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THE HIDDEN EFFECT OF RULES: BEHAVIOURAL CONSEQUENCES OF OBLIGATIONS

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The Hidden Effect of Rules:

Behavioural Consequences of Obligations

(preliminary draft, june 2006)

Roberto Galbiati[♣] and Pietro Vertova[♠]

"...FOR LEGISLATORS MAKE THE CITIZENS GOOD BY FORMING HABITS IN THEM, AND THIS IS THE WISH FOR EVERY LEGISLATOR, AND THOSE WHO DO NOT EFFECT IT MISS THEIR MARK, AND IT IS IN THIS THAT A GOOD CONSTITUTION DIFFERS FROM A BAD ONE." – ARISTOTLE (*NICOMACHEAN ETHICS*)

Abstract

How formal rules (e.g. laws and public policies) affect human behaviour represents a crucial issue in economic analysis. Formal rules are defined as obligations backed by incentives. The economic literature has largely studied the role of material incentives in shaping individual behaviour. Yet, the role of obligations, i.e. what formal rules ask people to do or not to do, is still a black box. In this paper we run a public good game to analyze the behavioural effects of obligations. We find experimental evidence that obligations can affect cooperative behaviour not only by coordinating conditional co-operators' beliefs about others' behaviour, but also by directly shaping social preferences.

Keywords: Beliefs, Human Behaviour, Incentives, Obligations, Preferences, Public Good Game.

JEL Classification: C91, C92, H26, H41, K40.

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1. Introduction

When authorities (e.g. legislators, managers, parents,…) want to influence people's behaviour (e.g. citizens, employees, children), they set rules of conduct. They ask people to do or not to do something and try to induce compliance by setting incentives in the form of rewards and/or sanctions. Economic theory provides powerful tools to predict the effects of incentives through the analysis of their impact on individuals' material payoffs. Furthermore, recent developments in behavioural economics provide new and powerful models of human motivation able to explain some psychological effects of incentives that cannot be fully understood through the lens of material costs and benefits (Fehr and Falk, 2002). By extending the model of human motivation in order to cope with powerful non-pecuniary motives (e.g. the desire to reciprocate or to avoid negative emotions from social disapproval or the intrinsic motivation to perform certain tasks), economists are now able to better understand behavioural responses to changes in the structure of incentives[1]. Yet, despite studying the effects of incentives is a necessary condition in order to fully understand the behavioural consequences of formal rules, sometimes this might not be sufficient. Indeed, incentives are only one side of the coin of a formal rule, the other side being represented by the obligations set up by the rule itself. According to an old Anglo-American legal tradition – the imperative theory of law - formal rules (e.g. laws) are defined as "obligations backed by sanctions"[2]. A formal rule is typically a statement such as: "you ought to… or else you will pay…" (or "you ought to… and you then will get…"). In this sentence, incentives are captured by "or else…", while obligations by "you ought to…".

In this paper we aim at understanding whether or not obligations exert any independent effect on the main motives of people's behaviour. According to the traditional view of human motivation based on material payoffs, obligations *per se* do not have any independent effect on behaviour because they do not influence material payoffs. Yet, if we admit that people's behaviour is driven by diverse motives than self-interest (*social preferences*), obligations may entail some behavioural consequences. Exploring this possibility is the main aim of this research.

In order to understand and predict the behavioural effects of rules or changes in rules, we have to explore their effects on the reasons of behaviour, that is to say on people's beliefs and preferences. Beliefs consist in what people think others will do; preferences are a complex set of motives accounting for individual actions (Bowles, 1998): tastes, values, the way in which a situation is framed (Tversky and Kahneman, 1986), self-perception, emotions, psychological dispositions. The economic literature shows that changes in incentives do affect individual behaviour not only by modifying material payoffs, but also by exerting effects on people's self-

[1] See Fehr and Falk (2002) for a broad discussion of the empirical evidence on the behavioural effects of incentives and their psychological rationale; Benabou and Tirole (forthcoming and 2003), Fehr and Schmidt (2004) and Frey (1997) among the others, encompass psychological motives in models of behaviour and make theoretical predictions about the effects of incentives.

[2] See Cooter (2000) and Raz (1980).

perception and self-approval[3], people's emotions and values (Bowles and Gintis, 2003), people's beliefs about others' behaviour. Our objective is to understand whether or not obligations, that is to say what rules ask people to do or not to do, exert any independent effect on individuals' beliefs and preferences and, as a consequence, on individuals' behaviour. We pursue this task by designing and running an experiment able to isolate the effects of obligations from those of incentives.

