

Social approval, competition and cooperation

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Received: 11 April 2015 / Revised: 12 May 2016 / Accepted: 27 May 2016 /
Published online: 12 July 2016
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Abstract Non-monetary rewards are frequently used to promote pro-social behaviors, and these behaviors often result in approval from one's peers. Nevertheless, we know little about how peer-approval, and particularly competition for peer-approval, influences people's decisions to cooperate. This paper provides experimental evidence suggesting that people in peer-approval competitions value social approval more when it leads to unique and durable rewards. Our evidence suggests that such rewards act as a signaling mechanism, thereby contributing to the value of approval. We show that this signaling mechanism generates cooperation at least as effectively as cash rewards. Our findings point to the potential value of developing new mechanisms that rely on small non-monetary rewards to promote generosity in groups.

Keywords Peer approval · Competition · Cooperation

JEL Classification D02 · D03 · D64 · H4

1 Introduction

In social dilemma environments, extrinsic peer monetary rewards (or sanctions) are frequently used to promote cooperation. Individuals can reward or punish their peers by incurring costs to increase or decrease the earnings of their fellow group

Electronic supplementary material The online version of this article (doi:[10.1007/s10683-016-9485-0](https://doi.org/10.1007/s10683-016-9485-0)) contains supplementary material, which is available to authorized users.

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members. Typical results suggest that such monetary peer sanctions effectively mitigate free-riding behavior (Fehr and Gächter 2000). At the same time, they may also adversely impact economic efficiency and lead to spirals of revenge (Denant-Boemont et al. 2007; Dreber et al. 2008). While peer reward can help to avoid such concerns, it is typically less effective than sanctions at promoting cooperation (Andreoni et al. 2003; Sefton et al. 2007).

As a result, recent attention has focused on non-monetary incentives. For example, Dugar (2013) showed that while non-monetary peer approval promotes contribution, it is not sustainable. Some studies have also combined monetary and non-monetary rewards. In this vein, Eriksson and Villeval (2012) studied the manner in which costly symbolic rewards influence effort.¹

Our study advances this literature by investigating the impact of symbolic non-monetary rewards in a social dilemma environment where rewards are earned by winning a peer approval competition.² In particular, rewards are provided based on whether one has earned the most approval from his peers. This differs from the literature on competitive rewards, as those rewards are often earned based on directly observable outcomes, like individual performance, rather than peer approval. For example, Charness et al. (2010) awarded status³ (through rank) to subjects based on their performance (in a real effort task); Kosfeld and Neckemann (2011) awarded congratulatory cards based on performance; and Fuster and Meier (2010) awarded cash based on contribution in public goods games.

While performance (either effort or contribution) is easily observable in some environments, it can be costly to observe in others. Take, for instance, the example of a cashier. The cashier's nearby colleagues are in a much better position to easily observe the cashier's productivity than is his/her manager. Assembly workers are another example. Their efforts may not be evident in the final product of their labors, but their close colleagues are likely in a good position to observe their work. As these examples illustrate, the peer approval mechanism may be particularly useful in environments where cooperation is needed, but each individual's contribution is difficult to monitor.

In light of the foregoing, there exists a need for peer approval mechanisms. Despite the proven effectiveness of such mechanism, the empirical literature has not yet investigated how non-monetary rewards based on peer approval might influence contributions in public goods games. In contrast, economic theory on this topic

¹ Ellingsen and Johannesson (2007) documented work that relates to how non-monetary incentives (e.g., respect) influence worker productivity.

² Pan and Houser (2011) report three of the seven treatments reported in this paper (new to this paper are the “*Star*”, “*Competition-only*,” “*Cash*” and “*Control*” treatments). The earlier paper connects the patterns in our data to theories in evolutionary psychology, with an emphasis on gender effects. The present paper pursues a very different approach, analyzing and interpreting aggregate data patterns through the lens of economic theory. Loosely speaking, the first paper is interested in identifying specifically who did and who did not respond to specific treatment contexts. It then develops an explanation for why. The present paper, in contrast, attempts to explain aggregate behavior using economic theory that might generalize across contexts in a way that informs the design of institutions to promote pro-sociality.

³ Status in other studies has also been randomly assigned (Kumru and Vesterlund 2008; Visser and Roelofs 2011).

emerged long ago. In particular, Holländer (1990) provided an early and influential model of voluntary contributions in response to peer-to-peer approval. The model assumes that one's preference is based on utility from private goods, public goods and social (peer) approval. The theory formalizes the idea that the extent to which one values peer approval can impact one's cooperative actions in social dilemma environments. Consequently, for the purpose of institution design, it is crucial to know which environmental features might encourage people to highly value peer approval.

To study this question, we designed a ten-period public goods game in which each period consisted of two-stages. The first stage was a regular public goods game in which players simultaneously made contribution decisions to the public good. In the second stage, each player had an opportunity, after observing his⁴ group members' contributions, to assign costless non-monetary approval points to each of his fellow group members, but not to himself. As suggested by the name, the non-monetary approval points provided no monetary benefits to those who received them.

Our experiment included five treatments with competition (*Competition-only*, *Star*, *Cash*, *Mug*, *Ice-Cream*) and two treatments without competition. Of these latter two, we denote one the *No-competition* treatment because it lacks competition for approval. The other is a *Control* treatment that is identical to a standard public goods game. Details of these treatments are provided below.

In brief, we created a competitive environment by ensuring that, in all competition treatments, subjects learned the total approval they received from other group members in each period. However, we varied the consequences of this information. For instance, in the *Competition-only* treatment, we simply informed the participants as to who won the most approval points in their group in a given period. We did the same thing in the *Star* treatment; however, we also awarded an electronic gold star to the top earner of approval points in each group for each period.⁵ (It was common knowledge that, in case of ties for highest approval, all who tied were awarded a gold star.)

The *Ice-cream*, *Mug* and *Cash* treatments were identical to *Star*, except that each gold star earned increased the probability of receiving a final reward by ten percentage points. In the *Mug* treatment, we created a unique and durable reward of small monetary value: a mug emblazoned with the organization's logo. The mug could only be obtained by participating in our experiment. In the *Ice-cream* treatment, we used a non-unique and non-durable reward with the same monetary value: a Haagen-Dazs ice cream bar (see Fig. 5 in Appendix 1). In the *Cash* treatment, we used a *non-unique* but *durable* cash reward about 50 % higher in value than the average of the mug and ice cream rewards.

Our *No-competition* treatment did not include competition for peer approval or reward. In particular, participants assigned approval to others and received approval from others, but were informed only of the number of approval points they

⁴ For simplicity, we refer to a participant as "he".

⁵ For example, a player who receives the most approval points for three periods will see three gold stars displayed on their screen at the end of that period.

themselves received. Finally, our *Control* treatment is the same as a traditional public goods game, absent approval or competition.

