Voter Motivation and the Quality of Democratic Choice

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Abstract

The quality of democratic choice critically depends on voter motivation, i.e. on voters' willingness to cast an informed vote. If voters are motivated, voting may result in smart choices because of information aggregation but if voters remain ignorant, delegating decision making to an expert may yield better outcomes. We experimentally study a common interest situation in which we vary voters' information cost and the competence of the expert. We find that voters are more motivated to collect information than predicted by standard theory and that voter motivation is higher when subjects demand to make choices by voting than when voting is imposed on subjects.

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1 Introduction

A perennial concern with democracy is that voters are ignorant to such an extent that they hardly know what they are choosing or why (e.g. Lupia 2016). While voters must be willing to cast an informed vote for democracy to work well, incentives are stacked against making an effort to acquire information and to turn out.

Standard economics assumes that voters are exclusively motivated by material self-interest. From this perspective, voter ignorance is individually rational if the private costs of being informed outweigh its private benefits (Downs 1957). Information costs are high when voters face complex or unfamiliar issues. In these cases, voters must make an effort to search and collect dispersed information on the issue at stake and take the time to think about the matter. Private benefits of making such efforts are low because an individual voter is unlikely to make a difference for the outcome of the vote. As a result, free-rider incentives undermine costly information acquisition and the quality of democratic choice is predicted to remain low.

But voter motivation may also be driven by factors beyond strict self-interest. Voters may feel that it is their duty to turn out and to be well informed. In fact, voters often do turn out in large numbers and some are reasonably well informed. The extent to which voters make an effort has been shown to depend on many factors, including education and socio-economic status (Delli Carpini and Keeter 1996, Lijphard 1997).

This paper investigates voter motivation in a common interest setting in which the predictions of standard theory for participation and information are known and can therefore be tested. We show that voter ignorance is less pronounced than predicted by standard economic theory and that, as a consequence, the quality of democratic choice is not as poor as predicted. We also show that voters systematically respond to changes in information costs. This finding indicates that the high level of information and participation we observe is not simply due to confusion but to a motivation to contribute to democratic decision making which is not absolute but traded off against material motives. We then show that the quality of democratic choice is higher when citizens demand to make choices by voting (by signing a petition) compared to when voting is imposed on citizens. A successful petition makes voters optimistic that others will acquire information, which, in turn, motivates voters to acquire information themselves. We argue that the effect of a successful petition is causal (i.e. not due to selection) and that it is about as strong as cutting the cost of information from an intermediate to a low level. Overall, our findings suggest that voters are motivated to cast an informed vote beyond what is predicted by standard theory and

that while information costs are important, factors influencing social motivations may be even more important in determining the quality of democratic choice.

We obtain these results in a context where the motivation to acquire costly information is of particular relevance: a common interest situation. In such a situation, all voters agree to implement the "right" policy but are uncertain about what it is. For example, voters may agree that economic policy ought to promote economic prosperity but voters are uncertain about what kind of policy best serves that end.

Our experimental design is as follows. Subjects are assigned to groups and are in the role of citizens who face a choice between two policies, A and B. In the main treatment (*Endo*), they first decide about how to make that choice. The choice between A and B is made by majority voting if sufficiently many citizens demand to hold a vote by signing a petition. However, the choice is delegated to an expert of known competence if too few sign. In case the petition succeeds, citizens individually decide whether to acquire costly information and whether to participate in the majority vote. If they do acquire information, they obtain a noisy but informative signal about whether policy A or B is best. If the majority of vote is for the right policy, all citizens get the same positive payoff. That is, the individual voter's payoff is independent of whether or what a particular citizen voted. Improving the chances to make the right group choice by acquiring information is thus like contributing to a public good and is therefore subject to free-rider incentives. Treatment *Exo* is the same as *Endo*, except that there is no petition. Instead, how the decision is made – by voting or by the expert – is exogenously imposed on the group. This treatment comparison serves to isolate the motivational effect of demanding vs. imposing a vote on citizens. The treatment comparison is tightly controlled for experience by holding the sequence of decision situations constant across treatments.

Voting in our experiment is subject to information aggregation. Specifically, informational efficiency increases, i.e., the group is more likely to make the right choice, when more voters cast an informed vote. However, efficiency is depressed when informed voters abstain or when uninformed voters participate. The benefit of casting an informed vote falls as turnout of informed voters goes up, but information costs are independent of turnout in our experiment. Thus, given a sufficiently high turnout by others, incentives are stacked against casting an informed vote. Self-interested citizens therefore rationally prefer to remain ignorant if sufficiently many others do acquire information (e.g. Persico 2004). In treatment Endo, voters can demand to make the decision between A and B by majority voting. If they do not demand the vote, the decision is delegated to an expert. Clearly, delegating the choice to the expert is the more attractive the more competent the

expert, the less informed other voters are, and the higher the cost of acquiring information. We experimentally vary these parameters and find that voter behavior and efficiency responds in line with standard theory predictions. But in contrast to standard predictions, we find that citizens' willingness to be informed is high and can be further improved by providing social information indicating that other citizens are willing to be informed.

1.1 Related Literature

Our treatment variation *Endo* vs. *Exo* is inspired by field experiments on voter motivation (Gerber et al. 2008, Gerber and Rogers 2009, Nickerson and Rogers 2010, Bryan et al. 2011, Bond et al. 2012).[2] Nickerson and Rogers (2010) show that helping voters to elucidate a specific voting plan (e.g. what time they would vote, what they would be doing beforehand) increases turnout in US Presidential elections. In our treatment *Endo*, signing a petition may have similar effects as those observed when voters make a plan to vote. Bond et al. (2012) use Facebook to divulgate advertisements to "get out the vote!" along with a clickable "I voted" button. The treatment group, which in addition sees which of their friends had voted, has many more "I voted" clicks. Similarly, Gerber and Rogers (2009) show that messages emphasizing high expected turnout are more effective at motivating voters to turn out than messages emphasizing low turnout. Both of these field experiments therefore suggest that providing social information that indicates high participation by others increases turnout. We are inspired by these findings on participation and investigate whether they extend to the dimension of information acquisition. We are, to the best of our knowledge, the first to show that the belief that others are motivated to cast an

[2] Both field and lab experiments have their advantages and limitations (e.g. Camerer 2015). Field experiments are strong in demonstrating causal effects in large-scale natural settings but are often weak in explaining why these effects occur. Our lab experiment is simple and uses small groups but has the advantage of allowing for tight control. For example, "good" and "bad" choices are clearly defined in our setting. This affords us with a clear measure of the quality of democratic choice. We can also vary the conditions of interest in a controlled way. For example, we can change the cost of information while holding everything else constant. Field studies that investigate the effect of a variation in voting cost, e.g. the introduction of postal voting, often lack a clear measure of that cost and need to address selection issues. For example, Hodler et al. (2015) show that lowering voting costs is a selection device in that it attracts voters with fewer years of education and who know less on the ballot propositions. Funk (2010) shows that postal voting not only reduced the direct cost of participation but it also reduced social pressure to be seen at the ballot box. Funk shows that the latter effect tends to dominate in villages and small towns leading to a decline in participation in Swiss villages.

informed vote (because they signed the petition) induces higher willingness to cast an *informed* vote, and that this improves the quality of democratic choice.

Our results not only corroborate the findings in the field experiments cited above, but in addition shed light on the questions of how much and why. First, we can gauge the effect of our treatment variation involving social information to the effect of a controlled variation in cost. Second, by eliciting expectations and complementary measures, e.g., on conditional cooperation, we can show that the treatment is effective because it operates through beliefs. In a nutshell, we find that the success of the petition (i.e. many others sign) induces optimism about others' willingness to cast an informed vote which, in turn, motivates reciprocal voters to also cast an informed vote. This mechanism is well known to increase cooperation in laboratory experiments on public goods games (e.g. Fischbacher and Gächter 2010, Thöni et al. 2012) and field experiments (e.g. Fellner et al. 2013, Hallsworth et al. 2014, Schultz et al. 2007), but we seem to be the first to show that this logic also applies to voting in a common interest situation.

Markussen, Putterman and Tyran (MPT 2014) is closely related to our paper insofar as these authors also study a two-stage process in their main treatment (*Endo*). In the self-governance stage, subjects vote on how to punish free riding (by formal vs. informal sanctions). In the contribution stage, subjects individually decide on contributions to the public good (and on punishing free-riders if they have opted for informal sanctions in the self-governance stage). The control treatment (*Exo*) in MPT is the same as *Endo*, except that there is no self-governance stage, i.e. formal or informal schemes are imposed on groups. MPT find, as we do, that subjects make smart governance choices and that there is an "endogeneity premium" in the sense that efficiency is higher when informal sanctions were endogenously chosen than when they are exogenously imposed. While similar endogeneity effects have been found in a number of other papers, most notably in Dal Bo et al. (2010) and in Sutter et al. (2010), we are the first to find an endogeneity premium in a common interest problem with costly information acquisition.

Our lab experiment conceptually builds on a stream of literature studying information aggregation (e.g. Austen-Smith and Banks 1996) and more specifically on a considerable literature on voting experiments exploring common interest situations (e.g. Guarnaschelli et al. 2000, Battaglini et al. 2008, 2010, Goeree and Yariv 2010, Morton and Tyran 2011, Morton et al. 2012, Fehrler and Hughes 2014, Kartal 2015). However, none of these experiments involve endogenous information acquisition.

