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Abstract

We present an experiment that models a repeated public good provision setting where the policy maker or manager does not have perfect control over information flows. Rather, information seeking can be affected by changing the information default as well as the price of information. The default is one either with or without information about others' contributions, and having information comes with a positive, zero or negative financial incentive. When information comes without a financial incentive or even is financially beneficial, almost all subjects choose to have the information, but around a third have the information even when this is costly. Moreover, a default of not having information about the others' contributions leads to a slower unravelling of cooperation, independent of the financial incentives of having information. This slower unravelling is explained by the beliefs about others' contributions in these treatments. A secondary informational default effect appears to take place. When the default is no information, subjects do not seek information more often but, conditional on financial incentives, they tend to believe that more other subjects seek information.

Keywords: information defaults, public good, value of information.

JEL Classification Codes: C91, D83, H41.

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1. Introduction

"Information is the mortar that both builds and destroys empires."

- Tobsha Learner

We investigate how various types of default information settings affect information seeking and how this in turn influences individual contribution in a voluntary contribution context. There is hardly a consensus on how much information should be publicly available. Different countries or institutions may have diverse views on the interpretation of privacy. Taking the salary of university employees as an example, salary information for a lot of public universities in the US is publicly available. Conversely, information on individual salary in the UK is often treated as private and confidential. The answer to what might have resulted in this different treatment of information could be complex. It begs a more general and interesting question – how much information is it optimal to reveal? Given the importance of team collaboration for organizational productivity as well as more generally for public good provision, how to design an optimal information architecture to maximize team productivity is clearly of great importance. Often it is assumed that policy makers or managers have perfect control of information flows, and therefore can decide whether people will know about others' behavior; however, as anyone with managerial experience knows, more often than not information flow control is imperfect. The case of an endogenous choice architecture where the policy makers or managers can only affect what the information default is, and what incentives or barriers are to switch from one information state to another, is therefore an important one.

Our paper is a step forward in studying endogenously determined information architecture, i.e. one where a choice is given to agents on whether to have information. Specifically, we are interested in two types of defaults: (i) people have information on others' contribution by default and have to actively opt out if they do not want this information (Opt-out); (ii) people do not have such information by default and have to actively opt in if they want this information (Opt-in). In addition, we are interested in whether the effect of information defaults on information seeking is sensitive to the price of information. Paying a positive price to acquire/avoid information implies that people place positive/negative value on the information.

When it comes to information availability, one might think that more information is always better than less. Revealing peer information is indeed a common nudge used to promote pro-social behavior such as charitable giving (Smith et al. 2015) and voluntary contribution (Shang and Croson 2009). However, evidence also exists in the literature indicating otherwise. Depending on what the information is, how it is conveyed and whom it is communicated to,

information could generate contrastingly different effects. For instance, Goldin et al. (2017) find that stressing peers' low contribution rates to pensions encourages participation to pension plans. However, if this peer information mentions medium or high contribution rates, such effects do not exist. Peer information could even lead to negative responses such as reduced saving (Beshears et al. 2015). A possible explanation is that peer information results in social comparison, which may discourage the economically disadvantaged group.

In a similar vein, there is mixed evidence on the effect of peer information on individual contribution in voluntary contribution settings. Some studies find positive effects (Shang and Croson 2009; Nikiforakis 2010; Tasch and Houser 2018) while others find no effect (Sell and Wilson 1991; Weimann 1994; Croson 2001; Cox and Stoddard, 2015) or negative effects (Wilson and Sell 1997; Neugebauer et al. 2009; Chaudhuri et al. 2017) or, in a meta-review, mixed effects (Fiana and Suetens, 2017). Carpenter (2004) and Sonntag and Zizzo (2019) find contribution unraveling as a result of information in repeated public good contribution settings. Most of the research however is on an exogenously set information architecture.

There are four exceptions we are aware of looking at specific aspects of endogenously determined information architecture. In a circular public good game experiment, Kurzban and DeScioli (2007) found 46% of subjects are willing to pay a small price (0.40 USD) to view previous contribution information. In contrast, in a sequential public good game, subjects made contribution choices but then had an opportunity to revise choices based on information about the contribution of others, with 12% of subjects refusing to do so even when this is free (Tasch and Houser, 2018). Bigoni and Suetens (2012) had a treatment where subjects had a choice whether to have extra information on individual contributions for free and most of the subjects did, but in any case, they had aggregate contribution information. In a team real effort task, Sonntag and Zizzo (2019) found that people rarely seek knowledge about whether the others' production is due to effort or to chance, even when the cost of doing so is negligible.

Our paper is also related to the strand of literature on default options. Defaults have been found to be influential in various domains such as retirement saving (Madrian and Shea 2001; Thaler and Sunstein 2003; Choi et al. 2004; Beshears et al. 2008), insurance choice (Johnson et al. 1993) and organ donation (Johnson and Goldstein 2003). The effect may come from various channels. For instance, the perception of defaults being suggestions or normative signals (Madrian and Shea 2001; Choi et al. 2004; McKenzie et al. 2006; Thaler and Sunstein 2008), loss aversion (Kahneman et al. 1991; Samuelson and Zeckhauser 1988) and subtle influence on preferences (Dhingra et al. 2012). The use of *contribution* defaults has been studied empirically

in public good experiments. Those studies usually involve setting default options of contribution – either a fully passive default by contributing a certain amount (Messer et al. 2007; Altmann and Falk 2009; Cappelletti et al. 2014; Carlsson et al. 2015) or a hybrid default by requiring one to actively decide the contribution amount, which is positive by default (Liu and Riyanto 2017).

Our paper contributes to the literature on endogenous information architecture in four ways. First, to the best of our knowledge, we are the first to study *information* defaults in the voluntary contribution setting. The defaults used in the literature usually concern the contribution amount. The default we adopt is about the availability of others' contribution information. Though this information may exert influence on contribution, our default options do not involve contribution decisions directly. More broadly speaking, default options studied in the literature are often about certain actions (e.g., saving, organ donation, contribution). Our default options work on information instead of directly on actions, which makes our approach novel. Second, we are the first to look at a choice in a standard repeated public good contribution environment about whether to have or not have information about others' contribution. Third, we systematically change the price of information to be a zero, positive or negative meaningful price. Given that information could potentially hurt contribution, we cannot rule out the possibility that people may want to avoid this information (e.g., Huck et al., 2017). If this preference to avoid information is strong enough, people might be willing to pay for not having information. Fourth, by eliciting beliefs about contributions and about information seeking, we are able to explore mechanisms by which information architecture defaults and choice work. We are specifically able to shed light on whether the kind of imitation behavior that Bigoni and Suetens (2012) find is the result of a mindless rule of thumb behavior or may reflect a genuine desire to imitate what others are doing (for example, due to either conformist or social preferences).

We find that when information comes without a financial incentive (zero price) or even is financially beneficial (negative price), almost all subjects choose to have the information, but around a third have the information even when this is costly. Moreover, a default of not having information about the others' contributions leads to a slower unravelling of cooperation, independent of the price of information. This slower unravelling is explained by the beliefs about others' contributions in these treatments. Imitation of others' past contributions appears to take place, and at least to some degree reflects a desire to imitate what others are doing. Interestingly, a secondary informational default effect appears to take place. When the default

is no information, subjects do not seek information more often but, conditional on financial incentives, they tend to believe that more other subjects seek information.

The rest of the paper proceeds as follows. Section 2 introduces the experimental design and hypotheses. Section 3 details our results, followed by a discussion and conclusions in section 4.

2. Experimental Design and Hypotheses

Set-up and treatments

We employ a standard linear public good game as the platform. Subjects play in groups of size n and each one has an initial endowment of E. Each individual has a private account and all members of the same group share a common group account. Group members decide simultaneously how to allocate the endowment E into their private accounts and the group account. Every unit placed in the private account generates a payoff of one unit for the individual. Every unit placed in the group account generates α ($0 < \alpha < 1$) units payoff for every group member, regardless of who contributed the unit. Suppose subject i contributes c_i ($0 \leq c_i \leq E$) to the group account, her payoff π_i is as follows:

$$\pi_i = E - c_i + \alpha \sum_1^n c_j \qquad (1)$$

Since the marginal payoff from contributing to the group account is negative (i.e., $\partial \pi_i / \partial c_i = \alpha - 1 < 0$), the dominant strategy is to contribute nothing, which results in the zero-contribution equilibrium.

We adopt a full factorial 2 x 3 treatment design. On the one hand, we vary the information default. The default is either having information about the group members' aggregate contributions with the chance to opt out or not having that information with the chance to opt in. On the other hand, on the dimension of monetary incentives, we implement three levels: positive, zero and negative incentives for having the information. To minimize the noise in information seeking behavior and to elicit the preference for information, we set price (positive or negative) to a non-trivial amount. Table 1 outlines the experiment design.

Table 1: Experimental treatments

	Price of information is		
Default is	positive	zero	negative
Not having info	positive opt-in (PI, 10)	zero opt-in (ZI, 10)	negative opt-in (NI, 10)
Having info	positive opt-out (PO, 10)	zero opt-out (ZO, 10)	negative opt-out (NO, 10)

Note: Treatment abbreviations and number of independent observations in parentheses.

Procedures

The experiment was conducted in the Experimental and Behavioural Economics Lab at Newcastle University, United Kingdom. Subjects were recruited randomly using Hroot (Bock et al. 2014) and the experiment was implemented using z-tree (Fischbacher 2007). We used a between-subject design. All decisions were anonymous. We set the group size to 4, the endowment to 20 experimental currency units (ECU, each worth GBP 0.50), α to 0.4 and the cost of information to 2 ECU (= 1 pound). There were 40 subjects in 3 sessions for each treatment, totaling 240 subjects in 18 sessions. Subjects were seated randomly and were given written instructions.[1] Instructions were also read out aloud at the beginning of every session. Questions were answered privately. Subjects had to answer all control questions correctly before proceeding with the experiment.

At the beginning of the session, subjects were randomly matched into groups and the group composition remained the same during the course of the experiment. The fixed-partner matching was chosen because we wanted to learn about the evolutionary pattern of default effects over time. In addition, the partner matching suited our purpose of studying information seeking behavior. Each subject was given an endowment of 20 ECU at the beginning of every period. Beliefs on other group members' information seeking behavior and contribution were elicited *before* the contribution decision in every period.[2] Together with the contribution

[1] All instructions are available in the appendix.

[2] We elicit both descriptive beliefs (what others will do) and normative beliefs (what others should do). For beliefs on information seeking (information guesses), the question to elicit descriptive beliefs states "How many of your co-participants *will* choose to get the optional information this round?" in the three opt-in treatments. It states "How many of your co-participants will choose not to get the optional information this round?" in the three opt-out treatments. The wording always refers to the active action against the default option, that is, "choose to get" in the opt-in treatments and "choose not to get" in the opt-out treatments. Likewise, the question to elicit normative beliefs used "should choose to get" in the opt-in treatments and "should choose not to get" in the opt-out treatments. It was a design choice to use default-dependent wording as it gives precise descriptions of actions in corresponding treatments. For beliefs on contribution (contribution guesses), subjects were asked how much others *will* contribute in descriptive belief elicitation and how much others *should* contribute in normative belief elicitation.

decision, subjects had the option to choose whether to have the optional information at the end of the period, depending on the treatment they were in.[3] The optional information included the average and total group contribution. The belief elicitation was incentivized.[4] Subjects played the game for 10 periods. One period was randomly chosen as the binding period for payment. The average duration for the experiment was around 80 minutes and the average payment was around 17 British Pounds (equivalent to 24 US dollars roughly at the time of the experiment). Subjects were paid in cash and in private at the end of the experiment.

Hypotheses

Based on the existing literature, in this subsection, we outline our hypotheses.

Hypothesis 1: More subjects choose to have the optional information in the opt-out treatments than that in the opt-in treatments.