We bring about our experimental investigation on the behavioural effects of obligations in a public good setting. This choice is motivated by the fact that formal rules, and in particular legal rules, are often set by legislators and governments with the specific objective to overcome social dilemmas (e.g. free riding in income tax compliance, common pool resources management, traffic behaviour, environmental regulation) in order to align private incentives to common good. Our experimental design is based on a one shot linear public good game with the peculiarity that subjects face an exogenous obligation of *minimum contribution*: "you ought to contribute at least X tokens to the public good". This obligation is highlighted and enforced by a structure of incentives: an individual contributing less (more) than the minimum contribution is subject to a probabilistic penalty (reward). In this setting, we test whether or not obligations affect cooperative behaviours and if such a possible effect is due to an effect on preferences, beliefs or both of them. In particular, in order to understand the impact of obligations, we let vary the level of minimum contribution required across the different treatments, while we leave unaltered the structure of marginal incentives. In order to single out the effects of obligations on beliefs about others' behaviour from possible effects on preferences, after the first stage of the experiment based on unconditional contributions to the public good game, we elicit individual conditional contributions: we ask people to decide how much they want to contribute for different hypothetical average contributions in the group. By comparing the conditional contributions schedules emerging in the different treatments, we are able to determine whether or not obligations have any effects on preferences.

We find that obligations exert a clean and significant effect on unconditional contributions to the public good, thus supporting the idea that obligations have an independent role in driving individuals' behaviour[4]. This result can be explained by resorting to the fact, common in public goods experiments, that a share of people acts as conditional cooperators (Fischbacher et al. 2001). In this case, by affecting the expectations about others' contributions, obligations drive individual contributions to certain levels. Through the elicitation of beliefs on others' contributions, we corroborate this hypothesis. But is this all or do obligations also shape individual preferences for cooperation? The second part of the experiment helps to answer this

[3] Gneezy and Rustichini (2000) show that paying children for socially valuable activities (such as collecting donations to charities) may crowd out their effort. Such an effect is consistent with the fact that children feel themselves less praiseworthy when are paid for collecting money, thus reducing the psychological incentive to perform the activity.

[4] These findings are in line with those reported by Galbiati and Vertova (2005) in a dynamic setting.

question. We find that conditional contribution schedules are in average significantly different across the treatments. As conditional contributions represent what people decide to contribute given any possible level of others' contributions, this finding supports the idea that obligations are able to influence people's behaviours also by directly affecting their preferences.

Our results suggest that a full understanding of the effects of the introduction or a change of a formal rule should carefully consider the possible behavioural effects of an apparently negligible element: the contents of rules as expressed by obligations[5].

The paper is structured as follows. Section 2 reports the experimental design and the behavioural predictions. Section 3 describes and comments the results. Section 4 provides concluding remarks.

2. The Experiment

In this section we describe the experimental design. The aim of this experiment is to understand whether or not obligations have any behavioural effects independently from those of incentives backing them. To pursue this objective, we try to answer the following questions: a) do obligations affect cooperative behaviour? b) if obligations affect behaviour, how do they act? By affecting beliefs about others' behaviour, by affecting preferences for cooperation or both of them? In the first subsection we outline the experimental game. In the second we describe the experimental treatments, procedures and parameters. Finally we report behavioural predictions.

2.1. The experimental game

The experiment consists of a one shot linear public good game followed by a conditional contribution stage. Overall, we ask participants to make two choices. The first is a choice of 'unconditional contribution': subjects are asked to make their contributions to the public good game. After all subjects have chosen their unconditional contribution, we ask participants to make the choices of 'conditional contribution', that is to say to select how much to contribute to the public good in correspondence of different average contributions of the other group members.[6]

The linear public good game we implement differs from a standard voluntary contribution mechanism as we fix exogenously an obligation of minimum contribution. This obligation indicates a minimum level of contribution that each subject *should* provide for the public good. This obligation is enforced by a structure of incentives: in particular there is a probability of control and a probabilistic penalty (reward) for individuals whose contributions are lower

[5] It is worth remarking that our results are in line with the experimental findings on the behavioural effects of minimum wage obtained by Falk, Fehr and Zehnder (forthcoming).
[6] We apply here a modified version of the strategy method (see Selten, 1967).

(higher) than the level of minimum contribution required[7]. As we are interested in the effects of obligations *per se*, we keep as fixed across all treatments the level of marginal incentives, i.e. the probability to be audited and the penalty/reward rate. On the contrary, the level of the minimum contribution required by obligation changes across the treatments. The incentives are fixed at a very low level. This choice is due to two reasons: firstly, we aim at testing whether or not an obligation of minimum contribution affects cooperation when incentives are such that the optimal strategy for self-interested individuals is the full free-riding even if they are risk adverse within reasonable degrees. Secondly, we want to minimize the possible bias in our results caused by differences in risk preferences across samples.

