Huihui Ding[1]

Conformity Preferences and Information Gathering Effort in Collective Decision Making

[1] GREThA, Université de Bordeaux, avenue Léon Duguit, 33608 Pessac cedex, France, E-mail: huihui.ding@u-bordeaux.fr. http://orcid.org/0000-0003-2900-5641.

Abstract:
Our study concerns a collective decision-making model for the collection of information from two voters. Both voters, who tend to make the same voting choices because of their conformity preferences, collect information about the consequences of a project and then vote on the project. We focus on an informative equilibrium in which voters vote informatively using pure strategies. This is a symmetric Nash equilibrium. Our result is interesting as it shows that nonconformist voters exert less effort from a social perspective because of a positive externality that results in the free-rider problem, while conformity preferences can help to improve the sum of the voters' expected payoffs from the social perspective. This is because conformity preferences may alleviate the free-rider problem associated with coordination (making the same vote). Specifically, conformity preferences give special importance to the correlation between voters' signals, even if this correlation is unrelated to the accuracy of the signals. Furthermore, we present the exact conformity preference level which helps voters to exert an optimal effort level that maximizes the sum of the voters' expected payoffs compared to the nonconformist case. In addition, we graphically illustrate comparative statics on effort levels in informative equilibria.

Keywords: normative conformity preferences, information gathering effort, collective decision making

JEL classification: D72, D82

DOI: 10.1515/bejte-2016-0136

1 Introduction

Conformity refers to the act of changing one's behavior to match the behavior of others, which is a common observation in our lives (Cialdini and Goldstein 2004). Beginning with the famous conformity experiment of Asch (1951), there is an extensive body of literature in social psychology relating to conformity (Cialdini and Goldstein 2004). One popular explanation of the conformity phenomenon is a desire for information, i.e. informational conformity (Deutsch and Gerard 1955). According to this explanation, people facing a decision problem learn from the actions of others and adjust their behaviour for accuracy accordingly. Although information certainly drives a significant fraction of conformist behaviour, it does not explain all such behaviour (Binning et al. 2015). Social psychologists have established that a large proportion of conformist behaviour is based on the desire to gain group acceptance, which is referred to as "normative conformity" (Cohen 1978; Deutsch and Gerard 1955), because groups are viewed as rewarding non-deviants and punishing deviants, thereby providing private incentives for individuals to conform to the patterns of others in the group (Schachter 1951; Meade and Barnard 1973) .

Significant attention has been devoted to normative conformity in economic literature since the initial theoretical inquiry in Jones (1984). In this paper, we focus on normative conformity preferences in a group consisting of two voters with regard to collective decision making, i.e. each conformist voter has an incentive to conform to the other voter's decision besides an incentive to be right (Hung and Plott 2001; Dutta and Prasad 2004; Bardsley and Sausgruber 2005; Ghazzai and Lahmandi-Ayed 2009).

In general, examples of voting carried out by two voters in relation to collective decision making include a loan contract which needs to be agreed by two authorized loan officers of a bank, an investment which needs the agreement of two partners who own a common company, a military order which needs to be agreed by two officers, and so on. These are important practical situations in which normative conformity preferences become apparent, because of the nature of groups and social interaction (Hung and Plott 2001; Dutta and Prasad 2004; Bardsley and Sausgruber 2005; Ghazzai and Lahmandi-Ayed 2009). Zafar (2011) gives empirical evidence about the conformity preference [1].

The aim of this paper is to understand the consequences of normative conformity effects on the effort levels of two voters in relation to the collection of information for collective decision making before voting. We analyze

Huihui Ding is the corresponding author.

a variation of Swank and Wrasai (2003)'s model in which two voters with the same preferences have to make a binary decision about a public project that is subject to uncertainty. The two voters follow a decision-making procedure consisting of two stages. In the first stage, each voter acquires information about the consequences of the project. The quality of the collected information depends on the efforts the voters have devoted to acquiring the information. In the second stage, the voters vote on the project.

With regard to the binary states of the world in our voting game, voters have equal prior probability[2] and have an identical ability to pay for informative signals. Truth-telling by voters is the ideal status allowing for the maximum possible transmission of information. In this way, we focus on informative equilibria, which are symmetric Nash equilibria in pure truthful strategies, where voters vote sincerely according to their signals whose quality is determined by their information-collecting efforts. We assume that their efforts are measured identically according to the accuracy of the signals, and that incorrect signals are informative. Based on these assumptions, we show that the addition of normative conformity preferences has a significant impact on voters' effort levels in informative equilibria. As shown by Swank and Wrasai (2003), in the benchmark with no normative conformity preferences, we prove the existence of an informative equilibrium in which voters exert too little effort, which does not maximize the expected total payoff from a social perspective. Our main contribution in this paper is to demonstrate that if each voter has a payoff utility from voting for the same choice as the other because of normative conformity preferences, the voters' effort levels in informative equilibria increase and the entire expected payoff from a social perspective can be improved. This contribution shows that normative conformity preferences affect the effort that each voter puts into acquiring information. In particular, in an informative equilibrium that helps voters to exert an optimal social effort level which maximizes the expected total payoffs from a social perspective in a nonconformist situation, in which information becomes cheap, the degree of normative conformity preferences decreases; but if information becomes expensive, the degree of normative conformity preferences increases. Why? Given that information is almost free, voter 1 considers it very likely that voter 2 has received correct information. Consequently, this reduces the level of voter 1's conformity preferences in order to make voter 1 exert more effort in collecting information for society and prevent him or her from acting as a free-rider in informative equilibria. A similar situation applies to voter 2. However, if information is expensive, although it is far less likely that voter 2 will receive correct information, his or her probability of obtaining correct information is still no less that 0.5. Because of normative conformity preferences, voter 1 still wants to make the same voting decision as voter 2. Therefore, with the degree of normative conformity preferences increasing, voter 1 will devote more effort to collecting information. This may improve the expected social payoffs as a whole. A similar situation also applies to voter 2.

Shayo and Harel (2012) designed an experiment and found that voters may care about how they vote even if it does not affect the outcome. There are various reasons for this fact. We model one of these reasons: group acceptance, which relates to the work of Callander (2008) on normative conformity preferences with majority rule[3]. Conformist voters in our paper deviate from Callander (2008) in two ways. Firstly, we do not assume a given distribution of information between voters. Both of our voters must be motivated to choose an effort level for the collection of information. Secondly, through the unanimity rule[4] rather than majority rule, we emphasize the desire to vote for the same decision as the other voter rather than the desire to vote for the winner. As represented by normative conformity preferences in our paper, the desire to vote for the same decision as the other in a small group has already been modelled by Dutta and Prasad (2004) and Glazer (2008). In Dutta and Prasad (2004), conformity is labelled as imitation. In Glazer (2008)'s model, voter utility increases through the pleasure of having made the same voting choice compared with when they have made different voting choices. Furthermore, Cooper and Rege (2011) employ a series of controlled laboratory experiments to study choices under uncertain conditions and conclude that an individual's utility derived from an action is enhanced by others carrying out the same action. Levitan and Verhulst (2015) experimentally find that people adjust their responses to conform to those around them when they are asked to reveal their attitudes publicly.

Our paper is organized in the following manner. The next section presents the model and the voting rule. Section 3 analyzes how the two voters vote if they are non-conformist. In practice, we examine the existence of voters' informative equilibria and compare the individual effort level with the social optimal effort level in informative equilibria. Section 4 presents the effects of normative conformity preferences in informative equilibria. In particular, we find the degree of special normative conformity preference which makes conformist voters exert an effort level that is equal to the optimal effort level from a social perspective if the voters are assumed to be nonconformist. Section 5 consists of a graphical presentation of comparative statics on informative equilibria. Our conclusions are stated in Section 6. All proofs and Figures can be found in the appendix.

2 Model with Unanimity Rule

There are two voters, $i \in \{1, 2\}$, who own a common investment company facing a risky financial project with a negative expected payoff ($p < 0$). Two states of the world $S \in \{-h, h\}$ correspond to the project. If $S = h$ the project is profitable with profits of $\overline{G}$, ($\overline{G} = p+h > 0$). If $S = -h$, it is unprofitable with losses of $\underline{G}$,($\underline{G} = p-h < 0$). $v_i = Y$ means voter i wants to implement the project, while $v_i = N$ means he/she wants to reject it. The project is implemented ($D = Y$ where $D \in \{N, Y\}$) if and only if both of them vote for implementation, $(v_1, v_2) = (Y, Y)$, otherwise the project is rejected ($D = N$). In other words, the voting rule is the unanimity rule and abstention is not allowed. Both voters have identical preferences regarding D ($D \in \{N, Y\}$) and states, which are represented by $u_i(\cdot)$ in the following function (1).