There is substantial evidence showing that defaults are sticky. It shows that people tend to stay with the default option even though switching away from the default involves relatively low or zero cost. This phenomenon exists in various domains, such as organ donation (Johnson and Goldstein 2003), insurance choice (Johnson et al. 1993), retirement saving (Madrian and Shea 2001) and voluntary contribution in public good provision (Cappelletti et al. 2014; Carlsson et al. 2015; Liu and Riyanto 2017). In a similar vein, we expect this behavioral inertia in our study. In other words, we expect more subjects to end up having the optional information where having the information is the default.

Hypothesis 2: Information has a positive value, but the law of demand applies, i.e., as the price of information increases, fewer subjects choose to have the information.

Previous evidence from experimental public good games suggests that subjects behave as conditional cooperators (e.g., Fischbacher, Gächter, & Fehr, 2001; Croson, 2007), which suggests that they typically care about knowing their peers' contributions. Subjects might use such information to match their peers' contributions, thereby avoiding being free-ridden on by others. Such a matching could also be imperfect or self-biased (Neugebauer et al. 2009; Fischbacher and Gaechter 2010), indicating that subjects may contribute less than matching

[3] The wording is also default-dependent. The option states "I choose to get the optional information" in the opt-in treatments and "I choose not to get the optional information" in the opt-out treatments.
[4] The additional payoff from belief elicitation on information seeking is 8 ECU if their beliefs turned out to be what actually happened. The one from belief elicitation on contribution is 12 ECU, 8 ECU or 4 ECU depending on how close their beliefs are to the actual contribution.

proportionally to others' contributions. In any case, in order to condition their own behavior on the behavior of others, such information must be accessible in the first place. Following this line of reasoning, as well as previous experimental evidence as reviewed in section 1, we expect that people value the information about others' contributions and thus, we expect that subjects are willing to pay for this kind of information. However, the demand for information will follow the law of demand, i.e., demand for information will decrease as its price increases.

Despite the argument outlined above, we also include a negative price treatment as a control to incorporate the possibility that subjects might also be willing to pay to avoid having the optional information. Traditional economic theory takes for granted that people have no reason to reject information that has a bearing on their future decisions, especially when it is costless. However, it has been found that information avoidance exists in various domains (see Golman and Hagmann, 2010, for an excellent review). Studies show that subjects may actively choose to play ignorant in contexts involving health (Oster et al. 2013; Ganguly and Tasoff 2016;), financial investment (Karlsson et al. 2009; Sicherman et al. 2016) and task performance in real effort settings (Szech et al. 2016). If knowing bad news is worse than suspecting the possibility of bad news, people may choose to "bury their heads in the sand" to deliberately avoid the information (Karlsson et al. 2009). Following this line of reasoning, if subjects perceive knowing about others' free riding on their own contributions to be worse than suspecting so, they would choose not to have the information even when doing so is costly. The negative price treatments control for this possibility.

Hypothesis 3: Subjects adjust their contributions from t-1 to t to reduce the gap between their own contributions in t-1 and their beliefs about the group's average contribution in t-1. On having the optional information, subjects rely on the actual information.

Hypothesis 3 describes a dynamic updating process regarding the subject's contribution over time. In particular, our behavioral model builds on Bigoni and Suetens (2012), in the sense that we also model updates in the subjects' contributions over time as a function of previous gaps to the previous group's average contribution. Nevertheless, our hypothesis goes beyond Bigoni and Suetens (2012). Specifically, we hypothesize that, when information is not available, subjects use their beliefs about the other group members' contributions to adjust their own contributions. In this sense, we conjecture that there is not simple imitation of observed behavior as a mindless rule of thumb, a point we return in the discussion section. Since we elicit beliefs in every round, we can infer to what extent subjects base their contributions on beliefs.

Also, since whether to have information about the group's average contribution is endogenous in our setting, we can further infer to what extent the very fact of having had the information is used to update the contribution beliefs.

The expected behavior in hypotheses 3 is not stated in terms of absolute contributions, but in terms of differences between subjects' own contribution and their expectations about the other group members' average contribution. We expect that subjects will seek to close the gap between the contributions of other group members and their own contribution. Such behavior could be explained by inequality averse preferences, such as Fehr and Schmidt's (1999), or conformist preferences, where subjects would dislike contributing both more or less than other subjects of their group. In case subjects do not have the optional information, they will rely their contribution decisions on their own beliefs about the other group members' contributions. In case subjects have the optional information, they will base their contribution choices on the actual average contribution of their fellow group members, rather than on their beliefs about it.

Similar to Bigoni and Suetens (2012) we expect that whether subjects increase or decrease their contributions from period t-1 to t depends on whether their own contribution in t-1 was below or above the average contribution of the other group members in t-1 (in case the optional information is not available, the beliefs about them), respectively.

$$c_{it} - c_{it-1} = \alpha + \beta \, \Delta_{it} \tag{1}$$

with

$$\Delta_{it} = \tfrac{1}{4} \sum_{i=1}^{4} c_{it-1} - c_{it-1} \tag{2}$$

That is, we expect β in equation (1) to have a statistically significant positive sign. We also expect that β is of greater magnitude for subjects who had the optional information compared to those that did not.

3. Results

We begin by providing descriptive results of the overall sample. We then test the three hypotheses stated above. Finally, we provide additional results about contribution levels that are not directly linked to one of our hypotheses.

Table 2: Descriptive statistics

Treatment	N	Contribution	Contribution belief		Information	Information belief		Female	Age
			descriptive	normative		descriptive	normative		
PI	400	7.17	8.16	10.18	40%	50%	57%	50%	22.25
PO	400	6.41	7.43	8.97	34%	30%	28%	60%	22.85
ZI	400	7.40	7.82	9.79	87%	86%	89%	73%	23.60
ZO	400	5.15	5.76	8.30	90%	87%	86%	58%	22.23
NI	400	7.23	7.36	9.40	96%	96%	95%	63%	22.65
NO	400	6.56	6.67	8.09	97%	86%	87%	55%	22.60

Table 2 presents summary statistics for the overall sample. We cannot reject the null hypothesis that randomization into treatments was successful in the sense that observable individual characteristics such as gender, age or the field of study did not vary across treatments (Kruskal-Wallis tests: all $p > 0.100$).[5] We collected 10 independent observations per treatment.

Testing Hypotheses

Result 1: In contrast to H1, the informational default (opt-in or opt-out) does not affect the likelihood of having the information.

Whether having or not having the optional information as a default did not affect the proportion of subjects actually ending up with the optional information, at all (two-sided Wilcoxon ranksum test: $p = 0.789$).[6] This finding is surprising, given the substantial and robust effects of defaults in a variety of lab and field experimental settings, and we will come back to it in section 4.

[5] Unless otherwise stated, we conduct all non-parametric tests on group averages to account for non-independence of observations on individual level.

[6] The null-influence of the information default is robust across price levels (PI vs. PO: $p = 0.384$, ZI vs. ZO: $p = 0.359$, NI vs. NO: $p = 0.935$).

Result 2: In support of H2, subjects ascribe a positive value to information.

Figure 1: Proportion of subjects who end up with the optional information

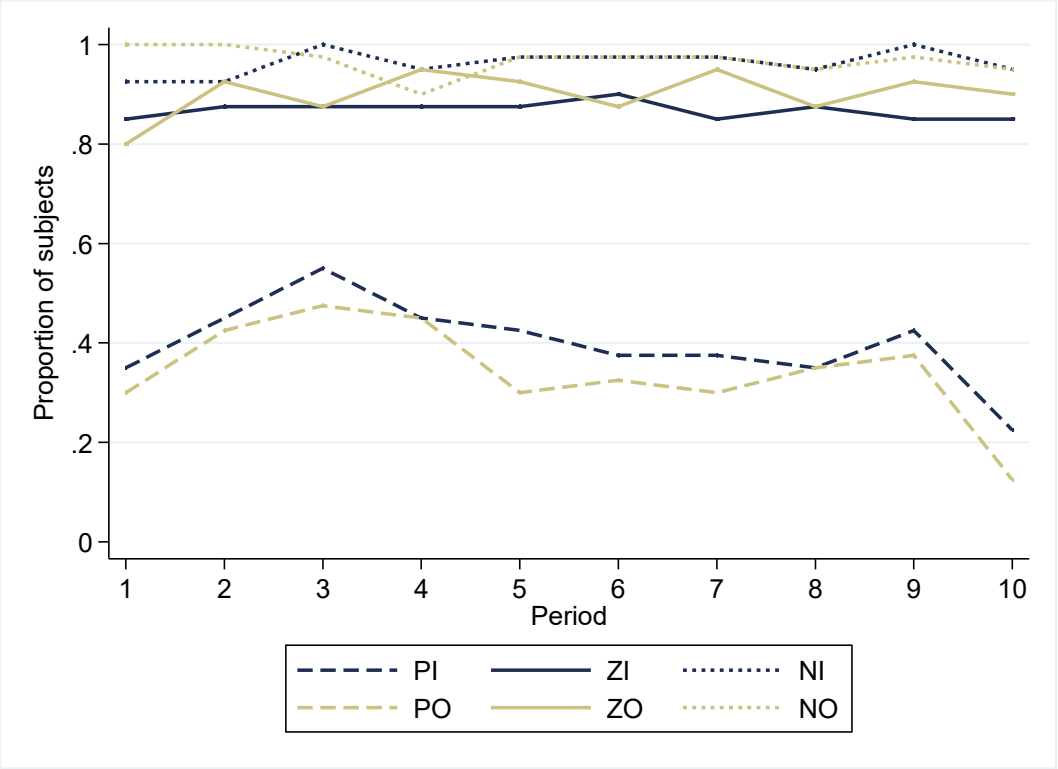


Figure 1 suggests that subjects on average ascribe a positive value to having the optional information. In treatments where following the monetary incentive is aligned with having the optional information (NI and NO), or where the price for information was zero (ZI and ZO), in over 92% of all cases subjects got the optional information. This high share is not significantly different from always having the optional information (Sign tests, all $p = 1.000$). However, the proportion drops dramatically to about 34% and 40% for the treatments PI and PO, respectively, where having the information comes at a positive price.[7] Although subjects seem to follow the monetary incentives to some extent, a significant proportion also seem to attach a positive value to the optional information. That is, they are willing to trade off additional earnings for information about their co-players' contributions (see Figure A1 in the appendix for detailed distributions on information types). In case subjects were only interested in money, but not in information, the proportion of people seeking information against their monetary interest should have dropped to zero, which it clearly did not (Sign tests, both $p < 0.001$). The

[7] The difference in the number of subjects that have information is significantly different between treatments where having the information goes against their financial interests (PI, PO) and where this is not the case (ZI, ZO, NI, NO; Ranksum test: $p < 0.001$). However, we observe no significant differences related to the information default (PI vs. PO, ZI vs. ZO, NI vs. NO: all pairwise Ranksum tests: $p > 0.359$).

nonparametric findings of result 2 above are confirmed by regression analysis (see Table 3, models 1 and 2).

Table 3: Likelihood of having the optional information and belief how many other group members will have the optional information

	(1) Having info	(2) Having info	(3) Belief info	(4) Belief info
Default no info	-0.00443	-0.0165	0.283***	0.283***
	(0.0328)	(0.0817)	(0.109)	(0.108)
Price	-0.295***	-0.315***	-0.763***	-0.836***
	(0.0223)	(0.0429)	(0.0668)	(0.0935)
Default: no info x price		0.0392		0.146
		(0.0454)		(0.132)
Constant			2.031***	2.031***
			(0.0771)	(0.0763)
Observations	2400	2400	2400	2400
Log. Likelihood	-749.3	-748.9	-2688.3	-2687.7
Chi-squared	131.4	131.4	137.3	141.4

Notes: Columns 1 and 2 contain marginal effects of logit estimations on the likelihood of having the information. Columns 3 and 4 contain coefficients of linear models on information belief, i.e., the number of how many other group members will have the information. All models were estimated using multi-level error clustering (subjects nested in groups); controlling for additional correlates such as age, gender and whether the field of study was Economics did not qualitatively change the picture (see Table A2 in appendix); levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Somewhat counter-intuitively, subjects believe that more group members will have the optional information when the default is not having the information (see Table 3, models 3 and 4), a point we will come back to in the discussion section.[8]

[8] As indicated in section 2, we also elicited normative information beliefs, i.e., the number of how many other group members *should* have the information. These beliefs are highly correlated with the descriptive beliefs (Pearson $\rho = 0.729, p < 0.001$, see also Table A6 in the appendix for regression results). Details about the specific distributions over time for all treatments are provided in Figures A2 and A3 in the appendix.

