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Huihui Ding

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SPÉCIALITÉ SCIENCES ÉCONOMIQUES

Par **Huihui DING**

**THE EFFECTS OF CONFORMITY
PREFERENCES IN VOTING**

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Soutenue le 4 Juillet 2016

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Titre: LES EFFETS DES PRÉFÉRENCES CONFORMISTES DANS UN CONTEXTE DE VOTE

Résumé: Cette thèse étudie le rôle du conformisme social dans un contexte de vote. Dans le premier chapitre, nous présentons la définition, en psychologie sociale, du conformisme. Nous passons en revue les éléments clés de la littérature afin de montrer l'influence du conformisme. Dans le deuxième chapitre, nous procédons à une revue de la littérature sur le rôle économique du conformisme, qui rassemble des travaux en économie expérimentale et en psychologie sociale. Dans le troisième chapitre, nous présentons des modèles théoriques en économie comportementale étudiant le rôle du conformisme. Sur cette base, le quatrième chapitre est consacré à une approche économique de la modélisation des préférences conformistes lorsque les électeurs souhaitent voter pour le candidat vainqueur, lors d'une élection sujette à la règle de la majorité. Concrètement, nous proposons d'expliquer comment le désir des électeurs de voter pour le gagnant peut dissuader le candidat sortant de prendre des décisions inefficaces pendant son mandat à des fins de réélection. Dans le cinquième chapitre, nous présentons un modèle intégrant des préférences conformistes, comme le désir de faire le même choix que la majorité, lors d'un vote à l'unanimité. La résolution du modèle permet de mettre en évidence qu'une préférence pour se conformer au comportement d'autrui peut améliorer le bien-être social des votants et atténuer le problème du passager clandestin. Bien que le conformisme ait toujours eu une mauvaise réputation, tous nos résultats mettent en lumière son utilité dans divers contextes de vote.

Mots-clés: Conformisme informationnel Conformisme normatif Désir de gagner Réélection Voting

Title: THE EFFECTS OF CONFORMITY PREFERENCES IN VOTING

Abstract: This thesis studies the role of social conformity in voting. In the first chapter, we present the definition of social conformity in social psychology. We review key elements of literature in order to show the influence of conformity. In the second chapter, we conduct a literature review on the economic role of conformity, which brings together work in experimental economics and social psychology. In the third chapter, we present theoretical models in behavioral economics studying the role of conformity. On this basis, the fourth chapter is devoted to an economic approach to modeling the preferences of conformity as voters' desire to win in a re-election under Majority rule. Concretely, we offer an explanation about how voters' desire to win can deter incumbents from inefficient decisions while in office. In the fifth chapter, the thesis comes to model conformity preferences as desire to make the same vote as the majority in voting for collective decision-making under the unanimity rule. The findings of the model highlight that conformity preferences can improve the sum of voters' social welfare and alleviate the free-rider problem. Though conformity has always had a bad reputation, all our results shed light on its usefulness in various contexts to vote.

Keywords: Informational conformity Normative conformity Desire to win Re-election Voting

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À mes parents,

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As required by the Bordeaux University, this thesis is my personal work. It doesn't include any collaborative work.

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HUIHUI DING, 24th May 2016.

Summary in French - Résumé en français

L'objectif principal de cette thèse est d'étudier le rôle des préférences conformistes dans deux situations distinctes : lors d'une réélection et lors d'un vote pour un projet. Nous étudions l'existence d'équilibres dans ces deux situations et nous présentons nos résultats du point de vue du planificateur social. Nous cherchons alors à résoudre deux problèmes des plus intéressants : celui du titulaire qui choisit une mauvaise politique à des fins de réélection et le problème du passager clandestin dans le vote.

Dans le chapitre 1, nous faisons une revue de littérature sur le conformisme en psychologie sociale. Tout d'abord, nous présentons la définition que donnent les psychologues sociaux, à la notion de conformisme : « un comportement est dit conformiste lorsqu'un individu, dans un groupe, se conduit conformément à un comportement parce que c'est de cette façon que l'individu se reconnaît le plus dans les autres (Claidière and Whiten, 2012). » Deuxièmement, nous passons en revue les travaux expérimentaux en psychologie sociale faisant état de l'importance du conformisme. Ces expériences fondamentales nous fournissent une classification du conformisme et de ses motivations. Ainsi, cette classification établit deux grands types de conformisme : le conformisme informationnel et le conformisme normatif. Pour une meilleure compréhension du conformisme normatif, nous faisons la distinction entre ce type de conformisme et la notion d'obéissance en psychologie sociale. En reprenant la typologie de Kelman (1958), nous faisons la distinction entre trois formes de conformisme normatif : l'acquiescement, l'intériorisation et l'identification. Enfin, sur la base du tableau proposé par Claidière and Whiten (2012), nous discutons des différences théoriques et empiriques entre le conformisme informationnel et le conformisme normatif, en psychologie sociale, avant de conclure ce chapitre.

Dans le chapitre 2, nous présentons certains résultats des travaux en économie expérimentale concernant d'une part le conformisme informationnel et, d'autre part, le conformisme normatif. Tout d'abord, nous nous concentrons sur les cascades informationnelles qui correspondent à une forme de conformisme informationnel en économie expérimentale (Anderson and Holt, 1997; Cipriani and Guarino, 2005). Deuxièmement, nous passons en revue la littérature en économie expérimentale au sujet de l'acquiescement, une forme de conformisme normatif qui est relative à la pression sociale. Enfin, nous donnons de nombreuses preuves expérimentales concernant l'intériorisation, soit le conformisme normatif qui est issu d'une préférence authentique pour le conformisme. Cette revue nous permet notamment de mettre en évidence le fait que les psychologues sociaux et les économistes se rejoignent pour dire que l'influence du conformisme informationnel et du conformisme normatif ne peuvent pas être complètement différenciés. Par ailleurs les recherches en économie visant à démontrer ce résultat, se sont concentrées sur des méthodes d'analyse de données, sans présenter de travaux expérimentaux.

Dans le chapitre 3, nous examinons la littérature, en économie comportementale, sur les modèles théoriques qui étudient le conformisme. Dans la première section, nous passons en revue les différents types de modèles de conformisme informationnel. Ces modèles se différencient au niveau du processus de décision qui peut être séquentiel ou non. Dans le cas de modèles de décision séquentielle, nous présentons d'abord les modèles de décision séquentielle exogène, puis, dans un second temps, nous nous intéressons aux modèles de décision séquentielle endogène. Enfin, nous présentons les modèles de décision non-séquentielle.

Dans la deuxième section, nous détaillons les modèles d'acquiescement (forme de conformisme normatif provenant de la pression sociale). Nous présentons ainsi de nombreux modèles économiques d'acquiescement où le conformisme peut être soit endogène, soit exogène. En outre, nous examinons les préférences conformistes exogènes par acquiescement des électeurs lorsque l'abstention est interdite. Dans ces modèles, une préférence exogène pour le conformisme par acquiescement signifie que les électeurs désirent voter pour le candidat gagnant, et qu'ils obtiennent également de la satisfaction lors d'un vote à l'unanimité. Dans la troisième partie de ce chapitre, nous examinons les modèles, dans la littérature en économie, qui traitent du conformisme d'intériorisation, dans lesquelles les préférences des individus peuvent changer au cours du temps.

Dans le chapitre 4, nous développons un modèle de réélection (vote sur deux périodes) avec information complète sur la qualité des candidats. Dans notre modèle, trois différents types d'électeurs sont possibles : les partisans du titulaire, les partisans du challenger et les électeurs indépendants. Les électeurs indépendants peuvent être conformistes dans le sens où ils veulent voter pour le gagnant, ce qui peut impliquer, pour ces électeurs, un compromis entre le fait de voter pour le meilleur candidat et le fait de voter pour le candidat qui est le plus susceptible de gagner.

Le déroulement du modèle est le suivant. Au début de la période 1, un titulaire est choisi au hasard, par la Nature, et peut être très performant (type H) ou peu performant (type L). Le titulaire du poste met ensuite en œuvre une politique qui affecte le bien-être social. La réussite, ou non, de cette politique n'est cependant observée que par le titulaire lui-même. De plus, la politique a une plus grande probabilité d'être couronnée de succès, lorsque le titulaire est de type H. Avant les élections, qui ont lieu à la fin de la période 1, le titulaire choisit de poursuivre ou d'abroger sa politique. Poursuivre une politique réussie augmente le bien-être social d'un montant b , tandis que la poursuite d'une politique ratée diminue le bien-être social d'un montant c . En outre, l'abrogation d'une politique s'effectue sans entraîner de coût. Le titulaire du poste se soucie du bien-être social, mais il cherche également à être réélu. Le choix de poursuivre ou d'abroger une politique est observé par les électeurs indépendants qui mettent à jour leurs croyances à propos de la qualité du titulaire, ce qui affecte la probabilité que le titulaire gagne la réélection. Par la suite, un challenger est choisi au hasard et les élections ont lieu. Le gagnant met en œuvre une politique lors de la période 2 et observe ensuite le résultat de celle-ci. On suppose, pour simplifier, qu'il n'y a pas de nouvelle réélection, par la suite. Ainsi, le gagnant est supposé poursuivre une politique qui a fait ses preuves et abroger une politique défailante. Enfin, le jeu se termine.