The papers that match ours closest are Bhattacharya, Duffy and Kim (BDK 2015) and Grosser and Seebauer (GS 2016) which both study endogenous information acquisition while varying group sizes. GS focus on the effect of compulsory vs. voluntary (i.e. allowing for abstentions) voting on information acquisition. BDK vary the cost and precision of information under compulsory voting (i.e. no abstentions allowed). In line with our results, BDK find that the demand for information is higher than theoretically predicted and that it responds to the cost of information. Another close match is Elbittar, Gomberg, Martinelli and Palfrey (EGMP 2014) who show that voters acquire more information under majority than under a unanimity voting rule.

While our study has many elements in common with these studies, we take a more behavioral perspective as we study the effect of providing social information (whether the petition has been accepted) which is ineffective according to standard theory, and our experiment is somewhat more complex as it has an additional stage which allows us to study stylized self-governance. Because of its complexity, our experiment is also couched in a naturalistic scenario (citizens choosing whether to delegate the choice to a mayor or vote on construction projects in their city) to facilitate understanding.

We proceed as follows. Section 2 presents the experimental design, section 3 reports the results and section 4 concludes.

2 Experimental design

Section 2.1 provides a general description of the design. Section 2.2 explains parameters, procedures, and predictions under standard assumptions, i.e. when voters have no intrinsic motivation to vote but are strictly self-interested and rational.

Our experimental design serves to study the motivation for informed voting in a clean environment. This environment provides fairly clear predictions for the behavior of rational and self-interested voters which allows us to evaluate whether there is some additional motivation in place that is not captured by the standard model. In addition, we implement a manipulation intended to increase voter motivation.

2.1 General description

The general description of our baseline treatment (*Exo*) is as follows. Subjects are in groups of n players and earn payoffs depending on which of two policies is implemented. One policy is better for all group members than the other, but subjects do not know which one it is.

Specifically, all group members earn the same positive payoff if the right choice is made but earn nothing if the wrong choice is made.

The choice between the two policies can be made either by an expert of known competence or by majority voting. If the policy choice is made by majority voting, subjects can acquire information by purchasing a "signal" about the suitability of the policies at a private cost. The signal is informative but noisy. That is, when the signal says that policy A is better than B, then A is indeed more likely to be right but there is still some chance that B is right. The signals that subjects obtain are independent (uncorrelated). When subjects have made their decision whether to buy information at a cost, they decide whether and what to vote. That is, voting is not compulsory (abstentions are allowed) and participation is costless but casting an informed vote is costly.

We study a situation with positive information aggregation through voting. That is, the group is more likely to make the right choice as more subjects cast an informed vote. We study a common interest situation in which all subjects have the same material preference that the right choice is made. However, because casting an informed vote is costly, a rational and self-interested subject will balance the private cost of acquiring information against the private benefit of improving the choice for the group. Because rational and self-interested subjects do not take into account the positive externality of information acquisition (other subjects also benefit from an improved group choice), too little information is bought and the expected group payoffs are not as high as they could be. That is, standard theory predicts an inefficient outcome in voting due to free-rider incentives that increase in the cost of information.

We implement a standard laboratory experiment but we use "naturalistic" labeling. For example, the subjects are called "citizens", the expert is called "mayor" and the policy choice is which of two companies to hire for a construction project (e.g. bridge, stadium, hospital) in a city. Citizens know that one of the two companies is more qualified for the job, and all citizens equally benefit if the "right" company is chosen. We use naturalistic labels to facilitate subject understanding of the decision situation.

In the main treatment, called *Endo*, citizens decide whether the choice between the two companies is delegated to the mayor or is made by the citizens in a majority vote. The default is delegation to mayor. However, the choice is made by voting if sufficiently many citizens *demand to hold a vote* by signing a "petition". The only difference between *Endo* and *Exo* is that *Exo* does not have the petition. In both treatments we vary the competence of the expert to make the right choice and the cost of acquiring information over time. As we will show in more detail below, delegating the choice to the expert is more attractive

when the expert is more competent and when the cost of buying information is high for citizens.

We ran the *Endo* sessions (where citizens choose how to choose) first and the *Exo* sessions (where the mode of choice between the policies is imposed) later. This sequence is allows us to match a particular group *g'* in *Exo* with group *g* in *Endo* such that the choices that were endogenously chosen in *g* are imposed on *g'*. We thus hold the sequence of parameters and decision situations at any point constant across matched groups.

2.2 Parameters, predictions, and procedures

Parameters. In abstract terms, our basic design is as follows. Consider a group of n citizens facing two alternative policies, P_A and P_B. The state of the world, ω, has two possible realizations, A and B, which are equally likely to prevail ex ante, $prob\ (A) = prob\ (B) = 0.5$. All citizens get a positive monetary payoff u_m when the policy that matches the state of the world is implemented ($u_m(P_A \mid A) = u_m(P_B \mid B) = 25€$), but they get a zero payoff when not ($u_m(P_A \mid B) = u_m(P_B \mid A) = 0$). One round is randomly selected for payment.

The mayor has some known competence q to make the right choice ($prob(P_A \mid A) = prob(P_B \mid B) = q$ which can take two values $q_H = 0.9$ and $q_L = 0\ .6$. When the choice is made by majority vote, voters simultaneously decide whether to acquire costly information and then (without knowing whether others have acquired such information) decide whether and what to vote. Information acquisition means to pay a private cost c to obtain a private signal $s_i \in \{A^*, B^*\}$. The cost can take three values: $c_L = 0.1€$, $c_M = 0.9€$ and $c_H = 1.7€$. Signals are imperfect but informative about the state of the world ω, and are of the same quality but uncorrelated across subjects: $Pr\{\omega = A \mid s_i = A^*\} = Pr\{\omega = B \mid s_i = B^*\} = p = 0.6$.

Predictions. The voting game can be solved by backwards induction assuming common knowledge of rationality and self-interest. The relevant equilibrium concept is subgame perfect Nash equilibrium. A full characterization of the equilibria and a description of possible off-equilibrium improvements is available in our supplementary online materials (SOM) which can be downloaded from the authors' homepages.

Stage 3: *participation and voting choices*. The predictions for participation and voting given that the players are in the voting game are straightforward. First, given that voters are informed, they vote their signal. The reason is that because the signal is informative, voting against it decreases the probability of making the right choice. Second, uninformed

voters abstain. The reason is that uninformed voting runs into the risk of canceling out an informed vote.

Stage 2: demand for information. Buying information is profitable for a citizen if his marginal expected benefit from doing so exceeds his marginal cost, $\Delta prob$ * 25€ > c_j. Therefore, we expect that the demand for information falls as the cost of information increases, all else equal. But the demand for information by voter i depends also on the demand by other voters. In particular, $\Delta prob$ depends on the number of informed voters k as follows.

We define $\Delta prob = \pi(k+1) - \pi(k)$, where the predicted "success probability" (SP) is

$$\pi(k) = \begin{cases} \sum_{l=0}^{\frac{k-1}{2}} \binom{k}{\frac{k+1}{2}+l} p^{\frac{k+1}{2}+l} (1-p)^{\frac{k-1}{2}-l} & for\ k\ odd\ . \\ \pi(k-1) & for\ k\ even \end{cases}$$

Table 1 serves to illustrate the pure-strategy Nash equilibria of the game (shaded cells). To derive those, we start with column (2) which shows that the success probability weakly increases in the number of informed voters k, and strictly increases with each odd-numbered informed voter. According to the Condorcet jury theorem (Condorcet 1785), $\pi(k)$ > p if k > 2, and $\pi(k)$ approaches 1 as k approaches ∞ due to information aggregation.

For example, according to the equation above, the probability to make the right choice with k = 3 is $\pi(3)$ = 0.648 which is considerably higher than the probability of each voter making the right choice individually, p = 0.6. Intuitively, information aggregation occurs because a right choice results when all three vote for the right option (0.216 = 0.6^3) or when two out of three do so (and there are three ways for this happen, 0.432 = 3 * 0.4 * 0.6^2). Note that $\pi(k)$ only weakly increases with k. In particular, $\pi(k)$ does not increase when an informed voter joins an odd-numbered electorate. In these cases, we have $\Delta prob$ = 0 in column (4). For example when moving from k = 3 to k = 4, the success probability remains at 0.648 because uninformed voters may cancel out the vote of informed ones in a tie ("swing voter's curse"). Column (3) shows gross efficiency, i.e. the sum of expected earnings in a group in euros (recall that each group member gets 25€ in case the group makes the right choice). Column (6) shows net efficiency which results from subtracting the cost of information for k voters from gross efficiency. Net efficiency increases with each odd-numbered k.

The shaded cells in table 1 indicate pure-strategy Nash equilibria of the voting game. In equilibrium, there is no incentive for one additional voter to join and to buy costly information (because the gross private benefit is zero), and there is no incentive for those who

do buy information to stop buying it (because that would result in a loss). Table 1 shows, perhaps unsurprisingly, that the equilibrium demand for information falls as cost goes up. More precisely, the set of pure-strategy Nash equilibria is largest for low cost c_L and smallest for high cost c_H.[3]

Table 1: Pure-strategy equilibria

(1) k	(2) $\pi(k)$	(3) Gross efficiency	(4) $\Delta prob$	(5) Gross private gain	(6) Net efficiency		
					$c_L = 0.1$	$c_M = 0.9$	$c_H = 1.7$
0	.500	87.5	-	-	87.5	87.5	87.5
1	.600	105.0	.100	2.50	104.9	104.1	103.3
2	.600	105.0	.000	0.00	104.8	103.2	101.6
3	.648	113.4	.048	1.20	113.1	110.7	108.3
4	.648	113.4	.000	0.00	113.0	109.8	106.6
5	.683	119.4	.035	0.86	118.9	114.9	110.9
6	.683	119.4	.000	0.00	118.8	114.0	109.2
7	.710	124.3	.028	0.69	123.6	118.0	112.4

Notes: k is the number of informed voters voting their signal. $\pi(k)$ is the predicted success probability that the group makes the right choice. Gross efficiency is the sum of expected earnings in the group in euros, $n * \pi(k) * 25€$; $\Delta prob = \pi(k+1) - \pi(k)$. Gross private gain is $\Delta prob * 25€$. Net efficiency is Gross efficiency - kc_j. The three rightmost columns show net efficiency in euros for three cost levels. Shaded cells show pure-strategy equilibria, dark shading indicates Pareto-dominant equilibria.