Figure 2: Belief about how many other group members will have the optional information

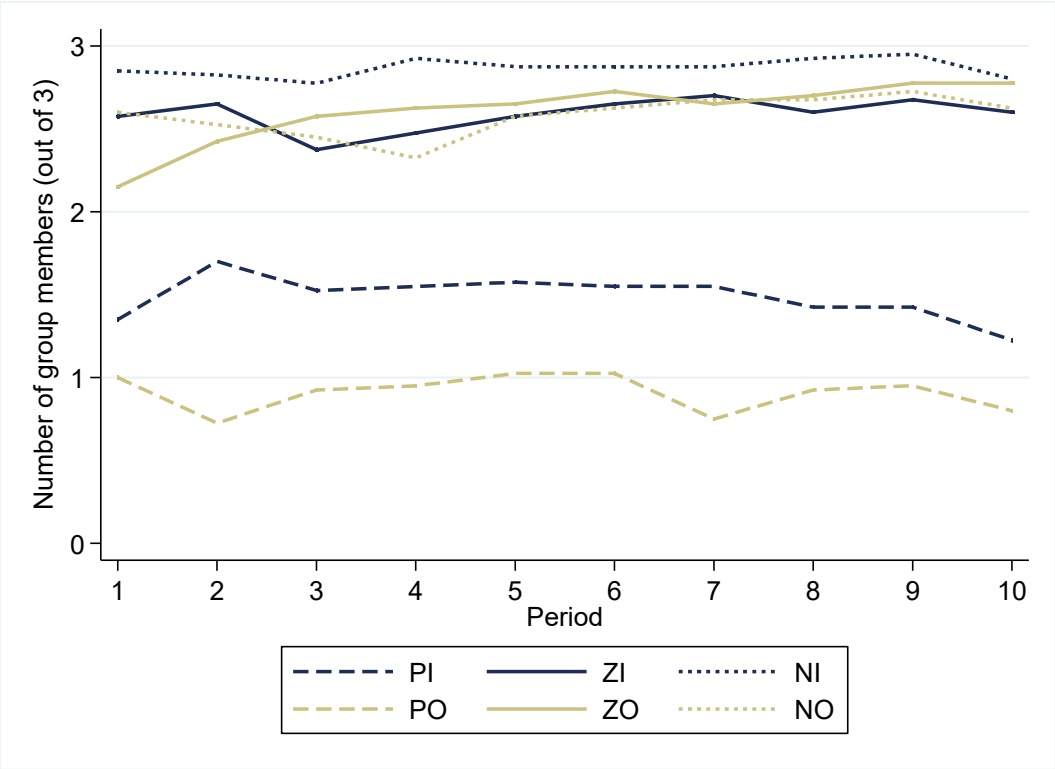


Figure 2 depicts the subjects' beliefs about how many co-players out of 3 will have the optional information. The beliefs are generally in line with actual observations (i.e., higher beliefs about having information when doing so is aligned with monetary incentives and lower beliefs when monetary incentives are not aligned, two-sided Wilcoxon rank-sum test ZI, ZO, NI & NO vs. PI & PO: $p < 0.001$). However, there exists a secondary information default effect. When information is costly, and when not having the optional information is the default, the believed number of other group members having the optional information is significantly higher than that in the case where having the information is the default (Ranksum test PI vs. PO: $p = 0.001$). Interestingly, this secondary information default effect is only present when information is costly (Ranksum tests ZI vs. ZO: $p = 0.404$, NI vs. NO: $p = 0.111$).

Result 3: In support of H3, subjects adjust their contributions towards the previous period's average group contributions, or their beliefs towards the previous period's average group contributions if they do not have the information.

Table 4: Imitation of previous period's average group contributions

	(1)	(2)	(3)	(4)	(5)	(6)
			Contribution (t) - (t-1)			
	all	all	all	pos. Δ only	neg. Δ only	all
Δ (t-1)	0.552***	0.399***	0.589***	0.126*	0.588***	0.399***
	(-0.0212)	(-0.042)	(-0.026)	(0.0650)	(0.0745)	(0.0415)
Δ (t-1) x having info (t-1)		0.199***		0.180***	0.235***	0.416***
		(-0.0475)		(0.0632)	(0.0737)	(0.0542)
Δ (t-1) x pos. price			-0.122***			
			(-0.0445)			
Δ (t-1) x having info (t-1) x pos. Δ (t-1)						-0.483***
						(0.0606)
Constant	-0.303***	-0.299***	-0.303***	0.541***	0.472**	0.203*
	(-0.0946)	(-0.094)	(-0.0932)	(0.177)	(0.200)	(0.114)
Observations	2160	2160	2160	1157	1003	2160
Log. Likelihood	-5754.1	-5745.4	-5750.4	-2871.1	-2756.5	-5714.1
Chi-squared	676.6	698.3	679.2	50.23	309.9	795.1

Notes: Columns 1-6 contain coefficients from linear models on subjects' contribution increase as specified in equation (1) on page 9; standard errors in parentheses with multi-level clustering: subjects nested in groups; controlling for additional correlates such as age, gender and whether the field of study was Economics did not qualitatively change the picture (cf. Table A3 in the appendix); levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 estimates the change of a subject's contributions across periods (contribution in period t minus contribution in period t-1) as a function of *Δ(t-1)*, the difference of the subject's contributions in the previous period and the average contribution of the group in the previous period. This is estimated based either on the actual average contribution of the group in the previous period (if subjects have the information) or (when they do not) on their belief on the average contribution of the group in the previous period. We find that the difference from the group's average contribution in the previous period is a strong predictor for the change of contributions over time. The positive regression coefficient of model 1 means that subjects significantly increased their contributions if they contributed less than the (believed) average in the previous period and that they significantly reduced their contributions when they contributed more than the (believed) average. Thus, we find strong support for the behavioral pattern of 'imitating the group average'. Model 2 controls for whether subjects had the optional information in the previous period. By controlling for this, the coefficient on *Δ(t-1)* can then be interpreted as the effect of the belief about the average contribution of the group in the previous

period. We still find a strong imitation effect in terms of believed difference from the group's average in the previous period (around 40%). This is consistent with subjects not relying on mindless imitation of others' behavior, but rather – at least to some degree – on social or conformist preferences. Model 2 also shows that subjects do more strongly imitate the group's average contribution of the previous period when they actually had the optional information in comparison to when they did not have it. Since having the information has a precision that a simple belief does not have, this is to be expected. However, since whether or not to have the optional information is endogenous to the subject, we cannot interpret the positive coefficient of the term *Δ (t-1) x having info (t-1)* as necessarily entailing a causal effect of having the information on contribution behavior. To address this, we can use a positive price of information as an exogenous proxy for not having information. This is because optional information seeking is negatively correlated with the price of information (Result 2), and the price of information, as a treatment variable, is exogenous to subjects' unobserved characteristics that might affect both information choice and contribution behavior. Because optional information seeking is negatively correlated with the price of information, we expect the coefficient on *Δ (t-1) x pos. price (t-1)* to be negative, and this is indeed the case (Model 3). The net effect of *Δ (t-1)* remains positive, as in Model 2.

Models 4-6 show that the effect of information on the previous period's group average asymmetrically depends on whether the own contribution in t-1 was above or below the group average in t-1. Having information leads to stronger adjustments towards the group mean when subjects learn that they contributed more than the group average (disadvantageous inequality) than when they contributed less than the group average (advantageous inequality). Models 4 and 5 only contain observations for advantageous and disadvantageous inequality, respectively. Model 6 shows that this asymmetry in behavioral reactions is statistically significant (coefficient of *Δ (t-1) x having info (t-1) x pos. Δ (t-1)*). The fact that people dislike both free-riding on others and being free-ridden on by others, but that they dislike the latter even more than former, is in line with preference-based explanations of imitation postulating such an asymmetry (e.g., Fehr & Schmidt, 1999).

Further results

Result 4: Contributions decrease over time, and much more so in treatments where subjects received the optional information as a default.

Figure 3(a) shows that contributions substantially decline over time. This decline amounts to an average -0.28 units per period across all treatments and prevails when controlling for level difference between treatments (see Table 5, model 2). However, model 3 in Table 5 shows that, when not receiving the optional information is the default (PI, ZI and NI), this time trend is significantly less steep than in treatments where subjects received the optional information as a default (PO, ZO and NO, see *Period x Default no info*). In other words, we find slower unravelling of cooperation in treatments where the default is not having information about the others' contributions. That is particularly interesting in light of Result 1, because Result 4 indicates slower unravelling of cooperation where having no information was the default despite the fact that the propensity to have the optional information did not vary by information default. We will discuss this further in the next section.

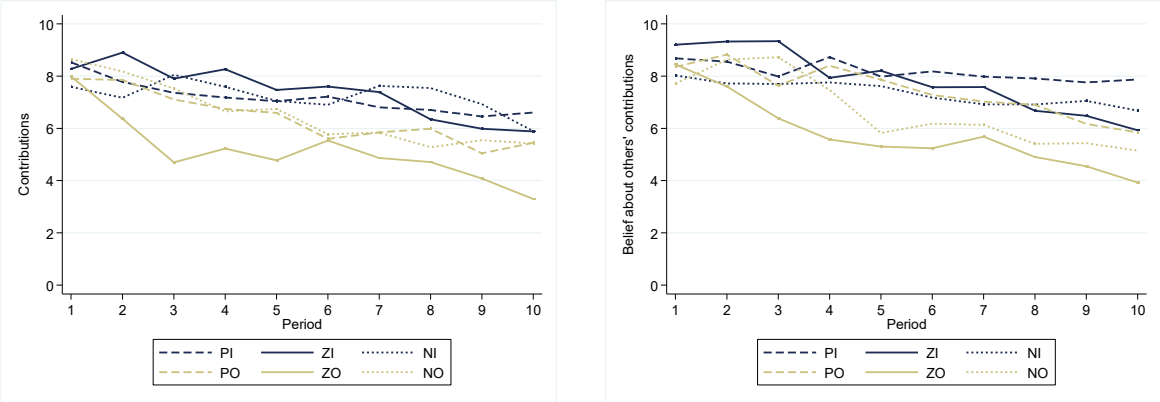
Result 5: The different evolution of contributions between treatments over time is driven by a different evolution of beliefs about the average contribution of other group members.

Adding the descriptive belief about contributions ("How many ECU will your co-participants contribute on average to the project this round?") to the regressions makes the coefficient interaction term *Period x Default no info* insignificant and close to 0 (see Table 5, models 4 and 5), as well as leading to an improvement in fit (in terms of log likelihood).[9] Contribution beliefs are an equally good predictor of individual contributions in all treatments (see Table 5, model 6, interaction terms with *Contribution belief*). Overall, this evidence shows that cooperation unraveling in the no information default treatments is explained by contribution beliefs and how these evolve with time, rather than these being weighted differently in the no information default treatments. Figure 3(b) and the regression analysis in Table A5 (model 3, coefficient *Period x Default no info*) show that indeed contribution beliefs evolve differently and, specifically, have a more negative time trend in the no information default treatments (PO, ZO and NO) than in the others (PI, ZI and NI).