The voters do not know the true state of the world, but both of them have equal prior probabilities about the states. Furthermore, each voter receives a private signal, $s_i \in \{-h, h\}$, about the true state. We suppose that both voters have an identical ability to pay for information in their private signals. A signal is informative, meaning that a signal reveals the state of the world with probability of $e_i (0 \leq e_i \leq 1)$. For the sake of simplicity, we equate the probability e_i and the level of effort that voter i has expended on collecting information. Examples of this effort are money and time, etc.[5] Therefore, a signal is uninformative with a probability of $1 - e_i$. An uninformative signal is not correlated to the state of the world. In line with the assumption of the voters' equal prior probability about the states, if a signal is uninformative, s_i is assumed to be randomly drawn from $\{-h, h\}$ with $Pr(h) = Pr(-h) = \frac{1}{2}$. In particular, if $Pr(S = h|s_i = h) = 1$ and $Pr(S = -h|s_i = -h) = 1$, s_i is a fully informative signal. And when both s_1 and s_2 are fully informative signals, $s_1 = s_2$.

When a voter has received a signal, he or she does not know whether the signal is informative or uninformative. However, he or she knows the relationship between the effort and the probability of receiving an informative signal. After the voters have received their signal, they vote on the project which marks the end of the game.

Let us return to e_i, which shows the relationship between the effort and the quality of a signal. As such, the effort of each i is e_i. We assume that effort is costly, i.e. an informative signal is costly. $c(e_i)$ denotes the cost of e_i. We assume that $c(0) = 0$, $c'(e_i) > 0$, and $c''(e_i) > 0$. In particular, $c(e_i) = be_i^2$ where b is a constant and $b > 0$. It shows that voters are identical in their disutility of effort for collecting information. Accordingly, voter i's payoff U_i is given by:

$$U_i(D, S, e_i) = u_i(\cdot) - be_i^2 + k * 1_{\{v_1 = v_2\}}, \tag{1}$$

where $1_{\{v_1 = v_2\}}$ is the indicator function of the event $v_1 = v_2$, and $u_i(\cdot)$ is decided by D and S:

$$\begin{aligned} u_i(D = Y|S = h) &= \overline{G}, \\ u_i(D = Y|S = -h) &= \underline{G}, \\ u_i(D = N|S = h) &= 0, \\ u_i(D = N|S = -h) &= 0. \end{aligned}$$

In addition, $v_1 = v_2$ means that both voters have made the same decision when voting.

Specifically, the final term in Function (1), which is assumed to be identical for both voters, represents the conformity element, where k reflects a material benefit for each voter from having made the same decision. It is assumed that $k \geq 0$. And $k = 0$ is the special case without conformity. Including the conformity element k in the payoff function (1) is the key to this model, which arises from the desire for a degree of conformity. It embodies the idea that the voters' information collection efforts have an emotional benefit through their voting decisions that is determined by whether or not the decisions are the same. Note that the emotional benefit is a distributional rather than productive benefit. In addition, I have chosen to represent it as a function of their decisional choices (v_i), rather than in terms of the effort levels they have provided (e_i), because this is consistent with the decisional choices being public knowledge, while the effort that voter i provides remains his or her private knowledge.

Finally, Table 1 presents a formal description of our game with the unanimity rule.

Table 1: The description of our game.

Players: $i \in \{1, 2\}$
Timing

- Nature randomly chooses $S \in \{-h, h\}$ with $Pr(s = h) = Pr(s = -h) = \frac{1}{2}$.
- Each voter i chooses $e_i \in [0, 1]$.
- Each voter i observes $s_i \in \{-h, h\} : Pr(s_i = S) = \frac{1}{2}(1 + e_i)$ and $Pr(s_i \neq S) = \frac{1}{2}(1 - e_i)$.
- Each voter i chooses $v_i \in \{N, Y\}$.

Payoffs:
If $(v_1, v_2) = (Y, Y)$, then $D = Y$ and $U_i(S = h, e_i) = \overline{G} - be_i^2 + k$
and $U_i(S = -h, e_i) = \underline{G} - be_i^2 + k$.
If $(v_1, v_2) = (N, Y)$ or $(v_1, v_2) = (Y, N)$, then $D = N$ and $U_i = -be_i^2$.
If $(v_1, v_2) = (N, N)$, then $D = N$ and $U_i = -be_i^2 + k$.
Assumptions:
$p < 0, h + p > 0; \overline{G} = p + h, \underline{G} = p - h; b > 0; k \geq 0$.

3 A Benchmark: Nonconformity

In this section, we assume that there are no normative conformity preferences. The model in Section 2 is then reduced to a conventional two-voter economic model in voting without conformity (Swank and Wrasai 2003). Each voter makes two decisions. Firstly, each voter chooses how much effort to devote to collecting information. Secondly, each voter chooses how to vote. For the sake of clarity, we proceed by backward induction. We start by showing the necessary conditions for informative equilibrium under the assumption of sincere voting decisions. Sincere voting decisions mean that it is optimal for each voter to vote in line with his or her signal, given that the other voter also votes in line with his or her signal. We then go back to define the conditions for sincere voting decisions in Lemma 1.

3.1 The Informative Equilibrium

Under the unanimity rule, the project will be rejected unless both voters receive a positive signal. Assuming sincere voting decisions in which voters vote in line with their signals, an overall analysis of the decisions concerning the effort to be devoted to the collection of information is shown in Figure 1.

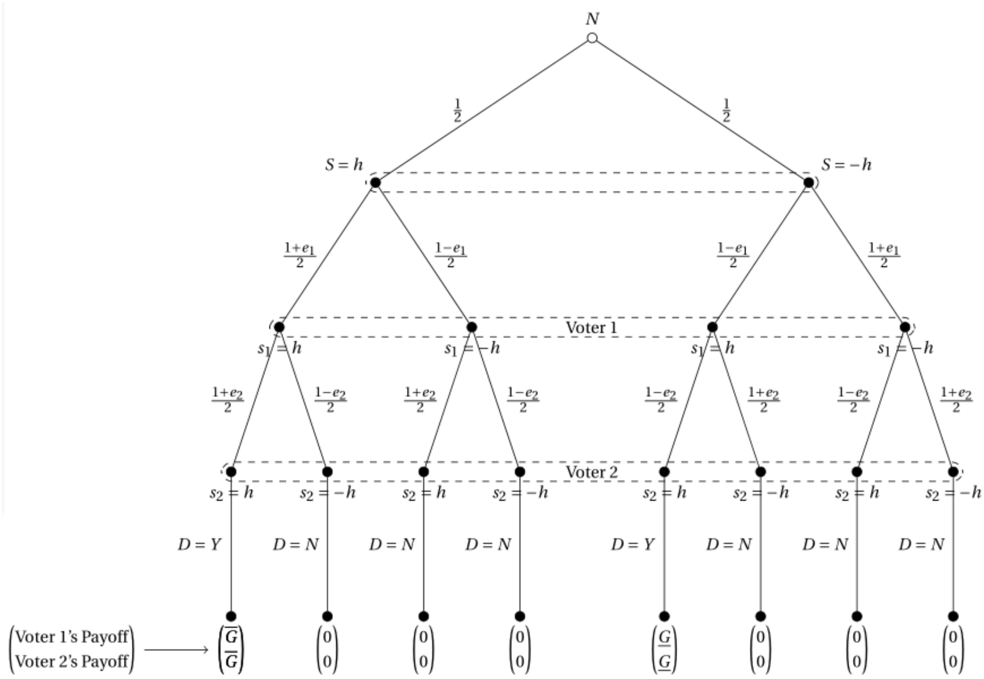

Figure 1: The outcomes of the project when both nonconformist voters vote sincerely with e_1 and e_2.

According to Figure 1, when both voters have the same signals under the unanimity rule, if the signal is correct, the corresponding expected utility for voter i is $\frac{1}{2}\overline{G} + \frac{1}{2} \times 0$, whereas if the signal is wrong the corresponding expected utility is $\frac{1}{2}\underline{G} + \frac{1}{2} \times 0$. If their signals are different, the policy cannot be applied under this voting rule and therefore, the expected utility is 0. Consequently, when choosing an effort level of e_1, voter 1's expected payoff is $S_{1N}(e_1)$:

$$\begin{aligned} S_{1N}(e_1) &= \frac{1}{2}\overline{G} \times \frac{1}{4}(1+e_1)(1+e_2) + \frac{1}{2}\underline{G} \times \frac{1}{4}(1-e_1)(1-e_2) - be_1^2, \\ &= \frac{\overline{G}+\underline{G}}{8}(1+e_1e_2) + \frac{\overline{G}-\underline{G}}{8}(e_1+e_2) - be_1^2. \end{aligned}$$

Differentiating the preceding function with respect to e_1 yields the first-order condition:

$$S'_{1N}(e_1) = \frac{\overline{G}-\underline{G}}{8} + \frac{\overline{G}+\underline{G}}{8}e_2 - 2be_1.$$

We make the first order condition equal to zero:

$$S'_{1N}(e_1) = 0. \tag{2}$$

Equation (2) implicitly defines voter 1's effort as a function of $\overline{G}$, $\underline{G}$, and e_2.

We can write an analogous expression for voter 2:

$$S'_{2N}(e_2) = \frac{\overline{G}-\underline{G}}{8} + \frac{\overline{G}+\underline{G}}{8}e_1 - 2be_2,$$

and make this first order condition equal to zero:

$$S'_{2N}(e_2) = 0. \tag{3}$$

Equation (3) defines voter 2's effort as a function of $\overline{G}$, $\underline{G}$, and e_1.