We ran these treatments for the following reasons. First, studies have shown that “signaling motives” may directly influence pro-social behaviors (see e.g., Harbaugh 1998; Bénabou and Tirole 2006; Ariely et al. 2009).⁶ Previous studies have shown that unique and durable rewards are good signaling mechanisms (Pan and Houser 2011 and cites therein; Kosfeld and Neckermann 2011). We chose rewards that vary in three key dimensions: uniqueness, durability, and monetary value. The mug reward was unique, durable and of small monetary value; the ice cream reward was non-unique, non-durable, and of a similarly small monetary value; and the cash reward, while durable and of a higher monetary value, lacked uniqueness. The *Star* reward, which was unique and present in all three treatments with final rewards, thus served to evaluate how effective the other rewards (cash, mug or ice cream) were at promoting cooperation. The *Competition-only* treatment served as a baseline for these other treatments with competitive rewards. As we detail below, comparing our treatments allowed us to learn about the types of environments in which approval from peers is most likely to be valued and thus increase contributions in equilibrium.

Our key finding is that competition for social approval is most effective at promoting cooperation when winners receive non-cash rewards that are both unique and durable (mug). We find that such rewards are as effective as a cash reward with 36 % higher monetary value, and are more effective in triggering high contributions than the cash reward. On the other hand, a non-cash reward with the same monetary value that is neither unique nor durable (ice cream) cannot promote cooperation. We also find that providing social comparison information alone (*Competition-only*) detrimentally impacts cooperation in comparison to the *No-competition* treatment. This detrimental impact is not reversed when competition for social approval leads to symbolic rewards (*star*) or a generic and non-durable reward with monetary value (ice cream). Finally, we find that cooperation in *Competition-only* is insignificantly different from what occurs in the standard public goods game.

Our experiment also informs the way peers dispense approval. Holländer (1990) denotes the ratio of contributions to approval received as the “approval rate,” and shows in theory that when one values peer approval more, each unit of approval triggers greater contributions. Our data are consistent with this prediction as they reveal a clear inverse relationship between these variables in our treatments that include competition.⁷

Our study provides important policy insights on how to promote pro-social behaviors. In particular, it might hold significant value for organizations with profit-

⁶ Also referred to as “image motives,” the idea is that an individual’s behavior can be directed by a desire to create a good impression in the eyes of others. Signaling motives have been invoked to explain a number of pro-social behaviors, including why charities advertise their donors’ names (Harbaugh 1998), why football teams place highly visible emblems on the helmets of high performers (Wired 2011), and why top employees are rewarded with prizes, e.g., gold cups for employees of the month.

⁷ Note that Holländer’s model cannot make predictions regarding the relationship between contributions and the approval rate in either the *No-competition* or *Control* treatments, because the environments are different.

sharing schemes, where employees have strong incentives to evaluate each other's efforts (e.g., Avis Corporation; *see also*, Kandel and Lazear 1992; Mas and Moretti 2009). Our results also suggest that competition under peer evaluation should be adopted with caution. In particular, the nature of rewards may interact with the peer approval to jointly influence the level of contributions.

The remainder of this paper is structured as follows: Sect. 2 presents the literature review. Section 3 describes our theory. Section 4 details the experiment design and our hypotheses. Section 5 reports our results. Finally, Sect. 6 concludes and discusses implications.

2 Literature review

2.1 Non-monetary rewards in competitive environments that do not include peer evaluation

Previous studies have investigated non-monetary rewards in environments that do not include peer approval (Ellingsen and Johannesson 2007, 2011; Ariely et al. 2009; Andreoni and Bernheim 2009; Charness et al. 2010; Lacetera and Macis 2010; Kosfeld and Neckermann 2011). Most of these studies consider environments where individuals' efforts can be separately identified. For instance, Ariely et al. (2009) showed that increasing visibility increases the level of giving towards charities with positive image. Kosfeld and Neckermann (2011) studied the impact of status and social recognition on worker performance in a field experiment. They found that students who were offered a congratulatory card honoring the best performance showed a 12 % increase in their performance over their counterparts.⁸ Charness et al. (2010) found that people increased their effort when provided with the information on their rank (status), even going so far as to sabotage others' outputs to artificially increase their own relative rank.⁹ Lacetera and Macis (2010) studied the role of public image on blood donation. They rewarded donors with "medals" when they reached certain donation quotas, finding that this mechanism was only effective when the prizes were publicly announced in the local newspaper and awarded in a public ceremony. Our study differs from the aforementioned studies in that centralized monitoring is difficult, but effort is easily observable to peers.

Theoretical studies have also investigated the role of non-monetary incentives on pro-social behaviors. Ellingsen and Johannesson (2007) documented the role of respect on workers' efforts. Ellingsen and Johannesson (2011) developed a model that helped to explain the prevalence of volunteering through signalling motives, in the sense that people want to appear generous in the eyes of other generous people.

⁸ The effect of non-monetary rewards has also been studied by others (Neckermann et al. 2014; Dugar 2010). Dugar studied non-monetary rewards with social approval. Using panel data, Neckermann Cueni and Frey studied the effect of an award on subsequent worker performance in the field (a call center).

⁹ Kumru and Vesterlund (2008) found the important role of status on voluntary contribution. Low status followers are likely to mimic contributions by high-status leaders; in turn, this encourages high-status leaders to contribute.

Also, Andreoni and Bernheim (2009) developed a theoretical model on audience effects under the assumption that people prefer to be perceived as fair.

2.2 Social comparison and competition without rewards or peer approval

The literature has investigated the effect of social comparison and competition without rewards or peer approval on effort provision. Andreoni and Petrie (2004) showed that identifying givers and the amount they contributed significantly increased giving in public goods games. Chen et al. (2010) found that social comparison information about others' behaviours promoted individual contributions to an online community. Duffy and Kornienko (2010) found that individuals' giving decisions were responsive to how they were ranked: participants increased giving when placed in a generosity tournament, but decreased their giving when placed in an earnings tournament. Andreoni (1995) found that providing players with information about how their earnings ranked tended to reduce cooperation in public goods games. While our study also provides social comparison information, we differ from these studies in that our social comparison is based on peer evaluation rather than being a direct function of the contribution amount.

2.3 Peer-evaluation absent competition

Many studies consider environments that include a peer evaluation system, and particularly the role of peer punishment in deterring free-riding (Fehr and Gächter 2000; Masclet et al. 2003; Noussair and Tucker 2005). At the same time, studies have also shown that peer punishment can adversely impact economic efficiency (Bochet et al. 2006; Sefton et al. 2007; Denant-Boemont et al. 2007). Antisocial punishment towards contributors has also been observed across many societies. It may be socially beneficial if complemented by strong social norms of cooperation (Herrmann et al. 2008). Punishment can also have detrimental effects when interacting with other incentives (Fuster and Meier 2010). For this reason, studies have also investigated peer reward systems.

Some studies of peer-based reward have found it useful in mitigating free-riding behavior (Rand et al. 2009), while other studies have found it less effective (Andreoni et al. 2003; Sefton et al. 2007; Stoop et al. 2011). Yet Stoop et al. (2011) found that even if peer reward is socially efficient (when the reward is worth more to the recipient than to the sender), such profitable bilateral exchanges rarely take place among the group members. Despite their focus on peer evaluation mechanisms, to our knowledge, the existing literature has not investigated how competition for peer approval affects cooperation.