In this one shot public good game, the expected monetary payoff for individual i is:

$$X_i = y - a_i + m\sum_{j=1}^{n} a_j - pg(\hat{a} - a_i) \qquad (1)$$

where y is the individual endowment, m indicates the marginal per capita return to the public good $A \equiv \sum_{j=1}^{n} a_j$, p is the probability of audit, g is the penalty/reward rate. We set the parameters such that the following inequalities hold: $m > 1/n$ and $m + pg < 1$.

In order to understand whether the possible effect of obligations on cooperation should be imputed to an influence on preferences, on beliefs or on both of them, we need to understand: a) if individuals beliefs about others' contributions are significantly different in the different treatments; b) if, given others' hypothetical contributions, individuals' conditional behaviour significantly varies in the different treatments. In order to pursue the latter task, we follow the experimental design presented by Fischbacher et al. (2001). After the unconditional contribution stage, subjects are asked to report their conditional contributions. In particular, each subject has to fill in a conditional contribution table: for each possible level of average contribution in the group, and given the level of minimum obligation, she has to declare how much she wants to contribute to the public good. To give subjects the material incentives to take their conditional contribution decisions seriously, we adhere to the procedure designed by Fischbacher et al. (2001). Subjects are told that, after they have taken both decisions, a random mechanism would select which one of the two decisions becomes effective in determining their payoffs. In each group, one subject is randomly selected. For this subject the conditional contribution table determines her actual contribution to the public good, whereas for the other group members the relevant decision is the unconditional contribution. This mechanism ensures that all entries in the conditional contribution table are potentially relevant in determining the payoffs of each subject. The procedure described above is equivalent to the following game: first, nature selects

[7] The penalty (reward) is proportional to the negative (positive) difference between the actual contribution and the minimum contribution required.

n-1 players who make their unconditional contribution decisions simultaneously given the payoff structure described above. The *n*-th player learns the average contribution of the other players and takes her contribution decision. Each player knows if she is the *n*-th player and, in case she is not, she does not know who this player is.

After all players have decided how much to contribute to the public good, the control stage takes place: a player's contribution may be randomly controlled (with probability *p*) and the player may get a monetary reward (sanction) if she has contributed more (less) than the minimum contribution required by obligation.

Finally, in order to have a proxy of people's beliefs about others' contributions, in each treatment we ask each subject what she expects others have contributed on average in the unconditional contribution decision. In order to give the incentive to take this decision seriously, those who actually make the right prediction gain an adjunctive monetary payment.

2.2. Treatments, parameters and procedures.

We implement three different conditions for the minimum contribution: a '0 condition', where no minimum contribution is required by obligation, a 'low obligation condition' ('L condition') where subjects are required to contribute a fraction of 1/5 of their total endowment, a 'high obligation condition' ('H condition'), where the minimum contribution required corresponds to 4/5 of an individual's total endowment . As we are interested in the effects of obligations *per se*, we keep as fixed across all treatments the level of marginal incentives, i.e. the probability to be audited and the penalty/reward rate.

In the instructions we stress that the obligation fixes a minimum contribution required to each individual, but that the feasible contribution for each participant varies between 0 and her overall endowment. Moreover we explain in detail the consequences of each choice on individual payoffs.

The parameters of the game are set as follows. The initial endowment is $y = 20$, the number of subjects per group is $n = 6$, the marginal per capita return to the public good is $m = 0.3$, the probability of control is $p = 1/12$, the sanction/reward rate is equal to $g = 1.2$ (this ensures that: $m > 1/n$ and $m + pg < 1$), the minimum contributions fixed by obligation are respectively $\hat{a} = 4$ in the 'L condition' and $\hat{a} = 16$ in the 'H condition'.

The experiment was conducted in a computerized laboratory where subjects anonymously interacted with each other[8]. No subject is ever informed about the identity of other group members. We conducted three sections, one for each treatment. In each session participants are

[8] For conducting the experiment we used the experimental software 'z-Tree' developed by Fischbacher (1999).

divided into 6 groups of size 6 for a total number of 108 subjects. Subjects were undergraduate students of different faculties, each subject participated to one session only and nobody had previously participated in other public goods experiments before. The experiment was conducted in the experimental laboratory of the University of Siena (Italy). Each session lasted about one hour and the average earning for each subject had been of 14 euros (about 17 US dollars).