Pour autant que nous le sachions, notre modèle est le premier à envisager que lorsqu'un titulaire est animée par une « rente égoïste » (notée X_2) générée par l'accès au pouvoir, la présence d'électeurs indépendants, ayant une préférence pour le conformisme, puisse influencer les conditions d'existence de deux types d'équilibre : l'équilibre stratégique socialement efficace (S) et l'équilibre stratégique « office-seeking » (P). L'équilibre (S) est tel que le titulaire, lors de la première période, continue une politique qui est réussie et abroge une politique qui échoue. Parallèlement, l'équilibre (P) est tel que le titulaire, lors de la première période, continue la politique qu'il a déjà mise en place, indépendamment du fait qu'elle réussisse ou non. Nos résultats montrent que lorsque les électeurs indépendants sont suffisamment conformistes, l'équilibre (S) est le seul qui existe. Ceci implique qu'un fort niveau de conformisme tend à promouvoir (S) et à prévenir (P). Ainsi, un fort conformisme tend à améliorer le bien-être social. En revanche, lorsque les électeurs indépendants sont faiblement conformistes, cela tend à rendre plus difficile l'existence de l'équilibre (S) et à rendre moins strictes les conditions d'existence de l'équilibre (P), en comparaison avec le cas où les électeurs indépendants sont non conformistes. Ainsi, un faible niveau de conformisme a tendance à nuire au bien-être social. En outre, lorsque le conformisme des électeurs indépendants n'est ni trop fort, ni trop faible, nous sommes capables de déterminer les conditions dans lesquelles le conformisme est en mesure d'améliorer le bien-être social, par la promotion de (S) et la prévention de (P). En bref, la préférence conformiste des électeurs indépendants peut aider à dissuader le titulaire de prendre des décisions inefficaces (problème de « incumbent's pandering », en anglais). A la fin de ce chapitre, nous discutons des potentiels bienfaits du conformisme, dont l'existence n'était pas un résultat intuitivement évident.

Dans le chapitre 5, nous étudions un modèle où deux votants doivent entreprendre une collecte d'informations avant de prendre une décision collective. Les votants peuvent être conformistes, au sens où chacun d'entre eux aime faire le même choix de vote que son partenaire. Avant de voter pour un projet, chaque votant cherche à recueillir des informations sur les conséquences possibles du projet. Nous nous concentrons sur l'équilibre d'information (de l'anglais « informative equilibrium ») qui est un équilibre de Nash symétrique. Dans cet équilibre, les votants font leur choix en suivant l'information qu'ils ont obtenue et en utilisant des stratégies pures. Nous examinons alors les effets de l'introduction de préférences pour le conformisme, chez les votants, du point de vue du planificateur social. Notre principal résultat est que, lorsque les votants sont non-conformistes, ils exercent socialement trop peu d'efforts dans la recherche d'information, à l'équilibre, en raison de la présence d'externalités positives, ce qui se traduit par le problème du passager clandestin. En effet, chaque votant est en mesure de profiter de l'effort de recherche d'information consenti par son partenaire. Au contraire, la présence de préférences pour le conformisme, chez les votants, peut permettre l'existence d'un équilibre d'information, dans lequel la somme des gains espérés des deux votants est plus importante. La raison de ce résultat est que les préférences pour le conformisme normatif, qui conduisent à désirer faire le même vote, peuvent atténuer le problème du passager clandestin. Plus précisément, les préférences pour le conformisme normatif impliquent que les votants accordent une importance particulière au fait que les signaux qu'ils obtiennent soient corrélés, même si cette corrélation n'est pas en lien avec la précision de ces signaux. Nous présentons le degré de préférence pour le conformisme exact qui fait que chaque votant conformiste exerce le niveau d'effort qui maximise son propre gain espéré, ce qui permet alors d'augmenter la somme des gains espérés, pour les deux votants, par rapport au cas où ceux-ci sont non-

conformistes. De plus, nous montrons que le problème du passager clandestin est renforcé par l'apparition d'un votant supplémentaire ayant la caractéristique spécifique d'avoir des préjugés, au sens où celui-ci a déjà formé son point de vue à propos du projet et qu'il souhaite le soutenir. La raison en est que ce nouvel agent vote pour le projet, sans avoir préalablement recherché d'information sur sa probabilité de réussite, et les préférences conformistes des deux autres votants les conduisent alors à exercer moins d'effort puisqu'ils peuvent suivre cette décision de vote.

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Part I

Introduction

Introduction

Most people are other people. Their thoughts are someone else's opinions, their lives a mimicry, their passions a quotation.

Wilde (1905)

De Profundis

Point of departure

Besides the above speech mark, if you type “quotes about conformity” in Google, the enormous findings show that too many celebrities have talked about “conformity”. These celebrities consist of writers, politicians, singers, and so on. For example, Rita Mae Brown saying “I think the reward for conformity is that everyone likes you except yourself.”, John F. Kennedy saying “Conformity is the jailer of freedom and the enemy of growth.”, John Lennon saying “It’s weird not to be weird.”. All of these things indicate a basic finding of psychology: conformity. Unfortunately, conformity has a bad reputation. Stated baldly, the aim that underlines this thesis is to offer two economic models in voting towards the usefulness of conformity.

Indeed, conformity can be seen everywhere in society. Conformity always influences our behaviour and attitudes towards events, sometimes even make us change our self-image and religious beliefs. For example, a forecaster may prefer the chance of being wrong with others to the risk of providing a deviant forecast that turns out to be the only wrong guess. For another example, conformity sets up boundaries among groups, since it creates a social identity for people who are the members of a distinctive group. Beginning with the experiments from Jenness (1932), which notes that most of group members’ estimates of the number of beans in a jar influence the estimate of each individual, conformity has received extensive attention in social psychology (Sherif, 1936; Asch, 1955; Blake, Rosenbaum and Duryea, 1955; Bond and Smith, 1996; Cialdini and Trost, 1998; Cialdini and Goldstein, 2004).

Conformity in social psychology refers to a behaviour that is said to conform when an individual in a group displays that behaviour because it is the most frequent the individual witnessed in others (Claidière and Whiten, 2012).

In addition, Bond and Smith (1996) find cross-national support for conformity effect. Particularly, they show that conformity can differ in degree from one country to another. For example, because Chinese people are social-oriented, conformity strongly affects Chinese people. Because United States prefers to advocate individualism, conformity has less effect in this society (Meade and Barnard, 1973).

Conformity can make people behave irrationally and unpredictably. However, it is certain that conformity can also be a fundamental and effective social process. Through conformity, people are able to be organised into groups and take effective actions from a collective point of view. For instance, because people conform to group norms that organise driving, it is possible to drive down a narrow street.

In our society, many important decisions like those on country's policy or companies' business strategy are made by groups through voting rather than an individual. Economists have devoted attention to compare behaviour of individuals and behaviour of individuals in groups. For example, Keynes (1936)'s beauty-contest. The context is an analogy to describe the action of rational agents in a market, where entrants are asked to choose the six most attractive faces from a hundred photographs. Those who picked the most popular faces have prizes. "keeping up with the joneses", for another example, is an idiom that refers to influences from one's neighbor in social class. Here, the individuals are assumed to be self-interested and rational, which is a traditional assumption in traditional economic models. Their decisions are made to maximize their own benefits through using all available information in rational ways. However, individuals are not totally rational and selfish in real society. They are also driven by psychological influences. Actually, psychologist Asch (1951)'s experiments about conformity challenged the assumption about rational individuals. Moscovici (1985) reaffirms conformity evidence in social psychology that groups may shift individual attitudes towards moderate positions. Furthermore, behavioural economists realize that conformity's effect is undeniably influential, especially, in the presidential nomination elections (Sunstein and Thaler, 2008). Unfortunately, it is still not clear whether this effect is beneficial for our society from a social point of view. We will research on this question in a more concrete environment such as re-election and voting on a project. We focus on using economic approaches to offer what conformity's effects are when voters are conformist in their voting decision processes. Our two models in the thesis belong to the standard economic paradigm, but include conformity preference as an exogenous variable named "desire to win" and "desire to vote unanimously" separately.

By the way, conformity as one obvious psychology influence in society has been broadly studied by economists. With the initial theoretical literature (Akerlof, 1980; Jones, 1984; Banerjee, 1992; Bikhchandani, Hirshleifer and Welch, 1992; Bernheim, 1994; Akerlof, 1997), besides in voting (Coleman, 2002, 2004; Callander, 2007, 2008), economists have studied conformity phenomena in many other economic activities during the past four decades, such as legal issues (Sunstein, 2002; Patacchini and Zenou, 2012), voluntary contributions to public goods (Carpenter, 2004), cooperation (Mengel, 2009), tax avoidance (Balestrino, 2010), labour supply (Grodner and Kniesner, 2006), social transitions (Levy, 2005), tipping (Azar, 2004), formation of culture (Bednar, Bramson, Jones-Rooy and Page, 2010), and so on. Rather than taking preferences as stable, another strand of the conformity literature in economics attempts to explain unstable preferences that exist among individuals who have desire to conform (Bala and Goyal, 2001; Wooders, Cartwright and Selten, 2006; Klick and Parisi, 2008; Dequech, 2013).

The way by which our thesis absorbs conformity is similar to the behavioural economics work of Jones (1984). Individuals in our models will take the perceived social penalties from conformity preferences into account when deciding how to behave. But each individual in our models is still the unit of analysis and the self-interested maximization person. Conformity in our models does not affect individualism and rationality. For example, an individual who is influenced by his friends can still be taken as the basic unit of analysis to choose efficient ways to achieve his goals. In the light of Jones (1984) who has chosen to focus on conformity in a workplace context about workers, our thesis focuses on conformity in voting contexts about voters.

Because our thesis is related to voters, it is important to understand its relation to voting. There are two directions to research conformist voters' effect. One direction is voter turnout, i.e., whether to vote or not. The other one is "how to vote" without abstention. First, some authors have considered conformity about voter turnout. The voter turnout means the percentage of eligible voters who cast a ballot in an election. Coleman (2002) predicts a unique quadratic relationship between reported crime rates and voter turnout under the assumption that people are fairly consistent in their response to conforming to norms about voting and conforming to norms about against crime. Coleman (2004) investigates the effect of conformity on voting behaviour for presidential elections. The paper confirms the hypothesis that if conformity motivates people to vote, it also stimulates conformist behaviour among some voters when they decide which party to vote for. Second, when abstentions are not allowed, many papers about conformist voters emphasize the question of "how to vote". It is also the main focus of our thesis. For example, Callander (2007) shows that an equilibrium exists on the sequential voting game in which a bandwagon begins with probability 1. He concludes that the exogenous conformity preference term as desire for the winning candidate

is critical to the existences of voting bandwagon as they cannot be driven merely by an informational incentive for electing the better candidate. In a companion paper, Callander (2008) investigates simultaneous elections and establishes that desire to win creates multiple equilibria. Some of the equilibria exhibit negative information aggregation. Thus information aggregated in them helps the worse candidate get elected. Besides being regarded as voters' desire to win under majority rule, exogenous conformity preference term manifests itself in making the same vote as the majority for "identification" in groups (Herrera and Martinelli, 2006; Hung and Plott, 2001; Sunstein and Thaler, 2008; Glazer, 2008; Cooper and Rege, 2011; Seidmann, 2011; Zafar, 2011; Compains and Alvarez, 2014; Levitan and Verhulst, 2015).