3 Theory

Previous theories provide some insight into how to model the role of incentives on provision of pro-social behavior. Some of these theories studied the signaling motives (also as public image motives) on provision of pro-social behaviors

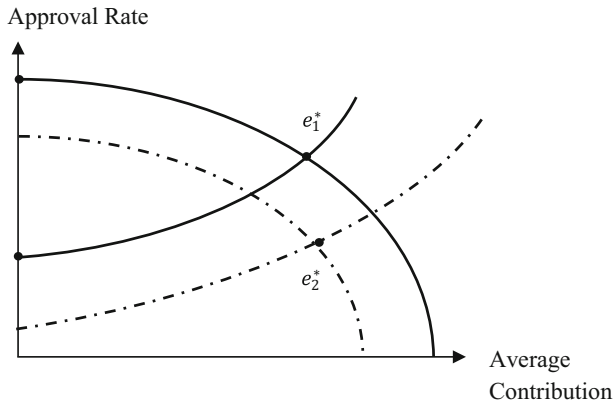


Fig. 1 The approval per unit contributed to the public good is represented on the *vertical axis* (price of contributions). The quantity contributed is shown on the *horizontal axis*. The *upward sloping curve* represents the supply of contribution and the *downward sloping curve* is the demand for contributions. The *dashed lines* represent the shifts of the supply or demand curve after a change in the competitive environment (e.g., due to a change in value of final rewards). For additional discussion and detail see Appendix 2

(Andreoni and Bernheim 2009; Bénabou and Tirole 2006). Some theories focused on the use of peer punishment on provision of pro-social behaviors (Kandel and Lazear 1992). Ours is based on Holländer (1990), which is the only theoretical study that considered the impact of social approval on contribution in public goods games.

Holländer (1990) assumes all agents derive utility from the private good, the public good, and approval from peers. Holländer’s model provides an equilibrium answer to the questions: how much will people contribute, and how much approval will people award for each unit contributed? Details of Holländer’s (1990) theory will be illustrated in Appendix 2. Here we summarize its key implications using Fig. 1 below (which is based on Fig. 1 in Holländer 1990). The vertical axis measures the approval rate, that is, the amount of approval assigned (or received) per unit of contribution to the public good. This is the “price” of a contribution. The horizontal axis measures the level of average contribution to the public good. A participant acts as both a seller and a buyer. In particular, one pays approval points to “buy” others’ contributions and one also “sells” his own contribution to earn approval points.¹⁰

The downward-sloped curve, which derives from Holländer’s theory, is akin to a demand curve. Specifically, it is the *VW curve* in Holländer (see also Fig. 6 in the Appendix),¹¹ which we will refer to as the “demand curve” from this point forward. In particular, the lower the “price” (the approval one needs to assign per unit of contribution), the higher the demand for contributions. Meanwhile, the upward sloping curve can be regarded as a supply curve for contributions. This curve is

¹⁰ Note Holländer does not refer to these curves as Supply and Demand. We do so because they share features of supply and demand curves relevant for our purposes. Appendix 2 details the formation of these curves.

¹¹ See Eq. (8) in Appendix 2.

referred to as the $g\bar{g}$ curve in Holländer's model,¹² and we will refer to it as the "supply curve" from this point forward. That is, the higher the approval points one may receive for each unit of contribution, the more one will contribute to the public good. The intersection is the equilibrium approval rate (price) and the equilibrium contribution amount (quantity). Again, details are discussed in Appendix 2.

Competition for approval shifts both the supply and demand curves. In particular, the higher the level of competition, the more one values receiving approval. Holding the approval rate (price) constant, the more one is willing to supply contributions (a rightward and downward shift in the supply curve). With respect to demand, the higher the level of competition, the more one values having more approval than others, and the lower the amount of approval points one is willing to pay to others for their contributions, representing a downward shift in the demand curve. Consequently, an unambiguous prediction of Holländer's model is that increased competition for approval leads to a lower approval rate (price). In contrast, the effect of competition on contributions cannot be determined from the model, as it depends on the way in which the supply and demand curves shift as a result of changes in the competitive environment.

4 Experiment design and hypotheses

To test the impact of non-monetary reward based on peer approval in a public goods game, we designed a peer approval system that could lead to different types of rewards, thereby creating different levels of competition. The key feature of our design is that a reward is earned based on the approval a participant receives from his group members. Additionally, we record rewards a participant has received over time. That is, a participant is notified as to how many times, over a maximum of ten periods, that he received the most approval. In treatments with final rewards, the more often a participant receives the most approval, the more likely he is to win a final reward with material value.

4.1 Experiment design

We ran seven treatments. Five treatments included competition for approval: *Competition-only*, *Star*, *Mug*, *Ice-cream* and *Cash*. The other two treatments were: *No-Competition*, which included approval but not competition for approval; and *Control*, which was identical to a traditional public goods game, and thus included neither competition nor approval.

All treatments included ten periods. In every treatment but *Control*, each period included both a contribution stage, which occurred first, and an approval assignment stage, which occurred last. *Control* included only a contribution stage. The details are shown below.

¹² See Eq. (6) in Appendix 2.

4.1.1 Contribution stage

In all treatments, participants played ten periods of a public good game in fixed groups of four. In each period, each group member $i \in \{1, 2, 3, 4\}$ received an endowment of 20 Experimental Dollars (henceforth, E\$) and could contribute any integer amount between 0 and 20 to a public good (referred to as a “group project”; for details see instruction in Supplementary material). All group members decided simultaneously on their g_i in each period. The monetary payoff of each individual i from the group project in each period is given by

$$\pi_i^t = (20 - g_i) + m \sum_{j=1}^4 g_j$$

where m is the marginal per capita return from each 1E\$ contribution to the public good. Following the previous literature (Fehr and Gächter 2000; Masclet et al. 2003), m was set to equal to 0.4. For each participant, the opportunity cost of contributing 1E\$ to the public good was 0.6 E\$, while the total benefit to his three fellow group members was 1.2 E\$ (0.4 E\$ for each other group member). Therefore, it was always in a participant’s material self-interest to invest 0 E\$ to the public good, regardless of the contributions of the participant’s group members. At the same time, the group’s payoff was maximized if all group members contributed their full endowment.

4.1.2 Approval assignment stage

As noted above, the approval assignment stage was absent in the *Control* treatment, but present in all other treatments. In this stage, participants were informed of their group members’ contribution amounts in that period. They could then assign approval points to their group members to express how much they approved of their group members’ contribution decisions (at no cost to themselves). The ratings could hold any integer value from 0 to 10, with 0 indicating the least approval and 10 indicating the greatest. All approval decisions were made simultaneously, and subjects were not able to assign approval to themselves. Sending approval was not costly and had no impact on the final earnings of the receiver.

4.1.3 Overall feedback

4.1.3.1 Control and No-competition treatments At the end of each period, participants received feedback information about: (i) their contribution decision for this period; (ii) their earnings for this period; and (iii) their aggregate earnings up to this period. In the *Control* treatment that is all that occurred. In *No-competition* treatment, in addition to this feedback, they also learned the total approval points received from their group members. While subjects were informed of the cumulative total of approval points they received from the other three group members, they knew nothing about the approval points received from any specific

member. This ruled out any targeted reciprocal or spiteful approval assignment towards a particular group member.