The functions (2) and (3) imply the following eqs. (4) and (5):

$$e_1 = \frac{\overline{G}+\underline{G}}{16b}e_2 + \frac{\overline{G}-\underline{G}}{16b}, \tag{4}$$

$$e_2 = \frac{\overline{G}+\underline{G}}{16b}e_1 + \frac{\overline{G}-\underline{G}}{16b}. \tag{5}$$

Assuming $\frac{h}{-p} > \frac{h}{8b}$, Figure 2[6] illustrates these two reaction functions between voter 1 and voter 2.

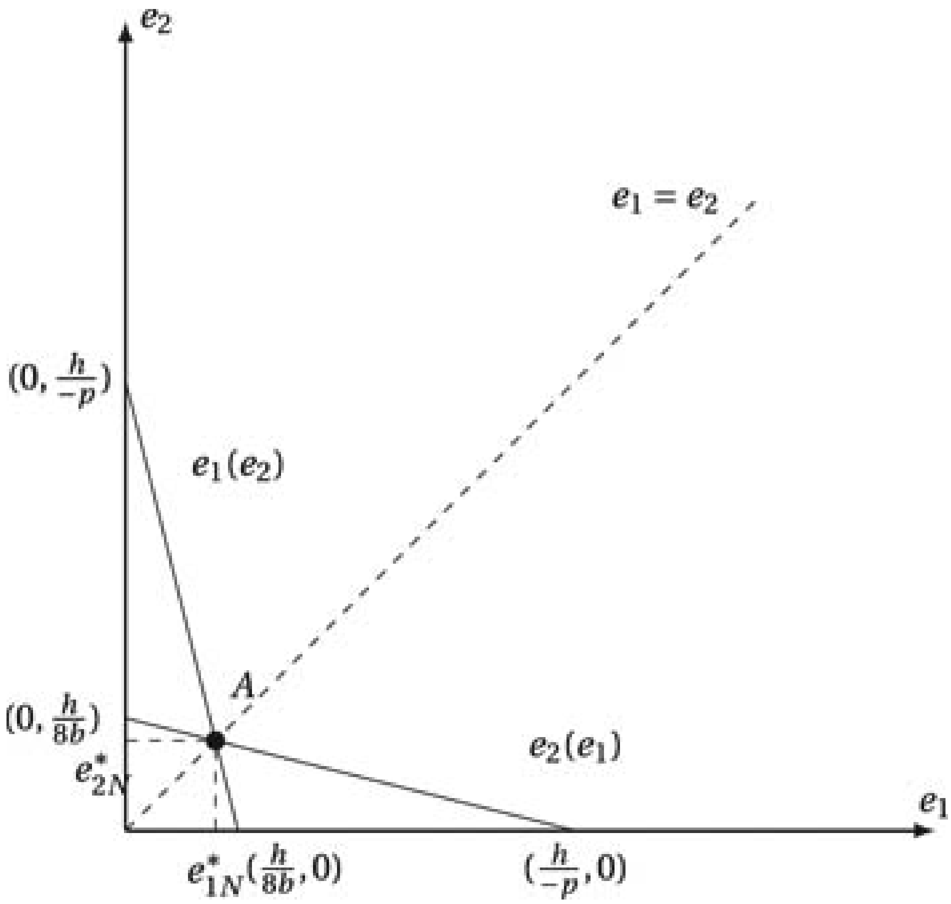

Figure 2: The informative equilibrium. Dot A denotes the equilibrium point. $e_1(e_2)$ is voter 1's reaction function. $e_2(e_1)$ is voter 2's reaction function. $\overline{G} + \underline{G} = 2p$ and $\overline{G} - \underline{G} = 2h$.

Using the functions (4) and (5), at the informative equilibrium (e_1^*, e_2^*) in Figure 2:

$$e_{1N}^* = e_{2N}^* = \frac{\overline{G} - \underline{G}}{16b - (\overline{G} + \underline{G})}, \text{if} e_{1N}^*, e_{2N}^* \in [0, 1].$$

For convenience, we note $e_{1N}^* = e_{2N}^* = e_N^*$. Thus,

$$e_N^* = \frac{\overline{G} - \underline{G}}{16b - (\overline{G} + \underline{G})}, \text{if} e_N^* \in [0, 1]. \tag{6}$$

Because

$$S''_{1N}(e_1) = S''_{2N}(e_2) = -2b < 0,$$

e_{1N}^* and e_{2N}^* simultaneously maximize $S_{1N}(e_1)$ and $S_{2N}(e_2)$ separately.

3.2 Sincere Voting Decisions

In Figure 2, we have shown that the equation $e_1 = e_2$ is a prerequisite for an informative equilibrium with the assumption of sincere voting decisions. With the equation $e_1 = e_2$, Lemma 1 presents the conditions under which there are sincere voting decisions.

Lemma 1:
Let us assume the level of effort $e_1 = e_2 = e$, $(e \in [0, 1])$, so that $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) > 0$. Therefore, it is optimal for each voter to vote in line with his or her signal, given that the other voter votes in line with his or her own signal.

Therefore, we suppose that $e_N^* = \frac{\overline{G}-\underline{G}}{16b-(\overline{G}+\underline{G})}$ where $e_N^* \in [0,1]$, so that the condition in Lemma 1 holds, i.e. when $e = e_N^*$, $\frac{1+e^2}{4}(\overline{G}+\underline{G}) + \frac{e}{2}(\overline{G}-\underline{G}) > 0$. The informative equilibrium now exists, in which (i) each voter votes informatively and (ii) each voter chooses the effort e_N^*.

The following discussion shows that there is a free-rider problem in the benchmark. Using the informative equilibrium strategies of both voters, it is easy to calculate the sum of the expected payoff for both voters $(S_N(e_N^*))$:

$$S_N(e_N^*) = \frac{\overline{G}+\underline{G}}{4}[1+(e_N^*)^2] + \frac{\overline{G}-\underline{G}}{2}e_N^* - 2b(e_N^*)^2.$$

The corresponding function with respect to e_N^* is:

$$S_N(e_i) = \frac{\overline{G}+\underline{G}}{4}[1+(e_i)^2] + \frac{\overline{G}-\underline{G}}{2}e_i - 2be_i^2.$$

We differentiate the function $S_{NC}(e_i)$ with respect to e_i:

$$S'_N(e_i) = \frac{\overline{G}+\underline{G}}{2}e_i + \frac{\overline{G}-\underline{G}}{2} - 4be_i.$$

Furthermore, we differentiate the function $S'_{NC}(e_i)$ with respect to e_i:

$$S''_N(e_i) = \frac{\overline{G}+\underline{G}}{2} - 4b.$$

From the assumptions, for all the e_i,

$$S''_N(e_i) < 0.$$

We see that if e_N^{**} with $e_N^{**} \in [0,1]$ satisfying the function $S'_N(e_N^{**}) = 0$, e_N^{**} maximizes the function $S_N(e_i)$, where

$$e_N^{**} = \frac{\overline{G}-\underline{G}}{8b-(\overline{G}+\underline{G})}, \text{if} e_N^{**} \in [0,1]. \quad (7)$$

On returning to the function $S'_{1N}(e_N^*) = 0$, we see that $\frac{1}{2}(\overline{G}-\underline{G}) + \frac{e_N^*}{2}(\overline{G}+\underline{G}) = 8be_N^*$.

Therefore, we note that

$$\begin{aligned} S'_N(e_N^*) &= \frac{\overline{G}+\underline{G}}{2}e_N^* + \frac{\overline{G}-\underline{G}}{2} - 4be_N^* \\ &= \frac{\overline{G}+\underline{G}}{2}e_N^* + \frac{\overline{G}-\underline{G}}{2} - 8be_N^* + 4be_N^* \\ &= 4be_N^* > 0. \end{aligned}$$

The fact that $S''_N(e_i) < 0$ also shows that $S'_N(e_i)$ is decreasing with e_i. Therefore, because $S'_N(e_N^*) > 0 = S'_N(e_N^{**})$ and $S''_N(e_i) < 0$, e_N^{**} is bigger than e_N^*, i.e.

$$e_N^{**} > e_N^*.$$

This means that from a social perspective, the two voters exert too little effort in the informative equilibrium. The reason is a positive externality, which results in the free-rider problem. In the standard free-riding problem, information has a public benefit component which is achieved by the unanimity rule in this paper. This unanimity-rule-based approach to the free-riding problem was initially developed in Swank and Wrasai (2003)'s "Deliberation, Information Aggregation, and Collective Decision Making". Through the unanimity rule in our game, when voter 1 increases his or her effort to receive an informative signal, voter 2 also benefits. The social benefits of collecting information thus exceed their private benefits.