In fact, given the assumption that voters are conformist, the question "how to vote" is discussed in our thesis about two problems. One is the incumbent's pandering problem. In re-elections, the incumbent's pandering problem appears when an incumbent implements a policy that voters think is in their best interest, even though the incumbent knows that a different policy is actually better for the voters (Canes-Wrone, Herron and Shotts, 2001). The other one is the free-rider problem. In economics, the free rider problem occurs when those who benefit from resources, goods, or services do not pay for them, which results in an under-provision of those sources, goods or services (Baumol, 1967). We study these two problems theoretically and separately. Our context which sets the pandering problem is a two-period re-election, where conformist voters have a desire to win and abstention is not allowed. We find that voters' desire to win can deter incumbents from inefficient decisions under certain conditions. Our context which sets the free rider problem is a one-period voting model about collective decision-making for a project with a joint interest between two conformist voters who want to make the same vote. We show that conformity preference may alleviate the free-rider problem. It needs to say clearly that though our thesis assumes that voters are conformist in the two contexts, conformist preference has different manifestations between the two contexts. In our two-period re-election model as Chapter 4, each conformist voter has a motivation to win. In our one-period voting model as Chapter 5, each conformist voter has a desire for identification in small groups and wants to vote unanimously.

What and how do we add

In Chapter 1, we present some of the social psychology literature to argue that conformist preference is both important and pervasive. Specific examples and concrete experiments are given. In Chapter 2, the economic experimental evidence about social conformity is presented. In Chapter 3, we review the important theoretical economic models on conformity. Especially, we review some models about how conformist voters vote without abstention. In Chapter 4, we present a model about incumbents' policy decisions with conformist voters in a two-period re-election. In Chapter 5, we examine the effects of voters' conformity in a one-period voting model about collective decision making. Finally, we conclude. The remainder of the introduction provides an overview of each chapter.

In Chapter 1, we first present what is conformity in social psychology. Second, we review classic experimental research on social conformity. Third, we identify social conformity's classification: informational conformity and normative conformity. Here, normative conformity has three types. They are compliance conformity, internalization conformity and identification conformity. Fourth, we show the relationship between informational conformity and normative conformity.

In Chapter 2, first we present economic experimental evidence about informational conformity, for instance, information cascades. Second, we show economic experimental evidence about normative conformity.

In Chapter 3, first we review economic models of informational conformity. We divide this part into three subsections according to sequential decision: exogenous sequential decision, endogenous sequential decision and non-sequential decision. Second, we present economic theoretical model literature which discusses compliance conformity and internalization conformity in the next two sections separately. Especially, we show two different kinds of compliance conformity. They are endogenous compliance conformity because of the existence of social norm, and exogenous compliance conformity because of desire to conform. Further, we present a brief review about standard economic voting models (simultaneous voting and sequential voting). Accordingly, we present the prominent literature about exogenous compliance conformity with conformist voters without abstention from two points separately. One point is that conformist voters want to be the winner's side. The other point is that conformist voters who respect the norm of consensus want to vote unanimously for identification in small groups. About internalization conformity, economic theoretical models consider it by assuming that people's preferences are not stable but changeable. Finally, we conclude.

Chapter 4 and Chapter 5 are our two important models. There are three reasons for building the two models. First, to our knowledge, there is little theoretical economic model literature

on conformity about re-election. Even among the related papers, the focus is only on conformist voters (Coleman, 2002, 2004; Callander, 2007, 2008). Whereas, we pay our attention to incumbents with conformist voters. That is, the pandering problem about incumbents' policy-making with conformist voters. Incumbent's pandering can be bad. Therefore, a reduction in the incentives to pander can be helpful. This is the role played by the conformist voters in our Chapter 4. Second, the voting rule in almost literature with conformist voters is majority rule. Though majority rule is important and widespread, there are still other voting rules in our life. According to the information we have, we model in Chapter 5 for the first time focus on the unanimity rule between two conformist voters. The unanimity rule means that agreement requires that both conformist voters vote for agreement, otherwise disagreement is the voting decision. Third, these two activities (re-election and voting) have many empirical and experimental examples showing conformity. For examples, Foladare (1968) states that many economists and politicians have addressed with consensus that social norms develop and create conformity. For another example, empirical work of Bartels (1985) and experimental work of Niemi and Bartels (1984) show that voters are motivated in part by a desire to vote for the winning candidate. Overall, there is much related interesting literature (McAllister and Studlar, 1991; Dorff and Brenner, 1992; Mehrabian, 1998; Hodgson and Maloney, 2013; Kiss and Simonovits, 2014; Evrenk and Sher, 2015; Morton, Muller, Page and Torgler, 2015).

Specifically, in Chapter 4 we focus on an analysis about a re-election seeking incumbent's pure policy-making strategy with conformist voters. We refer to the incumbent as "she" and each voter as "he" for convenience. We analyse a two-period model with one policy decision in each period. The incumbent has re-election pressure, thus she should take care of her first period actions. We focus on two special Pure Perfect Bayesian Equilibria. One is the social efficient strategy equilibrium (shortened to **S** for social). In **S**, the incumbent uses her information to promote social interests efficiently. The other one is the office-seeking strategy equilibrium that is a pooling equilibrium (Shortened to **P** for private interests or for pooling). In **P**, the incumbent makes her decision as an office seeker. In this model, there are three kinds of players: the incumbent, a challenger and the voters. Compared to the present literature, we enrich the setting by assuming that candidates face three kinds of voters, instead of a single representative voter. They are incumbent partisans, challenger partisans and independent voters. The independent voters are conformist, who not only wish to vote for the better candidate but also to pick the winner. We show that a strong desire to win (i.e., strong conformity) reduces incumbent's pandering through promoting **S** and restraining **P**. However, we also find that a weak desire to win (i.e., weak conformity), induces incumbent's pandering through restraining **S** and promoting **P**.

In chapter 5, we study a model of collective decision making about an information collection

between two conformist voters. Each voter likes to make the same voting choice as the other's because of his conformity preference. Each voter collects information about the consequences of a project and then votes on the project. We focus on the informative equilibrium which is a symmetric Nash equilibrium in which voters vote informatively using pure strategies. We examine the effects of voters' normative conformity preference from a social point of view. Our interesting result is that "when voters are nonconformist, they exert too little effort in the informative equilibrium from a social point of view because of positive externality. Thus, the free-rider problem occurs. While the existence of conformity preference can help to improve the sum of voters' expected payoffs from a social point of view in the informative equilibrium". The reason for this result is that normative conformity preference may alleviate the free-rider problem associated with coordination (making the same vote). Moreover, we present the exact conformity preference level which helps voters exert an optimal effort level that maximizes the sum of voters' expected payoffs compared to the nonconformist case. In addition, we highlight that the appearance of one prejudiced new voter tends to lead the two conformist voters to exert less effort, thus reinforces the free-rider problem. Of course, comparative statics about voters' effort levels in informative equilibria have been graphically illustrated.

At last, we summarize our main findings and provide topics for further work.

Part II

A brief overview of related literature

Chapter 1

Conformity in social psychology

In this chapter, we present a brief overview of conformity studies in social psychology. First, we pursue a definition of conformity inspired by the large corpus of work in social psychology. Second, we give the important experimental relevance of conformity in social psychology. Third, we detail the classification of conformity in social psychology and the relationship between the different types of conformity in social psychology. Finally, we briefly conclude.

1.1 What is conformity in social psychology?

Social psychology is an interdisciplinary domain that bridges the gap between sociology and psychology. Social psychology studies “how people’s thoughts, feelings, and behaviour are influenced by the actual presence of others, imagined presence of others (such as by watching television) or implied presences of others (such as by following internalized cultural norms)” (Smith, Mackie and Claypool, 2014). On the whole, social psychologists have a preference for laboratory-based or empirical findings, thereby social psychology theories tend to be more specific rather than global and general.

Are our behaviours independent? No, they aren’t. It has become evident from a myriad of psychological studies that our behaviour is extremely prone to the influence of others’ ideas and actions (Cialdini and Goldstein, 2004). Part of our tendencies to adjust our behaviour according to others is the consequence of explicit rules, authorities, or requests. However, much of the influence of others is less direct than rules or authoritative orders. Without explicit authorities or rules, our behaviours, even our feelings and thoughts, often change simply in a certain way through interactions and communications, because others have behaved like this before or are behaving like this right now (Schnuerch and Gibbons, 2014). Such kind of conformism is highly prevalent when people are buying cars or clothes, choosing a school or

a restaurant, voting and so on (Cialdini and Goldstein, 2004). In fact, at the beginning of the 20th century, conformism was already an important topic of research in social psychology (Moore, 1921; Jenness, 1932; Sherif, 1936; Asch, 1951; Crutchfield, 1955). Until today, conformity is still a fascinating topic in social psychology (Moscovici, 1985; Cialdini and Trost, 1998; Cialdini and Goldstein, 2004; Schnuerch and Gibbons, 2014).