4.1.3.2 Competition-only treatment The *Competition-only* treatment differed from the overall feedback information above in that participants were further informed whether or not they had earned the highest approval ratings from their group members. In particular, in addition to feedback they received in *No-Competition*, they were also informed of: (i) the number of times (periods) they had earned the highest approval including the most recent period; (ii) the experiment ID (not the real name) of the player who received the most approval in the current period; and (iii) the contribution of the player who received the highest approval in the current period.¹³

4.1.3.3 Star treatment The *Star* treatment was identical to the *Competition-only* treatment except that in *Star*, participants who earned the most approval in a particular period earned a gold star. The gold stars were then displayed on their screen, with the number of stars equaling the number of times they earned the most approval. In case of a tie, all of the most highly-approved subjects had an additional gold star displayed on top of their screen. It is important to emphasize, however, that the gold stars in the *Star* treatment did not lead to any final material reward for the star winners.

4.1.3.4 Ice-cream, Mug and Cash treatments We made the symbolic rewards more salient in the *Cash*, *Mug* and *Ice-cream* treatments by adding in a final reward. In these treatments, each gold star received increased the probability of receiving a final reward by ten percentage points. Thus, a person with zero gold stars at the end of the game could not win the award, while a person with ten gold stars won the award with certainty.

The rewards were as follows: in the *Ice-cream* treatment, a Häggen–Dazs ice cream bar,¹⁴ in the *Mug* treatment, a mug, uniquely designed mug for the experiment and emblazoned with the organization's logo; and for the *Cash* treatment, a three-dollar cash reward (see Fig. 5 in Appendix 1). A willingness-to-pay elicitation indicated that the mug and the ice cream bar do not have statistically different value outside of a competitive environment.¹⁵ The cash reward in the *Cash* treatment was of 50 % higher monetary value than the rewards in *Mug* and *Ice-cream*.

In these treatments, participants had an added incentive to contribute, but our willingness-to-pay elicitation suggests that these incentives were small and

¹³ If more than one player in a group earned the most approval, we display the highest contribution among these winners.

¹⁴ All sessions were run in summer, with temperatures approaching eighty degrees Fahrenheit.

¹⁵ We invited another 30 students to participate in the Willingness-to-pay (WTP) elicitation game based on the Becker–DeGroot–Marschak (1964) random auction mechanism. We elicited values for the mug as well as the Haagen–Dazs ice cream bar (see Fig. 5 in Appendix 1). We found participants to have statistically insignificantly different WTP for the mug and the ice cream (mug vs. ice cream: \$2.20 vs. \$1.70, $n = 30$, $p = 0.81$).

statistically insignificantly different between treatments with a final reward. Thus, the Nash equilibrium strategy would still be to contribute nothing to the public good. Nevertheless, if subjects place sufficient value on the rewards, it becomes evident that positive contributions could be consistent with the Nash equilibrium in reward treatments. Yet, any such pecuniary effects would be identical between the mug and ice cream treatments, and therefore could not explain between-treatment differences.¹⁶

4.1.3.5 Procedures A total of 344 students from George Mason University participated in our sessions, all of which were conducted at the Interdisciplinary Center for Economic Science. The experiment used the software z-Tree (Fischbacher 2007).

Upon entering the laboratory, each subject was seated in a carrel separated from other subjects in a way that ensured anonymity. All interactions in the experiment took place anonymously. Participants then received written instructions. After the experimenter read the instructions aloud, participants were quizzed to ensure they understood the procedures and the payoff structure. The experiment did not proceed until each subject had completed the quiz successfully.

At the end of the experiment, participants who earned stars in the *Mug*, *Ice-cream* or *Cash* treatments had the opportunity to draw once from a deck of ten cards, numbered 1 through 10. Subjects would receive the reward if the number they drew was equal to or smaller than the number of stars they earned during the experiment. The experimenter distributed the reward, along with the cash payment, to each subject privately. The experiments lasted 45–50 min, and on average subjects earned \$16.00 per session.

4.2 Hypotheses

Holländer's model suggests that increased competition triggers one to be more stringent in assigning approval points to others, but to be more responsive to approval received. With increasing competition, the equilibrium prediction is unambiguously lower approval rates. With respect to contribution levels, if the rightward/downward shift in supply overwhelms the leftward shift in demand, then the equilibrium prediction is increased contributions combined with decreased approval rates. If the reverse is true, then decreased contributions and approval rates could be observed. Below we detail, in Hypotheses 1 and 2, the ordering of level of contribution by treatment according to whether competition has a negative or positive effect on contributions.

The rewards in our experiment vary in three dimensions: uniqueness, durability and monetary value. All three characteristics are desirable features of a reward (for discussion see, e.g., Pan and Houser 2011). *Mug* is the only reward that includes all three features. Consequently, we expect the mug reward to trigger the highest level

¹⁶ We chose a cash value equal to \$3, which is higher but marginally significantly different from the elicited point estimate of the value of the mug ($p = 0.08$, two-sided t test). The higher cash value works against our hypothesis of the dominance of mug rewards over cash.

of competition.¹⁷ Cash rewards include two features, monetary value and durability, and thus are expected to generate the 2nd highest level of competition. The ice cream reward, which is neither unique nor durable but does have monetary value, is expected to generate the 3rd highest level of competition. After *Ice-cream*, *Star* should generate the next-highest level of competition after *Ice-cream*. The *Competition-only* treatment, which includes only the competitive effect, is hypothesized to result in the fewest contributions among the competition treatments. In sum, we expect the intensity of the competition to be ordered as follows: $Mug > Cash > Ice-cream > Star > Competition-only$.

We are now in a position to state our hypotheses.

Hypothesis 1 If competition has a positive effect on contributions, then contributions will be highest in Mug and lowest in Competition-only.

Contributions: $Competition-only < Star < Ice-cream < Cash < Mug$

This hypothesis is consistent with previous studies that find competition to positively promote one's pro-social behaviors (Kosfeld and Neckermann 2011; Duffy and Kornienko 2010). These studies, however, do not examine pro-social behaviors in public goods environments.

Hypothesis 2 If competition has a net negative effect on contributions, then contributions will be highest in Competition-only and lowest in Mug.

Contributions: $Competition-only > Star > Ice-cream > Cash > Mug$

This hypothesis accords with previous studies that find a negative effect of social comparison and competition on cooperation (Andreoni 1995). This study differs from ours, however, in that the competition is based directly on contribution amounts rather than social approval received.

Hypothesis 3 Among the five competition treatments, we expect the approval rate to be highest in Competition-only and lowest in Mug.

Approval rate: $Competition-only > Star > Ice-cream > Cash > Mug$.

Note that we do not form hypotheses regarding the average contributions in *No-competition* and the *Control* based on the Holländer's model. The reason is that key information required for Holländer's theory is clearly absent in both the *No-competition* and *Control* treatments. We run these treatments as necessary baselines, and they also have the advantage of connecting our paper more closely to related research that studies non-monetary peer evaluation systems (Dugar 2013; Noussair and Tucker 2005).