9 As indicated in section 2 we also elicited subject's normative contribution beliefs. These are highly correlated with the descriptive beliefs (Pearson $\rho = 0.590, p < 0.001$). Normative beliefs are on average about 2 ECU above descriptive beliefs, irrespective of the treatment. While the main text of this paper uses descriptive beliefs, the same qualitative results can be found using normative beliefs. See section A.2.4 in the appendix for more details on normative beliefs.

Figure 3: Average contributions and beliefs about the average contribution of others

(a) (b)



Notes: Panels (a) and (b) contain the average contributions and the average beliefs about the average contributions of other, by treatment and period, respectively. Both contributions and contribution beliefs decline faster in opt-out treatments where having the information is the default (PO, ZO and NO).

Table 5: Individual contribution

	(1)	(2)	(3)	(4)	(5)
Default no info	1.225	1.225	0.458	0.280	0.625
	(0.846)	(0.846)	(0.890)	(0.471)	(0.599)
Price	0.0541	0.0541	0.260	0.335	0.492
	(0.518)	(0.518)	(0.771)	(0.408)	(0.470)
Period		-0.277***	-0.347***	-0.0930***	-0.0866***
		(0.0252)	(0.0356)	(0.0312)	(0.0321)
Default no info x Price			-0.414	-0.310	-0.327
			(1.090)	(0.576)	(0.579)
Period x Default no info			0.139***	0.0280	0.0170
			(0.0503)	(0.0429)	(0.0445)
Period x Price			-0.0336	-0.000193	-0.00532
			(0.0436)	(0.0370)	(0.0381)
Period x Default no info x Price			0.0677	0.0517	0.0542
			(0.0617)	(0.0523)	(0.0526)
Contribution belief				0.681***	0.699***
				(0.0207)	(0.0296)
Contribution belief x Default no info					-0.0393
					(0.0418)
Contribution belief x Price					-0.0173
					(0.0257)
Constant	6.042***	7.564***	7.948***	2.048***	1.885***
	(0.598)	(0.614)	(0.629)	(0.378)	(0.421)
Observations	2400	2400	2400	2400	2400
Log. Likelihood	-6786.2	-6727.6	-6723.1	-6306.2	-6305.6
Chi-squared	2.108	122.6	132.0	1268.1	1267.9

Notes: Reference treatment in all columns: default=info, price=0; Contribution belief refers to descriptive contribution beliefs; all columns contain coefficients of linear models, each with multi-level error clustering: subjects nested in groups; errors in parentheses; controlling for additional correlates such as age, gender and whether the field of study was Economics did not qualitatively change the picture (cf. Table A4 in the appendix); see the Table A5 in appendix for regression results on the beliefs about average contributions of others; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4. Discussion and conclusions

While sometimes it is the case that policy makers or managers have perfect control of information flows, and therefore can decide whether people will know what everyone else has been contributing, more often than not the control of information flows is imperfect. The case of an endogenous choice architecture where the policy makers or managers can only affect what is the information default and what it takes to switch from one information state to another, is therefore both a pertinent and a realistic one.

Our results are a combination of the expected and the unexpected. As predicted, information has positive value: 30-40% of participants were willing to pay a pound to obtain information, with no evidence of a negative trend in information seeking (see Figure 1). Note that, unlike previous research including Sonntag and Zizzo (2019) and Bigoni and Suetens (2012), in our experiment the alternative to receiving information was receiving *no* information, i.e., we were not in a naturally information rich environment.

Also as predicted, we were able to generalize and find support for Bigoni and Suetens' (2012) behavioral imitation model. More specifically, we found evidence consistent with imitation not being driven by a mindless rule of thumb by which, when subjects see what the others have done, they tend to copy it. Rather, even in the absence of information, on average subjects rely on their beliefs about the other players' contribution behavior in the previous period to play a conditionally cooperative strategy. This is consistent with playing according to social preferences such as inequality aversion, or other kind of conformist preferences. The adjustment towards the group contribution is stronger with disadvantageous than with advantageous inequality, which is especially consistent with models such as Fehr and Schmidt (1999) that explicitly incorporate such an asymmetry.

One other sign that subjects had a reasonable understanding of the decision environment is in the fact that, unexpectedly, they were immune to a standard default effect as predicted by our Hypothesis 1. They sought information to the same extent whether or not the default was that they had or they did not have information. In this sense, there was no *primary* default effect, i.e., no effect of the default directly on the variable over which the default applies, that is (in our experiment), information. As this is the first experiment on information defaults, we leave it to future research to determine whether the lack of such primary information default effects reflects something specific to a public good setting, or whether it would generalize to other settings.

We find, however, evidence of a *secondary* default effect. While almost everyone understands that almost everyone will seek information under zero or negative price of information, when the price of information is positive, subjects tend to believe that more other subjects have information under a no information default than under an information default. This secondary information default is not only unexpected but also working in the opposite direction to what one might expect. Future research will need to determine whether it is a robust finding and, if so, what its explanation might be.

A more important effect of information defaults is on public good contribution. While information defaults do not affect the *actual* availability of information, having no information as a default leads to slower cooperation unraveling than if the default is having information. The evolution of contribution beliefs explains the different dynamics across treatments. A possible conjecture is that, if subjects believe that under an information default people either end up having less information (the secondary information default effect) or in any case paying less attention to the information that they have, they expect contribution to unravel more quickly due to lower cooperation enforcement. Lower contribution beliefs, in turn, may lead to faster cooperation unraveling. Obviously, this is just a conjecture which future research will need to test.

What we can conclude is that policy makers and decision makers should bear in mind that a default of no information about other players' past public good contributions can work better for cooperation than when the default is information. If in a different setting, our findings add to Carpenter (2004) and Sonntag and Zizzo (2019) in showing the dangers of cooperation unraveling when information is given to subjects – in our paper, simply as a default relative to a default of no information.

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Appendix

Contents

A.1 Experimental Instructions

A.1.1 General Instructions (same for all treatments)

Instructions

Welcome to this experiment. The session will begin shortly. Before we start, we ask you to turn off your mobile phone and other devices completely. Please refrain from talking to other participants during the experiment. All participants have the same instructions.

First, we will read the instructions out aloud for you before we check that you understood them completely. After that you will make decisions for ten rounds. A subsequent questionnaire concludes the session and you will be paid in private and in cash directly afterwards. If you have a question at any point during this session, please raise your hand.

By participating in this experiment you can earn money. How much you will earn depends on your decisions and on the decisions of other participants. All decisions will be absolutely anonymous, i.e. your identity will neither be revealed to your co-participants nor to the experimenters at any time during or after the experiment. You will be matched with three other participants to form a group of four. In every group, each participant will be randomly assigned to take the role of participant 1, 2, 3 or 4. The composition of each group and the roles of participants will not change throughout the experiment. Groups are independent, in the sense that what happens in other groups will not affect the earnings of your group in any way.

Your payment

During the experiment we shall not speak of UK Pounds, but of Experimental Currency Units (ECU).

Each round of the experiment will consist of a contribution task and four guessing tasks, as described below. After the ten rounds, two different rounds will be randomly selected for payment per group. The earnings from the two selected rounds will be converted into UK Pounds at an exchange rate of 1 ECU = 50 pence.

One of the two rounds will determine the earnings from the contribution tasks. The other round will determine the earnings from the guessing task. The randomly selected rounds will be the same for all participants in each group.

Suppose that the two randomly selected rounds for your group are rounds 2 and 6. Then your final earnings will be the sum of your earnings from the contribution tasks in round 2 and your earnings from one randomly selected guessing task in round 6.

In addition, each participant receives a participation fee of 4 ECU at the end of this experiment. This participation fee will only be added to your total earnings at the very end.

In each of the ten rounds of the experiment you will be asked to complete a contribution task and four guessing tasks. The following sections explain what these tasks are about in detail.

A.1.2 Specific Instructions: positive opt-in (PI)

Earnings from the contribution tasks

In every round, each participant will receive 20 ECU. In the following, we shall refer to this amount as the "endowment". Your task is to decide how to use your endowment. In particular, you have to decide how many of the 20 ECU you want to contribute to a project (from 0 to 20) and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your earnings from the contribution task in each round are calculated using the following formula. If you have any difficulties, do not hesitate to ask us.

Earnings in ECU from the contribution task	= Endowment – Your contribution to the project	(1)
	+ 0.4 * Total contribution to the project	(2)
	- Either 2 or 0	(3)

This formula shows that your earnings from the contribution task consist of 3 parts:
(1) The share of the endowment which you have kept for yourself (endowment – your contribution).
(2) The earnings from the project, which are equal to 40% of the group's total contribution.
(3) Minus possibly 2 ECU, as described in the paragraph on *optional information about contributions* below.

The earnings of each group member from the project are calculated in the same way. Suppose the sum of the contributions of all group members is 60 ECU. In this case, each member of the group receives earnings from the project (see bullet point 2 above): 0.4 * 60 = 24 ECU regardless of how much they individually contributed to the project.

You always have the option of keeping your endowed ECU for yourself or contributing them to the project.

Optional information about contributions

As a default, you will not have information about the average and total contributions of your group (including your contributions). However, you can choose to be informed about the contributions of your group. For choosing to get this optional information, 2 ECU will be deducted from your earnings this round. You can choose to get this optional information (i.e., about the average and total contributions of your group) by ticking a box on the screen. In every round you will be allowed to change your mind by ticking or un-ticking this box. Choosing to get this optional information is entirely voluntary.

Earnings from the guessing tasks

In every round, before completing the contribution task, you will be asked to answer four guessing tasks: two information guesses and two contribution guesses. You will now learn how you can earn money from completing these guessing tasks.

Information guesses

Every round you will be asked to guess:

IG1. How many of your co-participants *will* choose to get the optional information this round?

IG2. How many of your co-participants *should* choose to get the optional information this round?

You will be able to answer these questions by typing your guessed number (i.e. either 0, 1, 2 or 3) in the text box next to each question on the computer screen.

For your first information guess (IG1), if your guess is correct, you will be paid 8 ECU and 0 ECU otherwise.

For your second information guess (IG2), if your guessed number matches the average number guessed by your co-participants (rounded to the next whole number), you will be paid 8 ECU and 0 ECU otherwise.

So for both information guesses you should try hard to guess correctly to earn money.

Contribution guesses

After making the information guesses you will be asked to guess:

CG1. How many ECU *will* your co-participants contribute on average to the project this round?

CG2. How many ECU *should* your co-participants contribute on average to the project this round?

You will be able to answer these questions by typing your guessed number (between 0 and the full endowment of 20 ECU) in the text box next to each question on the computer screen.

Your earnings from CG1/CG2 depend on the absolute difference between your guess and the average contribution/guess of your co-participants, respectively.

Absolute difference between your guess and the average contribution (for CG1) or guess (for CG2) of your co-participants	Your earnings from CG1/CG2
Less than 1 ECU	12 ECU
1 ECU or more than 1 ECU but less than 2 ECU	8 ECU
2 ECU or more than 2 ECU but less than 3 ECU	4 ECU
3 ECU or more than 3 ECU	0 ECU

So for both contribution guesses you should try hard to guess correctly to earn money.

A.1.3 Specific Instructions: positive opt-out (PO)

Earnings from the contribution tasks

In every round, each participant will receive 20 ECU. In the following, we shall refer to this amount as the "endowment". Your task is to decide how to use your endowment. In particular, you have to decide how many of the 20 ECU you want to contribute to a project (from 0 to 20) and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your earnings from the contribution task in each round are calculated using the following formula. If you have any difficulties, do not hesitate to ask us.

Earnings in ECU from the contribution task	= Endowment – Your contribution to the project	(1)
	+ 0.4 * Total contribution to the project	(2)
	+ Either 2 or 0	(3)

This formula shows that your earnings from the contribution task consist of 3 parts:
(1) The share of the endowment which you have kept for yourself (endowment – your contribution).
(2) The earnings from the project, which are equal to 40% of the group's total contribution.
(3) Plus possibly 2 ECU, as described in the paragraph on *optional information about contributions* below.