Table 1 shows that (except for high costs) multiple pure-strategy equilibria prevail. Coordinating on one of these equilibria is difficult despite the fact that they are Pareto-rankable (equilibria involving a larger number of informed voters have higher net efficiency). Coordination is difficult because these equilibria imply that some voters buy information while others do not (the exception is the equilibrium at c_L and $k = 7$ in which all citizens buy information). Given the presence of these difficult coordination problems, it may seem natural to believe that citizens randomize their choices and play a mixed-strategy equilibrium. We provide a discussion of symmetric mixed-strategy equilibria in the

[3] The precise relations between cost and equilibrium number of informed voters are as follows: $k = 0$ for $c > c_0 = 2.5$, $k = 1$ for $1.2 = c_1 < c \leq c_0$, $\{k\} = \{1, 3\}$ for $0.864 = c_2 < c \leq c_1$, $\{k\} = \{1, 3, 5\}$ for $0.691 = c_3 < c \leq c_2$, and $\{k\} = \{1, 3, 5, 7\}$ for $c \leq c_3$.

SOM. The conclusion of that discussion is, again unsurprisingly, that demand for information falls as its cost goes up.

Stage 1: signing the petition. In Endo, citizens decide whether to delegate the policy choice to the mayor or to make the choice in a majority vote. Delegation to the mayor occurs if the petition fails and voting occurs if it succeeds, i.e. if a majority of voters sign the petition (i.e. 4 out of 7 citizens). Signing is costless.

It is dominant to delegate the choice (at all cost levels) if the mayor makes high-quality decisions (q_H = 0.9), because delegating is costless and the highest success probability that can be attained in voting is lower than that (0.71, see table 1). However, matters are more complicated when the mayor is of low competence.

When the mayor is of low competence, signing the petition is weakly dominated at cost level c_H. Hence, at c_H expert delegation is still individually optimal. For the other two cost levels, however, signing the petition is no longer dominated. On the contrary, it becomes individually optimal if either $\pi(k^*) - c > 0.6$ (i.e., it is better to have democracy and cast an informed vote, given the equilibrium expectation that k^* - 1 others will do so as well), or one plans to free-ride on at least three informed voters. Hence, for $k^* \geq 3$ and $c \neq c_H$, it is individually optimal to sign the petition (both for those who plan to get informed and those who plan to free-ride).

Moreover, given that citizens can coordinate on an equilibrium involving at least k = 3 informed voters, voting entails both higher informational efficiency and, hence, higher net expected group payoffs, than delegation. Voting also Pareto-dominates the mayor for any cost level $c \in \{c_L, c_M, c_H\}$ in this case. While coordination on such pure-strategy equilibria seems plausible at low cost[4], and is at least possible at middle costs, it is not an equilibrium outcome at high cost.

In summary, standard theory provides some (fairly clear) bounds on information acquisition in the coordination game described above with the main conclusion that the demand for information does not increase if cost goes up in both treatments, that delegation is common in *Endo* when cost of information is high and when the mayor is competent, and that at c_m, all pure-strategy equilibria under democracy are asymmetric and hence involve a serious coordination problem. As a consequence, incentives are rather stacked against voter motivation if the cost of information is not very low.

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[4] It is also dominant to delegate when the cost is low and citizens play a mixed-strategy equilibrium, see SOM.

Table 2: Summary statistics and standard predictions for voting (i.e. $q_L = 0.6$)

	Observed				Standard prediction			
	Endo		*Exo*		*Pure strategy*		*Mixed strategy*	
(1) Petition succeeds (percent of groups)	c_L	100.0	n.a. by design		c_L	100.0	c_L	100.0
	c_M	100.0			c_M	100.0	c_M	0.0
	c_H	100.0			c_H	0.0	c_H	0.0
	all	100.0			all	75.00	all	25.00
(2) Information acquisition (percent of subjects)	c_L	90.77	c_L	76.49	c_L	100.0	c_L	100.0
	c_M	77.98	c_M	64.73	c_M	42.85	c_M	22.10
	c_H	70.83	c_H	54.76	c_H	14.28	c_H	6.80
	all	79.39	all	65.18	all	50.00	all	37.75
(3) Vote in line with signal (percent of voters)	c_L	96.39	c_L	94.55	c_L	100.0	c_L	100.0
	c_M	97.71	c_M	93.79	c_M	100.0	c_M	100.0
	c_H	97.48	c_H	96.74	c_H	100.0	c_H	100.0
	all	97.28	all	94.63	all	100.0	all	100.0
(4) Vote against signal (percent of voters)	c_L	2.68	c_L	4.17	c_L	0.0	c_L	0.0
	c_M	1.64	c_M	2.98	c_M	0.0	c_M	0.0
	c_H	0.89	c_H	0.89	c_H	0.0	c_H	0.0
	all	1.71	all	2.75	all	0.0	all	0.0
(5) Voted uninformed (percent of voters)	c_L	3.87	c_L	9.82	c_L	0.0	c_L	0.0
	c_M	9.82	c_M	9.23	c_M	0.0	c_M	0.0
	c_H	12.80	c_H	12.20	c_H	0.0	c_H	0.0
	all	9.08	all	10.12	all	0.0	all	0.0
(6) Efficiency (percent of delegation benchmark)	c_L	13.98	c_L	14.07	c_L	17.60	c_L	17.60
	c_M	4.70	c_M	3.75	c_M	5.4	c_M	6.70
	c_H	16.97	c_H	-5.51	c_H	-1.6	c_H	0.80
	all	10.09	all	4.02	all	6.70	all	7.60

Notes: We have a total 168 subjects, 84 subjects in 12 groups of 7 subjects per treatment (*Endo*, *Exo*). Each treatment has 4 terms with an expert of low quality ($q_L = 0.6$, 1 term with c_H and c_L each, 2 with c_M), 2 terms with an expert of high quality ($q_H = 0.9$, 1 term each with c_M and c_H). Lines (2) to (6) indicate percentages conditional on voting. Standard prediction for pure-strategy equilibrium assumes perfect coordination at the Pareto-dominant equilibrium.

Procedures. The experiment was conducted at the Vienna Center for Experimental Economics with a total of 168 undergraduate subjects recruited from all disciplines using the software ORSEE (Greiner 2015) and the experimental software z-tree (Fischbacher 2007) to run the experiment. We have 24 independent groups of 7 who make policy choices in 6 terms of 4 periods each, resulting in a total of 4'032 policy choices. Half of the subjects are randomly allocated to *Endo*, half to *Exo*. In *Endo*, subjects face a petition in 6 phases, 4 of which offer a choice between voting and an expert of low quality ($q_L = 0.6$, 1 term with c_H

and c_L each, 2 with c_M), and 2 offer an expert of high quality as an alternative to voting (q_H = 0.9, 1 term each with c_M and c_H).

At the beginning of each session, subjects were randomly matched into groups of seven. We used partner matching to give our groups the opportunity to learn and to facilitate coordination. Before the experimental session started, all subjects received instructions that described the game to them in detail (see appendix A). Subjects answered control questions on the specifics of the game and the experiment started only after all subjects had answered correctly. This fact was publicly announced.

To get a better understanding of what the quality q of decision making by the mayor implies, subjects were given the opportunity to simulate the outcome of expert judgment for both qualities, high and low, for about 3 minutes. Expert judgment was framed as delegating the decision between the two policies (choosing firms for a construction job) to the mayor of the town.

Before the beginning of the first period, subjects learned the parameters p, q, and c that would prevail for the next 4 rounds (a block of 4 rounds was called a "term"). Parameters q and c varied across terms. We chose to have one term for each combination of q and c except that we did not implement the uninteresting combination q_H and c_H (because incentives are extremely stacked against voting in this case) and we had two terms with the most interesting combination q_L and c_M (because theoretical predictions are least sharp in this case).

In treatment *Endo*, a term starts with the *petition stage*. Subjects can demand to make policy choices by voting by signing a petition with a nickname that was assigned to them at the beginning of the experiment. Signing was free. If at least 4 group members signed the petition, policy choices in the upcoming term were made by voting. Otherwise, the choice was delegated to the automated expert who made the correct choice with chance q. At the end of the petition stage, subjects learned whether the petition was successful but not how many had signed.

If the petition succeeded, subjects entered the *information stage*. Each subject privately decided whether he or she wanted to acquire the costly signal on the true state of the world, knowing that the signal would be correct with 60% chance. Subjects also estimated how many others in their group would acquire information. If their estimate was correct, they earned 0.10€.

In the *voting stage*, subjects individually decided whether to vote for P_A or P_B or abstain. Individuals who chose to abstain were given an unpaid quiz (that was entirely unrelated to the experiment) to prevent that subjects perceive abstention as less interesting and vote simply to avoid the boredom of being idle. The computer implemented the policy that got a majority of the votes. Ties were broken randomly. At the end of each round, subjects learned how many group members bought information, how many participated in the vote, which policy was implemented, and whether it was the correct policy.