4 A Model of Normative Conformity Preferences

In this section, we examine the normative conformity preferences effect. We present an informative equilibrium with conformist voters who have normative conformity preferences. As in the benchmark model in Section 3, conformist voters vote on the project after they have received their signals. Each conformist voter makes two decisions. Firstly, each conformist voter chooses how much effort to devote to collecting information. Secondly, each conformist voter chooses how to vote. As in the previous section, we start by showing the conditions required for an informative equilibrium under the assumption of sincere voting decisions. We then go back to find the conditions for sincere voting decisions in Lemma 2.

4.1 The Informative Equilibrium with Conformity

Under the assumption of sincere voting decisions, we consider voters' decisions about the effort to be devoted to information collection. How much effort do the voters devote to collecting information, given that they are conformist and vote in line with their private signals?

Given that voter i chooses effort e_i and votes sincerely, Figure 3 presents the game tree with conformity.

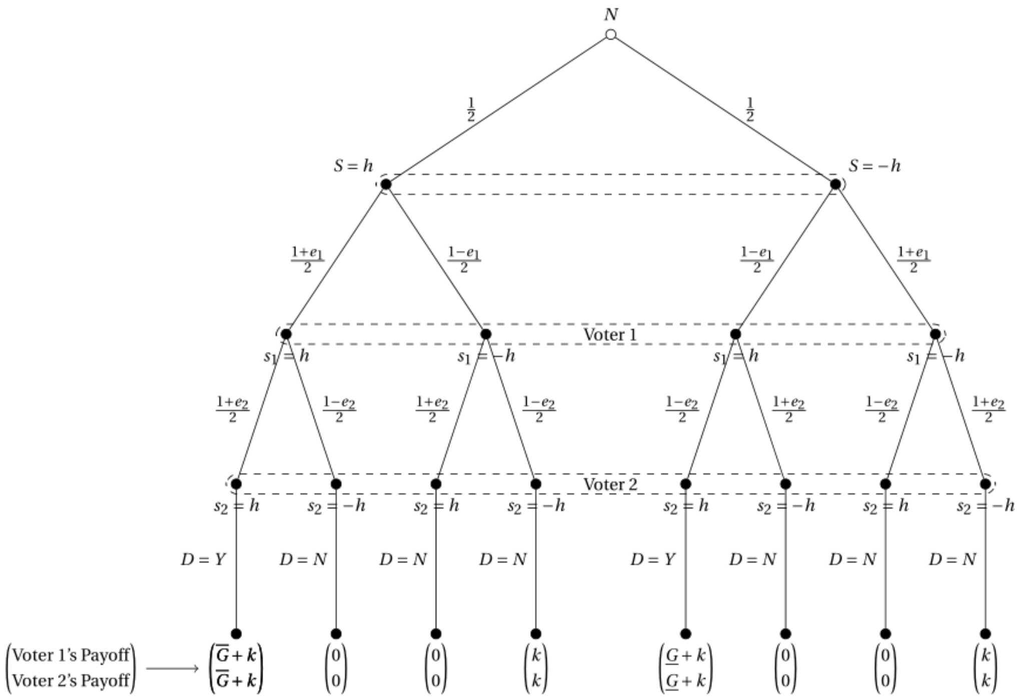

Figure 3: The outcomes from the project when given both conformist voters vote sincerely with e_1 and e_2.

When voter 1 chooses the effort, his or her expected payoff, which is equal to his or her expected payoff without normative conformity preferences added to the normative conformity preferences utility, i.e. the conformity preferences level k multiplied by the probability that the two voters have the same signals, is as follows:

$$S_{1C}(e_1) = (\frac{\overline{G}}{2} + k) \times \frac{1}{4}(1+e_1)(1+e_2) + (\frac{\underline{G}}{2} + k) \times \frac{1}{4}(1-e_1)(1-e_2) - be_1^2.$$

Differentiating this function with respect to e_1 yields the first-order condition:

$$S'_{1C}(e_1) = \frac{\overline{G} - \underline{G}}{8} + (\frac{\overline{G} + \underline{G}}{8} + \frac{1}{2}k)e_2 - 2be_1. \tag{8}$$

We make the first-order condition equal to zero:

$$S'_{1C}(e_1) = 0. \tag{9}$$

Equation (9) implicitly defines voter 1's effort as a function of $\overline{G}$, $\underline{G}$, e_2 and k. An analogous condition can be derived for e_2:

$$S_{2C}(e_2) = (\frac{\overline{G}}{2} + k) \times \frac{1}{4}(1 + e_2)(1 + e_1) + (\frac{\underline{G}}{2} + k) \times \frac{1}{4}(1 - e_2)(1 - e_1) - be_2^2.$$

Differentiating the above function with respect to e_2 yields the first-order condition:

$$S'_{2C}(e_2) = \frac{\overline{G} - \underline{G}}{8} + (\frac{\overline{G} + \underline{G}}{8} + \frac{1}{2}k)e_1 - 2be_2.$$

We make the first order condition equal to zero:

$$S'_{2C}(e_2) = 0 \tag{10}$$

Equation (10) implicitly defines voter 2's effort as a function of $\overline{G}$, $\underline{G}$, e_1 and k.

The functions (9) and (10) imply the functions (11) and (12).

$$e_1 = (\frac{\overline{G} + \underline{G}}{16b} + \frac{k}{4b})e_2 + \frac{\overline{G} - \underline{G}}{16b}, \tag{11}$$

$$e_2 = (\frac{\overline{G} + \underline{G}}{16b} + \frac{k}{4b})e_1 + \frac{\overline{G} - \underline{G}}{16b}. \tag{12}$$

Figure 4 illustrates these two reaction functions: (11) and (12).

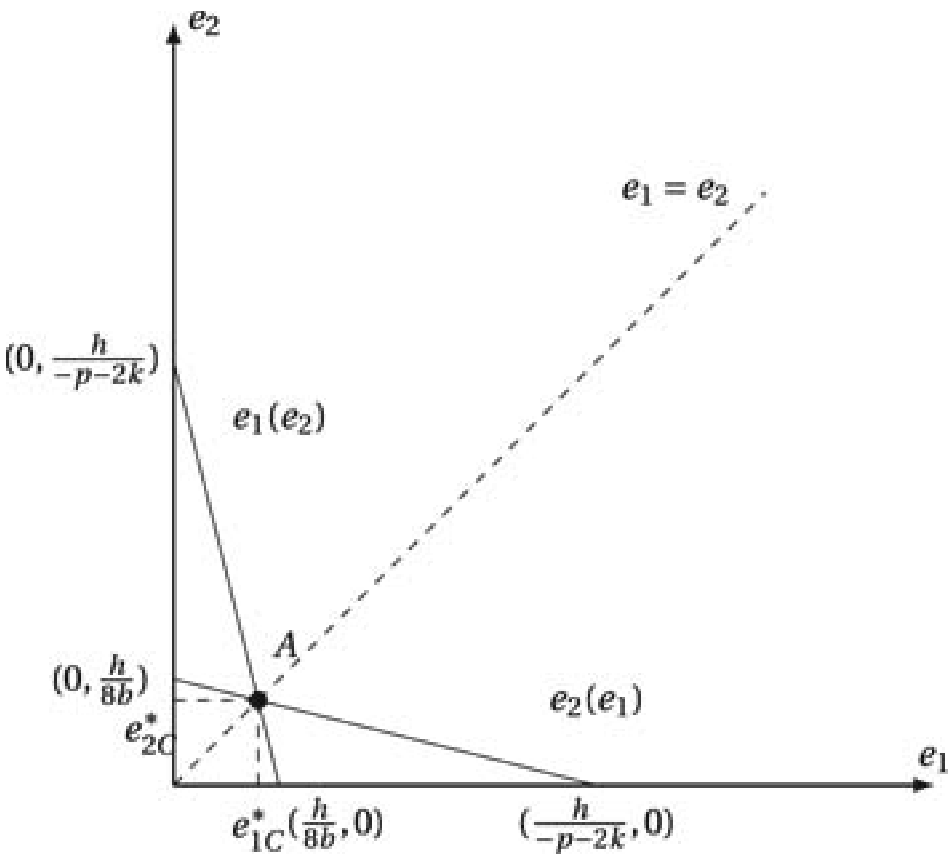

Figure 4: The informative equilibrium with conformity. Dot A denotes the equilibrium point. $e_1(e_2)$ is voter 1's reaction function. $e_2(e_1)$ is voter 2's reaction function. $\overline{G} + \underline{G} = 2p$ and $\overline{G} - \underline{G} = 2h$.

Using the functions (11) and (12), the informative equilibrium (e^*_{1C}, e^*_{2C}) in Figure 4 is:

$$e^*_{1C} = e^*_{2C} = \frac{\overline{G} - \underline{G}}{16b - 4k - (\overline{G} + \underline{G})}, \text{if} e^*_{1C}, e^*_{2C} \in [0, 1].$$

Because $S''_{1C}(e_1) = S''_{2C}(e_2) = -2b < 0$, $e^*_{1C} = e^*_{2C} = \frac{\overline{G}-\underline{G}}{16b-4k-(\overline{G}+\underline{G})}$, where $e^*_{1C}, e^*_{2C} \in [0, 1]$, simultaneously maximize $S_{1C}(e_1)$ and $S_{2C}(e_2)$.