¹⁷ There are two assumptions underlying this. One is that rewards with a greater number of these three (independent) features are more desirable than rewards with fewer. The other is that people compete more for more desirable rewards.

5 Results

5.1 Effects of approval competition on contributions

RESULT 1: Contributions are highest in *Mug* and lowest in *Control*.

Our results confirm Hypothesis 1 and fail to confirm Hypothesis 2, in that contributions are ordered as follows: *Competition-only* < *Star* < *Ice-cream* < *Cash* < *Mug* ($p = 0.00$, trend test, $n = 14$ groups¹⁸ for *Mug*, $n = 12$ for all other treatments, Fig. 2b). Thus, competition has a net-positive effect on cooperation among the competition treatments. Computing pair-wise comparisons, we find contributions to be significantly higher in *Mug* ($n = 14$) compared to *Ice-cream* ($n = 12$, $p < 0.01$, two-sided Mann–Whitney test¹⁹), *Star* ($n = 12$, $p < 0.01$) and *Competition-only* (12 groups, $p < 0.01$).

Average contributions are statistically similar between *Mug* and *Cash* (12 groups, $p = 0.20$), though the distribution of contributions differs. In particular, significantly more groups in *Mug* contributed more than 75 % of their endowment on average over ten periods (15 out of 20) than groups in the other treatments (Fig. 2a). For visual ease, we aggregate contributions as follows: between 0 and 5, between 5 and 10, between 10 and 15, between 15 and 20.²⁰ The majority of groups in *Mug* fall into the highest contribution category: that is, 57 % (8 out of 14 groups) on average contributed between 15 and 20 during the ten periods, which is significantly higher than that in *Cash* or the *No-competition* treatment, where only 17 % groups (2 out of 12) did so ($p < 0.05$). This is also significantly higher than in all other treatments, where only 8 % of groups (1 out of 12) did so ($p < 0.05$, *Competition-only*, *Star*, *Ice-cream*, see and Fig. 2a) and none of 12 groups did so in *Baseline* ($p < 0.01$).

Compared to treatments with no competition, we find that *Mug* ($n = 14$) continues to be significantly higher than both *No-competition* ($n = 12$, $p < 0.1$) and *Control* ($n = 12$, $p < 0.01$, Fig. 2b). We find that contributions in *No-Competition* are significantly higher than those in *Competition-only* and *Star* ($n = 12$ for both, $p < 0.05$), while insignificantly different from *Cash* ($n = 12$, $p = 0.29$) and *Ice-cream* ($n = 12$, $p = 0.17$). Further, contributions in *Control* ($n = 12$) are significantly lower than that in *No-competition* ($n = 12$, $p < 0.01$), but are not significantly different from those in *Competition-only* ($n = 12$, $p = 0.33$), *Star* ($n = 12$, $p = 0.36$) and *Ice-cream* ($n = 12$, $p = 0.13$) treatments.

5.2 Effects of approval competition on approval received

RESULT 2: Consistent with Hypothesis 3, we find approval rate, to be highest in *Competition-only* and lowest in *Mug*.

¹⁸ The number of observations reported in Results 1, 2 and 3 correspond to number of groups. In Result 4, where we compare among cooperators and among free-riders, the number of observations is number of individuals.

¹⁹ Unless otherwise noted, all p-values derive from two-sided Mann–Whitney tests.

²⁰ We categorized this way due to the pattern of individual contributions: 83.6 % of all contribution decisions are at exactly 0, 5, 10, 15 or 20 (with 23 % at 0, 9 % at 5, 11 % at 10, 8 % at 15 and 33 % at 20).

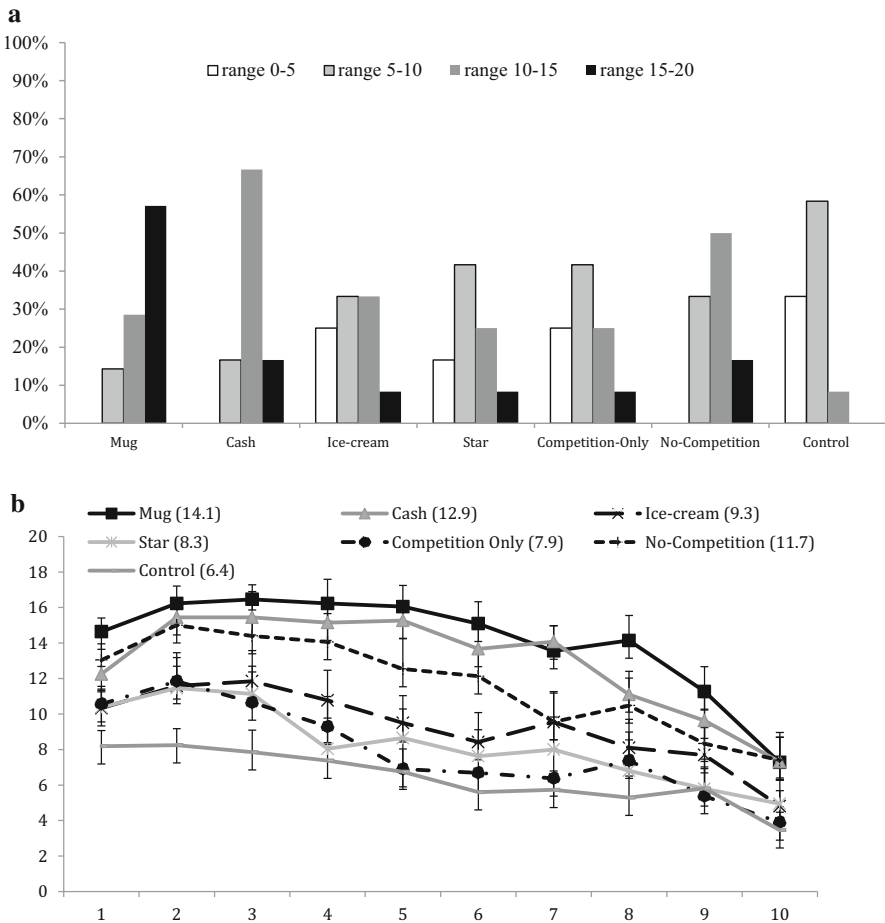


Fig. 2 **a** Distribution of contributions across treatments. This figure presents the distribution of group average contribution over ten periods into four categories: [0, 5], (5, 10], (10, 15] and (15, 20]. **b** Contributions over ten periods. Average contributions over ten periods are in parenthesis next to the treatment label. Each observation is the average contribution of all subjects in that treatment. Besides *Mug* (n = 14), all other treatments contain 12 observations. The standard error for each period is calculated according to the number of groups in each treatment

We confirm Hypothesis 3 and find the approval rate (approval received per unit contribution) to be lowest in *Mug* and highest in *Competition-only* ($Competition-only > Star > Ice-cream > Cash > Mug$, n = 14 for *Mug*, n = 12 all other treatments, $p < 0.01$, trend test).

RESULT 3: Combining Results 1 and 2, we find an inverse relationship between contributions and the approval rate. That is, a higher contribution is associated with lower approval points received for each unit of contribution.

