Norms and efficiency in a multi-group society: an online experiment

Marco Catola[a], Simone D'Alessandro*[a], Pietro Guarnieri[a], Veronica Pizziol[b]

[a]Department of Economics and Management, University of Pisa
[b]IMT School of Advanced Studies, Lucca

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Abstract

In this study we provide a novel measurement of personal normative beliefs, empirical expectations and normative expectations in the multilevel public goods game. The objective is twofold. On the one hand, we aim at investigating whether personal and social norms are reactive to variations in the relative efficiency of the public goods. On the other hand, we aim at understating which kind of norm better explains contribution to both the public goods. In our online experiment, personal norms, as elicited by personal normative beliefs, play a crucial role. They are both more reactive to efficiency gains and more in line with contribution decisions as efficiency increases. However, social norms, as elicited by empirical expectations and normative expectations, still anchor contribution decisions to social expectations, especially when the efficiency of the related public good is relatively low. Moreover, we highlight a norm spillover effect among the public goods with the empirical expectations concerning one good impacting (negatively) the contribution to the other public good. This result reveals how norms referred to alternative reference networks may interact with each other and possibly conflict.

JEL classification: $C9$; $D71$; $H4$.
Keywords: Multilevel public good game, online experiment, personal norms, social norms, social dilemma.

1 Introduction

The multilevel public goods game (MLPGG) presents subjects with a peculiar social dilemma. In this game, subjects are asked to choose between contributing to the welfare of the local group where they belong or to the welfare of the global good where their local group is embedded together with other local groups. This decision context is representative of modern multi-group societies in which individuals typically belong to (cultural, class, professional, ethnic) local groups embedded in an overall global group of (institutionalized or spontaneous, regional, national, international) societies. Investigating decision-making in the context of the MLPGG and related measures

*Corresponding author, e-mail: simone.dalessandro@unipi.it

of policy intervention suggests useful insights to improve the ability of institutions to overcome social particularism and guarantee cohesion. These conditions crucially involve social norms.

The MLPGG provides us with an interesting context to discuss two relevant issues in the theory of social norms that are connected to two potential conflicts in decision-making. First, since in the MLPGG the individual belongs simultaneously to two groups in a nested structure, a potential conflict regarding which of the two groups acts as her reference network may arise. Indeed, two social norms (one relative to the local group, the other relative to the global good) may affect her decision and potentially counteract each other. Secondly, the MLPGG allows for investigating the relationships between efficiency and norm compliance. Depending on the relative efficiency of the local and global public goods, economic incentives may conflict with the norms sustaining contribution to the individual's group or to the overall society.

With this contribution, we further develop the analysis of a previous study on contribution decisions in the MLPGG.[1] In Catola et al. (2020), we measured to what extent increasing the efficiency of the global good increases the contribution to the global good and overall social contribution (i.e., the sum of the contributions both to the local and the global public goods). On average, an increase in efficiency induces an increase in the contribution to the global public good and an equal decrease in contribution to the local good, thus leaving overall social contribution unchanged. In this paper, we investigate the reasons behind those contribution decisions by applying the analytical methodology developed by Cristina Bicchieri and coauthors (Bicchieri, 2005, 2016). Specifically, we use measures of personal normative beliefs (PN), empirical expectations (EE) and normative expectations (NE) to study a) whether and to what extent efficiency changes affect personal unconditional norms (as elicited by PN) and social conditional norms (as elicited by EE and NE), and b) to what extent personal and/or social norms explain contribution to the local and the global public goods.

Our results show that in the MLPGG personal norms are both more reactive to efficiency and have a stronger impact on contribution decisions than social norms. Moreover, as relative efficiency increases, personal norms are more and more in line with contribution both to the local and the global public good. However, our measure of personal norms presents methodological difficulties (discussed in Section 2) that we addressed with an additional experimental session aimed at checking whether the personal and social norms held by experimental subjects were biased by the circumstance that they responded to the elicitation questions immediately after taking the decision and thus by *ex-post* self-justification.[2] To this purpose, we elicited PN, EE and NE in a group of subjects who did not face the experimental task. Despite some limitations, this approach allows us to provide arguments in favour of the reliability of measures of personal and social norms in our online context.

The remainder of the paper is organised as follows. In Section 2, we present the experimental design, discuss the methodology of norm measurements, and set the theoretical hypotheses. In Section 3, we illustrate the results of our main and

[1] Both the analyses were preregistered on aspredicted.org. Preregistration 45141, available on request.

[2] Preregistration 45320, on aspredicted.org, available on request.

secondary analyses. In Section 4, we check for the reliability of our findings under the light of norm measurements independent on the task completion. Section 5 draws some concluding remarks.

2 Methods

2.1 Experimental design and implementation

Following Gallier et al. (2019), we set the MLPGG by randomly assigning each subject to a local group composed of 4 individuals and forming the global group by matching two local groups (see Figure 1). Subjects have to decide in a one-shot interaction how much of their 10-tokens endowment to contribute to the local public good, the global public good or to keep for themselves.