4.2 Sincere Voting Decision with Conformity

In Figure 4, we have shown that $e^*_{1C} = e^*_{2C}$ is a necessary condition for informative equilibrium with conformity under the assumption of sincere voting decisions. Supposing $e_1 = e_2 = e$, we consider the conditions for conformist voters' sincere voting decisions. And Lemma 2 presents the results, i.e. the conditions under which it is optimal for conformist voter 1 (2) to vote in line with his or her signal, given $e_1 = e_2 = e$ and that the other conformist voter also votes in line with his or her signal.

Lemma 2:
Let us assume that a level of effort $e_1 = e_2 = e$, $(e \in [0, 1])$, so that $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2 k > 0$. In this case, it is optimal for each conformist voter to vote in line with his or her signal, given that the other voter also votes in line with his or her own signal. Moreover, when the condition for sincere voting with nonconformist voters is met, the condition for sincere voting with conformist voters is also met for certain.

We suppose that $e^*_{1C} = e^*_{2C} = e^*_C$, so that, when $e = e^*_C$, the condition $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2 k > 0$ in Lemma 2 holds. The informative equilibrium with normative conformity preferences now exists, in which (*i*) each conformist voter votes informatively and (*ii*) each conformist voter chooses e^*_C. And e^*_C is a constant determined by $\overline{G}$, $\underline{G}$ and k, where

$$e^*_C = \frac{\overline{G} - \underline{G}}{16b - 4k - (\overline{G} + \underline{G})}, \text{if} e^*_C \in [0, 1]. \tag{13}$$

Theorem 1:
Let us assume that $k > 0$, and the level of effort (e_i) is sufficiently high, $(e_i \in [0, 1])$, so that, when $e = e_i$, $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2 k > 0$. Now there is an informative equilibrium. In the equilibrium, the conformity preference level k cannot help to maximize the welfare from a social perspective i.e. $e^*_C \neq e^{**}_C$, where e^{**}_C means the voters' effort level that maximizes the sum of the expected social payoffs $(S_C(e_i))$. In practice,

if k satisfies	the effort level
$4k > 8b - (\overline{G} + \underline{G})$	$e^*_C > 0 > e^{**}_C$
$4k = 8b - (\overline{G} + \underline{G})$	$e^*_C \neq e^{**}_C$
$4k < 8b - (\overline{G} + \underline{G})$	$e^{**}_C > e^*_C > 0$

Moreover, when $k \gtreqless 2b$ and $\frac{1+(e^*_C)^2}{4}(\overline{G} + \underline{G}) + \frac{e^*_C}{2}(\overline{G} - \underline{G}) > 0$,

$$e^*_C \gtreqless e^{**}_N, \tag{14}$$

where $e^*_C, e^{**}_N \in [0, 1]$. This means that the conformity preference $k = 2b$ resolves the free-rider problem in the benchmark.

Theorem 1 implies that (i) from a social perspective, the voters may exert more or less effort; (ii) when the conformist degree is $k = 2b$, the sum of the expected payoffs to the two conformist voters is improved in an informative equilibrium compared with the case with $k = 0$; and (iii) when $k > 2b > 0$ $(2b > k > 0)$, in informative equilibria, the effort level with conformity e^*_C is always higher (lower) than the optimal social effort level without conformity e^{**}_N.

The intuitions behind the Theorem 1 are straightforward.

i. Voters compare the costs and benefits of effort in order to choose effort levels in the informative equilibrium. In our model, there are two types of benefits. Firstly, by devoting more effort, the voter reduces the probability of receiving a wrong signal. Secondly, devoting more effort increases the probability of both two voters having the same signals. Without conformity, information is important for making the right choice. And the correlation of the signals affects each voter's effort level (i.e. the accuracy of their signal), because of the free-riding problem. With conformity, the correlation between both voters' signals is important for their coordination (making the same vote). Even if the correlation is unrelated to the accuracy of both voters' signals, it would still be important to them. In this way, the voters' normative conformity preferences affect the effort levels which they devote to acquiring information in the informative equilibrium, and mean that conformist voters may devote too little or too much effort from a social perspective. Even so, normative conformity preferences do not eliminate the free-rider problem.

ii. We suppose that conformist voters devote the exact effort level required to maximize the expected total payoff from a social perspective in the informative equilibrium for the nonconformist case. When information is almost free, voter 1 considers it very likely that he or she will receive more accurate information. Meanwhile, voter 1 considers that voter 2 has also received more accurate information, which establishes a strong correlation between the voters' signals. Because there is already a strong correlation, the optimal normative conformity preference level, which alleviates the free-rider problem by letting the two voters gain utility by making the same decision as the other, needs to become smaller in order to induce voters to exert that exact level of effort. When information is expensive, it becomes far less likely that voters will receive accurate information. The correlation between their signals is weak. Since the normative conformity preferences prompt both voters to make the same voting decision, which reduces the severity of the free-rider problem, its level needs to increase in order to make them devote that exact level of effort. In short, when information is cheap, the level of normative conformity preferences decreases in an informative equilibrium to help voters exert the optimal social effort level required to maximize the expected total payoffs from a social perspective in situations in which there are no conformity preferences. When information is expensive, this normative conformity preference level increases.

iii. Moveover, the inequalities in eq. (14) convey the following underlying intuitions. For $k > 2b > 0$, for whatever reason, if there is an increase in the conformity parameter k, each conformist voter i increases e_C^* in the informative equilibrium. But clearly, to the extent that the disutility of effort b is relatively small (i.e. $k > 2b > 0$), the change in k exceeds the associated change in b in e_C^*, thereby yielding the result $e_C^* > e_N^{**}$, and conversely for $2b > k > 0$.

Overall, a normative conformity preference makes the correlation between the signals of both conformist voters important for coordination (making the same vote), even when the correlation is unrelated to the precision of the signals. Therefore, in the informative equilibrium, both voters with a special conformity preference level can exert the exact level of effort required to maximize the expected total payoffs from a social perspective in a situation of non-conformity in which voters exert less effort because of a positive externality. It is equally true to say that the expected total payoffs in the informative equilibrium can be increased through conformity preferences.

5 Comparative Statics

Many properties of our model can be highlighted by comparing two informative equilibria in which only one element differs. Taking account of differing parameters concerning the project or the preferences of the voters' effort, we calculated our results and illustrated the results graphically.

Firstly, if we consider two equilibria, α and β in which the profit of the project differs, such as $\overline{G}_\alpha - \underline{G}_\alpha > \overline{G}_\beta - \underline{G}_\beta$, then it is clear that more effort is provided when the higher profit $\overline{G}_\alpha + \underline{G}_\alpha$ prevails (Figure 5), and both reaction functions shift outwards in a parallel manner. The expression for conformist voters, where $k > 0$, is similar.

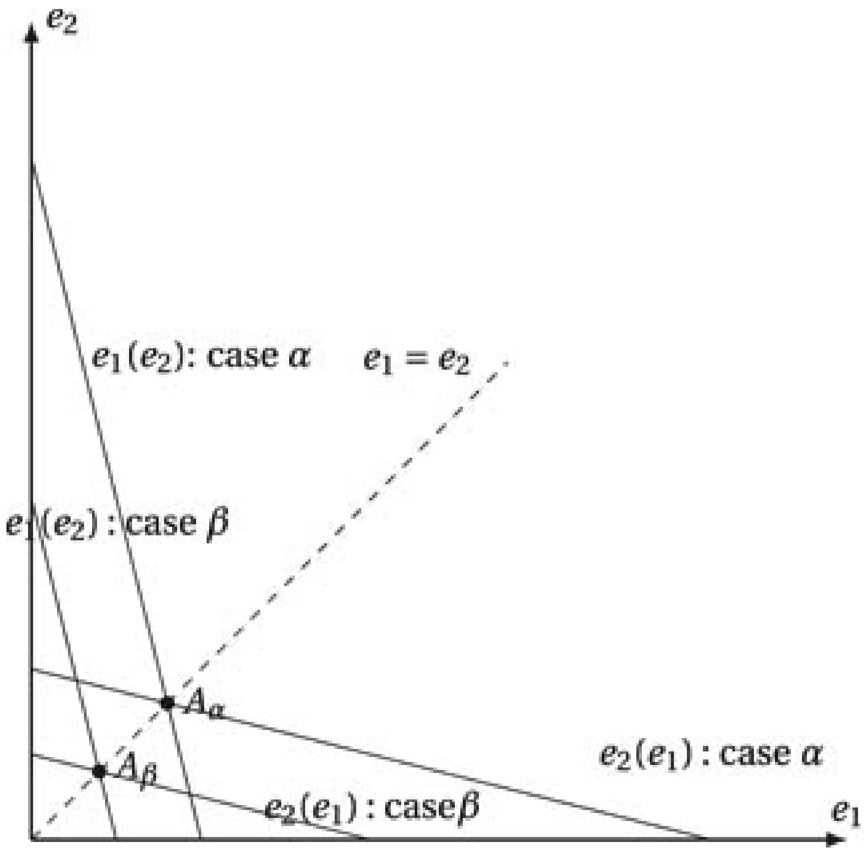

Figure 5: The effect of a difference in the profit: $\overline{G}_\alpha - \underline{G}_\alpha > \overline{G}_\beta - \underline{G}_\beta$. Dots A_α and A_β denote the equilibrium points.