On the basis of a large corpus of social psychology, psychologists Claidière and Whiten (2012) propose the definition of conformity in social psychology:

“Conformity: a behaviour is said to conform when an individual in a group displays that behaviour because it is the most frequent the individual witnessed in others.”¹

According to this definition, conformity is a behaviour. It is the influence of others on one’s own behaviour. It refers to the inclination of an individual to change spontaneously (without any order or request by anyone) his behaviour, his opinions or his perceptions to match the behaviour and judgements of real or imagined other people or to copy the most prevalent behaviour and judgements in a population. We can deduce from this definition that there are three necessary conditions to conform. (1) He has to choose between several alternative behaviours. (2) He chooses the one displayed by a majority of other individuals. (3) He does so because it is the option chosen by the majority and not for alternative reasons. Thus, conformity diverges from other forms of social influences, such as social learning, prestige and so on. We acknowledge that conformity and social learning may interact when an individual does learn a novel action displayed by a majority of a community. But social learning must require the individual to learn something new from other individuals, conformity does not need. For example, we might conform when choosing between eating with our fingers or with cutlery, when both being options we already know well. Conformity diverges from prestige because conformity refers to a form of group pressure in which the size of the group and the proportion of the majority may be influential factors, not the identity of the individuals or

¹ As given the conformity definition in social psychology, we would like to mention that conformity is inseparable from anti-conformity and nonconformity (Hornsey, Majkut, Terry and McKimmie, 2003). Anti-conforming individuals are usually noticed when other individuals conform. For example, when everybody is dressed casually, anti-conforming individuals arrive in suits, and when everybody is in suits, anti-conformists arrive casually dressed (Griskevicius, Goldstein, Mortensen, Cialdini and Kenrick, 2006). Anti-conformity can further be distinguished from nonconformity. Nonconforming individuals are simply not sensitive to group pressure; they are not motivated to be similar (conformity), or different from others (anti-conformity). Assessing the existence of anti-conformity and nonconformity will be difficult unless conformity is well studied. Therefore, we limit our thesis to conformity only, but note that anti and nonconformity represent interesting avenues for our future research once the research of conformity is well done.

their social relationship with the participants. Metaphorically speaking, compare the person who buys a particular vehicle because her favorite football player drives a similar car with the person who does the same because most people she knows drive such a car. In the first instance, prestige drives the change in behaviour, and a single person provides this influence. In the second case, conformity to a group drives the change in behaviour. Finally, we note that this definition of conformity leaves open the object of the frequency calculation, because the question of whether the frequency represents a proportion of individuals or a frequency of behaviours is an empirical issue (Henrich and Boyd, 1998).

Reviewing conformity literature in social psychology, some individuals are more likely to conform than others (Asch, 1955). Even for one individual himself, he is more likely to conform in some cases than other cases. For instance, one will be more likely to conform when his responses are public than when his responses are private (Deutsch and Gerard, 1955; Argyle, 1957; Hardy, 1957). For another instance, one is more like to conform when an individual has little confidence in his initial judgments than when he is highly loyal to his judgments (Luchins, 1945; Crutchfield, 1955; Wiener, 1958; Walker and Heyns, 1962; Allen, 1965). Accordingly, Claidière and Whiten (2012) define a conformist tendency at the level of the individual:

Conformist tendency: a disposition to be conformist, that is, a disposition to be influenced by the most frequent behaviour witnessed in others.

Conformist tendency can be graded relative to the rest of the population and might also be graded across behavioural domains such as politics, consumer research and so on. This definition gives a direction to economists for modelling conformist behaviour in the standard economic paradigm, which we will discuss in the chapter 3.

For further understanding conformity analysis in social psychology, we need to do classification about conformity. But before we go to detail conformity's classification in social psychology, we first present important laboratory experiments about conformity in social psychology, in order to have a concrete cognition about conformity.

1.2 Classic experiment research on conformity in social psychology

The earliest investigations into conformity were carried out by social psychologists in experiments during the twentieth century and were focused very much on its causation, i.e., on the social contexts that elicited it (Jenness, 1932; Sherif, 1936; Asch, 1951; Crutchfield,

1955; Berns, Chappelow, Zink, Pagnoni, Martin-Skurski and Richards, 2005; Schnuerch and Gibbons, 2014). These works are very decisive and deserved a brief description.

Jenness (1932) is one of the earliest studies on conformity in social psychology. This experiment is a vague situation that involves a glass bottle filled with beans. In the experiment, participants are firstly asked to individually estimate how many beans the bottle contains. Then the participants are organized into a group in a room with the bottle of beans and asked to reach a group estimation by participating in a discussion. After that, the experimenter organizes interviews with the participants individually and asks if they would like to change their estimates or stay with the group's estimate. Jenness (1932) wants to find out whether their initial estimates are altered based on the influence of the group estimate. His experimental result shows that a majority of the participants change their initially individual estimates to be closer to that of the group estimations.

Sherif (1936) is another one of the earliest studies on conformity. Sherif believes that Americans, in general, tend to conform because their democracy emphasizes mutually shared agreements. Sherif (1936) makes use of the "autokinetic effect", which is a visual illusion that makes a stationary pinpoint of light in a dark room appear to move and demonstrates that people conform to group norms when they are put in an ambiguous situation.

In his experiment, the participants have to estimate the "apparent" movement of a stationary light in a completely dark room. At first, each of these participants is asked alone individually to judge the movement of the light to develop his individual estimate. Their judgments vary widely: some see a movement of a few inches while others report that the spot moves many feet. Each person establishes a range within most of his reports would fall. Next, he is put into a group with several others. Then they view the light again and give their estimates out loud, which allows them to hear each other's judgement. Even some participants' initial estimates are very different to one another but rapidly converge to a single group estimate. Although different groups have very different estimates, each group develops a consensus judgement that remains stable over time. After many sessions, participants are split up. Now alone, each participant is asked to continue to make estimates of the movement of the light, which is the test of the conformity to the new norm established in that group. The participants uses their group standard estimate to guide their personal estimates, departing significantly from their earlier initial personal estimates. This indicates that the group standard estimate has influenced each participant in private acceptance form, i.e., people view group standard estimate as an important source of information about the reality and believe the group standard estimate to be the most accurate judgment of reality. Furthermore, Rohrer (1954) find that people who are individually retested still report the group standard estimate as much as a year after the group standard estimation's induction.

Sherif also manipulates the composition of the group with three special participants. About two persons of them, when alone, their estimates of the light movement are very similar. And the third person's estimate is very different. Each person in the group has to say aloud how far he thinks the light has moved like in the first group setting. Over many sessions, participants' estimates merge into a group standard again, i.e., the person whose personal estimate of movement is greatly different to the other two in the group conforms to the estimate of the other two. Sherif (1936) says that this shows that mere exposure to the others' different judgments influences participants to gradually abandon their divergent points of estimate for a uniform group standard even when they have well-established personal standards. Furthermore, Sherif (1936) indicates that as the stimulus situation becomes more ambiguous, judgments converge increasingly even when the variation of individual estimates becomes larger. Sherif (1936) concludes that because they want to do the right thing but may lack appropriate information when in an unfamiliar situation each participant tends to get the appropriate information by using the others near as a guide for his behaviour and ignores his originally individual opinion.

Many social psychologists believe that Americans are actually more independent than Sherif's work have suggested. They believe that Americans could act independently, even when faced with a majority who see the world differently. They criticise that the extreme ambiguity of the autokinetic situation might be responsible for Sherif (1936)'s results. In such an ambiguous situation, participants have little to base their individual judgments on, so it is perhaps not surprising that they turn to others' judgements to help themselves decide what to think. They assert that real conformity requires the group to challenge the basic perception and beliefs of the individuals – to say that X is Y when clearly that is not true. Thus, there are questions: do people conform when the task is clear and unambiguous? Will they yield to a group consensus if it is obvious that the consensus is wrong?

Solomon Asch (Asch, 1951) firstly answers these questions in his classic experiments which also known as the Asch paradigm in social psychology literature.

Figure 1.1 shows the famous conformity experiment context which is conducted by Asch. Participants are asked with a clear and easy question: to choose which of the four lines has the same orientation as the line in card *A*. The real subject himself thinks he is surrounded by other participants, but in fact all the others are confederates who have been instructed on how to respond before the experiment. At the beginning of the experiment, the experimenter tells the participants they would be shown a card with a single vertical line (the standard) followed by a card with four vertical lines. Their task is to state out loud which of the four lines has the same length as the standard line. The participants announce their answers one by one in order around the table. The real subject is seated in a way that would require him

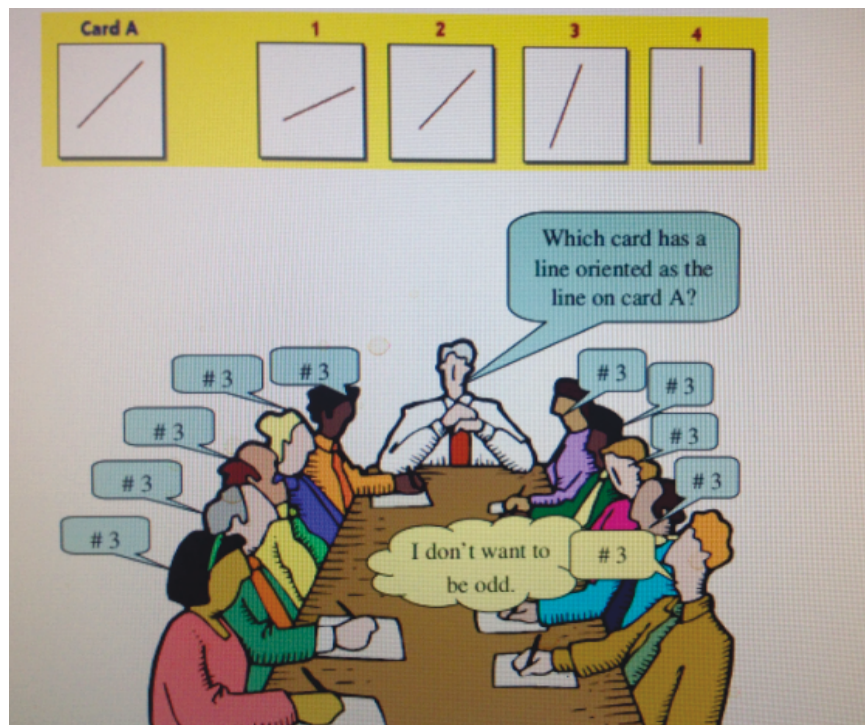


Figure 1.1: The conformity experiment of Asch (1951)

to voice his opinion last, after hearing all the confederates' responses. Since the third trial, the confederates unanimously chose the same wrong line, leaving the real subject alone in picking the correct answer. The subject here is placed in an absolutely conflicting position. Should he abide by what he knows or go along with the unanimous opinion of others? Although these tasks are so simple that individuals working alone as the control group have only 0.7 percent errors, it is shown that over 75% of the subjects conform to the erroneous majority opinion of the confederates in varying degrees, even when the confederates claim that two lines different in length by several inches are the same length². Asch (1951) asserts that in his experiments because the ambiguity effect has been eliminated, the conformity for correct information can be negligible. Asch concludes that it is difficult to maintain that you see something when no one else does. The group pressure implies by the expressed opinion of other people can effectively lead to modification and distortion and make you see almost anything.