The earnings of each group member from the project are calculated in the same way. Suppose the sum of the contributions of all group members is 60 ECU. In this case, each member of the group receives earnings from the project (see bullet point 2 above): 0.4 * 60 = 24 ECU regardless of how much they individually contributed to the project.

You always have the option of keeping your endowed ECU for yourself or contributing them to the project.

Optional information about contributions

As a default, you will have information about the average and total contributions of your group (including your contributions). However, you can choose not to be informed about the contributions of your group. For choosing not to get this optional information, 2 ECU will be added to your earnings this round. You can choose not to get this optional information (i.e., about the average and total contributions of your group) by ticking a box on the screen. In every round you will be allowed to change your mind by ticking or un-ticking this box. Choosing not to get this optional information is entirely voluntary.

Earnings from the guessing tasks

In every round, before completing the contribution task, you will be asked to answer four guessing tasks: two information guesses and two contribution guesses. You will now learn how you can earn money from completing these guessing tasks.

Information guesses

Every round you will be asked to guess:

IG1. How many of your co-participants *will* choose not to get the optional information this round?

IG2. How many of your co-participants *should* choose not to get the optional information this round?

You will be able to answer these questions by typing your guessed number (i.e. either 0, 1, 2 or 3) in the text box next to each question on the computer screen.

For your first information guess (IG1), if your guess is correct, you will be paid 8 ECU and 0 ECU otherwise.

For your second information guess (IG2), if your guessed number matches the average number guessed by your co-participants (rounded to the next whole number), you will be paid 8 ECU and 0 ECU otherwise.

So for both information guesses you should try hard to guess correctly to earn money.

Contribution guesses

After making the information guesses you will be asked to guess:

CG1. How many ECU *will* your co-participants contribute on average to the project this round?

CG2. How many ECU *should* your co-participants contribute on average to the project this round?

You will be able to answer these questions by typing your guessed number (between 0 and the full endowment of 20 ECU) in the text box next to each question on the computer screen.

Your earnings from CG1/CG2 depend on the absolute difference between your guess and the average contribution/guess of your co-participants, respectively.

Absolute difference between your guess and the average contribution (for CG1) or guess (for CG2) of your co-participants	Your earnings from CG1/CG2
Less than 1 ECU	12 ECU
1 ECU or more than 1 ECU but less than 2 ECU	8 ECU
2 ECU or more than 2 ECU but less than 3 ECU	4 ECU
3 ECU or more than 3 ECU	0 ECU

So for both contribution guesses you should try hard to guess correctly to earn money.

A.1.4 Specific Instructions: zero opt-in (ZI)

Earnings from the contribution tasks

In every round, each participant will receive 20 ECU. In the following, we shall refer to this amount as the "endowment". Your task is to decide how to use your endowment. In particular, you have to decide how many of the 20 ECU you want to contribute to a project (from 0 to 20) and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your earnings from the contribution task in each round are calculated using the following formula. If you have any difficulties, do not hesitate to ask us.

Earnings in ECU from the contribution task = Endowment – Your contribution to the project (1)

+ 0.4 * Total contribution to the project (2)

This formula shows that your earnings from the contribution task consist of 2 parts:
(1) The share of the endowment which you have kept for yourself (endowment – your contribution).
(2) The earnings from the project, which are equal to 40% of the group's total contribution.
The earnings of each group member from the project are calculated in the same way. Suppose the sum of the contributions of all group members is 60 ECU. In this case, each member of the group receives earnings from the project (see bullet point 2 above): 0.4 * 60 = 24 ECU regardless of how much they individually contributed to the project.

You always have the option of keeping your endowed ECU for yourself or contributing them to the project.

Optional information about contributions

As a default, you will not have information about the average and total contributions of your group (including your contributions). However, you can choose to be informed about the contributions of your group. You can choose to get this optional information (i.e., about the average and total contributions of your group) by ticking a box on the screen. In every round you will be allowed to change your mind by ticking or un-ticking this box. Choosing to get this optional information is entirely voluntary.

Earnings from the guessing tasks

In every round, before completing the contribution task, you will be asked to answer four guessing tasks: two information guesses and two contribution guesses. You will now learn how you can earn money from completing these guessing tasks.

Information guesses

Every round you will be asked to guess:

IG1. How many of your co-participants *will* choose to get the optional information this round?

IG2. How many of your co-participants *should* choose to get the optional information this round?

You will be able to answer these questions by typing your guessed number (i.e. either 0, 1, 2 or 3) in the text box next to each question on the computer screen.

For your first information guess (IG1), if your guess is correct, you will be paid 8 ECU and 0 ECU otherwise.

For your second information guess (IG2), if your guessed number matches the average number guessed by your co-participants (rounded to the next whole number), you will be paid 8 ECU and 0 ECU otherwise.

So for both information guesses you should try hard to guess correctly to earn money.

Contribution guesses

After making the information guesses you will be asked to guess:

CG1. How many ECU *will* your co-participants contribute on average to the project this round?

CG2. How many ECU *should* your co-participants contribute on average to the project this round?

You will be able to answer these questions by typing your guessed number (between 0 and the full endowment of 20 ECU) in the text box next to each question on the computer screen.

Your earnings from CG1/CG2 depend on the absolute difference between your guess and the average contribution/guess of your co-participants, respectively.

Absolute difference between your guess and the average contribution (for CG1) or guess (for CG2) of your co-participants	Your earnings from CG1/CG2
Less than 1 ECU	12 ECU
1 ECU or more than 1 ECU but less than 2 ECU	8 ECU
2 ECU or more than 2 ECU but less than 3 ECU	4 ECU
3 ECU or more than 3 ECU	0 ECU

So for both contribution guesses you should try hard to guess correctly to earn money.

A.1.5 Specific Instructions: zero opt-out (ZO)

Earnings from the contribution tasks

In every round, each participant will receive 20 ECU. In the following, we shall refer to this amount as the "endowment". Your task is to decide how to use your endowment. In particular, you have to decide how many of the 20 ECU you want to contribute to a project (from 0 to 20) and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your earnings from the contribution task in each round are calculated using the following formula. If you have any difficulties, do not hesitate to ask us.

Earnings in ECU from the contribution task = Endowment – Your contribution to the project (1)

+ 0.4 * Total contribution to the project (2)

This formula shows that your earnings from the contribution task consist of 2 parts:
(1) The share of the endowment which you have kept for yourself (endowment – your contribution).
(2) The earnings from the project, which are equal to 40% of the group's total contribution.
The earnings of each group member from the project are calculated in the same way. Suppose the sum of the contributions of all group members is 60 ECU. In this case, each member of the group receives earnings from the project (see bullet point 2 above): 0.4 * 60 = 24 ECU regardless of how much they individually contributed to the project.

You always have the option of keeping your endowed ECU for yourself or contributing them to the project.

Optional information about contributions

As a default, you will have information about the average and total contributions of your group (including your contributions). However, you can choose not to be informed about the contributions of your group. You can choose not to get this optional information (i.e., about the average and total contributions of your group) by ticking a box on the screen. In every round you will be allowed to change your mind by ticking or un-ticking this box. Choosing not to get this optional information is entirely voluntary.

Earnings from the guessing tasks

In every round, before completing the contribution task, you will be asked to answer four guessing tasks: two information guesses and two contribution guesses. You will now learn how you can earn money from completing these guessing tasks.

Information guesses

Every round you will be asked to guess:

IG1. How many of your co-participants *will* choose not to get the optional information this round?

IG2. How many of your co-participants *should* choose not to get the optional information this round?

You will be able to answer these questions by typing your guessed number (i.e. either 0, 1, 2 or 3) in the text box next to each question on the computer screen.

For your first information guess (IG1), if your guess is correct, you will be paid 8 ECU and 0 ECU otherwise.

For your second information guess (IG2), if your guessed number matches the average number guessed by your co-participants (rounded to the next whole number), you will be paid 8 ECU and 0 ECU otherwise.

So for both information guesses you should try hard to guess correctly to earn money.

Contribution guesses

After making the information guesses you will be asked to guess:

CG1. How many ECU *will* your co-participants contribute on average to the project this round?

CG2. How many ECU *should* your co-participants contribute on average to the project this round?

You will be able to answer these questions by typing your guessed number (between 0 and the full endowment of 20 ECU) in the text box next to each question on the computer screen.

Your earnings from CG1/CG2 depend on the absolute difference between your guess and the average contribution/guess of your co-participants, respectively.

Absolute difference between your guess and the average contribution (for CG1) or guess (for CG2) of your co-participants	Your earnings from CG1/CG2
Less than 1 ECU	12 ECU
1 ECU or more than 1 ECU but less than 2 ECU	8 ECU
2 ECU or more than 2 ECU but less than 3 ECU	4 ECU
3 ECU or more than 3 ECU	0 ECU

So for both contribution guesses you should try hard to guess correctly to earn money.

A.1.6 Specific Instructions: negative opt-in (NI)

Earnings from the contribution tasks

In every round, each participant will receive 20 ECU. In the following, we shall refer to this amount as the "endowment". Your task is to decide how to use your endowment. In particular, you have to decide how many of the 20 ECU you want to contribute to a project (from 0 to 20) and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your earnings from the contribution task in each round are calculated using the following formula. If you have any difficulties, do not hesitate to ask us.

Earnings in ECU from the contribution task	= Endowment – Your contribution to the project	(1)
	+ 0.4 * Total contribution to the project	(2)
	+ Either 2 or 0	(3)

This formula shows that your earnings from the contribution task consist of 3 parts:
(1) The share of the endowment which you have kept for yourself (endowment – your contribution).
(2) The earnings from the project, which are equal to 40% of the group's total contribution.
(3) Plus possibly 2 ECU, as described in the paragraph on *optional information about contributions* below.

The earnings of each group member from the project are calculated in the same way. Suppose the sum of the contributions of all group members is 60 ECU. In this case, each member of the group receives earnings from the project (see bullet point 2 above): 0.4 * 60 = 24 ECU regardless of how much they individually contributed to the project.

You always have the option of keeping your endowed ECU for yourself or contributing them to the project.

Optional information about contributions

As a default, you will not have information about the average and total contributions of your group (including your contributions). However, you can choose to be informed about the contributions of your group. For choosing to get this optional information, 2 ECU will be added to your earnings this round. You can choose to get this optional information (i.e., about the average and total contributions of your group) by ticking a box on the screen. In every round you will be allowed to change your mind by ticking or un-ticking this box. Choosing to get this optional information is entirely voluntary.

Earnings from the guessing tasks

In every round, before completing the contribution task, you will be asked to answer four guessing tasks: two information guesses and two contribution guesses. You will now learn how you can earn money from completing these guessing tasks.

Information guesses

Every round you will be asked to guess:

IG1. How many of your co-participants *will* choose to get the optional information this round?

IG2. How many of your co-participants *should* choose to get the optional information this round?

You will be able to answer these questions by typing your guessed number (i.e. either 0, 1, 2 or 3) in the text box next to each question on the computer screen.

For your first information guess (IG1), if your guess is correct, you will be paid 8 ECU and 0 ECU otherwise.

For your second information guess (IG2), if your guessed number matches the average number guessed by your co-participants (rounded to the next whole number), you will be paid 8 ECU and 0 ECU otherwise.

So for both information guesses you should try hard to guess correctly to earn money.

Contribution guesses

After making the information guesses you will be asked to guess:

CG1. How many ECU *will* your co-participants contribute on average to the project this round?

CG2. How many ECU *should* your co-participants contribute on average to the project this round?

You will be able to answer these questions by typing your guessed number (between 0 and the full endowment of 20 ECU) in the text box next to each question on the computer screen.

Your earnings from CG1/CG2 depend on the absolute difference between your guess and the average contribution/guess of your co-participants, respectively.