2.3. Behavioural predictions

If we assume common knowledge of rationality, risk neutrality and selfishness of all players, we expect that in every treatment the unconditional contribution of each subject is equal to zero and that conditional contribution entries are all zero for each subject. Indeed, consider in our setting the optimal choice of a risk-neutral and fully self-interested individual. Her optimal contribution, a_i^*, is the value of a_i which maximizes (1). The first order condition of the maximization problem yields:

$$\frac{\partial X_i}{\partial a_i} = -1 + m + pg < 0 \qquad (2)$$

Hence the dominant strategy for a (risk-neutral) self-interested individual is always the full free-riding: $a_i^* = 0$. This result depends crucially on the assumption that $m + pg < 1$, meaning that the monetary incentives are not sufficiently high to make the expected return from one unit of contribution higher than one unit kept for herself. Notice that the level of minimum contribution $\hat{a}$ required by obligation does not affect the optimal choice of a self-interested individual. This is straightforward since obligations do not affect monetary outcomes. In order to satisfy this condition, our setting present both a probabilistic penalty for those we contribute less than the minimum contribution and a probabilistic reward for those who contribute more. Notice that considering instead only a probabilistic penalty (reward) for the individuals who contribute less (more) than $\hat{a}$, we would obtain two distinct first-order conditions for the maximization problem, one for the interval $a_i \leq \hat{a}$ and the other one for the interval $a_i > \hat{a}$. But in this case different levels of $\hat{a}$ would imply different monetary incentives, which instead we want to keep fixed in order to isolate the effect of different obligations.

Nevertheless, a huge amount of empirical and experimental literature shows that in social dilemmas many individuals are characterized by social preferences, i.e. other regarding or process regarding preferences (for a survey on social preferences see Camerer and Fehr, 2002; Fehr and Schmidt, 2002). In particular there is evidence that a considerable share of individuals act as conditional cooperators, i.e. they are willing to cooperate (despite monetary incentives to free-ride) if the other members of their group cooperate to a sufficient extent. Moreover, individuals may internalize norms of cooperation and may suffer emotional consequences when they contribute less than the internalized level (Bowles and Gintis, 2003). When social

preferences are taken into account, obligations may affect people beliefs about others' contributions and people's preference for cooperation.

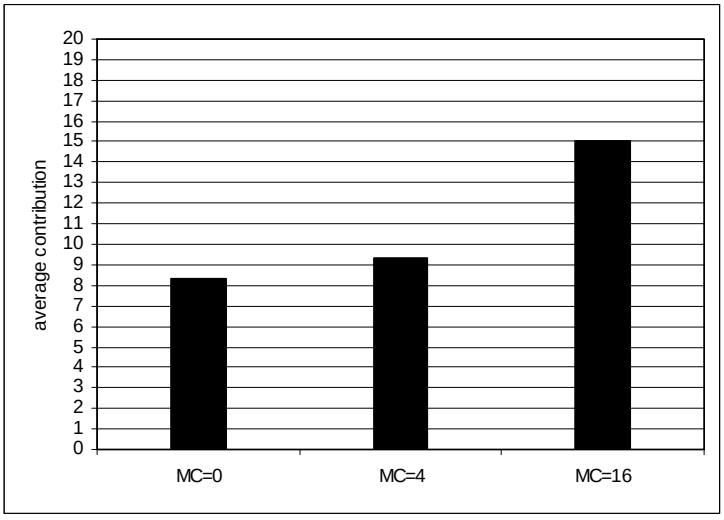
If obligations affect beliefs, we expect to observe significant differences in declared beliefs about others' contributions across treatments. If obligations affect preferences, we expect to find significant differences in the conditional contribution schedules. Indeed, if people make different contribution for the same hypothetical average contributions of other group members, this means that preferences for cooperation are directly shaped by obligations.

3. Results

3.1. Unconditional cooperation

Our first aim is to understand whether or not obligations affect unconditional contributions. In figure 1 we report average unconditional contributions in the three treatments, characterised by three different levels of minimum contribution required by obligation (respectively 0, 4 and 16 tokens). As one can notice, the treatment where the minimum contribution required is 4 tokens ('L condition') and the treatment where no minimum contribution is required ('0 condition') present similar levels of average contribution to the public good (respectively 9.36 and 8.30 tokens). Instead, the average contribution in the treatment where the minimum contribution required is equal to 16 tokens ('H condition') is remarkably higher (15.05 tokens) than in the two other treatments.

FIGURE 1
UNCONDITIONAL CONTRIBUTIONS
(average in the sample)



A Mann-Whitney rank-sum test[9] is applied in order to test the statistical significance of the differences in contribution levels between treatments[10]. Results are reported in Table 4. Mean

[9] The unit of observation in the statistical test is the group average contribution.

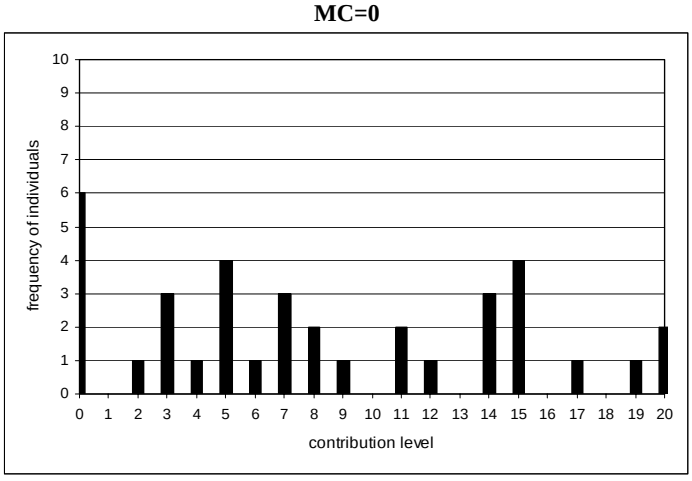
contributions under the 'H condition' are higher at significant statistical levels than mean contributions in both other treatments. Instead, we do not find a significant difference between average contributions under the '0 condition' and under the 'L condition'.