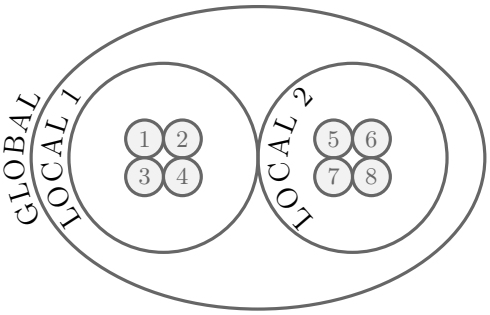


Figure 1: Group Composition

The experimental manipulation concerns the relative efficiency of the two public goods. In particular, we follow the standard procedure (Blackwell and McKee, 2003; Chakravarty and Fonseca, 2017; Gallier et al., 2019) and set 4 treatments where the marginal per capita return of the global public good (β) progressively increases, while the marginal per capita return of the local good (α) remains constant. Table 1 lists for each treatment the values of α, β and the total benefit (TB), computed as the individual earnings obtained when every group member make a one-token contribution to the relative public good (Gallier et al., 2019). It must be underlined that while the efficiency of the global good increases from T_1 to T_4 both in relative and absolute terms, the efficiency of the local public good decreases only relatively. This setting conveys a cognitive asymmetry whose consequences on decisions and norm compliance will be highlighted in the result discussion in Section 3.[3]

The experiment was run online using Prolific (Palan and Schitter, 2018) and programmed in oTree (Chen et al., 2016) and involved 634 participants randomly assigned to the four treatments as reported in Table 1.[4] The participants were all UK nationals showing homogeneous socio-demographic characteristics (gender, age, employment or student status, income) across treatments (see Table A.1 in the Appendix).

[3]For a further discussion of this treatment setting, we refer the reader to Catola et al. (2020).

[4]From the full pre-registered sample of 802 subjects we dropped the 164 participants who played a standard Public Goods Game not relevant for the scope of this paper and other 4 subjects who gave implausible answers in the norm-elicitation questions.

Treatment	Local PG			Global PG		
	M	α	TB	N	β	TB
T_1	4	0.6	2.4	8	0.15	1.2
T_2	4	0.6	2.4	8	0.3	2.4
T_3	4	0.6	2.4	8	0.45	3.6
T_4	4	0.6	2.4	8	0.6	4.8

Table 1: Summary of treatments' parameters

2.2 Personal and social norms measurements

After the decision task, we elicited PN, EE, and NE, following the methodology developed by Cristina Bicchieri and coauthors.[5] However, its application to simple allocation decisions – such as those in the dictator game (Bicchieri and Xiao, 2009; Bicchieri et al., 2020) and in the ultimatum game (Bicchieri and Chavez, 2010) – differs from its application in the context of the strategic interaction of public good games which pose peculiar difficulties.

The first difficulty is due to the fact that many factors can concur in determining what is perceived as the personal or the social norm in given experimental settings. We mention two factors: a) the expectations on others' decisions, since they determine the outcome of the strategic interaction; b) the expected return from contribution to the public good which is usually exogenously determined. These factors imply a variety of subjective normative orientations across individuals and circumstances. The second difficulty, connected to the first one, consists in the circumstance that the experimenter is not able to identify a salient norm to elicit social expectations (both empirical and normative) about it. As a consequence of these peculiarities, EE and NE cannot be elicited in terms of whether a certain given behaviour (for example the fifty-fifty split in the dictator game) or normative judgement about it is widespread in the reference population, but only as expectations, i.e. the expected average contribution to the public good by participants different from the decision maker to elicit EE; the expected average answer to the PN question by participants different from the decision maker to elicit NE.

A further complication is connected to the nested structure of the MLPGG. We applied the minimal identity approach (Tajfel, 1970, 1974, 1982) to avoid uncontrolled effect on contribution due to self-ascription of identity. Minimal identity was obtained by using neutral terms that did not characterize in any respect the membership and sense of belonging neither to the local group nor to the global group. This effect was strengthened by the fact that each participant was completely unaware of the characteristics of the individuals forming both the local group and the other matched group and by the circumstance that the experiment was run online, with no opportunity to have visual contact between participants. However, such a neutral condition risked producing no significant responses to norm elicitation by sterilis-

[5] In addition, after norm elicitation, participants responded to a comprehension task, performed a three-items Cognitive Reflection Test (Frederick, 2005) and completed the questionnaire devised by Falk et al. (2018) eliciting some relevant risk and social preferences. These variables were used as controls in our analyses.

ing also reference-network identification. In other words, it would have remained ambiguous whether the subject should reply to the norm elicitation question as a local-group member or as a global-group member. This is why we opted for explicitly referring to the member of the local group as the bearer of EE, PN and NE both for the local and the global good. These difficulties motivated us to elicit EE, PN and NE, by asking subjects to state, respectively, a) their expectations concerning the average contribution to the local and the global public good by the other participants in the local group; b) their belief concerning how much a member of the local group ought to contribute to the local and to the global good; c) their expectations concerning the average belief held by the other members of the local group about a member of the local group ought to contribute to the local and to the global good (i.e. the average answer to the previous question).

A potential endogeneity between the decision in the task and the replies to norm elicitation that followed it led us to investigate whether participants who actually performed the task share consistent PN, EE and NE with participants in another independent experiment who did not face the task[6]. This potential endogeneity could bias subjects' replies to norm elicitation, since they could adjust their responses to their decision, for example for the sake of self-justification. This risk is more relevant in the case of PN are concerned which was not incentivised. Following Krupka and Weber (2013), we asked an external and independent sample, gathering roughly 100 subjects per treatments with similar socio-demographic characteristics of the sample involved in the first experiment to express their expectations concerning: a) what local-group members in the experiment contributed; b) what a local-group member ought to contribute; c) what local-group members in the experiment expect others ought to contribute. This procedure gives us measures of PN, EE, and NE independent on the task completion that we use to test the reliability of the personal and social norm elicited from participants in the experiment. [7]

2.3 Theoretical framework

The MLPGG design is typically applied to investigate group identity effects on cooperation and in-group favouritism (Buchan et al., 2009; Gallier et al., 2019). Indeed, its nested structure allows for measuring the degree of discrimination in contribution decisions by interacting changes in the relative efficiency of the public goods with different kinds of manipulation of the salience of group membership. The theoretical connection between group identity and social norm is well-documented in the literature (Chen and Li, 2009; Benjamin et al., 2010). The cognition of the group that acts as the reference network and anchors norm compliance clearly correlates with the feeling of belonging to a specific social identity. However, to the best of our knowledge, no study has attempted to explain contribution decisions in the MLPGG by measuring norms. This literature gap leaves us with no reference to ground exact theoretical hypotheses. In this subsection, we attempt to sketch a theoretical framework to orient our analysis. Based on the literature on public goods and social

[6]We ran this second online session a few days after the first experiment, to make sure not to engage in periodic confounding factors. Also, we made sure to exclude from this second experimental session those participants who were engaged in the first experiment with the contribution task.