This result reveals that higher contributions are associated with a lower approval rate. In particular, this implies that the rightward shift of the supply curve overwhelms the downward shift of the demand curve, thus generating an inverse relationship between contributions and the approval rate in equilibrium. We find that treatments with higher average contributions have lower approval rates and those with lower contribution have higher approval rates (see Fig. 3). For instance, while contributions are lowest in the *Competition-only* and *Star* treatments, the approval rates are also higher at 1.6 and 1.5 respectively. That is, one receives 1.6 or 1.5 approval points for each unit of contribution. On the other hand, with the highest average contribution (mean = 14.1), *Mug* treatment ($n = 14$) also has a lower approval rate, significantly lower than that in *Competition-only* ($n = 12$, mean: 0.99 vs. 1.63, $p < 0.01$), *Star* ($n = 12$, mean: 0.99 vs. 1.53, $p < 0.05$), *Ice-cream* ($n = 12$, mean: 0.99 vs 1.46, $p < 0.01$), though not significantly different from that in *Cash* treatment ($n = 12$, mean: 0.99 vs. 0.99, $p = 0.96$). If we compare *Mug* with the *No-competition* treatment, we find it to be also lower ($n = 12$, mean: 0.99 vs. 1.43, $p < 0.05$). Taking groups in all treatments together,²¹ regressing the contribution for approval rate, cluster for group, yields a significant negative slope at -4.7 ($p < 0.001$, two-sided t test, $n = 74$).²²

5.3 Determinants of approval received

RESULT 4: In all treatments, we find that subjects who contributed more than average received more approval points than those who contributed less than average.

While our main focus is on how competition for peer approval influences contributions to public goods, it is interesting to know what determines approval received. In particular, we are interested in knowing whether those who contribute more, all else equal, receive more approval points. We find that in *all* treatments, those who contributed on average more than their group members also received more approval points than those who contributed less than the group average. This difference in approval points received remains significant across all treatments ($p < 0.01$, see Fig. 4).

We also compared approval received by those who contribute at least as much as their groups' average across different treatments (we call them *cooperators*). While cooperators contributed significantly more in *Mug* ($n = 30$ cooperators) than in other competition treatments except *Cash* (mean = 16.8. in *Mug*, 15.9 in *Cash*, $p = 0.16$; 11.1 in *Competition-only* ($n = 22$), 12.1 in *Ice-cream* ($n = 25$), 11.5 in *Star* ($n = 22$), 10.5 in *No-Competition* ($n = 24$), $p < 0.01$ for all except *Cash*)²³,

²¹ Note that there is no approval assignment stage in the *Control* treatment. The *No-competition* treatment has approval, but no competition for approval.

²² Whether the *No-competition* treatment is included in this analysis does not affect the level of significance ($p < 0.001$, two-sided t test, $n = 62$ groups).

²³ Note that *Control* is not reported here because it does not include approval points. However, contributions by cooperators in *Control* were significantly lower than in *Mug* (mean = 8.5 in *Control*, $p < 0.01$). The same results hold for free-riders when comparing between the two treatments (mean = 4.2 in *Control*, $p < 0.01$).

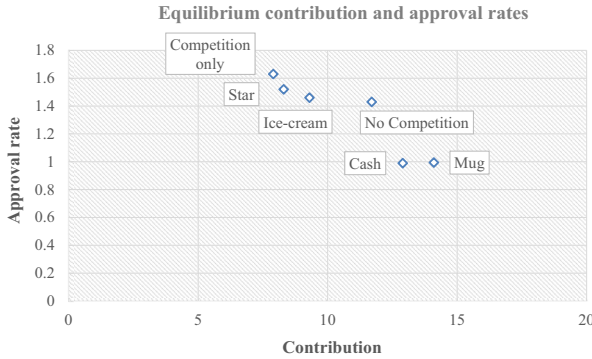


Fig. 3 An inverse relationship between contribution and approval rate. The vertical axis corresponds to approval rate (approval points received per unit contribution), while the horizontal axis corresponds to the level of contribution

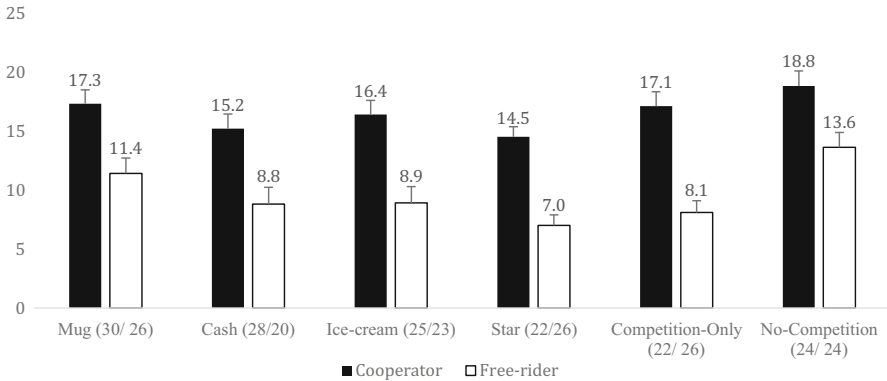


Fig. 4 Approval received by co-operators and free-riders. The solid bar denotes the average approval points received by those who contributed more than average (over ten periods) in their group; the open bar denotes the average approval points received by those who have contributed less than the average in their group. The number above each bar is the average approval received. The number in parentheses beside each treatment label denotes the number of observations for the solid and the open bar

cooperators in *Mug* received insignificantly different numbers of approval points in comparison with cooperators in all other treatments ($p > 0.1$ for any pair-wise comparison, see Fig. 4). These two results together reinforce our Hypothesis 3, in that fewer approval points are received per unit contributed as competition becomes more intense.

We also compared approval received by those who contributed less than their groups' average across different treatments (call them *free-riders*). Free-riders in *Mug* contributed significantly more than those in all other treatments except *Cash* and *No-Competition* (mean = 11.0 in *Mug* ($n = 26$): vs. 8.8 in *Cash* ($n = 20$) $p = 0.14$; vs. 9.9 in *No-Competition* ($n = 24$) $p = 0.29$; vs. 5.2 in *Competition-only*

($n = 26$), 6.2 in *Ice-cream* ($n = 23$), 4.5 in *Star* ($n = 26$), $p < 0.01$ for the rest). Yet, free-riders in *Mug* ($n = 26$) receive insignificantly different numbers of approval points as compared to *Cash* ($n = 20$) or *Ice-cream* ($n = 23$) or *Competition-only* ($n = 26$, $p > 0.1$ for all). On the other hand, they received more approval points than in *Star* ($p < 0.05$) or *No-Competition* ($p < 0.1$).²⁴

Finally, using a regression analysis, we investigated the effect of approval received in period $t - 1$ on overall contributions in period t (*Control* is not included because it does not include approval). We find that approval points received in period $t - 1$ have a statistically significant positive effect on contributions in period t for all players in all treatments (see Table 1).

6 Discussion and conclusion

Promoting prosocial behavior effectively and efficiently is critical for the proper functioning of organizations and society. While competition for non-monetary rewards has been shown to promote pro-social behaviors in non-social dilemma environments, little is known about how competition for non-monetary rewards based on peer evaluations influences pro-social behaviors. Previous research has focused on environments in which rewards are based on individual provisions of effort. We contributed to this literature by studying an environment in which rewards are based on peer approval. We offered experimental evidence, guided by economic theory, to identify features of non-monetary rewards that impact prosocial behaviors.