Absolute difference between your guess and the average contribution (for CG1) or guess (for CG2) of your co-participants	Your earnings from CG1/CG2
Less than 1 ECU	12 ECU
1 ECU or more than 1 ECU but less than 2 ECU	8 ECU
2 ECU or more than 2 ECU but less than 3 ECU	4 ECU
3 ECU or more than 3 ECU	0 ECU

So for both contribution guesses you should try hard to guess correctly to earn money.

A.1.7 Specific Instructions: negative opt-out (NO)

Earnings from the contribution tasks

In every round, each participant will receive 20 ECU. In the following, we shall refer to this amount as the "endowment". Your task is to decide how to use your endowment. In particular, you have to decide how many of the 20 ECU you want to contribute to a project (from 0 to 20) and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

Your earnings from the contribution task in each round are calculated using the following formula. If you have any difficulties, do not hesitate to ask us.

Earnings in ECU from the contribution task	= Endowment – Your contribution to the project	(1)
	+ 0.4 * Total contribution to the project	(2)
	- Either 2 or 0	(3)

This formula shows that your earnings from the contribution task consist of 3 parts:
(1) The share of the endowment which you have kept for yourself (endowment – your contribution).
(2) The earnings from the project, which are equal to 40% of the group's total contribution.
(3) Minus possibly 2 ECU, as described in the paragraph on *optional information about contributions* below.

The earnings of each group member from the project are calculated in the same way. Suppose the sum of the contributions of all group members is 60 ECU. In this case, each member of the group receives earnings from the project (see bullet point 2 above): 0.4 * 60 = 24 ECU regardless of how much they individually contributed to the project.

You always have the option of keeping your endowed ECU for yourself or contributing them to the project.

Optional information about contributions

As a default, you will have information about the average and total contributions of your group (including your contributions). However, you can choose not to be informed about the contributions of your group. For choosing not to get this optional information, 2 ECU will be deducted from your earnings this round. You can choose not to get this optional information (i.e., about the average and total contributions of your group) by ticking a box on the screen. In every round you will be allowed to change your mind by ticking or un-ticking this box. Choosing not to get this optional information is entirely voluntary.

Earnings from the guessing tasks

In every round, before completing the contribution task, you will be asked to answer four guessing tasks: two information guesses and two contribution guesses. You will now learn how you can earn money from completing these guessing tasks.

Information guesses

Every round you will be asked to guess:

IG1. How many of your co-participants *will* choose not to get the optional information this round?

IG2. How many of your co-participants *should* choose not to get the optional information this round?

You will be able to answer these questions by typing your guessed number (i.e. either 0, 1, 2 or 3) in the text box next to each question on the computer screen.

For your first information guess (IG1), if your guess is correct, you will be paid 8 ECU and 0 ECU otherwise.

For your second information guess (IG2), if your guessed number matches the average number guessed by your co-participants (rounded to the next whole number), you will be paid 8 ECU and 0 ECU otherwise.

So for both information guesses you should try hard to guess correctly to earn money.

Contribution guesses

After making the information guesses you will be asked to guess:

CG1. How many ECU *will* your co-participants contribute on average to the project this round?

CG2. How many ECU *should* your co-participants contribute on average to the project this round?

You will be able to answer these questions by typing your guessed number (between 0 and the full endowment of 20 ECU) in the text box next to each question on the computer screen.

Your earnings from CG1/CG2 depend on the absolute difference between your guess and the average contribution/guess of your co-participants, respectively.

Absolute difference between your guess and the average contribution (for CG1) or guess (for CG2) of your co-participants	Your earnings from CG1/CG2
Less than 1 ECU	12 ECU
1 ECU or more than 1 ECU but less than 2 ECU	8 ECU
2 ECU or more than 2 ECU but less than 3 ECU	4 ECU
3 ECU or more than 3 ECU	0 ECU

So for both contribution guesses you should try hard to guess correctly to earn money.

A.2 Further Results

A.2.1 Analysis of information types

From the analysis of whether subjects had the optional information in section 3.1, we know that subjects mostly have the information if doing so is either monetarily rewarded (NI, NO) or when the price of that information is zero (ZI, ZO). However, in treatments where information was costly, subjects had the optional information in about one third of all times (34% and 40% for PI and PO, respectively). From section 3.1 it is not clear whether this happens because one third of the subjects have the information all the time (and two thirds never have the information) or whether each subject individually samples information approximately every third period (or a mixture of both behavioral extremes). Thus, in the following we provide more information about the distribution of information behaviors.

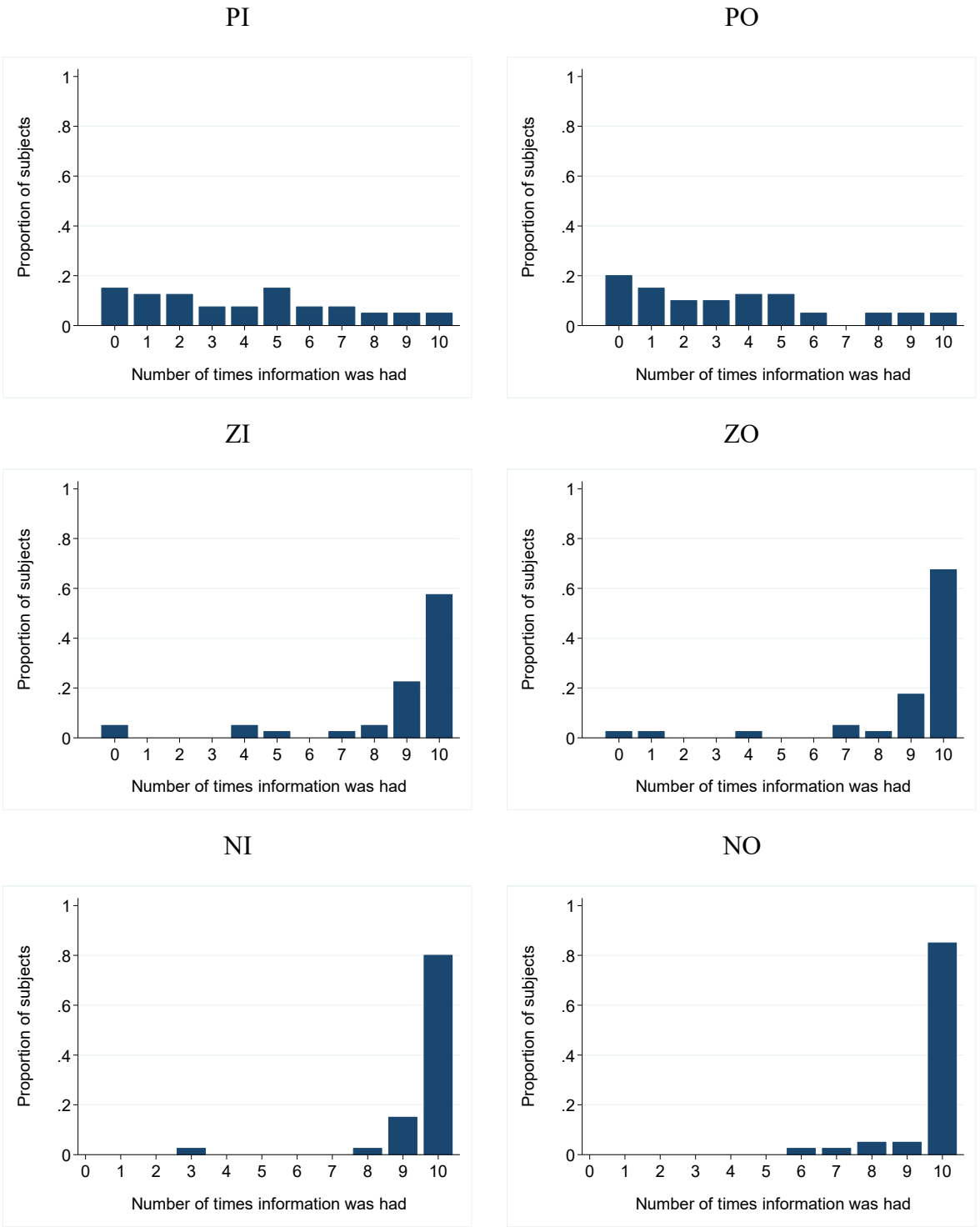
Figure A1 shows that in the treatments NI and NO as well as ZI and ZO, the massive majority had the information in every period (10 times) and almost no one had information less frequently than 9 times resulting in very high overall information rates. In contrast, the aggregate results of the treatments PI and PO (that around 40% of subjects have the information) is caused by an almost uniform distribution of information types.

Table A1: Numbers of subjects by information type and treatment

Treatment	Information type			
	0-2	3-6	7-10	Total
PI	16	15	9	40
PO	18	16	6	40
ZI	2	3	35	40
ZO	2	1	37	40
NI	0	1	39	40
NO	0	1	39	40
Total	38	37	165	240

Furthermore, we can cluster subjects based on their information types. We distinguish three simple information types: *type 0-2* has information in at most 2 (out of 10 possible) periods, *type 3-6* has information at least 3 and at most 6 times and *type 7-10* has information in at least 7 periods.

Figure A1: Proportion of subjects by number of times information was possessed and by treatment



The analysis of information types shows that the aggregate result of having the information in approximately one third of all times is indeed driven by different information types. About 40% of subjects almost never have the information (type 0-2), just below 40% of subjects occasionally have the information (type 3-6) and about 20% of subjects very frequently have the information (type 7-10), see Table A1.

One possible conjecture about these heterogeneous results regarding having the information is varying individual specific valuation of information. Subjects categorized as 0-2 might very rarely have the (costly) information because their individual valuation of information was below the monetary cost of having the information (which was 2 ECU in the experiment). Type 3-6 subjects could have a valuation of just about 2 ECU, making them sometimes decide for or against having the information, while type 7-10 subjects could be the ones with individual valuations of well surpassing 2 ECU.

A.2.2 Additional control variables

Table A2: Likelihood of having the optional information and belief how many other group members will have the optional information, additional control variables

	(1) Having info	(2) Having info	(3) Belief info	(4) Belief info
Default no info	-0.0512	-0.187	0.288***	0.287***
	(0.366)	(0.400)	(0.109)	(0.108)
Price	-3.275***	-3.496***	-0.765***	-0.833***
	(0.286)	(0.397)	(0.0666)	(0.0935)
Age	-0.0142	-0.0140	-0.00880	-0.00865
	(0.0331)	(0.0330)	(0.00703)	(0.00703)
Female	-0.134	-0.109	-0.0937	-0.0897
	(0.372)	(0.373)	(0.0811)	(0.0811)
Economics	-0.140	-0.193	-0.0349	-0.0400
	(0.857)	(0.860)	(0.179)	(0.179)
Default: no info x price		0.430		0.137
		(0.508)		(0.132)
Constant	3.129***	3.183***	2.286***	2.281***
	(0.868)	(0.870)	(0.186)	(0.185)
Observations	2400	2400	2400	2400
Log. Likelihood	-749.1	-748.8	-2687.0	-2686.4
Chi-squared	131.7	131.8	140.8	144.3

Notes: Columns 1 and 2 contain marginal effects of logit estimations on the likelihood of having the information. Columns 3 and 4 contain coefficients of linear models on information belief, i.e., the number of how many other group members will have the information. All models were estimated using multi-level error clustering (subjects nested in groups); levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Imitation of previous period's average group contributions, additional control variables