[7]The detailed instructions of both the norm elicitation strategies as well as details about the sample compositions can be consulted in the Appendix.

norms, we discuss the two main research questions we aim to respond to.

The first research question concerns whether and to what extent the designed changes in the relative efficiency of the two public goods affect personal and social norms. This question is of general interest since it captures a relevant aspect of motivation crowding phenomena (Bowles and Polania-Reyes, 2012; Bowles, 2016). Indeed, the interaction between monetary incentives and norm-based motives conditions the impacts of incentives on behaviour. This is particularly relevant in the PGG context where social norms typically motivate over-contribution (Fehr and Fischbacher, 2004; Herrmann et al., 2008). Accordingly, in the MLPGG the observed change in contribution decisions following the change in relative efficiency of the two public goods might be mediated by a change in the perceived norms, even if the magnitude and direction of the latter change are hardly predictable *ex ante*.

As a tentative hypothesis, we may expect that social norms are generally responsive to an increase in efficiency. This hypothesis seems particularly reasonable for EE specifically since a higher expected payoff implies an economic advantage connected to public good provision. NE should follow the same trend, given that in our design there are no reasons for a contrast between EE and NE and in such cases, the former should imply the latter (see Bicchieri and Xiao, 2009). Therefore, subjects may have increasing expectations concerning the contribution of other individuals following the rise in the relative efficiency of the local and global public good, respectively. On the other hand, we can expect that PN show a greater rigidity. Both the overall amount that the subject believes ought to be contributed to the two public goods and the internal allocation between the two could be recognised as a fixed share. In other words, since personal normative beliefs are not conditioned on social expectations, they are expected to reflect a stable judgement concerning the allocation of the subject endowment at least in part independent of efficiency increases, and in any case less adaptive than social norms which are conditional on social expectations. The second research question we address concerns to what extent personal (as identified by PN) and/or social norms (as identified by EE and NE) explain contribution to the local and to the global public goods. The main explanations about contribution in a single public good game rely on notions of social expectations analogous to empirical expectations. For example, the theory of conditional cooperators (Fischbacher et al., 2001; Thöni and Volk, 2018) accounts for contribution to the provision of the public good, as well as for over-contribution decay, as a decision conditioned on the expectations of the contribution of others, and as a consequence of the updating of these expectations round by round in repeated interactions. Moreover, not only descriptive norms but also injunctive norms are considered a way to explain the different levels of contribution observed across different socio-cultural and institutional contexts (Herrmann et al., 2008). These findings lead us to expect that empirical expectations (and normative expectations accordingly) have a significant impact on both public goods. Moreover, the dual structure of the MLPGG opens the possibility of what we define as normative spillovers, i.e. the possibility that social norms have a cross-influence between the two public goods. This consideration makes us hypothesise and investigate the possibility that empirical and normative expectations elicited for one public good affect the decision concerning the other public good.

In principle, normative spillovers could involve also personal norms and we will empirically assess this possibility. However, the interpretation suggested above ac-

cording to which the elicitation of PN may be perceived by the subject as the normative statement about a fixed share (i.e., the fixed allocation between the local and global public good of a given amount of money that the decision maker thinks she ought to contribute) makes us rule out this effect. Having said that, the MLPGG provides an interesting test for the relevance of PN *per se*. The framing of the decision as one concerning a share (and not two independent contribution decisions) is likely to make salient the PN of the decision maker. If this was the case, we can expect a significant impact of PN on the contribution to both the local and the global public good. Moreover, personal norms could help to make sense of two peculiar results we observed in contribution in treatments T_1 and T_4. In these cases, contributing to the global public good and the local public good respectively is unambiguously not advantageous in any economic sense (for a discussion see Catola et al., 2020). Accordingly, contributing to these public goods, under those circumstances, reflects an intrinsic willingness that might be motivated by personal unconditional preferences.

These hypotheses concerning PN relate to the small but growing literature that emphasises the role of personal norms, the internal standards about what is right or wrong to do, in shaping individual behaviour in social dilemmas (see Bašić and Verrina, 2020; Capraro and Perc, 2021). The MLPGG context highlights the dialectics and potential conflict that may involve personal and social norms when more than one normative orientation and reference network are at stake.

3 Results

Table 2 reports the descriptive statistics concerning PN, EE, NE, and contribution to both the local and the global public goods.