Asch (1951)'s results, which support that a large fraction of his subjects feel the group pressure to conform to the groups standards even when they know the group standards are wrong, demonstrate the power of social influence. Asch's own conclusion is that

² In Asch's study, approximately 25% of the participants conform most of the time, and an additional 50% of the participants conform at least once. That means that only 25% of the participants never conform.

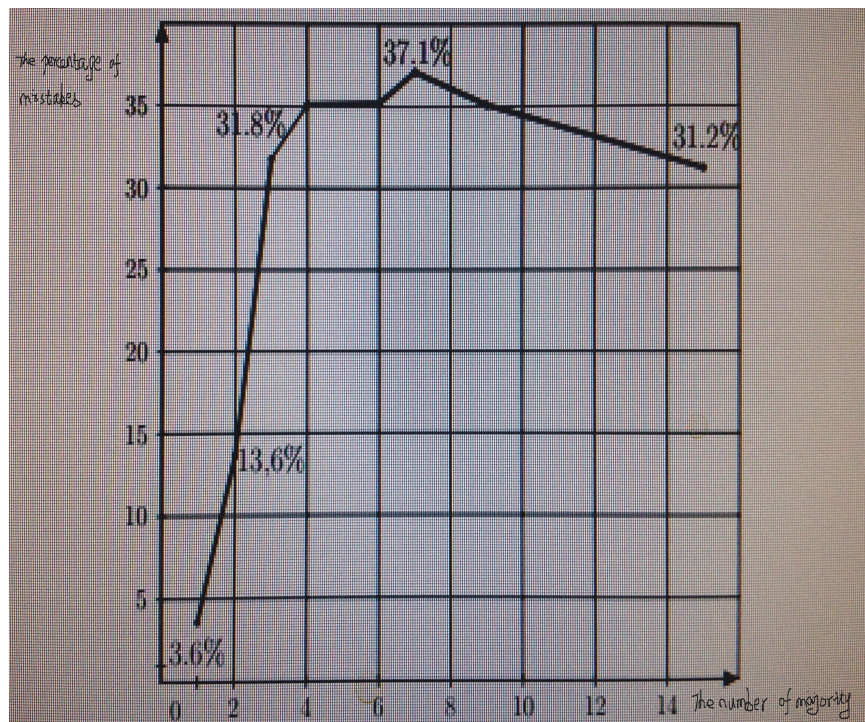
Our results raise the possibility that the social process is polluted by the dominance of conformity. That we have found the tendency to conformity in our society so strong that reasonably intelligent and well-meaning young people are willing to call white black is a matter of concern.

When some participants in Asch (1951) are asked why they go along with the clearly incorrect answer, they say that they know they are correct, but they don't want to be different from the rest of the group in fear of being ridiculed. They remain independent in their minds, but not in their actions. For others, they say they believe that the group's answer is correct and their perception is wrong because they must have missed something. These answers represent two types of normative conformity, compliance conformity and internalization conformity, which will be discussed in detail in the following section.

The follow-up study of Asch (1955) notes that, when there is only one confederate who gives an incorrect judgment, the subjects exhibit some uneasiness but maintain independence. Thus, Asch (1955) varies the number of confederates who give incorrect answers from 2 to 15. The result is that the size of confederates has effects on the subjects and the subjects conform to a group of 3 or 4 confederates as readily as they do in a larger group. In concrete Figure 1.2, with three (four) confederates opposed to the subject, errors rose to 31.8 (37.1) per cent. .

As an optimistic point, Asch (1956) finds one powerful way to promote independence. The way is to instructs one of the confederates to give correct answers. In the presence of this special confederate, the subjects conform only one-fourth as much as they do in the original experiments. Apparently, it is because that being a minority of one is difficult but being part of a minority of two is not so difficult. Asch (1956) gives several explanations for this reason: first, the subject observes that the majority of confederates do not ridicule the dissenter. Second, the dissenter's answer makes the subject more certain that the majority is wrong. Third, the subject now experiences social pressure from the dissenter as well as from the majority.

Asch's results have been replicated by many other social experiments. One of them is Crutchfield (1955). It brings a group of five participants into a lab and lets them sit in separate booths. Each booth has a panel of lights and switches. Each participant is told to respond to a series of problems presented on the slides. Responses of others would be displayed on the light panel of each participant. Each participant is asked to wait to give a response after having the responses of others. All the participants are unaware that they are all responding last and that the experimenter is in control of the responses of others. Just like in the Asch's experiment, the participants seem to agree with one another originally. In the following trials each participant sees that the responses of others appear to be a unanimous incorrect judg-



With a single confederate the subject errs only 3.6 per cent of the time; with two confederates he errs 13.6 per cent; three, 31.8 per cent; four 35.1 per cent; six, 35.2 per cent; seven, 37.1 per cent; nine, 35.1 per cent; 15, 31.2 per cent.

Figure 1.2: The relationship between the percentage of mistakes and the number of confederates (Source: Asch (1955)).

1.2. Classic experiment research on conformity in social psychology

ment on the light panel. At that time, each participant faces going along with the unanimous incorrect judgement or choosing his own perceived judgment. Just as in the Asch's study, each participant conforms to unanimous incorrect judgments on most tasks. It reconfirms Asch's results that each participant who is manipulated to see other participants' responses appears to conform.

In fact, through Asch's experiments being replicated a huge number of times, many factors that cause individuals conform have been identified, for example, group size (Bond, 2005), task difficulty and importance (Baron, Vandello and Brunsman, 1996)³, culture (Bond and Smith, 1996; Huang and Harris, 1973; Meade and Barnard, 1973; Kim and Markus, 1999), motivation (Griskevicius et al., 2006), mood (Tong, Tan, Latheef, Selamat and Tan, 2008), age (Walker and Andrade, 1996) and so on (Berry, 1967).

While we are reviewing social psychology literature during the recent ten years, advanced brain-scanning technology as a new technology, not available in Asch's day, offers intriguing insights into the role of the brain in social conformity (Schnuerch and Gibbons, 2014)⁴. Especially, Berns, Chappelow, Zink, Pagnoni, Martin-Skurski and Richards (2005) are the earliest researchers who investigate the neurocognitive bases of social conformity. They utilize the advanced brain-scanning technology to answer the question: "when people conform, are they rationally deciding to go along with the group out of normative needs, or are they actually changing their perceptions and accepting the validity of the new through erroneous information provided by the group?"

Here's how Berns et al. (2005)'s study works. Imagine that you are one of thirty-two volunteers who are recruited for a study of perception. You see many pairs of three-dimensional objects on a computer screen during a mental rotation period. Then, you need to decide whether the objects are the "same" (rotations can make them match) or "different" (no rotation can make them match). In the waiting room, you meet four other volunteers, with whom you practice games together. Before the game, you chat in order to be familiar with each one. Then, everyone takes a photo which goes along with one's responses in games on screen. In fact, your group is composed of actors except you. They will soon fake their answers on the test trials so that they are in agreement with one another, but not with the correct responses that you generate. You are selected as the only one to go into the brain-scanner. To produce social conformity, each trial begins with objects being shown first to the others. After a group

³ In a variation of the Asch conformity experiment, Baron et al. (1996) show that conformity is decreased by 50 percent when the task is easy. They find the opposite result in cases when the task is hard. One potential explanation for this finding is that when the task is easy, a little mental energy can create accurate decisions. When the task is hard, imitating the crowd may be the best available strategy.

⁴ It reviews the present previous study in neuro-imaging about social conformity

decision phase, the collective response of the others is displayed to you on your computer's screen, which ensures that you see your group's response before you make your decision. After 3 seconds, the same pair of objects is displayed to you and needs your response (Figure 1.3).

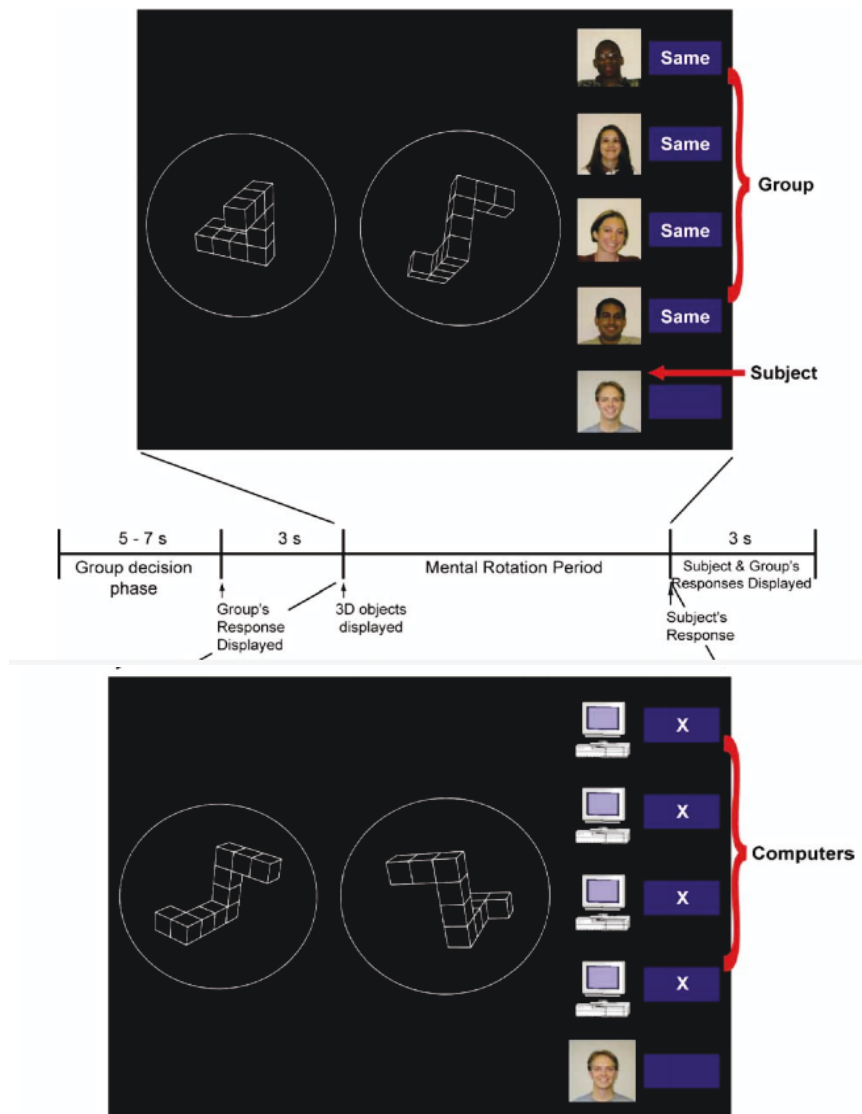


Figure 1.3: Procedure of Berns et al. (2005)'s experimental task (Source: Berns et al. (2005)).