TABLE 4
MANN-WHITNEY TEST ON UNCONDITIONAL CONTRIBUTIONS

Treatment Conditions	MC=4	MC=16
MC=0	z=-0.321; p=0.7483	z=-2.887; p=0.004
MC=4		z=-2.402; p=0.016

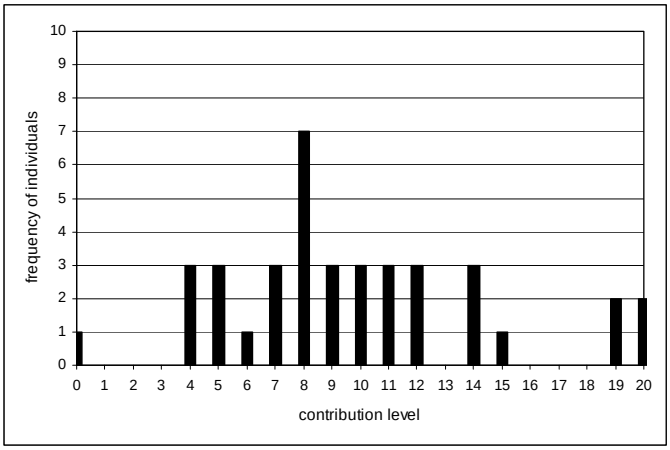
These results confirm the findings obtained by Galbiati and Vertova (2005) in a dynamic setting: for given marginal incentives, obligations can affect the average propensity to cooperate to a public good. In particular, when the minimum contribution required is sufficiently high ('H condition'), the level of cooperation is significantly higher than in presence of low or null obligation. Figure 2 reports the frequencies of contributions in the three samples. The distribution of individual contributions under the 'L condition' is not very different from the distribution of individual contributions under the '0 condition', even if in this last case the distribution is more concentrated towards an intermediate value (around 8 tokens). Instead the distribution of contributions under the 'H condition' is very different, being more shifted towards right, with individual contributions concentrated around the level of 16-18 tokens. Figure 2 suggests that, in presence of a higher level of minimum contribution required by obligation, conditional co-operators tend to cooperate more.

FIGURE 2
UNCONDITIONAL CONTRIBUTIONS
(frequency of contributions in the sample)

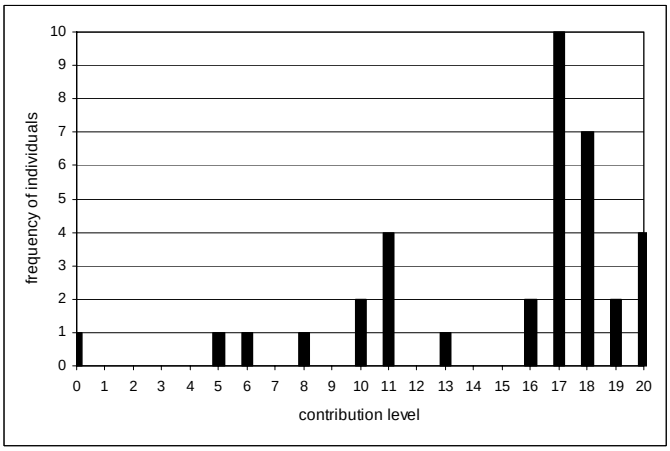


[10] We report both the values of the test (z) and the p-values (p).

MC=4



MC=16



The previous evidence can be summarized as follows:

Result 1. *Obligations affect the levels of average contributions to a one-shot public good. In particular average contributions are significantly higher when the minimum contribution required by obligation is sufficiently higher than average contributions as emerging in the 'no obligation' case.*

3.2. Beliefs

Our next step is to study how obligations affect beliefs about others' contributions. Figure 3 points out, for the three treatments, what are in average the beliefs about average unconditional contributions in the group. One can notice how the average beliefs are similar under the '0 condition' and the 'L condition' (respectively 9.44 and 8.69 tokens), whereas under the 'H condition' they are definitely higher (14.67). The results of the Mann-Whitney test reported in Tables 5 show that the previous descriptive comparison has a statistical significance. This means that obligations affect the expectations about others' contributions. In particular, when

the minimum contribution set up by obligation is sufficiently high, individuals expect other group members will contribute more.