Exo is the same as *Endo*, except that there is no petition stage. We conducted the *Endo* sessions first. We then matched *Endo* group *g* with *Exo* group *g'* such that the parameters that were chosen by *g* were imposed on *g'*. As a consequence, we keep not only the number of observations, but also the sequence of decision situations constant across the treatments. Subjects in *Exo* were neither informed about the fact that parameters were chosen by some other group nor about the existence of other groups that made choices.

After completion of the main experiment consisting of 24 rounds, subjects participated in a standard one-shot public goods game in reshuffled groups of 3. The purpose of this follow up is to obtain a proxy for (unconditional) cooperativeness. Subjects also filled in a questionnaire taken from the World-Value Survey on reciprocity and on attitudes on democracy and on delegation of decisions to experts. Subjects were paid out immediately at the end of the session, after about 2 hours, in cash. We randomly selected one of the 24 main rounds for payment, added earnings for correct expectations, added the earnings from the public goods game (9.7€ on average) and the survey (3€), for a total average of 32.5€ per subject.

3 Results

The presentation of results proceeds as follows. Section 3.1 shows that rational ignorance is not as pronounced as theory predicts, that the demand for information reacts to costs, and that information is used responsibly. Section 3.2 discusses our main results with respect to efficiency. We show that voting is more efficient that delegation when the mayor is inexperienced, that there is an endogeneity premium in the sense that voting is more efficient when it is demanded than imposed, and that this premium is caused by the treatment (i.e. the petition). We also find that self-governance is successful in the sense that the policy choice is delegated when doing so is more efficient and vice versa for voting. Section 3.3 investigates determinants of information demand. We find that the endogeneity premium is strong and robust, and that information demand is mediated through beliefs. Section

3.4 shows that beliefs mirror actions closely, i.e. more optimistic voters are willing to buy more information.

3.1 Little rational ignorance, information is used responsibly

We find that subjects acquire more information than predicted. That is, "rational ignorance" is much less pronounced than predicted by standard theory. The demand for information responds to its cost, indicating that voters trade the benefits of information acquisition off against its cost. Voters tend to make good use of information. That is, subjects almost always vote in line with the information they obtain. If they choose to remain uninformed, they tend to abstain instead of casting a counterproductive uninformed vote. These findings hold in *Exo* and are even more pronounced in *Endo*.

Table 2 shows in line (2) that rational ignorance is much less pronounced than predicted by standard theory when the policy choice is made by voting. In total, 79% and 65% of all subjects acquire information in *Endo* and *Exo*, respectively. These levels clearly exceed predicted rates of information even in the most favorable of all cases, i.e. assuming perfect coordination. The predicted rate of information acquisition is 50% on average in (Pareto-dominant) pure-strategy equilibria, and a meager 38% according to mixed-strategy equilibria (see Supplementary online materials for calculations). Statistical testing (against an assumed degenerate distribution in equilibrium) reveals that information demand is significantly higher for all cost levels jointly ($p < 0.01$ in *Endo* and $p < 0.05$ in *Exo*, Wilcoxon signed-rank test) and it is also higher when tested separately by cost level for c_M and c_H in both *Endo* and *Exo* ($p < 0.01$ for both c_M and c_H and *Exo* and *Endo*, WSR test).

Line (2) also shows that information demand responds systematically to voting cost as predicted. For example, the share of subjects buying information in *Exo* is about 76% when cost is low (c_L), 65% when intermediate (c_M), and 55% when high (c_H). In *Endo*, the respective values are 91%, 78% and 71%. The effect of cost is substantial, and information demand is therefore significantly lower at c_H than c_L in both *Endo* and *Exo* ($p = 0.000$ for both *Exo* and *Endo*, Fisher Exact test).

Table 2 also shows that most subjects make good use of their information. Line (3) shows that among voters who bought information, the vast majority votes in line with their signal (97% and 95% in *Endo* and *Exo*, respectively), as predicted by standard theory. Line (4) shows that, again as predicted, very few vote against their signal (2% and 3%, respectively), and a tiny rest abstains despite being informed. There is a substantial share (of about 10%) of uninformed voters, and this share tends to increase slightly with information cost in both treatments. We summarize our discussion above in

Result 1: *Rational ignorance is much less pronounced than predicted by standard theory, and voters acquire significantly more information in Endo than in Exo. The demand for information responds to its cost. Voters tend to use information optimally and uninformed voting is rare (about 10%) in both conditions.*

The rate of informedness is high and uninformed voting is rare compared to findings in two related experimental studies. Both Grosser and Seebauer (2016, henceforth GS) and Elbittar, Gomberg, Martinelli and Palfrey (2014, henceforth EGMP) find in treatments comparable to ours (groups of 7 and voluntary voting) that subjects buy information only about 30% of the time. Moreover, GS report 30% of uninformed voting. EGMP find that 60% of the uninformed participate in the vote. We speculate that the more favorable outcomes we observe are due to our naturalistic framing of choices (citizens, mayor, constructions projects etc.) which facilitates understanding compared to more abstract wording. Other differences to GS and EGMP concern the matching protocol (we use partner matching that facilitates learning and coordination) and, importantly, we provide individuals who abstain from the vote with an alternative occupation as a pastime (a non-paid quiz which reduces boredom effects).

3.2 Efficiency of voting

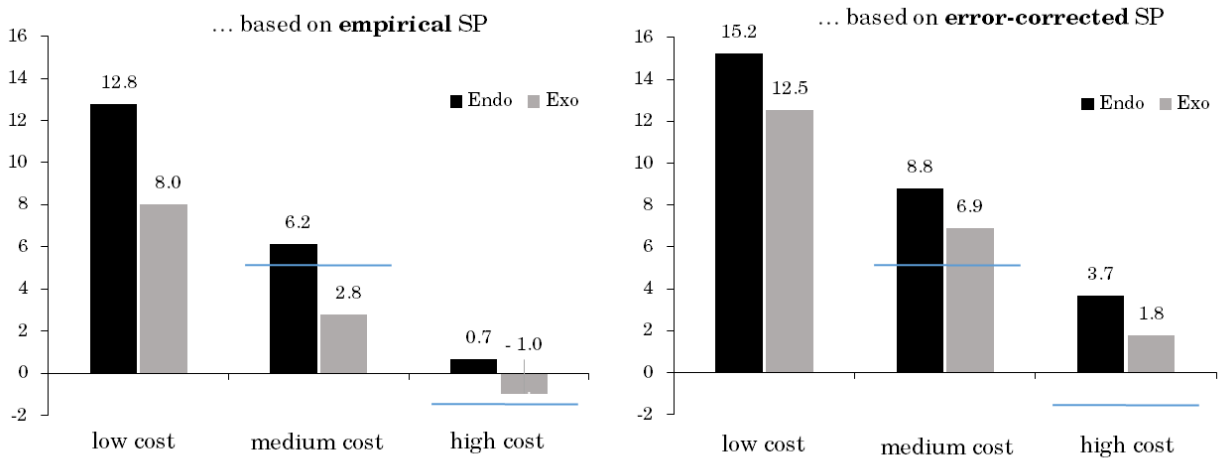
This section shows that efficiency is higher with voting than with delegation, that efficiency is higher in *Endo* than in *Exo*, and that this endogeneity premium is caused by the treatment (i.e. the petition).

Economic efficiency in our setting is driven by how many voters buy information (and at what cost), and whether they make good use of it. Voter motivation to acquire costly information may increase efficiency because of information aggregation, while errors – voting against one's signal, informed abstention and uninformed voting – undermine it. We now discuss alternative measures that allow us to isolate these effects.

We define the efficiency of voting (EV) relative to efficiency with delegation to the expert, using the success probability (SP) which is the chance to choose the correct policy as a group. That is, we calculate net expected payoffs of voting for a group (EPV = SP x 25€ x n - kc_j) relative to expected payoffs from delegating to the expert (EPD = q_L x 25€ x n), where q_L = 0.6 and k is the number of informed group members out of n = 7. More precisely, EV = (EPV – EPD)/EPD.

SP can be calculated in two ways. The *empirical* SP of a group is calculated from observed demand for information and from observed use of information in that group according to $\pi(k)$ (see section 2.2 and table 1). The empirical SP therefore allows for error resulting from voting against one's signal, informed abstention and uninformed voting. By contrast, the *error-corrected* SP, though also calculated from observed information demand, is based on (counterfactual) error-free use of information and participation behavior. The error-corrected SP shows how likely a group would have been to make the correct choice had its members all used information optimally and abstained if uninformed.

Figure 1: Efficiency of voting (in % of earnings with delegation to the expert)



Notes: Panels show efficiency of voting (EV), i.e. the net excess return of voting over delegating the policy choice to the expert as a percentage of earnings with expert judgment for $q_L = 0.6$. Expected net group earnings with voting are SP x 25€ x n - kc_j, where k is the number of informed voters, $n = 7$ is the number of group members. Expected net group earnings with delegation is q_L x 25€ x n. Left panel uses empirical (uncorrected) success probabilities (SP), right panel uses error-corrected SP. Horizontal lines indicate EV in Pareto-dominant pure-strategy subgame equilibria with voting.

Comparing EV based on empirical SP to EV based on error-corrected SP measures the inefficiency that is due to errors. Comparing EV based on error-corrected SP to efficiency according to the theoretical prediction measures what we call the motivational effect, i.e. the part of efficiency that is due to citizens' motivation to buy information above and beyond what is predicted for rational and self-interested participants. Note that EV can go up or down when information demand increases, depending on whether or not the

information aggregation effect trumps the cost of information. We therefore focus on measures of economic rather than informational efficiency below.[5]

Figure 1 summarizes our main results with respect to the efficiency of voting (EV). First, voting is more efficient than delegation. Bars in figure 1 show EV which, except for one, are all in the positive domain, meaning that EV was systematically higher with voting than with delegation. For example, the leftmost bar in the left panel indicates that voting with low information cost on average generated 13% higher net group earnings than delegation to the expert with empirical SP, i.e. when allowing for errors in using available information. When aggregating over all three cost levels, we find that EV is higher with voting than with delegation with empirical SP (left panel, $p = 0.000$ in *Endo* and $p = 0.007$ in *Exo*, WSR-test) and with error-corrected SP (right panel, $p = 0.000$ for both treatments, WSR-test). Except for high costs, voting is also significantly better than delegation when considering each cost level separately ($p < 0.01$ for both empirical and error-corrected SP, WSR-tests).