	T_1	T_2	T_3	T_4	Average
C_{Local}	4.556	4.354	3.624	3.196	4.375
	(2.490)	(2.315)	(2.387)	(2.017)	(2.607)
C_{Global}	2.675	3.146	4.223	4.412	3.560
	(1.782)	(2.140)	(2.707)	(2.699)	(2.461)
PN_{Local}	4.528	4.178	3.769	3.331	3.961
	(2.276)	(2.022)	(2.280)	(1.737)	(2.135)
PN_{Global}	3.097	3.602	4.266	4.597	3.879
	(1.883)	(2.069)	(2.565)	(2.457)	(2.324)
EE_{Local}	4.156	4.051	3.871	3.330	3.859
	(1.667)	(1.904)	(1.748)	(1.579)	(1.756)
EE_{Global}	2.978	3.203	3.886	3.859	3.474
	(1.401)	(1.663)	(1.883)	(1.832)	(1.745)
NE_{Local}	4.459	4.148	3.936	3.542	4.028
	(1.859)	(1.929)	(1.680)	(1.497)	(1.780)
NE_{Global}	3.023	3.377	3.888	3.922	3.546
	(1.423)	(1.770)	(1.899)	(1.821)	(1.772)

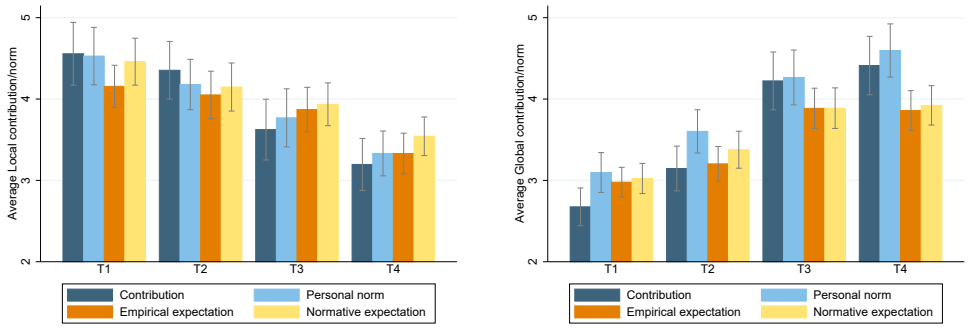
Table 2: Averages and standard deviations of the local and global contributions, personal normative beliefs (PN), empirical expectations (EE) and normative expectations (NE) by treatment.

Firstly, we check the degree of interconnection between PN, EE and NE relative to the provision of both the local and the global public good by reporting in Table 3 the correlation matrix of the six variables.

	PN_{Local}	EE_{Local}	NE_{Local}	PN_{Global}	EE_{Global}	NE_{Global}
PN_{Local}	1					
EE_{Local}	0.5674***	1				
NE_{Local}	0.5806***	0.7095***	1			
PN_{Global}	−0.4179***	−0.0330	−0.0493	1		
EE_{Global}	−0.0910**	−0.0687	0.0015	0.5505***	1	
NE_{Global}	−0.1115***	−0.0025	−0.0437	0.5775***	0.6939***	1

Table 3: Correlation Matrix for personal normative beliefs (PN), empirical expectations (EE) and normative expectations (NE) about contributions to either the local or the global public good. *p<.05, **p<.01, ***p<.001.

As one should have expected, the results of the tests show that all the elicited norms are correlated. Focusing either on the local or the global norms, we observe that the correlation coefficients between PN and EE or the NE are in the range $[0.55; 0.58]$, while the coefficient is considerably higher when we compare EE and NE. This is not surprising as EE and NE are interwoven components of social norms and our design does not provide any motive for subjects to form contrasting social expectations (see Bicchieri and Xiao, 2009). Moreover, if we consider cross interactions between norms concerning the contribution to the local and the global goods the only significant coefficient is the one computed for the PN. The strongly significant (negative) correlation confirms the insight advanced while discussing the theoretical framework in Section 2 for which the subjects states her normative preference as a unified consistent allocation, rather than as two independent normative judgements concerning two separated decisions. Figure 2 reports the average contribution to the public goods and the average value of PN, EE and NE, divided by treatment and by public good.



(a) Local public good

(b) Global public good

Figure 2: Averages of contributions of personal normative beliefs, empirical expectations and normative expectations for local and global public goods by treatment. C.I. at the 95% level.

The non-parametric tests provide further evidence of independence across elicited norms, in particular if we consider differences within treatments between EE and PN. Indeed, by applying *signed-rank* tests we find that, at the 5% statistical significance level, PN and EE are statistically different in T_1 for the local public good ($p = 0.0018$) and in T_2, T_3 and T_4 for the global public good (T_2, $p = 0.0136$; T_3, $p = 0.0302$; T_4, $p = 0.0001$). PN and NE are statistically different in T_1 for the local public good

($p = 0.0018$) and in T_2, T_3 and T_4 for the global public good (T_2, $p = 0.0136$; T_3, $p = 0.0302$; T_4, $p = 0.0001$). On the other hand, the difference between EE and NE is almost always not statistically significant with the only exception of T_1 and T_4 that exhibit a significant difference at the local level (T_1, $p = 0.0039$; T_4, $p = 0.0138$).

3.1 Efficiency and norms

Both contribution and all the elicited norms present a clear trend with respect to β. Figure 2 shows that in the case of the local good this trend is negative, while in the case of the global good the trend is positive. These apparent trends suggest that all three kinds of norms are responsive to variations of relative efficiency. To check whether this is actually the case, we run a Tobit regression for each norm against the efficiency coefficient β. Results are reported in Table 4.

	(1) PN_{Local}	(2) PN_{Global}	(3) EE_{Local}	(4) EE_{Global}	(5) NE_{Local}	(6) NE_{Global}
β	-3.055***	3.847***	-1.836***	2.312***	-2.063***	2.205***
	(0.565)	(0.620)	(0.406)	(0.412)	(0.423)	(0.418)
constant	5.024***	2.432***	4.524***	2.595***	4.782***	2.702***
	(0.235)	(0.230)	(0.168)	(0.157)	(0.182)	(0.160)
N	634	634	634	634	634	634

Table 4: Tobit regressions with robust standard errors in parentheses. The dependent variable is a different type of norm for each specification: in columns (1)-(2) local and global personal normative beliefs (PN); in (3)-(4) local and global empirical expectations (EE); in (5)-(6) local and global normative expectations (NE). The regressor β is a discrete variable which assumes the values of the MPCR specific to each treatment. *p<.05, **p<.01, ***p<.001.