This means that obligations anchored beliefs: indeed beliefs are coordinated towards higher (or lower) levels of expected co-operation when the level of minimum contribution required by obligation is higher (lower). Therefore, when the level of minimum contribution is sufficiently high, conditional co-operators, i.e. those people who want to cooperate when they expect others contribute at a sufficient extent, will cooperate more to the public good because of the effects of obligations on their beliefs. Result 2 summarizes evidence on beliefs.

Result 2. *Obligations affect the average beliefs about others' unconditional contributions. In particular average beliefs are significantly higher under the condition where the minimum contribution required by obligation is sufficiently high.*

FIGURE 3

BELIEFS ABOUT OTHERS' UNCONDITIONAL CONTRIBUTION

(average in the sample)

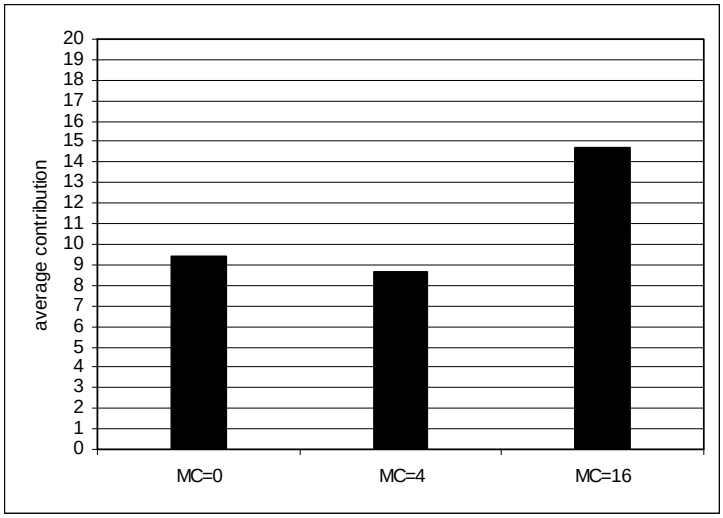


TABLE 5

MANN-WHITNEY TEST ON BELIEFS

Treatment Conditions	MC=4	MC=16
MC=0	z=0.485; p=0.679	z=-2.882; p=0.004
MC=4		z=-2.732; p=0.016

3.3. Conditional cooperation

Let us now analyze the patterns of conditional contributions under the different conditions. In average across the 21 choices (where each choice corresponds to each hypothetical average contribution in the group from 0 to 20), conditional contributions schedules are different in the three treatments (see figure 5). In particular, the average conditional contributions are about 7.81 tokens for the '0 condition', 10.31 tokens for the 'L condition' and 12.62 for the 'H condition'. The results of the Mann-Whitney test reported in Table 6 suggest that these differences are statistically significant. Figure 4 reports the patterns of conditional contributions under the three different conditions. Some interesting observations can be derived from this figure.

Comparing the curves corresponding respectively to the '0 condition' and the 'L condition', one can notice that for low levels (below 5 tokens) of hypothetical average contributions in the group, the two curves almost overlap. Instead, the two curves dramatically diverge when the hypothetical levels of average contributions in the group increase. When average contributions in the group are assumed to be 10-20 tokens, the average conditional contributions are remarkably higher under the 'L condition' than under the '0 condition'. The difference between the two curves suggests that preferences for cooperation emerging in the two treatments are different. In particular, our results show that, in correspondence to sufficiently high levels of others' hypothetical contributions, the presence of an obligation of low minimum contribution triggers a stronger preference for cooperation in the 'L condition' than in the '0 condition0'. A possible interpretation of this results is the following one: when a low contribution is required by obligation, people think that if others' contributions are higher than this 'norm', these 'others' deserve more reciprocation than in case they had contribute at similar levels but with no minimum contribution required. In conclusion, obligations represent reference points for the propensity to cooperate. It is interesting to note that, while preferences differ respectively in the '0 condition' and in the 'L condition', unconditional behaviours are very similar (see figure 1). Why? The reason is straightforward: average beliefs are very similar in the two cases and correspond to relatively low levels of average contributions in the group: in correspondence of these levels preference for cooperation are very similar between the two conditions and unconditional behaviours do not diverge.

Further clean evidence concerns the conditional contribution schedule under the treatment with high minimum contribution. One can notice that the curve of conditional contributions corresponding to the 'H condition' is always above the two other curves. For low values of hypothetical average contributions in the group, both differences are remarkable. Then, for higher values, while the difference with respect to the '0 condition' case remains almost the

same, the difference with respect to the 'L condition' becomes lower and lower as long as hypothetical average contributions increase. Two remarks are here worth doing. First, a high level of minimum contribution set up by obligation positively affects cooperation even controlling for beliefs. In other terms, people cooperate more when more is asked by obligation regardless what they think others will contribute. This means that preferences for cooperation are endogenous to obligations. Second, when hypothetical contributions are high, conditional contribution schedules are similar under respectively the 'L condition' and the 'H condition'. This means that unconditional contributions are significantly different in the two cases because the two levels of obligations coordinate beliefs around two different levels of expected cooperation. If instead beliefs were similar and sufficiently high, unconditional contributions would probably be similar. We can summarize the above evidence as follows.

