taking into account the fact that when $a^* < \frac{1-B+n\bar{\delta}}{c}$ or $a^* > \frac{1+B+n\bar{\delta}}{c}$, $g\left(a^*\right) \leq 0$ as shown in Lemma 3, we have when $n \geq \frac{2}{\bar{\delta}}B$, $a^* = \frac{1+n\bar{\delta}}{c}$, which is greater than $\frac{1+B}{c}$, maximizes $g\left(a^*\right)$.

Case (II): $n < \frac{2}{\bar{\delta}}B$. When $\frac{1-B+n\bar{\delta}}{c} \leq a^* \leq \frac{1+B}{c}$, $g\left(a^*\right)^{II}$ in Equation (11) is maximized and equals

$$\frac{\theta}{c\left(c+\theta\right)} \left(B - \frac{n\bar{\delta}}{2}\right) > 0 \tag{15}$$

at $a^* = \frac{1+B}{c}$, where the inequality is from $n < \frac{2}{\bar{\delta}}B$.

When $\frac{1+B}{c} < a^* \leq \frac{1+B+n\bar{\delta}}{c}$, Equation (11) becomes

$$g\left(a^*\right)^{II} = \frac{\theta}{c\left(c+\theta\right)} \frac{B^2 - \left(1 + n\bar{\delta} - ca^*\right)^2}{2n\bar{\delta}}. \tag{16}$$

If $n > \frac{B}{\bar{\delta}}$, $a^* = \frac{1+n\bar{\delta}}{c}$ lies in $(\frac{1+B}{c}, \frac{1+B+n\bar{\delta}}{c}]$ and maximizes (16), where $g\left(a^*\right)^{II}$ equals

$$\frac{\theta}{c\left(c+\theta\right)} \frac{B^2}{2n\bar{\delta}} > 0. \tag{17}$$

Because

$$\begin{aligned}&\frac{B^2}{2n\overline{\delta}}-\left(B-\frac{n\overline{\delta}}{2}\right)\\&=\frac{B^2-2n\overline{\delta}B+\left(n\overline{\delta}\right)^2}{2n\overline{\delta}}\\&=\frac{\left(B-n\overline{\delta}\right)^2}{2n\overline{\delta}}\\&>0,\end{aligned}$$

we have (17)>(15). Moreover, $\frac{1+n\overline{\delta}}{c}>\frac{1+B}{c}$ when $n>\frac{B}{\overline{\delta}}$.

If $n\leq\frac{B}{\overline{\delta}}$, $\frac{1+n\overline{\delta}}{c}$ is not feasible in $(\frac{1+B}{c},\frac{1+B+n\overline{\delta}}{c}]$; Equation (16) is continuous in $a^*$ and approaches its maximal, which is positive, when $a^*$ approaches the lower threshold $\frac{1+B}{c}$, which is exactly the optimal $a^*$ when $\frac{1-B+n\overline{\delta}}{c}\leq a^*\leq\frac{1+B}{c}$. Here, $\frac{1+B}{c}\geq\frac{1+n\overline{\delta}}{c}$.

Putting the above analyses on Case (II) together, when $n<\frac{2}{\overline{\delta}}B$ and $\frac{1-B+n\overline{\delta}}{c}\leq a^*\leq\frac{1+B+n\overline{\delta}}{c}$ (i.e.$\frac{1-B+n\overline{\delta}}{c}\leq a^*\leq\frac{1+B}{c}$ or $\frac{1+B}{c}<a^*\leq\frac{1+B+n\overline{\delta}}{c}$), $a^*=\frac{1+\max\left(n\overline{\delta},B\right)}{c}$ maximizes $g\left(a^*\right)^{II}$. Again, given that $g\left(a^*\right)\leq0$ when $a^*<\frac{1-B+n\overline{\delta}}{c}$ or $a^*>\frac{1+B+n\overline{\delta}}{c}$ as shown in Lemma 3, we have when $n<\frac{2}{\overline{\delta}}B$, $a^*=\frac{1+\max\left(n\overline{\delta},B\right)}{c}$ maximizes $g\left(a^*\right)$.

Overall, the above analyses on Cases (I) and (II) show that $a^*=\frac{1+\max\left(n\overline{\delta},B\right)}{c}$ maximizes $g\left(a^*\right)$.

(ii) Following the above analyses, when $n<\frac{B}{\overline{\delta}}$,

$$g\left(\frac{1+B}{c}\right)=\frac{\theta\left(B-\frac{1}{2}n\overline{\delta}\right)}{c\left(c+\theta\right)},$$

by (15); when $n\geq\frac{B}{\overline{\delta}}$,

$$g\left(\frac{1+n\overline{\delta}}{c}\right)=\frac{\theta}{c\left(c+\theta\right)}\frac{B^2}{2n\overline{\delta}}=\frac{V}{n\overline{\delta}},$$

by (14). ■

# References


[1] Akerlof, G. and R. Kranton, 2000, "Economics and identity," *Quarterly Journal of Economics*, CXV(3), 715-751.