In particular, we focused on three features of rewards: uniqueness, durability and monetary value. Our data suggested that competing for a mug reward can be more effective than a cash reward with even higher monetary value, or an equally valued ice-cream bar. Such differences, we argued, might arise from the uniqueness and the durability of the mug rewards, absent in other rewards. We also investigated behavior in the absence of competition. In comparison to the non-competitive environment, a valuable but non-unique and non-durable reward (ice cream) produced less cooperation, while a unique, durable and valuable reward (a mug) produced more. Indeed, the mug reward generated significantly more maximum contributions than a non-unique, durable, and more highly valued reward (cash).

Our results demonstrate a negative correlation between contribution and approval rates, a result predicted by the theory of Holländer (1990). That is, the higher the contribution, the lower the approval one receives per unit of contribution. Consequently, our study complements economic theory by providing empirical

²⁴ We also checked for the presence of anti-social approval patterns. In order to examine this, we created a group-level dummy variable which takes value 1 in a period if, in that period, the person who received the most approval also contributed the most in that group; and equals 0 otherwise. This gives 10 observations per group over ten periods, and by averaging over all groups and periods we found the overall frequency, for each treatment, that the person who received a highest approval also contributed the most. For all treatments, the frequency is 90 % or higher. Further, there are no significant differences in frequencies between these treatments and the *No-Competition* treatment where subjects have not been provided with any comparative information among group members.

Table 1 Effect of approval received in period $t - 1$ on contribution in period t

Treatment	(1) No- competition	(2) Competition- only	(3) Star	(4) Mug	(5) Ice- cream	(6) Cash
approvalreceived_lag1	0.365*** (0.055)	0.317*** (0.044)	0.337*** (0.093)	0.312*** (0.064)	0.457*** (0.048)	0.309*** (0.056)
Constant	5.421*** (1.132)	3.562*** (0.644)	4.196*** (0.882)	9.235*** (1.725)	2.977*** (0.855)	8.923*** (1.038)
Observations	432	432	432	504	432	432
R-squared	0.227	0.225	0.180	0.171	0.364	0.155

Robust standard errors (clustered by group) in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

evidence with respect to how contributions respond to competition for peer approval. Our results contribute our understanding of how contributions change according to the uniqueness, durability and monetary value of a reward.

While we investigated three characteristics of the reward—uniqueness, durability, and monetary value—a limitation of our study is that we did not examine trade-offs between these characteristics. Likewise, although we used a cash reward with higher average value than any of our other rewards, it was nonetheless of fairly small value (at \$3). Thus, our study leaves unanswered the question of whether sufficiently high rewards would dominate rewards with greater uniqueness and durability. This may be an important issue for some organizational policies, and would be valuable to explore in future research.

It is also worth noting that in natural environments people often seem to prefer not to spend their time or energy awarding approval to their peers (see, e.g., Li and Xiao 2014). In our environment, however, it is not costly to assign approval points. It would be of interest to investigate how competition for peer approval influences cooperation when peer approval is costly to dispense. Moreover, when the price of assigning approval varies across individuals, it would be useful to know how such variation influences one's willingness to cooperate.

Our study provides important policy insights regarding how to promote pro-social behaviors. Our study might have particular value for organizations with profit-sharing schemes, where employees have strong incentives to evaluate each other's efforts (Kandel and Lazear 1992; Mas and Moretti 2009). Our results shed light on how to construct mechanisms aimed at enhancing the value of decentralized social approval through various features of the rewards. While monetary rewards are effective, unique and durable non-monetary rewards may be a less expensive yet equally effective way to foster cooperation in social environments.

Acknowledgments We thank Omar Al-Ubaydli, David Eil, Ragan Petrie and seminar participants at George Mason University, University of Birmingham, University of East Anglia and University of St. Lawrence, University of Texas at Dallas, University of the Andes (Bogota) and the ESA American conference for helpful comments and discussions.

Appendices

Appendix 1

See Fig. 5.



Fig. 5 The photo on the *left* is the Haagen–Dazs ice-cream bar and the mug on the *right* is one that we have specifically designed for distribution only in this experiment

Appendix 2: The framework of Holländer (1990)

An individual receives utility from private consumption, public goods, and social approval. As a result, an individual must make decisions regarding private consumption, contribution to the public good and amount of approval to dispense to others. In making these decisions, a typical agent is confronted with the respective behaviour of others, characterized by w , the approval for each unit of contribution (i.e., the unit approval rate) and \bar{g} , the average contribution of the society.²⁵ An individual responds to others' behaviour by some rationally chosen contribution g_i , and what Holländer refers to as an “emotionally” determined approval rate, v , which he applies to others' contributions. These are the key quantities underlying the hypotheses in the current paper, and the following two sub-sections explain how these two variables are determined in Holländer's (1990) model.

Individual contribution g_i

Given that the unit approval rate of others is w , the absolute contribution of the individual is g_i , the approval assigned due to absolute contribution is wg_i , and approval assigned due to his contribution relative to the average contribution is $w * (g_i - \bar{g})$. If we assume that the overall approval assigned to any individual i is a weighted average of approval assigned due to an individual's absolute contribution level (weight $1 - \beta$) and approval assigned due to an individual's contribution relative to the average contribution (weight β), we have

²⁵ Assume that individual contribution is negligible in calculating the society's average contribution.

Approval assigned to individual i

$$(1 - \beta)wg_i + \beta w.(g_i - \bar{g}) = w.(g_i - \beta\bar{g}) \tag{1}$$

Note that if one contributes the same as the average contribution \bar{g} , the approval assigned to him is:

$$(1 - \beta)w\bar{g} \tag{2}$$

Holländer’s key departure from the traditional public goods literature is that he assumes people value receiving social approval. Intuitively, we not only want to receive approbation, but also care about how much approbation we receive in comparison to others. Therefore, assume that utility from approval received is determined by both the approval received by individual i , that is, Eq. (1) (weight $(1 - \alpha)$), and how much he receives relative to that received by the group average contribution, that is, $w(g_i - \bar{g})w * (g_i - \beta\bar{g}) - (1 - \beta)w\bar{g} = w * (g_i - \bar{g})$ (weight α). Therefore, the total utility from received approval for individual i is:

$$(1 - \alpha)w * (g_i - \beta\bar{g}) + \alpha w * (g_i - \bar{g}) = wg_i - (\alpha + \beta - \alpha.\beta)w\bar{g},$$

with $0 \leq \alpha, \beta \leq 1$

Let $\sigma = \alpha + \beta - \alpha\beta$, so that we have utility from received approval for individual i to be equal to:

$$w * (g_i - \sigma\bar{g}), \quad \text{with } 0 \leq \sigma \leq 1 \tag{3}$$

Note that σ increases with both α and β . β is a weight parameter that captures how competition influences approval assignment while α captures the role of competition on the way approval is valued. An increasing β indicates that approval assigned to a typical individual is based more on how much he contributes relative to the group average; an increasing α captures how much a typical individual cares about the relative approval received. Intuitively, a more competitive environment will increase α and β and thus increase σ .