Second, we find that sorting into voting is polar depending on expert competence, and that self-governance was successful in the sense that voting is more efficient than delegation to the expert when subjects demand to vote, and vice versa when they do not. In other words, subjects consistently chose the mode of decision making that maximizes their net earnings in *Endo*. They *always* demanded the vote (by signing the petition) with q_L which is more efficient than expert judgment as shown above, and *always* delegate to the expert when q_H. The latter result is perhaps not too surprising because the expert is more efficient by design than voting with $q_H = 0.9$ since the maximum SP of voting is 0.71 $< q_H$, see table 1. However, the result that citizens always demand to vote with q_L is remarkable because voting is not predicted to dominate the expert by standard theory (see line (1) in table 2) and it is not predicted to outperform delegation in all cases. For example, the petition is predicted to be rejected whenever the cost is not low in mixed-strategy equilibrium (see line (1) in table 2). We summarize the discussion above in

Result 2: *Voting is more efficient than delegation to a low-quality expert. Self-governance is successful, i.e. subjects always delegate when it is efficient (with a high-quality expert) and never delegate when it is not.*

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[5] Suffice it to say that empirical SPs exceed the probability with expert judgment ($q_L = 0.6$) both in *Endo* (69%) and in *Exo* (65%, see table 2, line 2). Voting in *Endo* significantly outperforms *Exo* in terms of empirical SP ($p = 0.033$, MWU test) and voting statistically outperforms delegation in *Endo* ($p = 0.004$, WSR-test).

Third, there is an "endogeneity premium" in the sense that EV is higher in *Endo* than in *Exo*. In figure 1, black bars are higher than grey bars in every single case in both panels. *Endo* is significantly more efficient overall than *Exo* (p = 0.024 for empirical SP, p = 0.021 for error-corrected SP, MWU-tests). The endogeneity premium shows that voters are more willing to collect costly information when they know that the majority of subjects has demanded the referendum than when the referendum is imposed on them.

Fourth, the endogeneity premium is caused by the treatment and is not due to selection. This is a surprising finding because selection effects are a plausible reason for observed differences between *Endo* and *Exo* a priori because more cooperative people may both be more likely to sign the petition and to buy information which means that more cooperative people are more likely to sort into voting while less cooperative people would delegate in *Endo*. If this were the case, comparing information demand by those who selected into voting in *Endo* to the demand by randomly assigned subjects in *Exo* would indeed be partly driven by unobserved cooperativeness and not entirely by the treatment. However, because of the polar outcomes of the petition, the endogeneity premium can be interpreted as being *caused* by demanding the vote. The reasons why selection can be ruled out is that we randomly allocate subjects to both treatments (which guarantees that subject characteristics are equally distributed across treatments before the petition stage) and that there can be no selection when *all* subjects in condition *Endo* get the *same* treatment (i.e. the petition succeeds in all cases). In addition, our design guarantees that each group in *Exo* perfectly matches a group in *Endo* in terms of parameters q and the sequence of the costs. The treatment comparison therefore controls for the effects of sequencing of parameters.

Fifth, we argue that superior efficiency of voting and the endogeneity premium is importantly driven by information demand above and beyond the benchmark, i.e. the level predicted by standard theory, and this effect is stronger in *Endo* than in *Exo*. We call the surplus efficiency that results from this "excess" demand the motivational effect (ME). Our measure of ME is conservative because the benchmark assumes that rational self-interested citizens succeed to perfectly coordinate on a pure-strategy equilibrium, and if there are several equilibria, to perfectly coordinate on the Pareto-dominant equilibrium, which is difficult to achieve in practice. Hence, our measure of ME tends to underestimate the true motivational effect. In fact, the ME for mixed equilibria is at least twice as large as the ME for pure-strategy equilibria as shown in figure 1 for both c_M and c_H.

The horizontal lines in figure 1 at middle and high cost indicate EV at pure-strategy equilibrium values (note that there is no scope for a motivational effect at low cost because

everyone is predicted to buy information in the Pareto-dominant equilibrium in this case). EV in equilibrium at c_M is 5.4% (= (110.7-105)/105), and at c_H it is -1.6% (= (103.3-105)/105, see table 1 for values). Despite being a very conservative measure, we find that the ME is sizeable at c_M (3.4% in *Endo*, 1.5% in *Exo*), and particularly large at c_H (5.3% in *Endo*, 3.4% in *Exo*) when correcting for errors (right panel). Moreover, the ME is statistically highly significant ($p = 0.000$ for both c_M and c_H in *Endo* and for c_H in *Exo*; $p = 0.001$ for c_M in *Exo,* WSR-tests). However, errors mitigate the beneficial ME as can be seen by the smaller positive distance of the bars from the benchmark line in the left compared to the right panel. Due to errors, EV is clearly below equilibrium predictions for medium cost in *Exo* but still exceed equilibrium values in *Endo* when allowing for errors (0.8% at c_M and 2.3% at c_H, left panel). In summary, we conclude that the observed efficiency of voting does not exceed the predicted values much because of errors (voting against one's signal and uninformed voting). However, when correcting for these errors, we find that there is considerable "excess" demand for information that results in efficiency gains that clearly exceed predicted levels.

We summarize the discussion above in

Result 3: *Voting is more efficient when the vote has been demanded rather than imposed on the group i.e. there is an endogeneity premium. Errors mitigate the beneficial effects of voter motivation but the efficiency gain due to motivation is substantial.*

3.3 Determinants of information demand

This section discusses the determinants of information acquisition, in particular the role of beliefs and conditional cooperation as drivers of the endogeneity premium. Regression analysis shows that our earlier findings on the endogeneity premium and on costs shaping the demand for information are robust to taking additional explanatory factors into account. We find that optimism about information acquisition of others is a key determinant of information demand. In particular, we find that those who hold more optimistic beliefs about information acquisition by others consistently acquire more information themselves.

We then argue that the treatment effect is partly mediated through beliefs, i.e. that the endogeneity premium prevails because subjects are more optimistic about the information demand by others in *Endo* than in *Exo*. Regression analysis further suggests that this relation is mainly driven by conditional cooperation. While we find that information demand is partly caused by (i.e. mediated by) beliefs, we also find evidence for a commitment effect in the sense that those who sign the petition are more likely to buy information.

Table 3 shows results from logit regressions on the determinants of a citizen's demand for information (*Infobuy*). The coefficients on *Endo* in the first line show that the endogeneity premium is significant, i.e. that subjects acquire more information when they vote because the group demanded it than when voting is imposed on them. The coefficient is highly significant in a specification without any controls (1) and is robust to adding many controls in (6), e.g. post-experimental survey measures on whether the respondent thinks there is duty to vote or a duty to gather information if one votes.[6] The effect of the cost of information (*Infocost*) in line 2 is strong and robust which confirms our earlier conclusion that information demand systematically responds to its cost.

The effect of *Endo* is remarkably strong and its size can be gauged to the effect of the cost of information. The coefficients on *Endo* and *Infocost* are not statistically significantly different from one another according to Wald tests ($p > 0.6$ for specifications (2) to (6) in table 3). This means that the effect of *Endo* corresponds to cutting the cost of information by 1 Euro. The effect of *Endo* is thus at least as strong as cutting the cost of information from medium to low or from high to medium (the difference is 0.8 in each case).

The coefficient on *Belief* is significant in all specifications and thus robust. This finding supports our earlier conclusion that one's own information demand is strongly correlated with one's belief about other's demand for information. The drop of the coefficient on *Endo* when adding *Belief* is particularly interesting (compare specification (2) to (3)). This drop suggests that the effect of *Endo* on information demand partly operates through beliefs. This conclusion is supported by mediation analysis (Baron and Kenny 1986) which yields highly significant test results, see appendix table B2.

[6] Subjects had to indicate their agreement on a scale from 1 to 4 to the following statements: "In a democracy, there is a duty to participate in elections" (average answer 3.3), and "In a democracy, there is a duty to gather information before participating in an election" (average answer 3.7).