[2] Akerlof, G. and R. Kranton, 2002, "Identity and schooling: Some lessons from the Economics of Education," *Journal of Economic Literature*, 40(4), 1167-1201.

[3] Akerlof, G. and R. Kranton, 2005, "Identity and the economics of organizations," *Journal of Economic Perspectives*, 19(1), 9-32.

[4] Akerlof, G. and R. Kranton, 2008, "Identity, supervision, and work groups," *American Economic Review Papers and Proceedings*, 98(2), 212-217.

[5] Akerlof, G. and R. Kranton, 2010, *Identity economics: How our identities shape our work, wages and well-being*, Princeton University Press.

[6] Andreoni, J., 1990, "Impure altruism and donations to public goods: a theory of warm-glow giving, *Economic Journal*, 100, 464–477.

[7] Bénabou, R. and J. Tirole, 2011, "Identity, dignity and taboos: Beliefs as assets," *Quarterly Journal of Economics*, 126, 805-855.

[8] Benjamin, D., J. Choi, and G. Fisher, 2010, "Religious identity and economic behavior," NBER Working Paper 15925.

[9] Bisin, A., E. Patacchini, T. Verdier, and Y. Zenou, 2011, "Formation and persistence of oppositional identities," *European Economic Review*, 55, 1046-1071.

[10] Burlando, R. and J. Hey, 1997, "Do Anglo-Saxons free-ride more?" *Journal of Public Economics*, 64(1), 41-60.

[11] Brekke, K., S. Kverndokk and K. Nyborg, 2003, "An economic model of moral motivation," *Journal of Public Economics*, 87, 1967-1983.

[12] Costa, D. and M. Kahn, 2010, "Why has California's residential electricity consumption been so flat since the 1980s? A microeconometric approach," NBER Working Paper 15978.

[13] Costa, D. and M. Kahn, 2013, "Energy conservation 'nudges' and environmentalist ideology: Evidence from a randomized residential electricity field experiment," *Journal of the European Economic Association*, 11(3), 680-702.

[14] Costa-i-Font, J. and F. Cowell, 2013, "Social identity and redistributive preferences: A survey," CESifo Working Paper, No. 4440.

[15] Croson, R., M. Marks, and J. Snyder, 2003, "Groups work for women: Gender and group identity in the provision of public goods," *The Negotiation Journal*, 24 (4), 411-427.

[16] Goldstein, N., R. Cialdini and V. Griskevicius, 2008, "A room with a viewpoint: Using social norms to motivate environmental conservation in hotels," *Journal of Consumer Research*, 18(5), 429-434.

[17] Hiller, V. and T. Verdier, 2014, "Corporate culture and identity investment in an industry equilibrium," *Journal of Economic Behavior & Organization*, forthcoming.

[18] Hammond, P., 1987, "Altruism," In J. Eatwell, M. Milgate, and P. Newman, (Eds.), *The New Palgrave: A Dictionary of Economics*, 85–87. London: Macmillan Press Ltd.

[19] Holländer, H., 1990, "A social exchange approach to voluntary cooperation," *American Economic Review*, 80(5), 1157-1167.

[20] Kahn, M., 2007, "Do greens drive hummers or hybrids? Environmental ideology as a determinant of consumer choice," *Journal of Environmental Economics and Management*, 54(2), 129-145.

[21] Kotchen, M. and M. Moore, 2008, "Conservation: From voluntary restraint to a voluntary pice premium," *Environmental & Resource Economics*, 40(2): 195-215.

[22] Monin, B., P. Sawyer, and M. Marquez, 2008, "The rejection of moral rebels: Resenting those who do the right thing," *Journal of Personality and Social Psychology*, 95(1), 76-93.

[23] Rege, M., 2004, "Social norms and private provision of public goods," *Journal of Public Economic Theory*, 6(1), 65-77.

[24] Schultz, P., J. Nolan, R. Cialdini, N. Goldstein, and V. Griskevicius, 2007, "The constructive, destructive, and reconstructive power of social norms," *Psychological Science*, 18, 429 –34.

[25] Shayo, M., 2009, "A model of social identity with an application to political economy: Nation, class, and redistribution," *American Political Science Review*, 103, 147-174.

[26] Solow, J. and N. Kirkwood, 2002, "Group identity and gender in public goods experiments," *Journal of Economic Behavior & Organization*, 48, 403-412.

[27] Thaler, R. and C. Sunstein, 2008, *Nudge: Improving Decisions about Health, Wealth and Happiness*, Yale University Press.