Secondly, if we consider two equilibria in which only the voter's disutility of effort parameter differs, such as $b^\alpha > b^\beta$, then a graph (Figure 6) illustrates how less effort is provided when the disutility of effort is higher (case α): voter 1's reaction function shifts to the left and becomes shallower; voter 2's reaction function shifts to the left and becomes steeper. The expression for conformist voters, where $k > 0$, is similar.

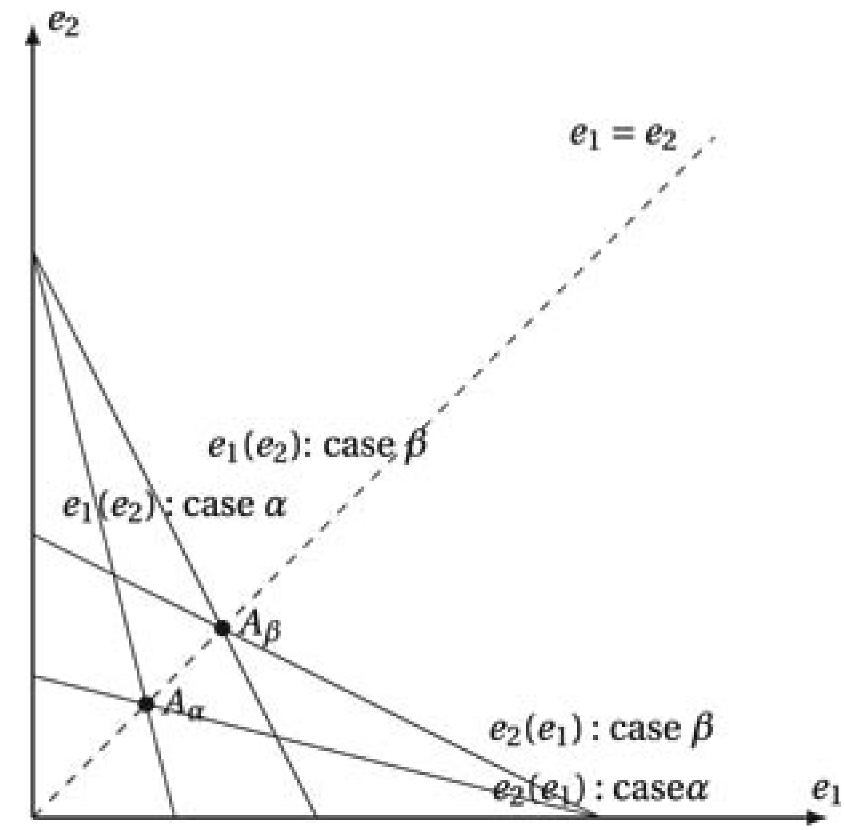

Figure 6: The effect of a difference in voters' disutility of effort: $b^{\alpha} > b^{\beta}$. Dots A_{α} and A_{β} denote the equilibrium points.

Thirdly, if we consider two equilibria in which only the project's negative expected utility payoff parameter differs, such as $\overline{G}_{\alpha} + \underline{G}_{\alpha} > \overline{G}_{\beta} + \underline{G}_{\beta}$, then a graph (Figure 7) illustrates how more effort is provided when the negative expected utility is higher (case α): voter 1's reaction function shifts to the right and becomes shallower; voter 2's reaction function shifts to the right and becomes steeper. A similar expression is for conformist voters where $k > 0$.

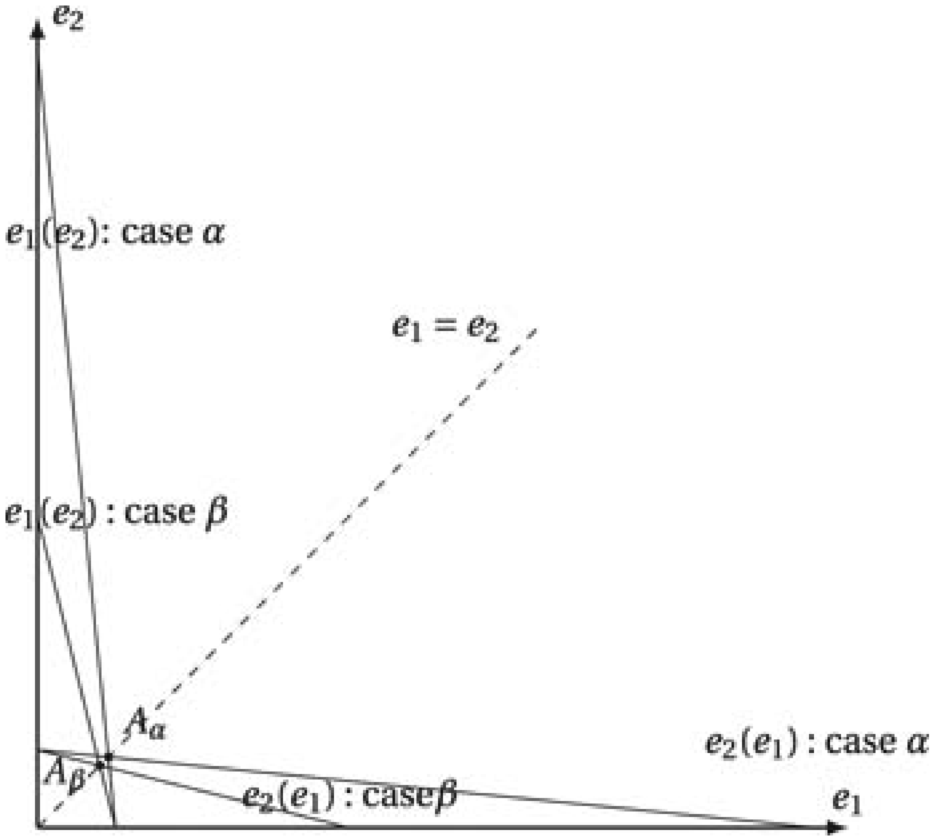

Figure 7: The effect of a difference in the project's negative expected utility payoffs: $\overline{G}_{\alpha} + \underline{G}_{\alpha} > \overline{G}_{\beta} + \underline{G}_{\beta}$. Dots A_{α} and A_{β} denote the equilibrium points.

Finally, we consider two equilibria where only the conformity parameter, k, differs, such as $k_{\alpha} > k_{\beta} > k = 0$. The following graph (Figure 8) illustrates how more effort is provided when the normative conformity preferences are higher (case α): voter 1's reaction function shifts to the right and becomes shallower; voter 2's reaction function shifts to the right and becomes steeper.

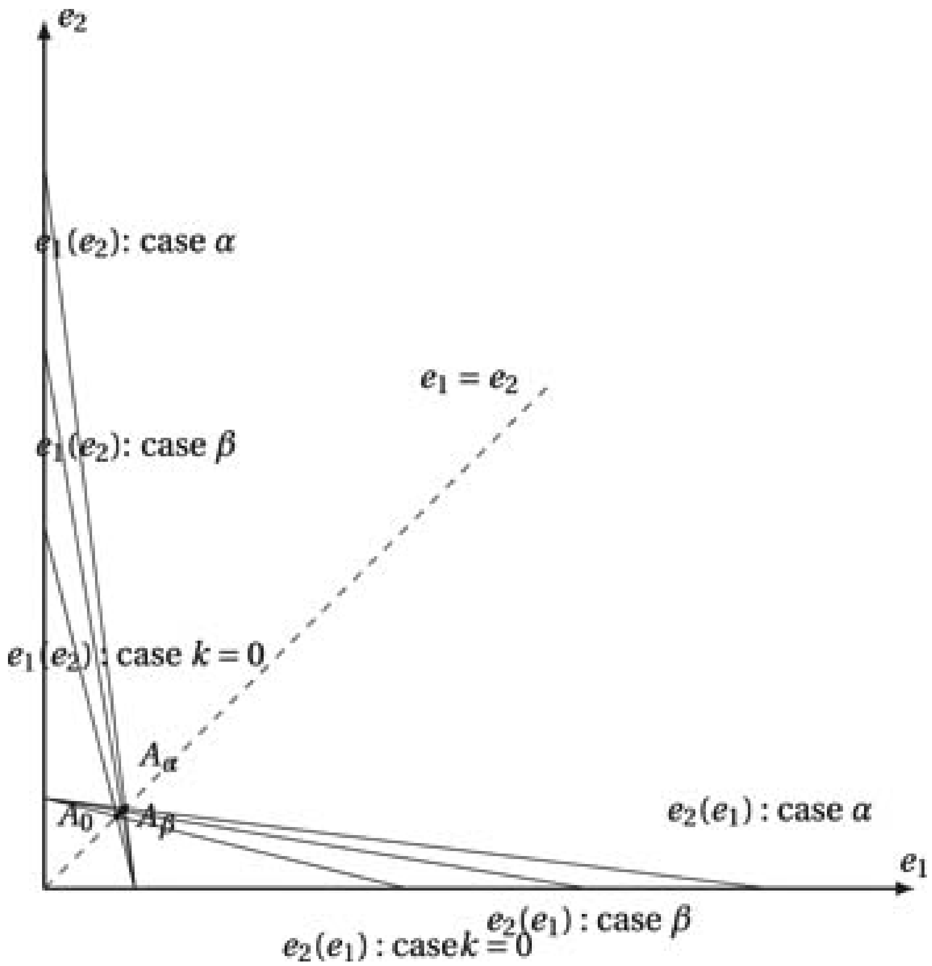

Figure 8: The effect of a difference in the profit: $k_\alpha > k_\beta > k = 0$. Dots A_α,A_β and A_0 denote the equilibrium points.