The result of Table 4 provides strong evidence that every norm is responsive to β as all coefficients are significant at the 0.1% level. This leads to our first result.

Result 1: *Norms concerning the contribution to the global (local) public good are increasing (decreasing) in β. Personal norms are more responsive to increases in inefficiency than social norms.*

This result, albeit not totally unexpected, is interesting in several respects. First, while we made the argument that social norms may well be affected by changes in payoffs, it was not obvious that personal normative beliefs would. Nevertheless, our estimations show that not only PN are responsive to efficiency, but, in fact, they are the most responsive for both the local and the global public good. Secondly, the fact that norms concerning the local good also show a downward trend compared to β is remarkable. Indeed, while norms regarding the global respond to an absolute improvement, the efficiency of the local public good is stable in absolute term across treatment, thus showing that a relative worsening is sufficient to negatively affect personal and social norms.

The finding that it is possible to influence personal and social norms by increasing the social returns that subjects can obtain through pro-social behaviours is relevant from a policy-making point of view. Specifically, policies capable of increasing the efficiency of the global public good would drive both personal and social norms

and possibly counteract norms sustaining in-group favouritism and particularism. However, this policy achievement would produce tangible results only in the case norms actually impact decisions in the MLPGG context.

3.2 Norms and contribution to multilevel public goods

In Catola et al. (2020), we showed that contribution is strongly influenced by the relative efficiency of the public goods. Consequently, the evidence that both personal and social norms increase with the relative efficiency of both public goods (Result 1) leads us to expect that norms play a significant role in explaining contribution choices. To measure the magnitude of the impacts of personal and social norms on decisions, we perform a Tobit regression of the contribution choice on the efficiency level of the global public good and the value of each elicited norm. Given that we are interested both in the impact of personal and social norms on the related public good as well as on potential spillovers on the other public good, we include in each regression the PN, EE and NE relative to both public goods.

The results are provided in Table 5. We run the analysis twice, the first time (models 1 and 2) with only norms as explanatory variables, while the second time (models 3 and 4) we include a full set of controls.[8]

	(1)	(2)	(3)	(4)
	C_{Local}	C_{Global}	C_{Local}	C_{Global}
β	-0.581	0.860	-0.703	0.999
	(0.492)	(0.486)	(0.568)	(0.550)
PN_{Local}	0.824***	-0.068	0.825***	-0.051
	(0.071)	(0.067)	(0.074)	(0.073)
PN_{Global}	-0.061	0.781***	-0.030	0.779***
	(0.066)	(0.070)	(0.065)	(0.071)
EE_{Local}	0.239*	-0.221*	0.325**	-0.297**
	(0.105)	(0.087)	(0.117)	(0.093)
EE_{Global}	-0.215*	0.431***	-0.232*	0.398***
	(0.090)	(0.084)	(0.093)	(0.082)
NE_{Local}	-0.025	-0.031	-0.105	0.013
	(0.094)	(0.083)	(0.096)	(0.084)
NE_{Global}	-0.030	-0.103	-0.024	-0.112
	(0.089)	(0.086)	(0.098)	(0.092)
constant	1.074**	0.303	-0.536	0.071
	(0.356)	(0.307)	(0.613)	(0.601)
Controls	No	No	Yes	Yes
N	634	634	522	522

Table 5: Tobit regressions with robust standard errors in parentheses. The dependent variable is either the local or the global contribution, the regressor β is a discrete variable which assumes the values of the MPCR specific to each treatment. The other explanatory variables are different types of norms: local and global empirical expectations (EE), personal normative beliefs (PN) and normative expectations (NE). *p<.05, **p<.01, ***p<.001.

The results of Table 5 provide evidence of several interesting phenomena. First, focusing on the impact of norms on the related public good, we observe that, for both public goods, both PN and EE are significant drivers of the contribution choices, while NE have no significant impacts. However, the impact of PN is significantly

[8]For full regressions with controls see Table B.1 in the Appendix.

stronger, thus suggesting that whilst social norms (and in particular its descriptive component) do have a role, personal unconditional normative preference is the main driver of the decision. Our analysis therefore leads to the following result:

Result 2: *Personal normative beliefs are the most important factor in explaining the contribution choice in the MLPGG. Empirical expectations have also a significant impact, while normative expectations have not.*

The significance of the impact of empirical expectations is an expected result, in line with the findings on conditional cooperators (Fischbacher et al., 2001; Thöni and Volk, 2018) and in general with explanations of pro-social behaviours based on social norms (Fehr and Fischbacher, 2004; Bicchieri, 2005; Herrmann et al., 2008; Krupka and Weber, 2013). The lack of significance of the normative expectations is not surprising too. Indeed, it is a well-established result that normative expectations are usually inferred from empirical expectations in the absence of explicit reasons to believe that the two social expectations are in contrast (Bicchieri and Xiao, 2009). Accordingly, in our experiment, EE and NE converge and this may be explained by complete anonymity and social distancing of the online interaction. The same condition might have favoured the result concerning personal norms. Their relevance in the context of the MLPGG can be also explained by considering the complex structure of the decision task and the fact that the elicitation of personal norms makes its interpretation as a simpler allocation task more salient. However, this result is in line with the recent literature stream highlighting the role of personal norms as complements of social norms in driving decisions in social dilemmas (Capraro, 2013; Bašić and Verrina, 2020).

The second result that we can derive from Table 5 concerns the spillover effects between norms across public goods. Indeed, whilst PN are the main predictors regarding the contribution to the respective public good, they do not have any significant spillover effect on the other public good. On the other hand, empirical expectations combine a direct positive effect on the respective public good with a negative spillover effect.