	(1)	(2)	(3)	(4)	(5)	(6)
	Contribution (t) - Contribution (t-1)			CG1 (t) - CG1 (t-1)		
Δ (t-1)	0.509***	0.363***	0.549***	0.161***	-0.0751**	0.190***
	(0.0318)	(0.0483)	(0.0366)	(0.0246)	(0.0377)	(0.0285)
Δ (t-1) x having info (t-1)		0.192***			0.311***	
		(0.0474)			(0.0380)	
Δ (t-1) x pos. price			-0.105**			-0.0695**
			(0.0447)			(0.0347)
Female	0.495***	0.465**	0.463**	0.339***	0.289**	0.320**
	(0.189)	(0.189)	(0.188)	(0.129)	(0.127)	(0.129)
Δ (t-1) x female	0.0758*	0.0762*	0.0624	0.0238	0.0208	0.0151
	(0.0425)	(0.0424)	(0.0427)	(0.0331)	(0.0326)	(0.0333)
Age	0.0329**	0.0285*	0.0309*	0.0127	0.00549	0.0115
	(0.0167)	(0.0167)	(0.0166)	(0.0114)	(0.0112)	(0.0114)
Economics	-0.299	-0.403	-0.350	-0.0264	-0.195	-0.0620
	(0.427)	(0.427)	(0.423)	(0.290)	(0.286)	(0.290)
Constant	-1.316***	-1.188***	-1.252***	-0.762***	-0.554**	-0.725**
	(0.416)	(0.417)	(0.413)	(0.283)	(0.280)	(0.283)
Observations	2160	2160	2160	2160	2160	2160
Log. Likelihood	-5746.9	-5738.7	-5744.1	-5372.5	-5339.5	-5370.5
Chi-squared	682.4	705.9	685.2	113.8	184.4	118.1

Notes: Columns 1-3 contain coefficients from linear models on subjects' contribution increase as specified in equation (1) on page 9 of the main article; columns 4-6 estimate similar effects on an increase of subjects' contribution beliefs; standard errors in parentheses with multi-level clustering: subjects nested in groups; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Individual contribution, additional controls

	(1)	(2)	(3)	(4)	(5)
Default no info	1.118	1.118	0.351	0.198	0.509
	(0.846)	(0.846)	(0.890)	(0.480)	(0.606)
Price	-0.0301	-0.0301	-0.307	-0.371	-0.533
	(0.517)	(0.517)	(0.770)	(0.414)	(0.476)
Age	0.0641*	0.0641*	0.0642*	0.0658**	0.0646**
	(0.0377)	(0.0377)	(0.0377)	(0.0317)	(0.0318)
Female	1.150***	1.150***	1.153***	0.804**	0.804**
	(0.439)	(0.439)	(0.439)	(0.364)	(0.365)
Economics	-0.827	-0.827	-0.830	-0.633	-0.652
	(0.950)	(0.950)	(0.951)	(0.812)	(0.812)
Period		-0.277***	-0.347***	-0.0939***	-0.0882***
		(0.0252)	(0.0356)	(0.0312)	(0.0322)
Default no info x Price			0.556	0.418	0.435
			(1.090)	(0.587)	(0.590)
Period x Default no info			0.139***	0.0283	0.0184
			(0.0503)	(0.0429)	(0.0445)
Period x Price			0.0336	0.000305	0.00572
			(0.0436)	(0.0370)	(0.0381)
Period x Default no info x Price			-0.0677	-0.0517	-0.0545
			(0.0617)	(0.0523)	(0.0526)
Belief Contributions				0.678***	0.695***
				(0.0208)	(0.0296)
Belief Contributions x Default no info					-0.0357
					(0.0419)
Belief Contributions x Price					0.0179
					(0.0257)
Constant	3.995***	5.518***	5.899***	0.169	0.0505
	(1.083)	(1.091)	(1.100)	(0.856)	(0.872)
Observations	2400	2400	2400	2400	2400
Log. Likelihood	-6780.9	-6722.3	-6717.8	-6301.5	-6300.9
Chi-squared	12.98	133.5	142.9	1272.3	1272.1

Notes: Reference treatment in all columns: default=info, price=0; belief contributions refers to descriptive contribution beliefs; all columns contain coefficients of linear models, each with multi-level error clustering: subjects nested in groups; errors in parentheses; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Descriptive belief about the average contribution of the other group members

	(1)	(2)	(3)	(4)	(5)	(6)
Default no info	1.162*	1.162*	0.261	1.155*	1.155*	0.254
	-0.701	-0.701	-0.738	(0.697)	(0.697)	(0.734)
Price	-0.392	-0.392	-0.111	0.400	0.400	0.104
	-0.429	-0.429	-0.639	(0.426)	(0.426)	(0.635)
Age				-0.0243	-0.0243	-0.0243
				(0.0229)	(0.0229)	(0.0229)
Female				0.439	0.439	0.440
				(0.268)	(0.268)	(0.269)
Economics				0.0998	0.0998	0.0993
				(0.577)	(0.577)	(0.577)
Period		-0.291***	-0.373***		-0.291***	-0.373***
		-0.021	-0.0296		(0.0210)	(0.0296)
Default no info x Price			-0.152			0.180
			-0.904			(0.899)
Period x Default no info			0.164***			0.164***
			-0.0419			(0.0419)
Period x Price			-0.0491			0.0491
			-0.0363			(0.0363)
Period x Default no info x Price			0.0236			-0.0236
			-0.0513			(0.0513)
Constant	6.619***	8.217***	8.668***	6.908***	8.506***	8.956***
	-0.496	-0.509	-0.522	(0.737)	(0.746)	(0.755)
Observations	2400	2400	2400	2400	2400	2400
Log. Likelihood	-6318.6	-6227	-6218.2	-6316.7	-6225.1	-6216.3
Chi-squared	3.582	194.8	214	7.563	198.8	218.0

Notes: Reference treatment in all columns: default=info, price=0; all columns contain coefficients of linear models, each with multi-level error clustering: subjects nested in groups; errors in parentheses; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.2.3 Normative information beliefs

In addition to descriptive information beliefs ("how many of the other group member will have the information"), we also elicited normative information beliefs ("how many of the other group members should have the information").[10] The reason for eliciting descriptive information beliefs is straightforward in the sense that believing that others may be more likely to have the optional information might change one's own contribution behavior due to observability effects. That is, if more people observe contributions levels, free-riding is more likely to be detected, thus speeding up the typical decline in contributions, in itself leading to lower payoffs than might have otherwise occurred. In addition, we were interested in analysing normative information beliefs to gain a better understanding of, and to disentangle, the behavioral components of one's own perception of what is "the right level of information to have" and an estimate of how others might behave in terms of having information.

In the following, we report distributions of the normative information beliefs (Figures A2 and A3) as well as a regression analysis that puts the results of the normative beliefs in perspective with the results of the descriptive information beliefs (Table A6).

[10] The quoted wording only serves illustrative purposes. The exact wording of the belief elicitation questions was varied by treatment, see instructions in section A.1.

Figure A2: Belief about how many other group members should have the optional information

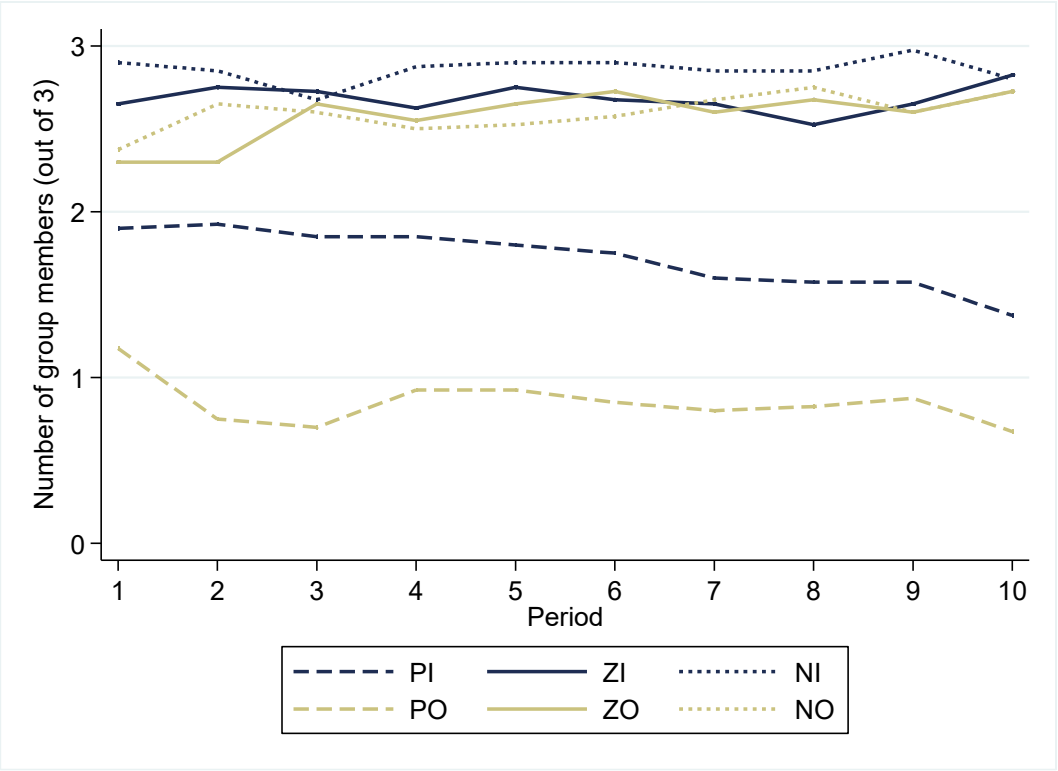


Figure A3: Normative and descriptive information beliefs, by treatment and period

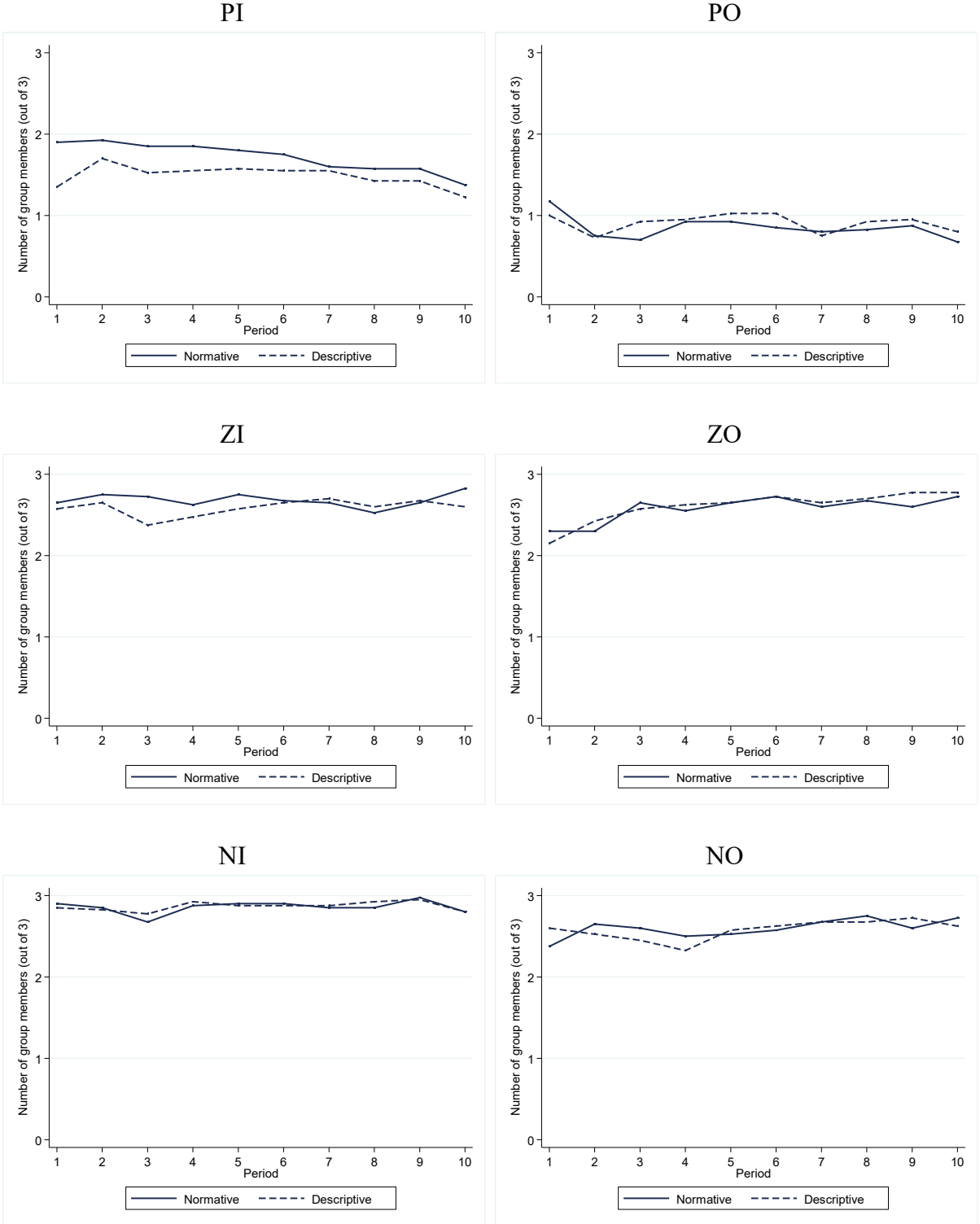


Table A6: Information beliefs

	(1)	(2)	(3)	(4)
	Desc. Belief	Desc. Belief	Norm. belief	Norm. belief
Default no info	0.283***	0.283***	0.412***	0.412***
	(0.109)	(0.108)	(0.122)	(0.117)
Price	-0.763***	-0.836***	-0.721***	-0.874***
	(0.0668)	(0.0935)	(0.0745)	(0.102)
Default: no info x price		0.146		0.305**
		(0.132)		(0.144)
Constant	2.031***	2.031***	2.008***	2.008***
	(0.0771)	(0.0763)	(0.0860)	(0.0829)
Observations	2400	2400	2400	2400
Log. Likelihood	-2688.3	-2687.7	-2721.3	-2719.1
Chi-squared	137.3	141.4	105.3	117.7