Table 3: Determinants of information acquisition

Dep.var. *Infobuy*	(1)	(2)	(3)	(4)	(5)	(6)
Endo	0.722*** (0.280)	0.743*** (0.286)	0.473*** (0.181)	0.471** (0.187)	0.524*** (0.198)	0.418** (0.196)
Infocost		-0.683*** (0.113)	-0.399*** (0.082)	-0.398*** (0.082)	-0.403*** (0.087)	-0.470*** (0.093)
Belief			0.498*** (0.076)	0.506*** (0.077)	0.536*** (0.077)	0.513*** (0.077)
High cooperation				0.361 (0.266)	0.354 (0.258)	0.348 (0.245)
Conditional cooperation					0.736*** (0.241)	0.675*** (0.262)
Controls	No	No	No	No	No	Yes
Constant	0.627*** (0.195)	1.264*** (0.239)	-1.036*** (0.355)	-1.240*** (0.379)	-1.727*** (0.399)	-0.827 (0.694)
Wald Chi^2	6.63	56.66	140.11	135.00	152.09	469.71
Prob > Chi^2	0.010	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.022	0.045	0.108	0.112	0.131	0.144
N	2'688	2'688	2'688	2'688	2'688	2'688

Notes: Table shows logit regressions with *Infobuy*, i.e. individual information demand, as the dependent variable. Standard errors are in parentheses, clustered at the group level. *Endo* is a dummy for the treatment. *Infocost* is the cost of information acquisition (c_L = 0.1, c_M = 0.9, c_H = 1.7). *Belief* indicates how many other group members acquire information. *High cooperation* = 1 if the individual contributes more than the median in a one-shot public goods game at the end of the experiment, 0 otherwise. *Conditional cooperation* = 1 if the individual claims to be more willing to return a favor to a stranger than the average person, 0 otherwise. Controls include answers to a post-experimental questionnaire on attitudes to democracy. Stars indicate significance of coefficients as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We interpret the significant coefficient on *Belief* as indicating that beliefs drive individual information demand. But this need not be so in the specification above. The reason is that the regressions in table 3 include 16 rounds of voting within the same group. Subjects get feedback at the end of each round about how many others acquired information, and one's belief about others' information acquisition in *t* is therefore likely to depend on observed information demand in *t*-1. However, these effects do not seem to be strong for two reasons. First, there are no clear patterns in information demand over time which suggest learning and feedback effects are not pronounced.[7] Second, we redo the regressions

[7] There is a slight downward trend in *Exo* (linear regression: *Infobuy* = 69.4 - 0.489 *round*) but no trend in *Endo* (*Infobuy* = 79.3 + 0.005 *round*).

with first-round data only which means there is no period t-1 that could have affected choices in t. We find that the effects of *Endo* and *Belief* remain significant ($p < 0.1$) in all specifications (see table B1 in the appendix). This finding suggests that optimism about others' information demand has indeed a positive causal effect on information acquisition.

Why do we find a positive relation between beliefs and information demand? Our conjecture is that the relation is driven by the interaction of optimism about information demand by others and a preference for conditional cooperation. Such a tendency has been documented in many cooperation experiments (e.g. Thöni et al. 2012) and is plausible to prevail here too since buying information is an act of cooperation and corresponds to the provision of a public good. The significant coefficients on *Conditional cooperation* ("How would you rate your willingness to do a favor for someone whom you have just met and who is doing you a favor?", scale 1-10) suggest that more conditionally cooperative voters tend to buy more information. The coefficient on *Conditional cooperation* remains significant when including *High cooperation*, a measure of cooperativeness. Perhaps surprisingly, *High cooperation* itself is not significant.[8] Taken together, this finding suggests that conditional cooperation drives information demand.

Hence, the conditional cooperators among our subjects seem to realize that being informed is an act of costly cooperation. As has been shown in many public goods experiments, these subjects are willing to contribute more if they are optimistic about contributions by others (as indicated by the estimates on *Belief*).

We summarize the discussion above in

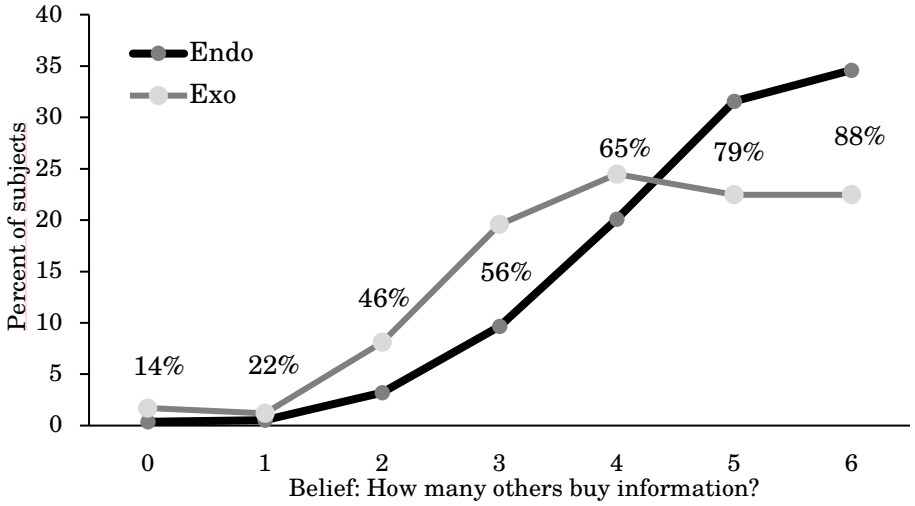
Result R4: The endogeneity premium is statistically robust to inclusion of controls and corresponds to cutting the cost from a medium to a low level. The effect of *Endo* is mediated through optimistic beliefs about information demand by others.

[8] The measure of cooperativeness is obtained from the contribution to a public goods game played at the end of the experiment. The game had the following parameters: Endowment = 8€, group size = 3, marginal per capita return = 0.5. The average contribution was 40% of the endowment (3.18€) and the average belief was 3.83€.

3.4 Beliefs on information acquisition

This section provides an in-depth analysis of our finding in the previous section that *Beliefs* are an important determinant of information acquisition. We now show that beliefs about others' information acquisition are optimistic in general, and that they are particularly optimistic in *Endo*. Optimistic beliefs go hand in hand with an increased tendency to buy information oneself which is characteristic for conditional cooperation.

Figure 2: Distribution of beliefs about information demand by others



Notes: Figure shows the share of subjects holding a particular belief about how many others in one's group will buy information). Percentages next to the lines indicate the share of informed subjects in each bin. For example, a total of 57% of subjects expected 6 (i.e. all) others in their group to buy information (35% in *Endo*, 22% in *Exo*). Of those subjects, 88% bought information.

Figure 2 shows that most subjects are optimistic about information acquisition by others and that subjects act in a way compatible with conditional cooperation, i.e. that they are more likely to acquire information when they expect many others to do so, too. Most subjects have highly optimistic beliefs. For example, only about 1% of all subjects are pessimistic and expect that none of the others would buy information, while a majority (about 57%) expects that all others buy information.[9] The numbers next to the graphs show that actions mirror beliefs closely. For example, among those with the most pessimistic beliefs, only 14% buy information. In contrast, among those with the most optimistic beliefs, 88%

[9] Beliefs are correct to a high degree. The correlation between individual beliefs about the number of informed others and the actual number of informed others is 0.55 (Spearman's rho is 0.54; $p = 0.000$, Spearman test).

buy information. The strong positive correlation (Spearman's rho = 0.321 highly significant with $p = 0.000$) between beliefs and own informedness is suggestive of conditional cooperation which has been shown to be an important preference in social dilemma situations.

Figure 2 also shows that there is a treatment effect on beliefs. We find that subjects are more optimistic about information acquisition by others when the group demanded to vote (in *Endo*) than when the vote is imposed on them (in *Exo*). For example, the share of very optimistic subjects, i.e. those who expect all others to buy information, is high in *Endo* (35%) but low in *Exo* (22%). Conversely, the share of subjects with an intermediate belief of 3 is higher in *Exo* (20%) than in *Endo* (10%). Over all levels, optimism about others' information demand is significantly higher in *Endo* than *Exo* ($p = 0.069$, MWU test). While this result shows that there was a treatment effect, one may again worry that a subject's information demand is driven by observed information demand by others in the past rather than contemporaneous, i.e. expected, information demand by others. However, we find that this test is also significant when using first-round beliefs only (for c_M and c_H jointly, $p = 0.027$, MWU test), showing that past experience is not the only driver.

While beliefs and information demand are higher in *Endo* than *Exo*, it is also true that most of the subjects who sign the petition (90% = 303/336) in *Endo* buy information and seem committed. This commitment effect is in line with evidence from field experiments that have shown that explicit plans about whether and when to vote increase turnout (Nickerson and Rogers 2010, see introduction). Signing the petition in *Endo* is like making a plan to vote. However, our results encompass previous findings that planning (in our paper in the guise of signing the petition) increases turnout. In addition, we find in regression analysis (See appedinx B3) that *informed* voting is higher among those who sign the petition, i.e. we extend previous results about turnout to a result about informed voting. RegresWe summarize our discussion in this section in

Result 5: *Beliefs mirror actions closely: those expecting high information demand by others tend to demand more information themselves. Subjects in Endo are more optimistic about others' information demand than subjects in Exo.*

4 Concluding Remarks

The main contributions of this paper are to show in a controlled setting that voter motivation to cast an *informed* vote is higher than predicted by standard theory, that voter motivation can be further improved by providing information about widespread informed voting in the electorate, that this effect operates through expectations, and that it is similarly

strong as cutting voting costs from a medium to a low level. Below, we discuss some caveats and alternative interpretations.

Common interest. We have studied voter motivation and its effect on information aggregation in the context of a common interest situation. In this context, voter motivation adds to the "epistemic quality" of democracy, and it is clearly desirable. But voter motivation in the guise of high participation may of course have benefits other than information aggregation. It may, for example, add legitimacy to public policy and thereby improve compliance and facilitate policy implementation. We think a pure common interest situation provides an ideal starting point to investigate voter motivation and how it shapes the quality of democratic choice. The reason is that casting an informed vote is crucial in such settings and we can calculate a clear benchmark for optimal information acquisition in our controlled setting. However, we also feel that a useful next step would be to analyze situations in which both conflict and common interests play some role. Such "mixed" situations are typical for many economic issues, but are much more difficult to analyze.