Result 3: *Personal normative beliefs only have a positive direct effect on the respective public good, while empirical expectations have both a positive direct and a negative spillover effect on contribution.*

The circumstance that social norms and in particular empirical expectations may influence decisions beyond the decision scope to which they are directly connected is relevant. This novel finding suggests the opportunity to theorize and investigate social norms as holistic systems affecting behaviours via interactions and cross-contamination among them. This perspective on norm interaction merits further research but goes beyond the scope of this paper.

3.3 The relative impact of personal and social norms

Figure 2 shows another interesting trend. As each public good becomes relatively more efficient, the difference between PN and EE seems to increase, while PN gets more aligned with the actual contribution. This suggests that the salience of personal and social norms and their capability to affect decisions may depend on the level of efficiency.

We check this intuition with a two-step procedure. In the first step, we consider the variable ΔN constructed as the difference between PN and EE for both public goods and test whether such measure is responsive to variations of β. In the second step, we test whether and to what extent the value of such difference explains the contribution to the public goods.

It makes sense to construct the variable ΔN as the difference between PN and EE since in every treatment either the average value of PN is always greater than EE or they are not significantly different.[9] Thus, we can interpret an increase in ΔN as an increase in the difference between PN and EE, and the other way round. We run a Tobit regression where we regress ΔN against β. Results are provided in Table 6.

	(1)	(2)
	ΔN_{Local}	ΔN_{Global}
β	-0.852	2.606**
	(0.625)	(0.954)
constant	-0.300	-2.122***
	(0.263)	(0.438)
N	634	634

Table 6: Tobit regressions with robust standard errors in parentheses. The dependent variable is β, a discrete variable which assumes the values of the MPCR specific to each treatment. The regressor is the difference (ΔN) between personal normative beliefs (PN) and empirical expectations (EE) at the local or global level. *p<.05, **p<.01, ***p<.001.

The results show that the impact of β is significant and positive for ΔN_{Global}, while is negative but not significant for ΔN_{Local}. The sign of both coefficients shows that as one public good increases in relative efficiency the difference between PN and EE increases as well. The lack of significance for the local good is again coherent with the asymmetry concerning the variation in the efficiency which is only relative in the case of the local public good.

The second step of the analysis leads us to verify to what extent this increasing distance between personal and social norms explains the contribution choice of individuals. In doing so we could grasp whether the perceived difference between the personal and the social normative orientations affects the contribution choice. We, therefore, perform a Tobit regression where the contribution is regressed against β and the value of ΔN.

[9] By performing *Wilcoxon signed-rank tests* for each treatment, we can observe that ΔN_{Local} is statistically different from zero in T_1 ($p = 0.0018$), while the difference becomes not statistically significant from T_2 to T_4 at the 5% level of significance. Instead for ΔN_{Global} we obtain the inverse, starting from a non-significant difference from zero in T_1 ($p = 0.5778$), becoming weakly significant in T_2 ($p = 0.0136$), and definitely appearing strongly significant in T_3 ($p = 0.0302$) and finally in T_4 ($p = 0.0001$).

	(1) C_{Local}	(2) C_{Global}
β	-3.351***	4.158***
	(0.609)	(0.627)
ΔN_{Local}	0.560***	
	(0.109)	
ΔN_{Global}		0.543***
		(0.097)
constant	5.036***	1.752***
	(0.257)	(0.239)
N	634	634

Table 7: Tobit regressions with robust standard errors in parentheses. The dependent variable is either the local or the global contribution, the regressor β is a discrete variable which assumes the values of the MPCR specific to each treatment. The other explanatory variable is the difference (ΔN) between personal normative beliefs (PN) and empirical expectations (EE) at the local or global level. *p<.05, **p<.01, ***p<.001.

The result of Table 7 confirms our intuition concerning the role of the difference between PN and EE. Indeed, when the difference increases the contribution to both public goods is positively affected; thus, suggesting that contributions tend to align more with PN when the difference with EE increases.

3.4 Intrinsic reasons to contribute to inefficient public goods

The last point that deserves further analysis concerns the choices of contribution to the global public good in treatment T_1 and to the local public good in treatment T_4. The reason for this specific interest is that, by their construction, these contribution decisions are not explained by any economic reasons. To interpret the possible intrinsic motives that may have led subjects to contribute in these special cases, we refer to our elicited norms and repeat the analysis in Table 5, but focusing only on these two specific treatments by selecting the relative sub-samples. The results are presented in Table 8.

	(1)	(2)
	C_{Global} T_1	C_{Local} T_4
PN_{Local}	0.086	0.910***
	(0.131)	(0.125)
PN_{Global}	0.463*	-0.160
	(0.197)	(0.099)
EE_{Local}	-0.250*	0.353
	(0.119)	(0.218)
EE_{Global}	0.470**	-0.258
	(0.170)	(0.156)
NE_{Local}	-0.199	-0.254
	(0.130)	(0.173)
NE_{Global}	-0.030	0.272
	(0.148)	(0.150)
constant	1.295*	0.317
	(0.533)	(0.529)
N	160	153

Table 8: Tobit regressions with robust standard errors in parentheses. Column (1) refers to the subsample of observations from treatment 1, where the dependant variable is local contribution. Column (2) refers to the subsample of observations from treatment 4, where the dependant variable is global contribution. The explanatory variables are local and global personal normative beliefs (PN), empirical expectations (EE) and normative expectations (NE). *p<.05, **p<.01, ***p<.001.

Looking at Table 8 we can observe that in the case of the contribution to the global public good in T_1, the impact of PN is much more limited than the average and is substantially equal to the positive impact of the empirical expectations, which instead is stronger than the average. So while, on the one hand, low efficiency negatively affects the importance of PN, this is not the case with EE, whereby individuals respond in any case to the expected contribution of others. In this case, an intrinsic motivation to contribute to the global good independent of efficiency reasons is boosted by social expectations rather than personal normative conviction.