6 Conclusion

Voters tend to like voters whose voting choices mirror theirs, which is a common observation in real life. This phenomenon reflects normative conformity in social psychology. In addition to making the right voting choice, voters who have the same normative conformity preferences may want to adopt the same voting choices in order to be liked and accepted by others belonging to the same small group. With reference to the work of social psychologists, we modeled the consequences of normative conformity preferences in voting instead of modeling how voters have normative conformity preferences. In this model, we have examined the effects of normative conformity on voters' effort and found the conditions under which normative conformity preferences make voters exert a level of effort that equals the level required to maximize the sum of the voters' expected social payoffs when the voters are nonconformist.

Our most surprising result is that normative conformity preferences can help to internalize the positive externality. Specifically, when the marginal cost of information is cheap, a low level of exogenous conformity compliance is needed to make conformist voters exert the exact level of effort required to maximize the sum of the voters' social benefits from a social perspective in the informative equilibrium when they are nonconformist, and conversely for a situation in which the marginal cost of information is expensive.

In short, a normative conformity preference has positive effects from a social perspective. This is because conformity preference makes the correlation between both voters' signals important for coordination (making the same vote). Even if the correlation is unrelated to the accuracy of the signals, the correlation still matters to the two voters. In this way, the normative conformity preference alleviates the free-rider problem.

Furthermore, one one hand, conformist voters may exert an effort that exceeds the optimum effort required to maximize the total benefits to society from a social perspective. However, nonconformist voters always exert too little effort and never more effort than their optimum effort for the society from a social perspective. Any extra effort exerted by conformist voters in relation to their optimum effort is a waste. The normative conformity preference thus leads to a waste of effort from the social perspective. It shows the one negative effect of normative conformity preferences. On the other hand, conformist voters exert an effort that exceeds the optimal social effort levels provided by nonconformist voters. This points towards another negative effect of normative conformity preferences, because social welfare is optimized by maximizing informational rather than utilitarian efficiency but k reflects an emotional benefit.

In contrast, although our model focuses on conformity, it could apply to people who value consensus or dislike disputes and disagreements. Our model could also be useful if we assume that people dislike uncertainty, even when they have no taste for conformity. This is because conforming gives people more confidence in their understanding of uncertain signals. Of course, we are aware that our results are derived from three restrictive assumptions. Firstly, we have considered only two voters who may be conformist. Supposing there are more than two such voters, additional conditions will be needed for the existence of a positive externality which results in the free-rider problem. Even under these extra conditions, we think that assuming there are more than two such voters would not compromise the main results of our paper, because we would need to redefine the conformity preferences. Secondly, our two voters are assumed to be identical. In particular, they are the same not only at the level of normative conformity preferences but also in their ability to pay for informative signals and in the disutility of their efforts. It is possible to make the two voters different, which would make our results more general. Thirdly, our model describes a silent world. In the real world, committees talk before they vote. If communication were allowed, with conformity, our results would be qualitatively affected. It would be interesting to find out how having the opportunity to communicate before voting could affect our results. We conjecture that the conformity preference would still play a role. The function relates to the effectiveness of the communication. Having communicated efficiently, voters receive more informative signals. The conformity element k would then play a more obvious role. Conversely, inefficient communication makes the effects of the conformity element k less obvious. In short, our future work could try to relax these three assumptions by introducing more similarly conformist voters, giving voters different levels of normative conformity preference, and offering voters a chance to communicate in a debate, for example.

Acknowledgements

I am grateful to Professor Cécile Aubert for her comments on an earlier version of this paper that have led to significant improvements. I would also like to thank Professor Emmanuel Petit who gave valuable guidance in the early stages of this work. Furthermore, I would also like to thank the editor-in-chef and the anonymous referee for their helpful comments and suggestions. In addition, this paper was written with financial support from the China Scholarship Council and GREThA at Bordeaux University.

Funding

China Scholarship Council, (Grant / Award Number: “2011811624”).

Appendix

Proof of Lemma 1:

Proof

Supposing that $e_1 = e_2 = e$, and that voter 2 follows his or her signal. When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoff $\frac{1}{2}(1+e)\times\frac{1}{2}(1-e)\times\underline{G}+\frac{1}{2}(1-e)\times\frac{1}{2}(1+e)\times\overline{G}-be^2$ that is equal to $\frac{1-e^2}{4}(\overline{G}+\underline{G})-be^2$ and $v_1 = N$ yields an expected payoff that is equals to $-be^2$, because of $\overline{G}+\underline{G} < 0$, therefore $v_1 = N$ dominates $v_1 = Y$.

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoff $\frac{1}{2}(1+e)\times\frac{1}{2}(1+e)\times\overline{G}+\frac{1}{2}(1-e)\times\frac{1}{2}(1-e)\times\underline{G}-be^2$ that is equal to $\frac{1+e^2}{4}(\overline{G}+\underline{G})+\frac{e}{2}(\overline{G}-\underline{G})-be^2$ and $v_1 = N$ yields an expected payoff that is equal to $-be^2$, therefore $v_1 = Y$ dominates $v_1 = N$ if $\frac{1+e^2}{4}(\overline{G}+\underline{G})+\frac{e}{2}(\overline{G}-\underline{G}) > 0$. The analogous argument applies to voter 2.

All in all, supposing a level of effort of $e = e_1 = e_2$ so that $\frac{1+e^2}{4}(\overline{G}+\underline{G})+\frac{e}{2}(\overline{G}-\underline{G}) > 0$, it is optimal for voter i to vote in line with his or her signal: if $s_1 = h$, then $v_1 = Y$, and if $s_1 = -h$, $v_1 = N$, given that the other voter votes in line with his or her signal.

Proof of Lemma 2:

Proof

We suppose that $e_1 = e_2 = e$ and conformist voter 2 follows his or her signal. When voter 1 has received $s_1 = -h, v_1 = Y$ yields an expected payoff of $\frac{1}{2}(1+e)\times\frac{1}{2}(1-e)\times(\underline{G}+k)+\frac{1}{2}(1-e)\times\frac{1}{2}(1+e)\times(\overline{G}+k)-be^2$ that is equal to $\frac{1-e^2}{4}(\overline{G}+\underline{G})+\frac{1-e^2}{2}k-be^2$, and $v_1 = N$ yields an expected payoff of $\frac{1}{2}(1+e)\times\frac{1}{2}(1+e)\times k+\frac{1}{2}(1-e)\times\frac{1}{2}(1-e)\times k-be^2$ that is equal to $\frac{1+e^2}{2}k - be^2$, because of $\frac{1-e^2}{4}(\overline{G} + \underline{G}) < 0$ and $\frac{1-e^2}{2}k < \frac{1+e^2}{2}k$, therefore $v_1 = N$ dominates $v_1 = Y$.

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoff of $\frac{1}{2}(1 + e) \times \frac{1}{2}(1 + e) \times (\overline{G} + k) + \frac{1}{2}(1 - e) \times \frac{1}{2}(1-e)\times(\underline{G}+k)$ that is equal to $\frac{1+e^2}{4}(\overline{G}+\underline{G}) + \frac{e}{2}(\overline{G}-\underline{G}) + \frac{1-e^2}{2}k-be^2$, and $v_1 = N$ yields an expected payoff of $\frac{1}{2}(1 + e) \times \frac{1}{2}(1 - e) \times k + \frac{1}{2}(1 - e) \times \frac{1}{2}(1 + e) \times k - be^2$ that is equal to $\frac{1-e^2}{2}k - be^2$, therefore $v_1 = Y$ dominates $v_1 = N$ if $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2k > 0$. The analogous argument applies to voter 2.

All in all, let us assume that a level of effort of $e_1 = e_2 = e$ so that $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2k > 0$, it is optimal for voter i to vote in line with his or her signal: if $s_1 = h$, then $v_1 = Y$, and if $s_1 = -h$, $v_1 = N$, given that the other voter votes in line with his or her signal.

Because $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) > 0$, $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2k > 0$. Consequently, from Lemma 1, we note that when sincere voting with nonconformist voters exists, sincere voting with conformist voters also exists.