High motivation. We observe in our experiment that the motivation to acquire costly information and to participate was higher than predicted by standard theory. Candidate explanations for this observation are a sense of civic duty and expressive voting. Brennan and Lomasky (1993) argue that voters derive utility from expressing support for ethical or ideological principles and Feddersen et al. (2009) show that this may result in a "moralistic bias" (see also Feddersen and Sandroni 2006, Coate and Conlin 2014, and Tyran and Wagner 2016 for a survey of the experimental literature). Ethical considerations do not seem plausible for the choice between A and B in our context (the options are ex-ante identical), but they do seem plausible with respect to casting an informed vote as such. Tyran (2004) shows that expressive voting on an ethical issue depends on expectations. In particular, he shows that people are more likely to vote for taxing everyone and to donate tax revenues if they think many others do. As in the present experiment, voters are more willing to incur a personal cost for a "good cause" if they think others are also willing.

Informed voting. Our design allows for various types of error in voting which undermine efficiency. In particular, casting an uninformed vote, voting against one's signal, or abstaining despite being informed are admitted. However, the observed rates of such counterproductive behavior are low (12%, 3%, and 1%, respectively) in our experiment compared to other studies that also allow for such behavior. For example, Grosser and Seebauer (2016) find rates of uninformed voting that are almost three time (about 30 percent) and Elbittar et al. (2014) about 5 times as large in comparable cases. We think that we observe much lower rates of uninformed voting because our naturalistic framing of the

choice situation reduces confusion and facilitates subjects' understanding. As a result, we observe a stronger correlation between information and voting in our experiment than previous studies.

Field studies have also found correlations between participation and information. For example, Jones and Dawson (2008) find in a survey study that those who believe that there is a duty to vote (and are therefore more likely to turn out) are better informed than those who do not. But this correlation may well be driven by unobserved characteristics such as the respondents' upbringing and education, or their "civic-mindedness". Lassen (2005) finds in a natural experiment in Denmark that better informed people are more likely to vote, Lopez de Leon and Rizzi (2014) find that forcing people to vote does not increase their informedness.

Size of electorate. Our electorates with $n = 7$ voters have a size comparable to similar studies (Grosser and Seebauer 2016 and Elbittar 2014 use groups of size 3 and 7, Bhattacharya et al. 2015 of size 3, 7 and 13). However, understanding the effect of group size is important for attempts to extrapolate the results to naturally occurring settings with large electorates. The benefits of buying information decrease with participation, i.e. information aggregation gets weaker as n increases. If the cost of information remains constant, a threshold is soon reached when voting is not individually rational for a self-interested voter, and another threshold may be reached later when voting is not socially optimal (see Corollary 2 in the SOM). While the basic characteristics (e.g. free-riding incentives, lower demand for information with higher cost) discussed in section 2 remain the same with larger electorates, increasing n does not improve (nor reduce) informational efficiency in theory beyond some point. However, things are not entirely straightforward even in theory when the cost of information increases with its precision. Martinelli (2006) shows for this case that even large electorates may be informationally quite efficient.

Social information. We find that the effects of providing social information are mediated by beliefs. In particular, demanding a vote (a successful petition) increases the expectation about the demand for information by one's fellow citizens. High expectations, in turn, increase one's own demand for information because many voters seem to be conditionally cooperative. As a result, we find a correlation between optimism about others' willingness to be informed and one's own willingness to be informed. Such correlations have also been observed in field studies. For example, Knack (1992) and Opp (2001) find that citizens are more likely to vote if they have politically active friends or partners. However, such a correlation may well be due to sorting: citizens with a strong interest in politics are more

likely to choose friends and partners with similar interests. In contrast, our results cannot be due to sorting because we randomly assign subjects to treatments.

Our results may well underestimate the relevance of such reciprocal relations for voting in the field because our design rules out (controls for) supply-side responses. In the field, an increased demand for political information is likely to induce an increase in the supply of information, i.e. reduce its cost. For example, Benz and Stutzer (2004) show that the media report more on a particular issue when citizens are about to vote on that issue than when the parliament will decide.

We believe that further investigations into how social information shapes voter motivation are important and promising. As was the case for the present study, field experiments could provide useful inspiration for further laboratory investigations. The field experiments of Della Vigna et al. (2014) and Rogers et al. (2016) show that (anticipated) social pressure may lead to higher turnout. Our framework would lend itself to investigate whether social pressure can also improve *informed* voting, not just participation. For example, an announcement that subjects will be asked (perhaps by other citizens) might prompt extra effort to collect information for fear to otherwise look like a clueless "idiot"[10] to one's peers.

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[10] An "idiot" in Athenian democracy was someone who was characterized by self-centeredness and concerned almost exclusively with private — as opposed to public — affairs, according to wikipedia. Declining to take part in public life, such as democratic government of the polis (city state), was considered dishonorable. "Idiots" were seen as having bad judgment in public and political matters.

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Appendix A: Instructions for *Endo* (translated from German)

Welcome! You will now take part in a decision-making experiment. You can earn money during the experiment, and all earnings will be paid out immediately at the end of the experiment. Your earnings depend on the decisions you and other participants in this experiment make.

The instructions below are identical for all participants. It is important that you read the instructions carefully so that you understand the decision-making situation well. In case anything is unclear or if you have questions, please raise your hand. We will answer your questions in private.

Please do not ask your questions aloud. Passing on any kind of information to other participants is not allowed. Talking to other participants during the entire experiment is not allowed. Whenever you have a question, please raise your hand; we will come to you and answer your question in private. Following these rules is essential for the scientific value of the experiment.

Once all participants have read the instructions and have no more questions, all participants will answer a short quiz. The quiz serves to make sure everyone understands the instructions.

All participants and their decisions will remain anonymous to other participants during the entire experiment. You will neither learn the true identity of your interaction partners nor will others find out about your identity.

General description. The experiment consists of three parts, and the first part has several rounds. In the first two parts participants may collect information and make decisions. You can earn money by your decisions. At the end of the entire experiment, the computer will randomly pick one round from the first part, which means that each round has the same chance to be picked. The amount that you earn in that round and the amounts you earn in the remaining parts will be paid to you in cash immediately at the end of the experiment.

Below, you will find the instructions for the first part of the experiment. Once the first part is completed you will receive instructions for the second part. After the second part, a survey with a few questions follows in a short third part. After that, you will receive your payment and the experiment ends. The sequence of the first part of the experiment, the decisions and the payment modalities are explained now.

First part. In this experiment you are in the role of a citizen and make decisions about **construction projects** in your city. Each construction project can be implemented by one of two companies. One of the companies is fit to do the job, the other is not. The task is to **hire the company that is fit** for the job.

The choice of a construction company can be made in two ways. The first way is that citizens **vote** on which company to hire. Citizens will only vote if they have demanded a vote. They can demand the vote by **signing a petition**. If sufficiently many sign the petition, a vote takes place. Citizens can individually investigate about which company is fit before voting, but investigating is costly. The second way to choose which company to hire is to delegate the choice to the **mayor**. The mayor only makes the choice if not sufficiently many citizens demand to vote by signing the petition. The mayor's competence to pick the right company for the job is known to all citizens.

The decision whether to demand a vote can depend on various factors. Under some conditions the citizens can be expected to make better choices, under other conditions the mayor is more likely to make better choices. The more citizens investigate about the companies, the more likely they are to

choose the better company through voting. The more competent the mayor is, the more likely he is to choose the better company. The exact procedure of the decision-making process is described below.

At the beginning of the experiment, all participants are randomly matched into groups of 7 participants. Group composition remains constant during the entire first part. As a member of your group, you are one of the 7 citizens who are all entitled to vote.

Choose one of two companies. The city plans to make a series of construction projects which benefit all citizens equally. For each project, two companies are eligible. Only one of the two companies is fit for the job, e.g. has the necessary specialists to implement the project successfully. The other company is unfit and if it is chosen, the construction project will be a failure. Hence, one of the two companies is fit for the job, the other is not. Which company is fit does not depend on the success or failure of prior projects and each of the two companies is equally likely to be the right one. If the fit company is chosen, the project is a success. In this case, all residents benefit equally. In particular, each citizen earns **25 Euro** when the construction project is a success, and each earns **0 Euro** when the project is failure.

Who has information about the companies and how can it be collected? At the beginning of the period, nobody can infer which of the two companies is fit for the job. To find out which company is better, investigations are necessary. There are two possibilities: Either the mayor does the investigation and decides by himself which company to hire. Or citizens vote, and in this case each citizen decides for him- or herself whether to investigate and collect information about the companies. The company who gets the majority of the votes is hired for the construction job.

Mayors are more or less used to make the choice between companies but they differ with respect to the level of their competence. Experienced mayors select the fit company in **90 out of 100 cases**, inexperienced mayors select the fit company in **60 out of 100 cases**. The role of the mayor is played by the computer.

Each citizen is uninformed about which is the fit company in each case, but when **all or a sufficient** number of citizens investigate, they are as a group **better** informed than the inexperienced mayor but they remain less well informed than the experienced mayor. If an individual citizen investigates, the **information** that he or she obtains serves to identify the company that is fit for job in **60 out of 100 cases**. If all citizens investigate, they choose the fit company by voting in 71 out of 100 cases.

In general: the more citizens are informed the more likely the majority is to make the right choice. However, investigating is costly. The cost is either 0.10 Euro, 0.90 Euro or 1.70 Euro.

The cost of information collection as well as the experience of the mayor can vary from one "term" to the next, but remain constant within a given term. Altogether there are 6 "terms" with 4 rounds each, which means that there are in total 24 rounds in which a choice between two companies has to be made.

The petition: deciding about which company to hire. At the beginning of each term, all citizens are informed about the information costs and the level of the mayor's experience in the coming 4 rounds. There is the opportunity to sign a **petition** to demand a majority vote. If sufficiently many sign the petition, meaning that **at least 4 out of 7** citizens sign, the choice of which company to hire is made by **voting** of the citizens. Otherwise the **mayor** makes the choice.