Interestingly, the same does not happen in the case of contribution to the local public good in T_4. In fact, in this, case EE do not influence the choice of individuals, neither directly nor through spillovers, and PN are the only (intrinsic) motive for choosing to contribute. Accordingly, we can say that in this circumstance a strong form of in-group favouritism is driven by personal norms, rather than social norms.

4 Internal vs External Norms

We derived our main results relying on the norms elicited from the subjects who performed the experimental task. However, as noted in Section 2, one may argue that there is a potential endogeneity problem between the stated norms and the actual decisions. In other words, participants may have adjusted their responses to the norm elicitation questions to the decision they made in the previous step. This might be particularly problematic for PN because the relative questions were not incentivised. Moreover, they could also be more subject to subjective evaluations and *ad hoc* manipulations since they are not anchored to social expectations. Accordingly, subjects might be tempted to justify themselves just reconfirming their contribution decisions. This tendency to ex-post self-justification would be particularly salient in case of low contributions. Intuitively, given that in terms of monetary payoff the dominant strategy is not to contribute to any public good, we expect that those who

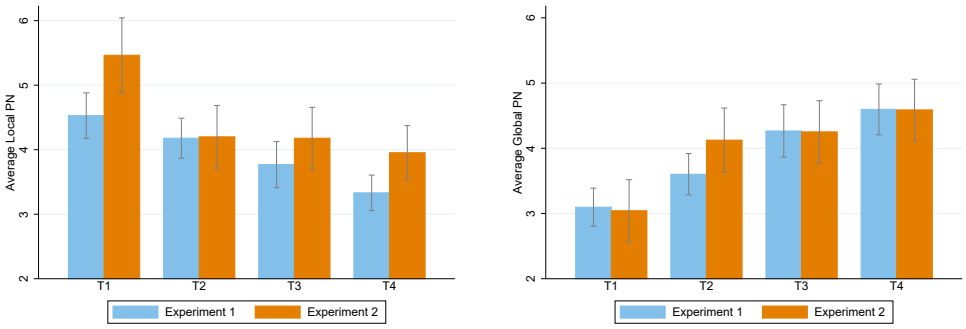
contribute large amounts have actually no real motive to justify themselves in the stated PN. On the contrary, those who behave in a more antisocial way, providing low contributions, could feel the need to self-deny her motivation in order to reduce cognitive dissonance.

As illustrated in Section 2, we elicited PN, EE and NE from individuals who did not face the experimental task, so obtaining norms measurements independent on the above-mentioned endogeneity issue.

To use this measure to assess the reliability of our findings, we first verify the comparability of the two studies in terms of samples. We performed Kruskal-Wallis tests for the variables: age, income, socioeconomic status and education, while Fisher's tests for the dichotomous variables: gender, student status and employment status finding no statistically significant difference across the two studies at the 5% level of significance.[10]

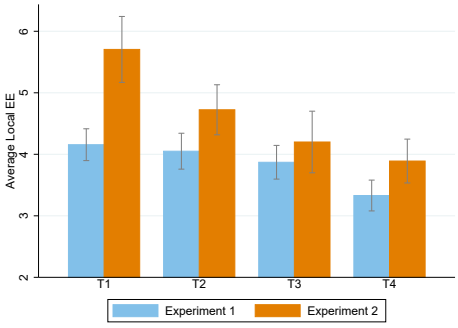
Figure 3 presents, for each public good and each treatment, the comparison between the norms elicited within the experiment in connection with the decision task (named *internal norms*) and those elicited in the sample who did not face the decision task (named *external norms*).

[10]Age, X^2=1.661, p=0.7978; personal income, X^2=1.106, p=0.2931; socio-economic status, X^2=1.039, p=0.3082; education, X^2=1.568, p=0.2105; gender X^2=0.0887, p=0.766; employment status X^2=3.7784, p=0.052; student status, X^2=0.7310, p=0.393.

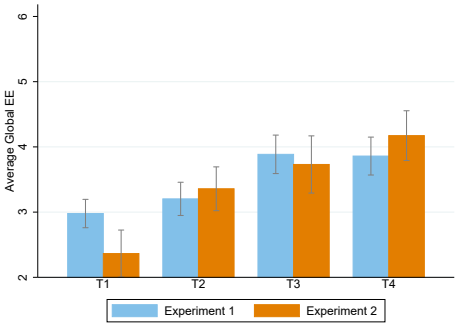


(a) Local public good

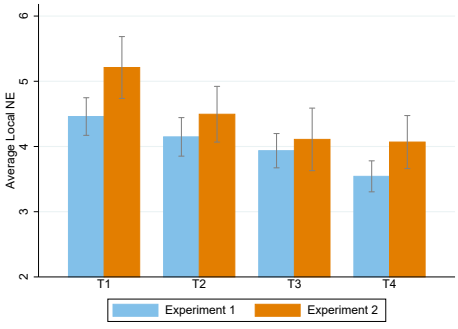
(b) Global public good



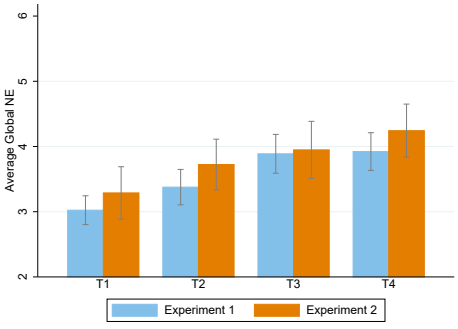
(c) Local public good



(d) Global public good



(e) Local public good



(f) Global public good

Figure 3: Average local and global personal normative beliefs, empirical expectations and normative expectations of Experiment 1 (internal norms) compared to those of Experiment 2 (external norms) by treatment. Confidence intervals are at the 95% level.