In Figure 1.3, the objects are different but have unanimously responses, and you are waiting to respond. In fact, trial types in the experiment are randomized across four conditions: group correct, group incorrect (as shown), group's answers mixed and benchmark (your group's responses are blinded to you with an "X".) You have to decide if the objects are the same or different as the group assesses them or as you see them? As in Asch's original experiment, you as a typical subject would conform to the majority's opinion because of group pressure.

1.2. Classic experiment research on conformity in social psychology

The average probability that you give the group's wrong answers is 41%. When your response yields to the group's wrong judgment, your conformity would be seen in the brain scanner as changes in selected regions of the brain's cortex dedicated to vision and spatial awareness. Surprisingly, Berns et al. (2005) find that

there is no change in areas of the forebrain that deal with monitoring conflicts and other higher-order mental activities. On the other hand, when you make independent judgments that go against the group, your brain would light up in the areas that are associated with emotional salience. This means that resistance creates an emotional burden for those who maintain their independence, i.e., autonomy comes at a psychic cost.

Usually, we like to think that seeing is believing. However, Berns et al. (2005)'s findings show that seeing is believing what the group tells us to believe, which means that people do change their mind as a result of social influences. This suggests that when other people's views are crystallized into a group consensus, this consensus would affect how we perceive aspects of the external world. After becoming aware of our voluntary to conform under group pressure, when our best interest is to not yield the conformity of mentality, we need to build resistance to this conformity.

To sum up, following insights from the above-mentioned important experiments, experimental and empirical evidence about conformity in social psychology begins to accumulate at a high-speed (Cialdini and Goldstein, 2004; Schnuerch and Gibbons, 2014). After having a better understanding of social conformity, we can handle its appearances. When we want to enhance social conformity in the fields such as politics, marketing, or advertising, Alquist, Ainsworth and Baumeister (2013) suggest that disbelief in free will increase temptations and pressure to conform. When we should prevent such behaviour, because independence is needed or risky behaviour should be avoided. Binning, Brick, Cohen and Sherman (2015) highlight that when people have satisfied their sense of self-integrity with a self-affirmation exercise or when they have low levels of social identification, they are less concerned with social norms. Then, they will reverse conformity if facing contradicting information evidence. In short, social psychologists do not depict conformity as inherently useful or useless. In contrast, they are more interested in conformity motivations. This corresponds to the classification of social conformity in Deutsch and Gerard (1955). According to Deutsch and Gerard (1955)'s work, conformity are classified into two categories in social psychology. They are informational conformity and normative conformity. In the next section, we detail the conformity's classification in social psychology.

1.3 Conformity's classification in social psychology

According to Deutsch and Gerard (1955), there are two central social influences: informational influence which is defined as an influence to accept information obtained from another as evidence about reality, and normative influence which is defined as an influence to conform to the positive expectations of another. In other words, informational influence means that people assume that the group is more likely to respond accurately than they themselves do and normative influence means that people do not want to contradict the group, but want to be accepted by the others through adjusting their behaviour so as not to stand out and provoke negative sanctions given by the group. Generally, informational influence is likely to be stronger when participants make private responses and communicate with the majority indirectly, whereas normative influence is likely to be stronger when participants make public responses and are face-to-face with the majority.

According to these two social influences types, two types of conformity in social psychology exist. They are informational conformity and normative conformity. These two types of social conformity have been investigated and identified repeatedly in various paradigms (Cialdini and Goldstein, 2004; Goodwin, Kukucka and Hawks, 2013). First, informational conformity asserts that we conform to others as a result of informational needs, because others often have ideas, views, perspectives, and knowledge that can be helpful for us to better navigate our world (Burnstein and Vinokur, 1973; Burnstein, Vinokur and Trope, 1973; Burnstein, Vinokur and Pichevin, 1974; Burnstein and Vinokur, 1975). Informational conformity is known as an accuracy-based conformity and is one of the most efficient forms of behaving. Second, normative conformity is, despite the lack of any uncertainty, under social pressure, individuals renounce their judgements and conform to the majority's judgements in order to avoid sanctions for deviating from the majority and to be accepted by the majority (Festinger, 1954; Brauer and Chaurand, 2010). In other words, because other people are more likely to accept us when we agree with them than we disagree with them, driven by a powerful need to belong, we yield to their majority views through replacing differences with similarities. Thus, if a person does not believe that another person is correct, he may nevertheless tend to conform by going along with or mimicking another person for producing fondness (Hatfield and Cacioppo, 1994; Chartrand and Bargh, 1999). It is obvious that normative conformity minimizes social conflicts. Therefore, normative conformity is known as an approval-based conformity (Baumeister and Leary, 1995; Insko, Drenan, Solomon, Smith and Wade, 1983; Martin and Hewstone, 2003).

For having a good overview of the following discussion, we present a "family tree" in figure 1.4 about conformity in social psychology and we will detail the family tree of social conformity.

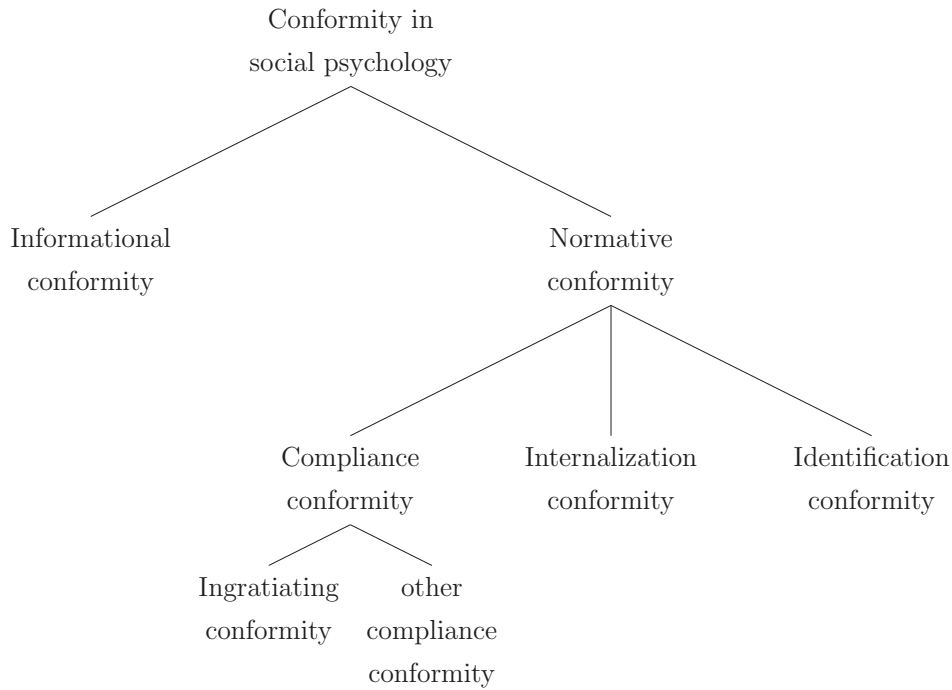


Figure 1.4: Family tree about conformity in social psychology.

1.3.1 Informational conformity: accuracy-based conformity

In many situations, we are uncertain how to think or how to act. We use the behaviour of others as a trustworthy source of information about reality, which helps us figure out what is going on and what to do about it. For example, a traveller at a new town is looking for a place to eat. He walks into a food court at a mall. There are three stalls open He finds that these three stalls offering similar menus but the entire crowd is seated and eating in front of only one of them. As a newcomer he would infer from others' behaviour that the particular stall has the best food because everyone else is eating there. And he decides to eat there. For another example, when we travel to other countries, we're unsure of how to act. Our observations of others point us in the right direction. Therefore, we change our behaviour based on the locals' actions. Informational conformity is so named because we believe that it gives us information that we do not previously have. Whether informational conformity does actually give us information is not important. The most important thing is we believe that it does. In Asch's experiments, some participants state that they believe they must be wrong since no one else agree with them. Thus, they change their responses so that they would be "right", which presents informational conformity. Because of ambiguity from visual illusion in autokinetic, Sherif (1936)'s experiments are also a good illustration of informational conformity. At last, we give four main conditions about informational conformity's existence.

- (1) When you are in a group rather than alone.
- (2) When the situation is ambiguous and your personal information is inaccurate or unreliable, you are trying to behave efficiently by relying on the most frequent behaviour witnessed (Crutchfield, 1955; Mackie, 1987; Cialdini, 2001; Chen and Lu, 2015).
- (3) When the situation is a crisis and your decision is needed immediately (Cialdini, 2001).
- (4) When other people in your group appear to be experts compared with you. Experts are a source of correct information because it costs less than to collect and handle the information by yourself.

1.3.2 Normative conformity: approval-based conformity.

Humans is a social species and have a fundamental need for social companionship. Thus, their behaviour presenting as conformity are motivated in large part by social factors, such as the desire for esteem, popularity, or acceptance. Such conformity belongs to normative conformity in social psychology. In our society, we frequently experience normative conformity. One example is standing ovations. Concretely, when you attend a performance that is of only average standard. And you think it is just okay. However, at the end of the performance, several persons around you stand while clapping. It wouldn't take very long for every person in the auditorium including you to stand up and clap your hands. Though you don't think the performance deserves the praise, you join in rather than remaining seated. You do not want to stand out like a sore thumb. Another example is about young persons. Most teens and pre-teens are particularly vulnerable to influence because they long to be accepted by their peers. It is usually true that when you are a teenager, "if all of your friends jump off a bridge, you would do it too". Other examples like fashion trends or following traditions are also good examples.