Proof of Theorem 1:

Proof

We suppose that $k > 0$ and the level of effort e_C^* from the function (13), where $e_C^* = \frac{\overline{G}-\underline{G}}{16b-4k-(\overline{G}+\underline{G})}$ and $e_C^* \in [0, 1]$, satisfies the condition for sincere voting in Lemma 2 (i.e. $\frac{1+(e_C^*)^2}{4}(\overline{G} + \underline{G}) + \frac{e_C^*}{2}(\overline{G} - \underline{G}) + (e_C^*)^2k > 0$). Then, using the functions $S_{1C}(e_C^*) = S_{2C}(e_C^*)$, it is easy to calculate the total expected social surplus, $(S_C(e_C^*))$:

$$S_C(e_C^*) = (\frac{\overline{G} + \underline{G}}{4} + k)[1 + (e_C^*)^2] + \frac{\overline{G} - \underline{G}}{2}e_C^* - 2b(e_C^*)^2.$$

We obtain $S'_C(e_i)$:

$$S'_C(e_i) = (\frac{\overline{G} + \underline{G}}{2} + 2k)e_i + \frac{\overline{G} - \underline{G}}{2} - 4be_i.$$

Therefore

$$S''_C(e_i) = \frac{\overline{G} + \underline{G}}{2} + 2k - 4b.$$

Consequently, if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b > 0, S''_C(e_i) > 0$, and if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b < 0, S''_C(e_i) < 0$. Therefore, $S'_C(e_i)$ increases with e_i if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b > 0$ and $S'_C(e_i)$ decreases with e_i if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b < 0$.

We assume that e_C^{**} leads to $S'_C(e_C^{**}) = 0$:

$$(\frac{\overline{G} + \underline{G}}{2} + 2k)e_C^{**} + \frac{\overline{G} - \underline{G}}{2} - 4be_C^{**} = 0.$$

We obtain

$$e_C^{**} = \frac{\overline{G} - \underline{G}}{8b - 4k - (\overline{G} + \underline{G})}.$$

From the function $S'_{1C}(e^*_C) = 0$, i.e. $(\frac{\overline{G}-\underline{G}}{2} + \frac{\overline{G}+\underline{G}}{2} + 2k)e^*_C - 8be^*_C = 0$. Moreover, we note that because $\overline{G} - \underline{G} > 0$, $e^*_C \neq 0$. Consequently,

$$\begin{aligned} S'_C(e^*_C) &= (\frac{\overline{G}-\underline{G}}{2} + \frac{\overline{G}+\underline{G}}{2} + 2k)e^*_C - 4be^*_C \\ &= (\frac{\overline{G}-\underline{G}}{2} + \frac{\overline{G}+\underline{G}}{2} + 2k)e^*_C - 8be^*_C + 4be^*_C \\ &= 0 + 4be^*_C = 4be^*_C > 0 \end{aligned}$$

Consequently e^{**}_C, which is derived from the function $S'_C(e^{**}_C) = 0$, cannot be equal to e^*_C, because the inequality, $S'_C(e^*_C) > 0$, is always right. This shows that even when voters have a normative conformity preference, the optimum entire social benefit of collecting information could never be achieved by maximizing each conformist voter's private benefits. In practice, e^*_C is greater than e^{**}_C if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b > 0$ and e^*_C is smaller than e^{**}_C if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b > 0$. All in all,

if k satisfies	the effort level
$4k > 8b - (\overline{G} + \underline{G})$	$e^*_C > 0 > e^{**}_C$
$4k = 8b - (\overline{G} + \underline{G})$	$e^*_C \neq e^{**}_C$
$4k < 8b - (\overline{G} + \underline{G})$	$0 < e^*_C < e^{**}_C$

In this way, from a social perspective, voters exert more effort when $4k > 8b - (\overline{G} + \underline{G})$, and voters exert less effort when $4k < 8b - (\overline{G} + \underline{G})$.

We now look for the optimal conformity preference level that resolves the free-rider problem in the benchmark. From the eq. (7) for e^{**}_N and the eq. (13) for e^*_C,

if

$$k \gtreqless 2b,$$

it is obvious that

$$e^*_C \gtreqless e^{**}_N = \frac{\overline{G} - \underline{G}}{8b - (\overline{G} + \underline{G})},$$

where $e^*_C, e^{**}_N \in [0, 1]$.

Furthermore, we assume that the effort level e^*_C satisfies the condition for sincere voting in Lemma 1, i.e. $\frac{1+(e^*_C)^2}{4}(\overline{G} + \underline{G}) + \frac{e^*_C}{2}(\overline{G} - \underline{G}) > 0$. We have therefore proved Theorem 1.

Notes

[1]Zafar (2011) confirms the fact that when asked for a personal opinion, people do not usually state what they truly think. Instead, they are tempted to misrepresent their opinions by conforming to their friends' opinions because any disagreement arouses feelings of discomfort.

[2]Changing this prior probability does not affect our main results.

[3]Callander (2008) emphasizes a bandwagon phenomenon resulting from the voters' desire to win.

[4]Requiring all voters to vote for implementation before a project can be implemented.

[5]In fact, a more complicated informative signal production function would involve two types of interdependencies of both voters' efforts. Firstly, the effort levels might be interdependent through the price of information. Secondly, the effort levels might also be interdependent through the interdependence of marginal informative signal productivity. Obviously, any interdependency of the second type can be represented through an interdependence via the pricing of information. Moreover, what ultimately matters to the voters is indeed the value of their signals. Consequently, our assumption is not restrictive at all.

[6]It is clearly noted that the cases $\frac{h}{-p} < \frac{h}{8b}$ and $\frac{h}{-p} = \frac{h}{8b}$ do not conflict with the rest of the results. In particular, $\frac{h}{-p} = \frac{h}{8b}$, eqs. (4) and (5) are the same equations, which directly implies that $e_1 = e_2$. For convenience, because the two cases are similar to the case $\frac{h}{-p} > \frac{h}{8b}$, we only present the case $\frac{h}{-p} > \frac{h}{8b}$ in the following Figures.

References

Asch, Solomon E. 1951. "Effects of Group Pressure Upon the Modification and Distortion of Judgments.". In *In Groups, leadership, and men, edited by Harold Guetzkow*. Pittsburgh: Carnegie Press.

Bardsley, Nicholas, and Rupert Sausgruber. 2005. "Conformity and Reciprocity in Public Good Provision." *Journal of Economic Psychology* 26 (5): 664–681.

Binning, Kevin R, Cameron Brick, Geoffrey L Cohen, and David K Sherman. 2015. "Going Along Versus Getting it Right: The Role of Self-Integrity in Political Conformity." *Journal of Experimental Social Psychology* 56: 73–88.

Callander, Steven. 2008. "Majority Rule When Voters Like to Win." *Games and Economic Behavior* 64 (2): 393–420.

Cialdini, Robert B, and Noah J Goldstein. 2004. "Social Influence: Compliance and Conformity." *Annual Reviews Psychology* 55: 591–621.

Cohen, Jere. 1978. "Conformity and Norm Formation in Small Groups." *Pacific Sociological Review* 21 (4): 441–466.

Cooper, David J, and Mari Rege. 2011. "Misery Loves Company: Social Regret and Social Interaction Effects in Choices Under Risk and Uncertainty." *Games and Economic Behavior* 73 (1): 91–110.

Deutsch, Morton, and Harold B Gerard. 1955. "A study of Normative and Informational Social Influences Upon Individual Judgment." *The Journal of Abnormal and Social Psychology* 51 (3): 629–636.

Dutta, Jayasri, and Kislaya Prasad. 2004. "Imitation and Long Run Outcomes." *The BE Journals in Theoretical Economics, Topics in Theoretical Economics* 4: 1.

Ghazzai, Hend, and Rim Lahmandi-Ayed. 2009. "Vertical Differentiation, Social Networks and Compatibility Decisions." *The BE Journal of Theoretical Economics* 9: 1.

Glazer, Amihai. 2008. "Voting to Anger and to Please Others." *Public Choice* 134 (3): 247–254.

Hung, Angela A, and Charles R Plott. 2001. "Information Cascades: Replication and an Extension to Majority Rule and Conformity-Rewarding Institutions." *American Economic Review* 91 (5): 1508–1520.

Jones, Stephen RG. *The Economics of Conformism* Blackwell, 1984.

Levitan, Lindsey C, and Brad Verhulst. 2015. "Conformity in Groups: The Effects of Others' Views on Expressed Attitudes and Attitude Change." *Political Behavior* 8: 1–39.

Meade, Robert D, and William A Barnard. 1973. "Conformity and Anticonformity Among Americans and Chinese." *The Journal of Social Psychology* 89 (1): 15–24.

Schachter, Stanley. 1951. "Deviation, Rejection, and Communication." *The Journal of Abnormal and Social Psychology* 46 (2): 190.

Shayo, Moses, and Alon Harel. 2012. "Non-Consequentialist Voting." *Journal of Economic Behavior & Organization* 81 (1): 299–313.

Swank, Otto H, and Phongthorn Wrasai. (2003). Rotterdam: Tinbergen Institute Discussion Paper No. TI 2002-006/1 Deliberation, Information Aggregation, and Collective Decision Making.

Zafar, Basit. 2011. "An Experimental Investigation of Why Individuals Conform." *European Economic Review* 55 (6): 774–798.