On the one hand, for the global public good external norms appear to be on average fairly consistent with internal norms. On the other hand, external norms systematically overestimate the norms concerning the contribution by experimental subjects who faced the task. In particular, as for personal normative beliefs, the only difference concerning the global public good is in T_2 (*Mann Whitney*-U test, $p = 0.0321$) while for the local contribution they differ in T_1 and T_4 (*Mann Whitney*-U test, T_1, $p = 0.0008$; T_4, $p = 0.0100$). The empirical expectations are fairly close when we consider the contribution to the global good where only T_1 presents a significant difference (*Mann Whitney*-U test, $p = 0.0017$), while for the contribution to local public good they are equal only in T_3 (*Mann Whitney*-U test, T_1, $p < 0.0001$; T_2, $p = 0018$; T_4, $p = 0.0097$). Finally, normative expectations are identical for the case of the global contribution (*Mann Whitney*-U test, $p > 0.1$ in all cases) while again they differ for the local contribution in T_1 and T_4 (*Mann Whitney*-U test, T_1, $p = 0.0009$; T_4, $p = 0.0415$).

The results, therefore, show that despite some significant differences between external and internal norms, they mainly concern the local group and in a regular way that may suggest that a systematic bias is at stake. Indeed, this bias is apparent in external norms which shows an overestimation of in-group favouritism that actually can be accounted for by referring to a) the structure of the treatments and b) norm elicitation. Indeed, on the one hand, we have already discussed above that the local public good is negatively impacted by β increases only in a relative way. This difference may be, on average, less salient for the subjects that do not have to face the task because they do not make any actual payment, thus leading to their overestimation of the norms concerning the local public good. On the other hand, since both the norm elicitation questions are referred to local-group members, this might have made salient in-group bias. The combination of these two effects may make the trade-off with the global public good less detectable in subjects that do not have to decide if and how much to contribute, thus leading to an overestimation of the norms regarding contribution to the local public good.

A further argument to sustain the compatibility between internal and external norms can be drawn by considering that both personal and social norms of the external group respond to β increases in the same way as in the internal group. This evidence is shown by the Tobit regressions of Table 9 where we repeat the analysis performed for the main sample.

	(1) PN_{Local}	(2) PN_{Global}	(3) EE_{Local}	(4) EE_{Global}	(5) NE_{Local}	(6) NE_{Global}
β	-3.406***	3.694***	-4.232***	4.151***	-2.653***	2.182***
	(0.872)	(0.836)	(0.740)	(0.617)	(0.713)	(0.656)
constant	5.722***	2.574***	6.248***	1.793***	5.474***	2.953***
	(0.388)	(0.353)	(0.331)	(0.254)	(0.303)	(0.270)
N	393	393	393	393	393	393

Table 9: Tobit regressions with robust standard errors in parentheses. The dependent variable is a different type of norm for each specification: in columns (1)-(2) local and global personal normative beliefs (PN); in (3)-(4) local and global empirical expectations (EE); in (5)-(6) local and global normative expectations (NE). The regressor β is a discrete variable which assumes the values of the MPCR specific to each treatment. *p<.05, **p<.01, ***p<.001.

Overall, given that internal and external norms are greatly consistent in the case of the global public good and systematically biased in the case of the local public good, we consider that our norm measurements are reliable and capable to ground the illustrated inferences concerning the relations between norms and efficiency in the MLPGG.

5 Conclusions

For the first time, this study provides a measure of the normative motives that sustain contribution decisions in the multilevel public goods game. To this purpose, we adapted the norm elicitation methodology developed by Cristina Bicchieri and coauthors to identify personal and social norms held by experimental subjects. This adaptation is subject to some limitations since: a) given that the decision context implies a complex strategic interaction, it provides only an *ex post* identification of norms, which may be subject to endogeneity with respect to the task completion; b) the nested structure of the game required us to anchor norm elicitation to the membership to the local group to favour perspective-taking by subjects but at the same time potentially biasing norm elicitation. To test for the reliability of our norm measurement we devised a second experiment where subjects had to state their own personal normative beliefs and predict the empirical expectations and normative expectations held by participants in the first experiment, without being involved in the decision task, and thus impartially with respect to the material interests of the groups. The consistency of the measurement in the two independent experiments let us conclude that the norms we elicited in connection with the decision task are overall reliable.

The MLPGG design allows for investigating two interesting issues concerning social norms and norm compliance. First, how do norm changes as a consequence of changes in the relative efficiency of the local and the global public good? Second, which norm better explains decisions in the context of the social dilemma implied by the MLPGG structure? Our results show that norms respond to efficiency changes, but, surprisingly, personal norms, as elicited by personal normative beliefs, are the most reactive; contribution both to the local and the global public goods are affected mostly by personal norms, but also descriptive norms, elicited by empirical expectations, play a significant role; there are normative spillovers in social norms for which empirical expectations about one of the two goods affect (negatively) contribution to the other public good; the higher the relative efficiency the more contribution is close to personal norms and far from empirical expectations for both public goods.

These results entail relevant policy implications. Increasing the efficiency of the global public good moves people away from the kind of descriptive norms which sustain in-group bias and makes them closer and closer to a kind of personal norm that sustains contribution to the welfare of the society as a whole. Affecting personal normative beliefs may not be an easy and prompt policy objective, but favouring their applicability by making pro-social (global) contribution worth it seems not only feasible but reasonable. In other words, public investments aimed at strengthening overall social welfare, will not only benefit citizens as a direct consequence of efficiency gains but also indirectly by promoting the kind of motivation crowding-in that favours the contribution of citizens in the collective good.

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