If you are in favor of voting for the upcoming 4 periods, “sign” by typing your pseudonym into the form (you will receive a pseudonym at the beginning of the experiment which remains the same during the entire session. It will be displayed on your screen when signing is possible). If you favor the decision to be made by the mayor, please type “no, thank you” into the form. You can proceed by clicking “confirm” (see figure).

Depending on the situation in a term it can be profitable for the citizens to sign the petition and the demand the vote, but this is so only if sufficiently many citizens investigate about the fitness of the companies for the job before voting.

* Screenshot “petition” here *

The decision by the mayor. The mayor decides which company to hire if the petition fails, i.e. if insufficiently many citizens sign the petition. In this case, there is no voting and you have to wait briefly until a decision is made. During that waiting period you can answer quiz questions. (The answers to these questions do not affect your payments. You will be informed about the answers to all quiz questions at the end of the experiment). You will then be informed which company the mayor has chosen, which company was fit for the job and how much you have earned in the current round. This cycle is repeated 4 times for each construction project in a term.

Voting and the acquisition of information. You have the possibility to do costly investigations about which company is fit for the job when sufficiently many have signed the petition. If you investigate, you will obtain information that is correct in **60 out of 100 cases**. If several citizens investigate, citizens may therefore reach different conclusions. When all citizens investigate and participate in the vote, it is quite probable that the majority reaches the right conclusion and therefore hires the better company. The more citizens get informed and then vote, the more likely it is that the city chooses an appropriate company.

Independent of whether you decide to investigate, you will be asked to estimate the number of citizens in your group who have made investigations. If you guess the number correctly, you earn 0.10 Euro.

Next, every citizen decides whether to participate in the voting or not.

You **increase** the chance that the city chooses the fit company for the job, i.e. you increase the chance that the construction project is successful, if you make investigations and vote according to the information you obtain. However, you **decrease** the chance that the better company is chosen if you have not investigated but vote anyway.

If you decide not to participate in voting you can answer quiz questions in the meantime. (The quiz does not affect your earnings. You will be given all answers to the quiz at the end of the experiment).

The company that receives the majority of votes is hired for the construction job. If there is a tie of votes or if nobody participates in voting, one of two companies will be picked at randomly by the computer. In this case, each company is equally likely to be hired.

After the voting you will learn how many citizens have investigated and received information, which company the majority has voted for, which company is fit for the job and how much you have earned.

This cycle is repeated 4 times for each construction project in a given term.

Your payment. At the end of the experiment the computer randomly chooses a round of the first part of the experiment that is relevant for your payment. If the construction project has been concluded successfully in this round you will receive 25 Euro, otherwise 0 Euro. Additionally you will receive 0.10 Euro if you have correctly estimated the amount of informed citizens in the selected round. Any information costs in this round will be deducted.

Simulation. At the beginning of the first part you will have the opportunity to review, for 2 minutes, the track record of experienced vs. inexperienced mayors in other (fictitious) cities. In contrast to your city, there is no petition in these fictitious cities which means that the mayor makes all decisions. Reviewing the track records of mayors elsewhere is supposed to improve your understanding of the situation in your city and does not affect your payment.

Summary. At the beginning of a term, you are informed about the experience of the mayor (can be high or low) and the information costs (can be high, medium or low). These values describe the situation for the next 4 rounds in which one of two companies is hired for a construction job.

A petition to demand a majority voting in the next 4 rounds is run. You sign the petition if you are in favor of making the hiring choices by voting. You do not sign if you are in favor of having the mayor decide by himself which company to hired. The petition succeeds if at least 4 out of 7 citizens sign.

If the petition fails, the mayor decides which company to hire in the next 4 rounds. An inexperienced mayor makes the right choice in 60 out of 100 cases whereas an experienced mayor makes the right choice in 90 out of 100 cases. If the better company is chosen, each citizens gets 25 Euro in the current round. If worse company is chosen, each resident gets 0 Euro in the current round.

If the petition succeeds, you and the other citizens decide on which company to hire by voting in the next 4 rounds. Prior to voting you and the other citizens can buy information that is correct in 60 out of 100 cases. In addition, you are asked to guess how many group members get informed.

The citizens who participate in the voting vote in favor of one of the two companies. Citizens who do not participate in the voting answer quiz questions that are not relevant for payments.

The company that obtains more votes is hired for the job. In case of a tie or if no citizen has bought information, one of the two companies will be picked at random with equal probability. If the city has hired the better company, each citizen receives 25 Euro minus any information costs the citizen may have incurred. You will be informed about the company the city has hired and whether it was the better one. You will receive 0.10 Euro in addition for correctly estimating the number of informed citizens.

At the end of the experiment, one round will be chosen at random from the first part for the payments. All rounds are equally likely to be picked.

Part 1 has 24 rounds. Part 2 follows after part 1. You can earn additional amounts of money in part 2.

Appendix B: Additional tables

Table B1: Information acquisition (all rounds)

Dep.var. *Infobuy*	(1)	(2)	(3)	(4)	(5)	(6)
Endo	0.839**	0.864**	0.777*	0.795**	0.852**	0.889**
	(0.386)	(0.386)	(0.397)	(0.403)	(0.407)	(0.421)
Infocost		-0.701**	-0.531	-0.605*	-0.613*	-0.886**
		(0.324)	(0.345)	(0.348)	(0.345)	(0.420)
Belief			0.403*	0.397**	0.393**	0.418**
			(0.156)	(0.160)	(0.162)	(0.173)
High cooperation				0.594	0.580	0.693*
				(0.405)	(0.406)	(0.418)
Conditional cooperation					0.448	0.224
					(0.402)	(0.437)
Controls	No	No	No	No	No	Yes
Constant	0.859**	1.573***	-0.501	-0.676	-0.874	-1.507
	(0.239)	(0.446)	(0.899)	(0.945)	(0.955)	(1.165)
Wald Chi^2	4.73	11.16	16.53	17.77	18.79	24.31
Prob > Chi^2	0.030	0.004	0.001	0.001	0.002	0.028
Pseudo R^2	0.028	0.055	0.090	0.102	0.109	0.166
N	168	168	168	168	168	168

Notes: Table shows logit regressions with *Infobuy*, i.e. individual information demand, as the dependent variable. Standard errors are in parentheses, clustered at the group level. *Endo* is a dummy for the treatment. *Infocost* is the cost of information acquisition ($c_L = 0.1$, $c_M = 0.9$, $c_H = 1.7$). *Belief* indicates how many other group members acquire information. *High cooperation* = 1 if the individual contributes more in a one-shot public goods game at the end of the experiment than the median, 0 otherwise. *Conditional cooperation = 1* if the individual claims to be more willing to return a favor to a stranger than the average person, 0 otherwise. Controls include answers to a post-experimental questionnaire. Stars indicate significance of coefficients as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table B2: Mediation analysis

	(1) OLS Regression	(2) Logit Regression 1	(3) Logit Regression 2
	Dep var: Belief	*Dep var: Infobuy*	*Dep var: Infobuy*
Endo	0.604*** (0.050)	0.722*** (0.089)	0.434*** (0.094)
Belief	-	-	0.540*** (0.036)
Standardized coefficients of variable Endo	-	0.195 (0.024)	0.109 (0.024)
Tests	Sobel	Aroian	Goodman
Test statistic	9.421	9.408	9.433
p-value	0.006	0.006	0.006

Notes: N = 2688. *Endo* is a dummy for the treatment. *Belief* indicates how many other group members acquire information. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The mediation analysis above follows Baron and Kenny (1986). The purpose is to test whether the effect of *Endo* on *Infobuy* is mediated by *Belief*, i.e. whether there is an indirect effect of demanding the vote on a subject's willingness to acquire information that operates through a higher expectation that others are acquiring information.

Column 2 confirms our finding from table 3 that *Endo* is indeed a significant predictor of *Infobuy*. Column 1 confirms that the *Endo* is a significant predictor of the mediator *Belief*. The comparison of Logit regression 1 and 2 shows that the (standardized) coefficient of *Endo*, the treatment variable, remains significant but becomes smaller when *Belief*, the mediator, is added as an explanatory variable. This effect is statistically significant according to three tests statistics. The interpretation is *Endo* is partly mediated through beliefs, i.e. that *Endo* has both direct and indirect (through beliefs) effects on *Infobuy*.

Table B3: Effects of signing the petition on *Infobuy* (treatment *Endo* only)

dep. variable: Infobuy	(1)	(2)	(3)	(4)
Petition signed	1.413*** (0.489)	1.342*** (0.485)	1.280*** (0.486)	1.420*** (0.430)
Infocost		-0.737*** (0.175)	-0.519*** (0.148)	-0.518*** (0.154)
Belief			0.379** (0.178)	0.406** (0.174)
Conditional cooperation				0.728* (0.440)
Constant	0.121 (0.413)	0.899* (0.481)	-1.021 (1.025)	-1.575* (0.872)
Wald Chi^2	8.35	46.05	64.93	151.27
Prob > Chi^2	0.004	0.000	0.000	0.000
Pseudo R^2	0.038	0.064	0.093	0.111
N	1'344	1'344	1'344	1'344

Notes: Table shows logit regressions with *Infobuy*, i.e. individual information demand, as the dependent variable. Standard errors are in parentheses, clustered at the group level. *Endo* is a dummy for the treatment. *Infocost* is the cost of information acquisition (c_L = 0.1, c_M = 0.9, c_H = 1.7). *Belief* indicates how many other group members acquire information. *Conditional cooperation* = 1 if the individual claims to be more willing to return a favor to a stranger than the average person, 0 otherwise. Controls include answers to a post-experimental questionnaire (available on request). Stars indicate significance of coefficients as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$