Result 3. *Conditional contribution schedules are significantly different across the different treatments. People's conditional contributions to the public good are in average anchored by the obligations. This suggests that people's preferences for cooperation are endogenous to obligations.*

FIGURE 5

CONDITIONAL CONTRIBUTIONS SCHEDULES

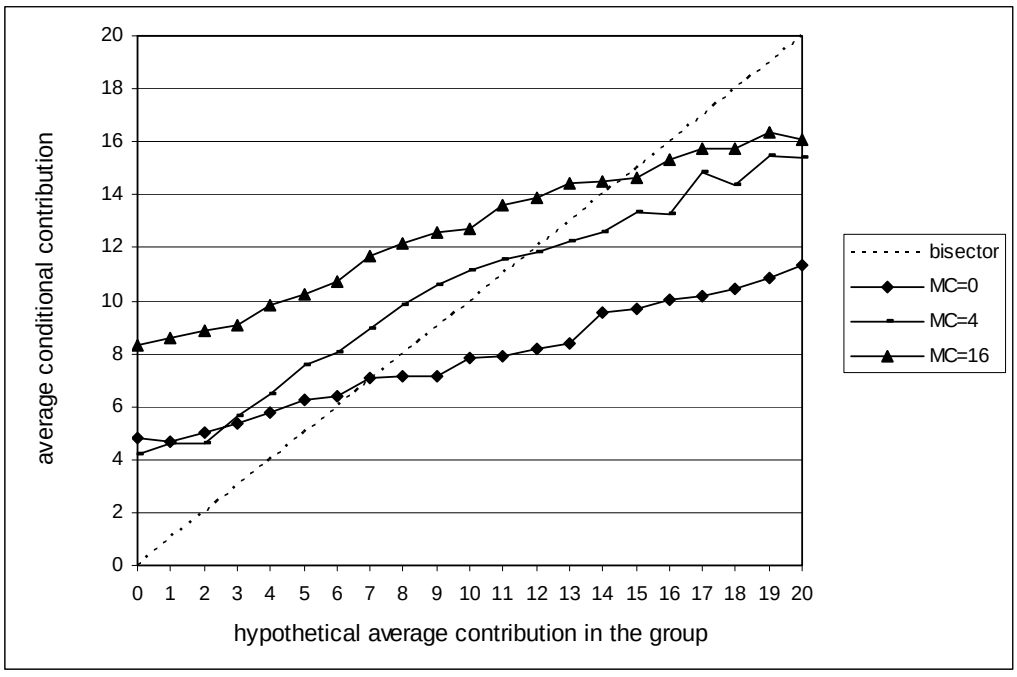


FIGURE 5

CONDITIONAL CONTRIBUTIONS

(average in the sample across 21 choices)

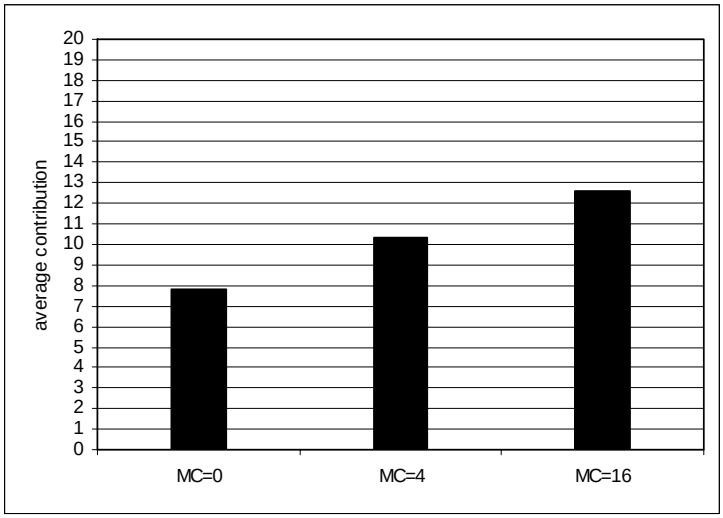


TABLE 6

MANN-WHITNEY CONDITIONAL CONTRIBUTIONS

Treatment Conditions	MC=4	MC=16
MC=0	z=-2.242; p=0.025	z=-2.882; p=0.004
MC=4		z=-2.242; p=0.025