Many social psychologists have designed experiments to emphasize normative conformity. For example, Asch (1951)'s experiments inform us that people without information uncertainty are heavily influenced by the consensus of the group and show that individuals are influenced by group pressure from a norm of consensus. In Cialdini, Reno and Kallgren (1990), subjects are given the opportunity to litter either a previously clean or a fully littered environment that represents the perceived norm of others' behaviour, after witnessing a confederate who either litters the environment (i.e., a highly salient norm) or walked through it (i.e., lowly salient norm). Cialdini et al. (1990) show that the likelihood of people dropping litter is a response to the amount of litter, and littering can be increased by making a norm supporting it more

salient. Recently, Knoll, Magis-Weinberg, Speekenbrink and Blakemore (2015) experimentally show that normative conformity is obvious in young adolescents.

Now we give the three main conditions about the existence of normative conformity.

- (1) When you are in a group rather than alone.
- (2) When your personal information is accurate and reliable.
- (3) When you are not trying to behave efficiently.

In summary, in social psychological research normative conformity is described as that: in order to be liked and accepted by others, they often change their behaviour or beliefs to conform when confronting with others' deviating behaviour and beliefs. To be worthy of attention, though in normative conformity you want to be part of a group and express an opinion like the majority of the group, you may still believe differently inward.

1.3.2.1 The differences between normative conformity and obedience

Normative conformity and obedience are two pervasive phenomena in our society. Before we start to present normative conformity's classification in social psychology, we first compare normative conformity with obedience for understanding well normative conformity, because they are very similar in manifestation but entirely different in essences (Milgram, 1963, 1974).

Different from normative conformity's definition, obedience refers to the performance of an individual adherence to a norm because an authority enforces the norm by punishment. The authority can be a small group or even a single person (e.g. the individual's community, the individual's leader or the police). In obedience, the authority usually demands the individual to make a binary choice. The individual understands well the possibility and severity of punishment from refusing to obey the authority. Nothing changes in the individual between the pre-norm adoption and post-norm adoption state (Adorno, Frenkel-Brunswik, Levinson and Sanford, 1950). Obedience is enforced behaviour in which the individual does not actually change his desires, but suppresses them due to threatened punishment from authority. Once the threat is removed the individual can come back to its "old ways". For example, we will not jump a red light in the car because we are afraid of being caught and fined by the police.

Milgram (Milgram, 1963, 1974) starts a remarkable series of research on obedience to authority. His experiments indicate how the Nazis have obediently killed Jews during the Holocaust. Suppose that after reading the following advertisement (Figure 1.5) in a newspaper you and other persons decide to apply.

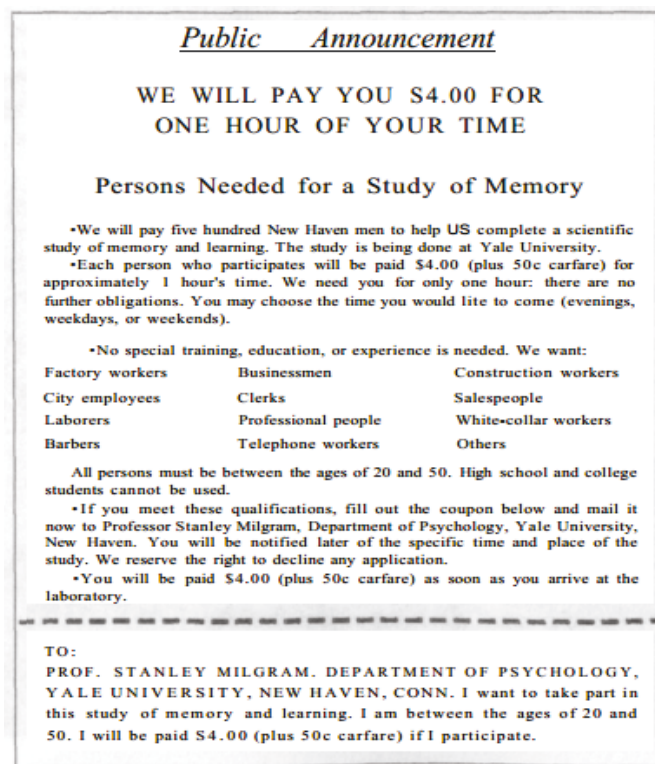


Figure 1.5: Advertisement of Milgram (1963)'s experiment about memory study.

This lab experiment involves role-playing: “teachers” and “learners”. The teacher gives the learner a set of word pairings to memorize. When the learner is right, the teacher gives a verbal reward, such as “Good!” or “That’s right”; when the learner is wrong, he would accept a physical punishment. The physical punishment in the form of electric shocks is administered by the teachers to the learners while the teachers are instructed by the experimenter. The shock generator has thirty switches, starting from a low level of 15 volts and increasing by 15 volts at each higher level. The experimenter will tell the teacher that every time the learner makes a mistake, he has to press the next higher voltage switch. The control panel indicates both the voltage level of each of the switches and a corresponding description of the level. The tenth level (150 volts) is labelled with “Strong shock”; the 13th level (195 volts) is “Very strong shock”; and 17th level (255 volts) is “Intense shock”; the 21st level (215 volts) is “Extremely intense shock”; the 25th level (375 volts) is beginning level of “Danger, severe shock; and at the 29 and 30th levels (425 and 450 volts) the control panel is simply marked with an ominous as XXX. For having a sense of what the shock levels mean, the “teacher” would get a sample of 45 volts, the third level, a slight tingly pain. You and another applicant draw straws to see who will play each role. The drawing is rigged, and the other applicant is a confederate of the experimenter who always plays the learner. The “learners” pretends to be shocked, but do not receive real shocks, though you think that

they are delivering real shocks to the “learner”. You and the “learner” communicate over the intercom, with the experimenter standing next to you. Initially, your pupil does well. As the experiment continues, your pupil begins making errors and you could hear your pupil’s increasingly desperate pleas to stop as the shocks intensify. Once the “danger shock” has been felt, the learner bangs on the wall and demands to be released. After this point, the learner becomes silent and does not continue to answer any questions. The experimenter then instructs you to treat the learner’s silence as an wrong answer and to deliver a further shock. The experiments’ results show that 65 percents “teachers” went all the way up the maximum shock level of 450 volts. It is noted that many of the “teachers” become extremely angry with the experimenter. However, most of them continue to follow orders all the way. Here is what one “teacher” reports about his action: “I didn’t know what the hell was going on. I think, you know, maybe I’m killing this guy. I told the experimenter that I was not taking responsibility for going further. That’s it”. When the experimenter reassured the worried teacher that he would take the responsibility, the teacher obeys and continues to the end. Zimbardo (2007) presents one reason for this startling level of obedience is related to the teacher’s unknowing how to exit from the situation, except for just blind obedience. Thus, the teacher may think the easiest exit lies at the end of the last shock lever.

In short, obedience means to change one’s behaviour in the face of an authority with possible punishment. But normative conformity means to change one’s behaviour to conform to a social norm for social approval. In addition, we acknowledge that conformity and obedience interact (Haslam and Reicher, 2012). On one hand, people can be said to conform passively and unthinkingly to both the instructions and the roles that authorities provide in Milgram (1963) and Zimbardo (2007). On the other hand, if individuals’ willingness to follow authorities is conditional on identification with the authority, it represents normative conformity, and if being conditional on an associated belief that the authority is right, it represents informational conformity.

1.3.2.2 Three different types of normative conformity: compliance conformity, internalization conformity and identification conformity

After understanding well what is normative conformity in social psychology, we distinguish three different processes that can result in normative conformity according to Kelman (1958):

1. compliance: “when an individual accepts influence because he hopes to achieve a favorable reaction from another person or group. He adopts the induced behaviour not because he believes in its content but because he expects to gain specific rewards or approval and avoid specific punishments or disapproval by conforming” (p53 in

Kelman (1958)),

2. internalization: “when an individual accepts influence because the content of the induced behaviour the ideas and actions of which it is composed is intrinsically rewarding” (p53 in Kelman (1958)),
3. identification: “when an individual accepts influence because there is a need to establish or maintain a satisfying self-defining relationship with another person or group” (p53 in Kelman (1958)).

Accordingly, we divide normative conformity into three types: compliance conformity, internalization conformity and identification conformity.

Compliance conformity Compliance conformity is a special kind of normative conformity. Compliance conformity means that a person publicly changes his behaviour to fit in with the group while privately disagreeing (Kelman, 1958). Here, to comply means to prioritise public values over one’s own values by making a normative decision. For example, compliance conformity can be seen in Asch (1951)’s line experiment.

“Ingratiating conformity” belongs to compliance conformity (Kauffmann and Steiner, 1968). Ingratiating conformity follows a proposition: persons favor individuals whose values and beliefs seem to be similar to theirs. Concretely, ingradiating conformity means when a person conforms to gain favour and acceptance from other people. It happens in a particular context where an individual complies because he assesses the particular behaviour as good. For example, one might comply because he wants to please someone (e.g. his parents, his friends and his employers). For example, a subordinate articulating an opinion or behaviour in a conduct that is consistent with the opinions, judgments, or behaviour of the superior. Ingratiating conformity always involves an intent to deceive that is motivated by the need for social rewards rather than the threat of rejection (Gordon, 1996; Tsang, 2015). Therefore, peer pressure as compliance conformity does not enter in ingradiating conformity.

In fact, compliance conformity can have two different effects which noted by Baron and Roper (1976). It could have an averaging effect, in which one seeks to conform to the central tendency of the group (Sherif, 1936; Visser and Mirabile, 2004), or an extremity effect (Jellison and Riskind, 1970; Pruitt, 1971; Myers, Wojcicki and Aardema, 1977), in which one tries to be “better” than the others in the group. Baron and Roper (1976) find that when a situation is seen as an opinion comparison, in which deviation is not valued, there is an averaging effect as beliefs commonly held by group members reinforce the common identity of the group. For example, a Democrat interacts with a group composed of other Democrats, and would fell a

string tie to her partisan group. With ability comparison, however, in which deviation from the mean in one direction is valued, there is an extremity effect (Festinger, 1954).