An individual’s total utility is characterized by additively separable preferences between private consumption, public goods, and approval received. Thus, the utility function for individual i is:

$$U_i = U_p(\pi - g_i) + U(\bar{g}) + U_A(w * (g_i - \sigma\bar{g})) \quad 0 \leq g_i \leq \pi \tag{4}$$

Taking the *f.o.c.* condition of U_i with respect to g_i , we find:

$$U'_p(\pi - g_i) = wU'_A[w * (g_i - \sigma\bar{g})] \tag{5}$$

We focus exclusively on symmetric equilibria, where an individual’s contribution is equal to the average contribution so that $g_i = \bar{g}$. Substituting this equality into Eq. (5), we have $U'_p(\pi - \bar{g}) = wU'_A[w * (\bar{g} - \sigma\bar{g})]$, so that,

$$w = \frac{U'_p(\pi - \bar{g})}{U'_A[w * \bar{g}(1 - \sigma)]} \tag{6}$$

As noted, this is referred as the $g_i\bar{g}$ equilibrium in Holländer (1990).

Assuming all utility functions are concave, an increase in \bar{g} leads to an increased ratio $\frac{U'_p(\pi - \bar{g})}{U'_A[w * \bar{g}(1 - \sigma)]}$. That is, the $g\bar{g}$ curve is an upward sloping curve, with approval rate w increasing with the average contribution \bar{g} . This curve is referred as the *supply curve* in the main text.

The approval rate v

The approval rate is determined by the marginal rate of substitution between public goods and private consumption. Intuitively, the higher the pleasure one derives from contributions to the public goods relative to that of private consumption, the higher the approval rate should be, and vice versa.²⁶

$$v = \frac{U'_g(\bar{g}) - \sigma w U'_A[w * (g_i - \sigma \bar{g})]}{U'_p(\pi - g_i)} \tag{7}$$

In equilibrium, the individual approval rate must be equal to the approval rate of others, $v = w$. Given (5), we know that $\sigma w U'_A[w * (g_i - \sigma \bar{g})] = \sigma U'_p(\pi - g_i)$. Substituting this and $v = w$ together into (7), we obtain $w = \frac{U'_g(\bar{g}) - \sigma U'_p(\pi - g_i)}{U'_p(\pi - g_i)}$, or

$$w = \frac{U'_G(\bar{g})}{U'_p(\pi - g_i)} - \sigma \tag{8}$$

Equation (8) is referred as the VW equilibrium in Holländer’s paper. It occurs when the individual approval rate is equal to others’ approval rates. This is the structure of the demand curve. We characterize the demand curve in social exchange equilibrium below. See the discussion surrounding Proposition 1.

Social exchange equilibrium

Holländer (1990) denotes the simultaneous VW and $g\bar{g}$ equilibrium as a social equilibrium. Substituting $g_i = \bar{g}$ into (8), we have

²⁶ “We generally approve of cooperative behavior even if it does not make us significantly better off. In doing so, we often seem to consider the hypothetical advantage we would enjoy if everybody else behaved cooperatively in like manner. This motivates the assumption that an agent’s approval rate, his subjective value of another agent’s marginal contribution stimulating approval, is equal to the hypothetical advantage, measured in terms of the private good, that the former agent would enjoy if not only the latter but also all other agents except him increased their contributions marginally. (Holländer 1990).

$$w = \frac{U'_G(\bar{g})}{U'_p(\pi - \bar{g})} - \sigma \tag{9}$$

Proposition 1 *An increase in the competitiveness of the environment (σ) leads to a downward shift of the VW curve.*

Assuming the utility function to be concave, based on Eq. (9), an increase in \bar{g} leads to a decrease in the ratio of $\frac{U'_G(\bar{g})}{U'_p(\pi - \bar{g})}$, and thus the VW curve is negatively sloped. This is the *demand curve* mentioned in the manuscript. Meanwhile, an exogenous increase in the competitiveness of the environment σ leads to a downward shift of the VW curve (see movement (1) in Fig. 6 below).

For the $g\bar{g}$ equilibrium, we had Eq. (6) as:

$$w = \frac{U'_p(\pi - \bar{g})}{U'_A[w * \bar{g}(1 - \sigma)]}$$

Proposition 2 *An increase in competitiveness of the environment σ shifts down the $g\bar{g}$ curve, which is referred as the supply curve in the main text. In particular, observe that the $g\bar{g}$ curve is influenced by two variables: the endowment π and the competitiveness of the environment σ . An increase in σ leads to a decreased ratio of $\frac{U'_p(\pi - \bar{g})}{U'_A[w * \bar{g}(1 - \sigma)]}$, thus a downward shift of the $g\bar{g}$ curve (see movement (2) in Fig. 6 below).*

Proposition 3 *When $\sigma < \frac{U'_G(0)}{U'_p(\pi)} - \frac{U'_p(\pi)}{U'_A(0)}$, there exists a unique social equilibrium with positive w^* and \bar{g}^* .*

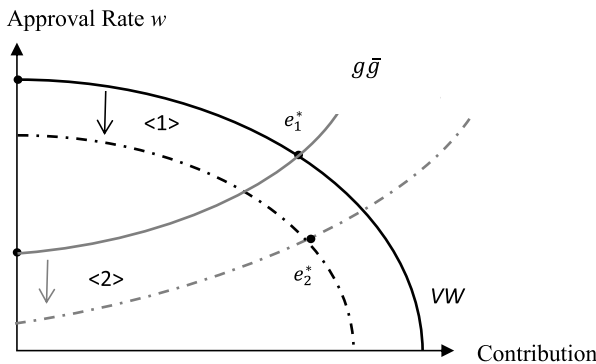


Fig. 6 The approval rate w is on the vertical axis and the average contribution \bar{g} on the horizontal axis. The solid black curve is the VW curve, also referred as the demand curve in the main text. The solid grey curve is the $g\bar{g}$ curve, also referred as supply curve in the main text. The black dashed line shows a downward shift of the VW curve [movement (1)] after an increase in the competitiveness of the environment. The dashed grey line shows a downward shift of the $g\bar{g}$ curve after an increase in the competitiveness of the environment. The equilibrium changes from e_1^* to e_2^* . We can see that the overall effect is a decreased approval rate w , and an ambiguous change in equilibrium contribution level

The intersection of the VW curve with the vertical axis occurs where $\bar{g} = 0$. Substituting this into in (9), we have: $w = \frac{U'_g(0)}{U'_p(\pi)} - \sigma$. The intersection of the $g\bar{g}$ curve with the vertical axis occurs where $\bar{g} = 0$, and substituting this into (6) we have $w = \frac{U'_p(\pi)}{U'_A(0)}$. Thus, if $\frac{U'_g(0)}{U'_p(\pi)} - \sigma > \frac{U'_p(\pi)}{U'_A(0)}$, that is, $0 < \sigma < \frac{U'_g(0)}{U'_p(\pi)} - \frac{U'_p(\pi)}{U'_A(0)}$, then there exists a unique social equilibrium with positive w^* and \bar{g}^* .

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