4. Concluding Remarks

Understanding how formal rules (i.e. "obligations backed by incentives") affect human behaviour represents a fundamental task for economic theory. The economic literature has largely studied the role of material incentives in shaping people's choices. Yet, the effects of obligations (i.e. what rules ask people to do or not to do) on human behaviour is still a black box. The traditional assumption of self-interested individuals explains why obligations represent the "dark side of rules". Indeed, since obligations *per se* do not affect material payoffs, self-interested people are completely neutral to them. However, a huge experimental literature has shown how people's preferences depart from mere self-interest: *Social preferences* matter. This is a new starting point to study the impact of obligations on human behaviour. In this paper we analyze the independent effect of obligations on individuals' reasons of behaviour in a public good game. Our results, in line with Falk et al. (forthcoming) on the behavioural effects of minimum wage, show that obligations *per se* (for given marginal incentives) can affect people's

behaviour. In particular, we find that he propensity to cooperate to the public good is significantly higher when the minimum contribution required by obligation is sufficiently high. Furthermore, through a strategy based on the elicitation of beliefs and conditional contributions to the public good, we find that the effect of obligations on behaviour depends not only on the fact that beliefs about others' contributions are anchored to obligations, but also on the direct impact of obligations on social preferences.

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Appendix 1: Controlling for differences in risk preferences

In order to control for the possible effect of risk preferences, at the end of the public good experiment we run a lottery to single out subjects' risk preferences. This lottery is similar to that implemented by Holt and Laury (2001). The experimental test is based on five choices between the paired lotteries reported in Table A1.

TABLE A1
PAIRED LOTTERY CHOICES

Option A	Option B	Payoff Differences (A-B)
1/10 100 tokens; 9/10 80 tokens	1/10 170 tokens; 9/10 10 tokens	56
3/10 100 tokens; 7/10 80 tokens	3/10 170 tokens; 7/10 10 tokens	28
5/10 100 tokens; 5/10 80 tokens	5/10 170 tokens; 5/10 10 tokens	0
7/10 100 tokens; 3/10 80 tokens	7/10 170 tokens; 3/10 10 tokens	-28
9/10 100 tokens; 1/10 80 tokens	9/10 170 tokens; 1/10 10 tokens	-56

In each paired lottery, subjects choose between an alternative A and an alternative B. Once all subjects have taken their choice, a pair of lotteries is randomly chosen and the computer assigns to each subject the option (A or B) she has chosen. Finally the lottery is run in order to determine each subject's payoff. Following the method proposed by Holt and Laury (2001), we classify individual risk preferences according to the sequence of choices taken in the lottery (see table 3).

TABLE A2
RISK PREFERENCES ASSOCIATED TO LOTTERY CHOICES

Sequence of Choices	Risk type
A-A-A-A-A	highly risk averse
A-A-A-A-B	risk averse
A-A-A-B-B or A-A-B-B-B	risk neutral
A-B-B-B-B	risk lover
B-B-B-B-B	highly risk lover
Other Sequences	inconsistent coiches

In table A3 we report the frequencies of subjects by classes of risk preferences as obtained by running the experiment described in paragraph 2.3.

TABLE A3

FREQUENCIES OF SUBJECTS BY CLASSES OF RISK PREFERENCES

Classes of risk preferences	Session 1 (MC=0)	Session 2 (MC=4)	Session 3 (MC=16)
Highly risk averse	6	1	2
Risk averse	5	3	6
Risk neutral	14	23	16
Risk lover	1	2	0
Highly risk lover	1	1	1
Inconsistent choices	9	6	11

It is worth noting that the frequencies are similar across the different samples. Furthermore, we notice that the number of risk-lover or highly risk-lover individuals is very small.

In order to test whether or not differences in risk preferences are relevant in explaining differences in contributions, we have subdivided our sample into three groups: the first group is composed of risk-neutral individuals, the second composed of risk-adverse individuals and the third one is composed of highly risk-adverse individuals[11]. Moreover we compute for each subject an index given by the difference between her unconditional contribution and the minimum contribution required in her treatment. Then we apply a Mann-Whitney rank-sum test of the difference in this index between each pair of groups. The Mann-Whitney rank-sum test of the difference in this index between risk neutral and highly risk adverse individuals yields $z = -1.295$, which is not statistically significant at conventional levels. The same test applied to the difference in this index between risk neutral and risk adverse individuals yields $z = -0.627$, which is certainly not statistically significant. Finally, the difference between highly risk adverse and risk adverse individuals is also found not statistically significant ($z = -0.539$).

Hence, differences in subjects' risk preferences across the different samples do not affect our results for two reasons. First, the distribution of subjects by class of risk preferences is very similar in the different sessions. Second, there is not any significant difference in individual behaviours with respect to the minimum contribution between highly risk adverse, risk-adverse and risk-neutral individuals. This last result can be explained by the fact that the probability to be audited in each round and the penalty rate are very low.

[11] We have not considered risk-lover or highly risk-lover individuals, who represent a negligible fraction of subjects in the sample, nor individuals whose choices are inconsistent.