Notes: Columns 1 and 2 contain coefficients of linear models on descriptive information belief, i.e., the number of how many other group members will have the information (see also Table 3 in the main article). Columns 3 and 4 contain coefficients of linear models on normative information belief, i.e., the number of how many other group members should have the information. All models were estimated using multi-level error clustering (subjects nested in groups); levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

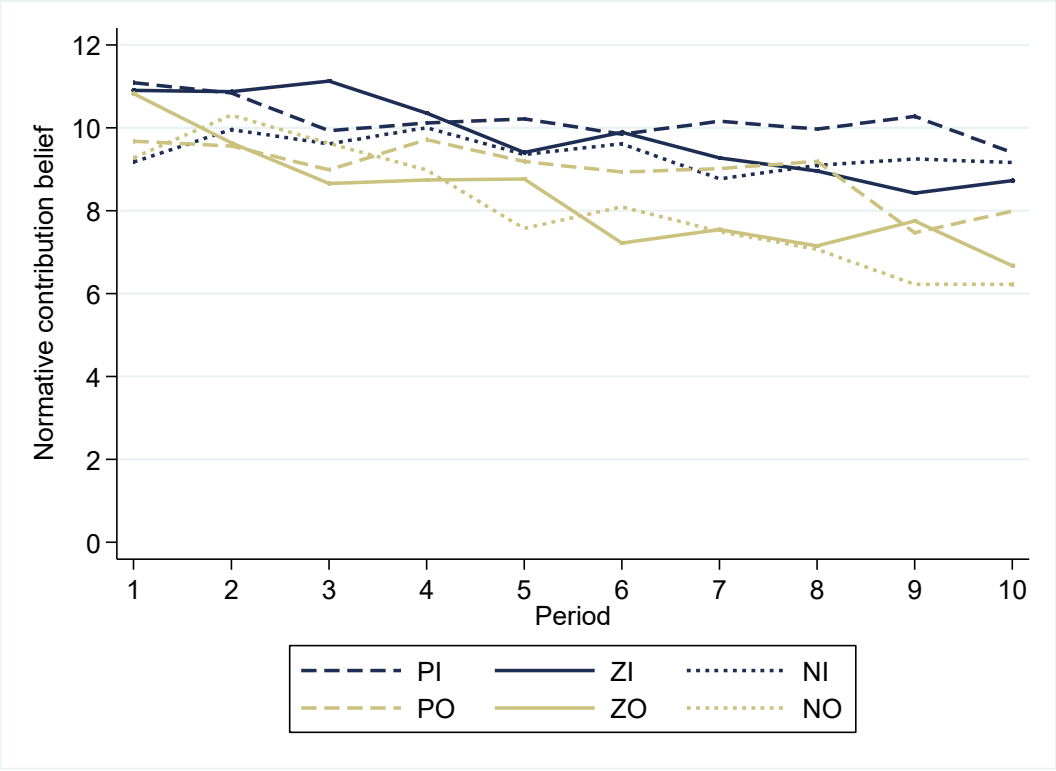
Table A6 compares regression results on descriptive and normative information beliefs. In line with the actually observed information behavior, both the descriptive and the normative information beliefs are negatively related to the price of information. Furthermore, in line with the secondary information default effect on descriptive information beliefs, also normative information beliefs are higher in situations where not having information is the default. This qualitative picture remains unchanged even allowing for the significant interaction effect in the normative beliefs regression model (4).

A.2.4 Normative contribution beliefs

In addition to descriptive contribution beliefs ("how many ECU will others contribute"), we also elicited normative contribution beliefs ("how many ECU should others contribute").[11] The reason for eliciting descriptive beliefs is straight-forward in the sense of justifying one's own contribution behavior conditional on what one expects the others will contribute. In addition, we were interested in analysing normative contribution beliefs to gain a better understanding of, and to disentangle, the behavioral components of one's own perception of what is "the right thing to do" and rationally "best-responding" to any expected contribution level of other group members.

In the following, we report distributions of the normative contribution beliefs (Figures A4 and A5) as well as a regression analysis that compares the results of the normative beliefs in perspective with the results of the descriptive contribution beliefs (Table A7). While Table A7 shows a poorer goodness of fit with normative beliefs, the qualitative picture is unchanged.

Figure A4: Belief about how much the other group members should contribute



[11] The quoted wording only serves illustrative purposes. The exact wording of the belief elicitation questions was varied by treatment, see instructions in section A.1.

Figure A5: Normative and descriptive contribution beliefs, by treatment and period

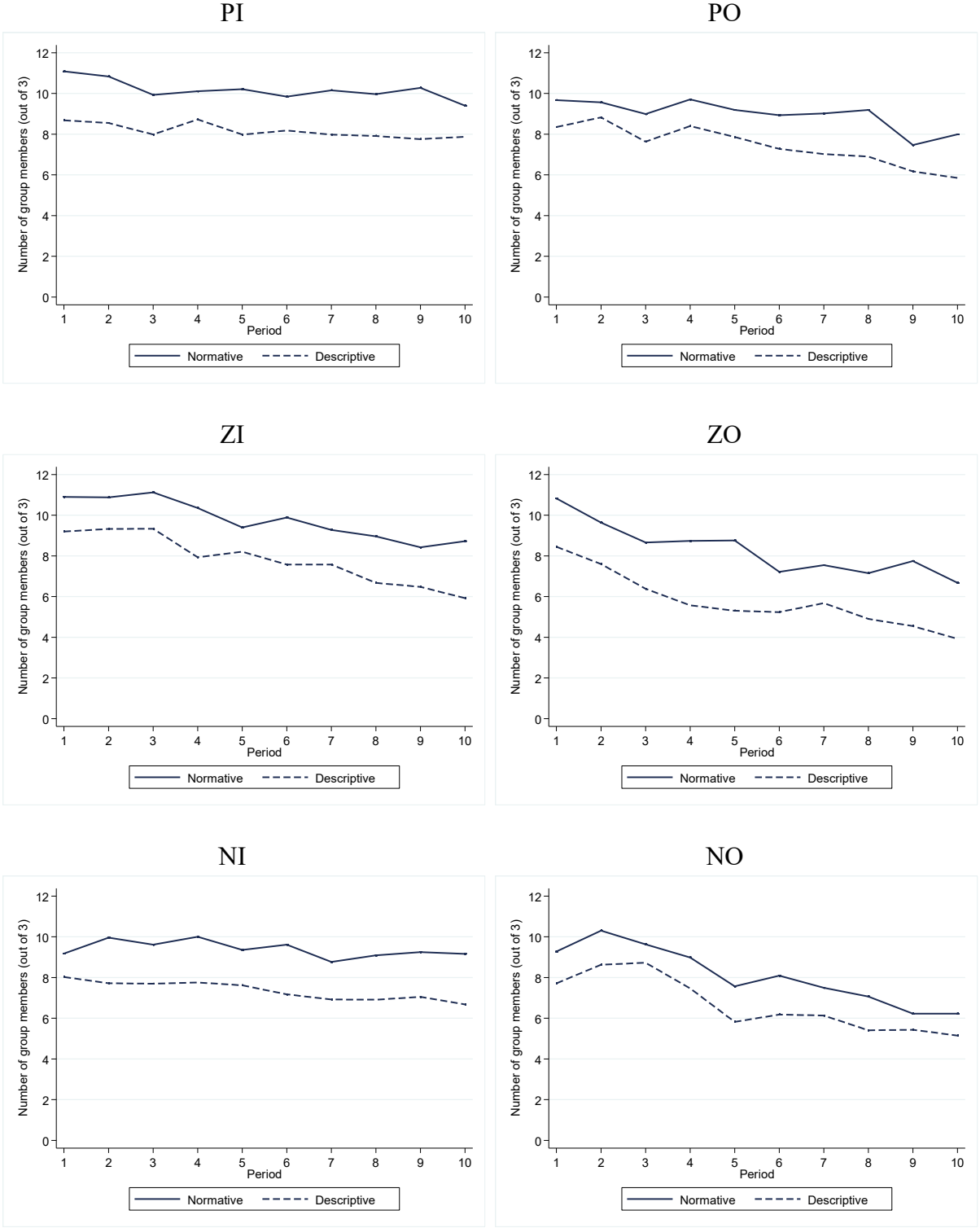


Table A7: Individual contributions

	(1)	(2)	(3)	(4)
Default no info	0.280	0.625	0.291	0.809
	(0.471)	(0.599)	(0.693)	(0.797)
Price	-0.335	-0.492	-0.149	-0.289
	(0.408)	(0.470)	(0.600)	(0.647)
Default no info x Price	0.310	0.327	0.0699	0.0780
	(0.576)	(0.579)	(0.848)	(0.850)
Period	-0.0930***	-0.0866***	-0.197***	-0.191***
	(0.0312)	(0.0321)	(0.0326)	(0.0331)
Period x Default no info	0.0280	0.0170	0.0621	0.0514
	(0.0429)	(0.0445)	(0.0453)	(0.0462)
Period x Price	0.000193	0.00532	-0.0221	-0.0205
	(0.0370)	(0.0381)	(0.0392)	(0.0399)
Period x Default no info x Price	-0.0517	-0.0542	-0.00113	-0.00209
	(0.0523)	(0.0526)	(0.0554)	(0.0557)
Desc. contri. belief	0.681***	0.699***		
	(0.0207)	(0.0296)		
Desc. contri. belief x Default no info		-0.0393		
		(0.0418)		
Desc. contri. belief x Price		0.0173		
		(0.0257)		
Norm. contri. belief			0.442***	0.465***
			(0.0186)	(0.0252)
Norm. contri. belief x Default no info				-0.0500
				(0.0373)
Norm. contri. belief x Price				0.0142
				(0.0233)
Constant	2.048***	1.885***	3.389***	3.156***
	(0.378)	(0.421)	(0.526)	(0.555)
Observations	2400	2400	2400	2400
Log. Likelihood	-6306.2	-6305.6	-6471.6	-6470.6
Chi-squared	1268.1	1267.9	732.2	734.8

Notes: Reference treatment in all columns: default=info, price=0; all columns contain coefficients of linear models, each with multi-level error clustering: subjects nested in groups; errors in parentheses; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$