Internalization conformity Festinger (1950) has said that “an opinion, a belief, an attitude is correct, valid, and proper to the extent that it is anchored in a group of people with similar beliefs, opinions and attitudes”, which present the fact that individuals measure their opinions' correctness by comparison with others in their group particularly in the absence of an objective measure. Similarly, Cialdini Robert (1993)'s principle of social proof shows that “people tend to view behaviour as correct to the degree that they see others doing it; when more people are doing something, additional people will do the same thing”. Thus, when there are discrepancies between the attitudes of individuals in a group, internalization conformity appears if individuals reduce these discrepancies by changing their attitudes towards those of the group (Festinger, 1950).

Concretely, internalization conformity means that a person changes his behaviour to fit in with the group and also agrees with the group privately (Kelman, 1958; McLeod, 2007). That is to say, internalization conformity occurs only when an individual accepts the content of the induced behaviour (Kelman, 1958). Markus, Kitayama and Heiman (1996) and Cialdini and Trost (1998) note that a goal to manage self-concept brings internalization conformity. Moreover, internalization conformity has an obvious relationship with social culture. East Asians present internalization conformity more often than Americans and Europeans (Milgram, 1963; Huang and Harris, 1973; Meade and Barnard, 1973; Kim and Markus, 1999). Except social culture, synchronous behaviour cause internalization conformity (Dong, Dai and Wyer Jr, 2015). Here synchronous behaviour is a behaviour that matches others actions in time (Hove and Risen, 2009). For example, soldiers march in step, choir members sing in unison and dancers perform the same actions simultaneously. It is because synchronous behaviour can induce feelings of group cohesiveness from the person who personally engage in this synchronous behaviour, and these feelings, in turn, lead to internalization conformity (Terry and Hogg, 1996; Crane and Platow, 2010; Haidt, 2007).

Sherif (1936)'s autokinetic experiment is a good example for internalization conformity. Sherif (1936) says the conformist tendency is a part of “human nature” and an absolutely necessary mechanism in maintaining society, especially in attitude formation and socialization. Recently, in Huang, Kendrick and Yu (2014)'s experiment about facial attractiveness rating, participants are asked to rate each face. After providing their rating, the participants are informed of the rating given by a peer group. Then participants retreat the same faces after 1, 3, or 7 days or 3 months. Their results show that individuals initial judgments are altered by the differing opinions of other people lasts several days and reflect that a short-term change appears in privately held views of participants, which supports internalization

conformity. Similarly, two experiments' findings in Levitan and Verhulst (2015) indicate a significant attitudinal conformity, and demonstrate this attitude conformity persists privately after participants left the laboratory, even weeks later. There is also a wide range of empirical evidence which supports internalization conformity (Cialdini and Trost, 1998; Cialdini and Goldstein, 2004; Berns et al., 2005).

Identification conformity Identification conformity means when an individual conforms to the behavioural expectations of a social role (Kelman, 1958; McLeod, 2007). The individual actually believes in these behavioural expectations, which is adopted through identification, but the specific content of the expectations is more or less irrelevant. The individual embraces the behavioural expectations because they are associated with the desired relationship. This is similar to compliance, but a change in private opinion may occur (Kelman, 1958). A famous book about prison study, which titled "The Lucifer effect: understanding how good people turn evil" (Zimbardo, 2007), gives a good experimental proof for identification conformity, where individuals conform to the expectations of a social role.

We sum up the three kinds of normative conformity in the following table.

Three kinds of normative conformity in social psychology:	Individuals publicly change their behaviour	Individuals privately disagree
(1) Compliance conformity	Yes	Yes
(2) Internalization conformity	Yes	Non
(3) Identification conformity	Yes	Maybe

Table 1.1: Three kinds of normative conformity in social psychology.

A fitting conclusion to our investigation of normative conformity is the following citation from Mahrzarin Banaji, who is a Harvard psychologist: "What social psychology has given to an understanding of human nature is the discovery that "forces" larger than ourselves determine our mental life and our actions. Chief among these "forces" is the power of the social situation." Different social situations lead to different types of normative conformity.

1.4. The relationship between informational conformity and normative conformity

And last, but not the least, our thesis does not talk much about identification conformity because identification conformity happens in some special cases and their influences are obvious and limited. Looking back at the definition of identification conformity, identification conformity happens when the individuals have been given a special social role and each individuals' preference may be changed. In other words, identification conformity can be regarded as a combination of compliance conformity and internalization conformity. When compliance conformity and internalization conformity have been well discussed, identification conformity's problem would be readily solved.

1.4 The relationship between informational conformity and normative conformity

As the simplicity of the task in the Asch experiments seems to preclude an informational goal, it has been argued that the subjects conform by being in agreement with his group, in order to achieve a normative reward. Given these Asch experiments, Deutsch and Gerard (1955) find that some subjects would still choose the clearly incorrect answer even when they made their decisions in the absence of confederates. They take this to mean that the confederates also exert some informational influence, under which the subjects may really believe the group decision. This hints at that informational conformity and normative conformity are often interrelated and hard to be separate from each other.

However, in social psychology literature, informational conformity is clearly different from normative conformity (Cialdini and Trost, 1998; Cialdini and Goldstein, 2004). Claidière and Whiten (2012) give a summary of theoretical and experimental differences between informational and normative conformity in social psychology from the conditions we can expect the presence of informational and normative conformity. We present his summary in our table 2.1.

Except these differences presented by Claidière and Whiten (2012), it is possible to add the following other four differences between informational conformity and normative conformity. The first difference is that there are emotional consequences only with normative conformity. We get socially emotional punishments as being ridiculed, rejected and even expelled by other group members when we do not normatively conform (Schachter, 1951; Miller and Anderson, 1979; Levine, 1989; Kruglanski and Webster, 1991; Baumeister and Leary, 1995; Janes and Olson, 2000). That is to say that in informational conformity individuals only care about the material consequences, but in normative conformity, people may conform independently of the material consequences of doing so. The second one is that informational conformity

Table 1.2: Summary of differences between informational and normative conformity in social psychology (Source: Claidière and Whiten (2012))

Condition	Informational conformity	Normative conformity
1. Theoretical differences		
• Function	Functions to gain nonsocial information and adapt ones behaviour to the nonsocial environment.	Functions to gain social information and adapt to one's social environment.
• Context	Individuals are motivated to find the best possible solution to a particular problem (e.g., foraging strategy).	Individuals are motivated to build and maintain social interactions and to maintain a positive evaluation of themselves (e.g., display group membership).
• Evolutionary origin	Informational conformity requires imperfect information and helps individuals adapt to uncertain environments. It is used as a proxy for finding the most appropriate behaviour in an uncertain situation.	Normative conformity could help manage social interactions: It can be used as an honest signal of group membership.
2. Experimental differences		
• Psychological uncertainty	Individuals face an unknown situation with unknown individuals.	Individuals are in a known situation with familiar individuals.
• The others awareness of ones behaviour	The behaviour continues in the absence of the group.	The behaviour stops in the absence of the group.
• Conflict between the individual and the group	The individual relies on social information only when his or her personal information is not reliable. The individual displays the most frequent behaviour only when it is also optimal. Having one ally has a limited effect on the influence of the group.	The individual relies on social information even when it is not reliable. The individual displays the most frequent behaviour even when it is not optimal. Having one ally can disrupt the influence of the group.
• Effect of varying the size of the influence group	Marginal effect decreases with group size for small group sizes.	Marginal effect increases with group size for small group sizes.
• Frequency of alternative behaviours	Linear or weak conformity.	Hyperconformity.
• Diversity of behavioural repertoire	Individuals learn and perform only one option.	Individuals learn and use several options and settle on one afterward.
• Evolution of diversity within group	Diversity of behaviour within group can remain stable over time.	Diversity of behaviour within group progressively disappears over time.
• Resistance to the introduction of new behaviour	Weak because individuals who discover new, more efficient behaviours readily display them.	Strong because individuals who discover new, more efficient behaviours are unlikely to display them in the presence of the group.
• Migration	If an individual with a different behaviour migrates in a group, the individual retains his or her initial behaviour.	If an individual with a different behaviour migrates in a group, the individual adopts the behaviour of the group.

must cause individuals to both publicly conform and privately conform, on the other hand, normative conformity is more likely to only cause individuals to publicly conform and to keep their private opinions the same, particularly, when people fear a negative evaluation (Menzel, 1957; Kelman, 1961; Allen, 1965; Gillig and Greenwald, 1974; Aronson, 2003; Wright, London and Waechter, 2010). The third one is that informational conformity can be temporary or long-range, on the other hand, normative conformity is less likely to have a permanent effect (Deutsch and Gerard, 1955; Argyle, 1957)⁵. The last one is that informational conformity must be more sensitive to the frequency of behaviours than the proportion of individuals displaying alternative behaviours, but normative conformity is more sensitive to the proportion of individuals displaying alternative behaviours than the frequency of behaviours.

1.5 Conclusion

The main objective of this chapter is to review related literature about conformity in social psychology. First, we present the definition of social conformity that is expressed by most social psychologists since the early years of the 20th century. The definition of conformity in social psychology is that “a behaviour is said to conform when an individual in a group displays that behaviour because it is the most frequent the individual witnessed in others” (Claidière and Whiten, 2012). Second, we review the important experimental relevance of conformity in social psychology for example, Jenness (1932), Sherif (1936), Asch (1951), Crutchfield (1955) and Berns et al. (2005). These great experiments give us clues classify conformity from motivations. We detail the classification of conformity in social psychology: informational conformity and normative conformity. For understanding normative conformity, we present obedience and compared it with normative conformity. Inspired by Kelman (1958), we divide normative conformity into three subdivisions: compliance conformity, internalization conformity and identification conformity (Claidière and Whiten, 2012). Scientists research social conformity in economics can get benefits from following this classification. At last, we present the theoretical and empirical differences between informational conformity and normative conformity in social psychology.

Overall, having revealed interesting influences of conformity on human behaviour in social psychology, we turn to economists who have already been led to social conformity. We will give a brief overview of experiments on conformity in economics in the following chapter.

⁵Exceptionally, informational conformity may be also temporary, only when the cue of a positively evaluated source becomes disassociated from the content of the message (Gillig and Greenwald, 1974).

Chapter 2

Economic experiments on conformity

Economic experiments are the application of experimental methods to study economic questions. Economic experiments may be conducted in the field or in laboratory settings. Economic experiments usually use cash to motivate subjects, in order to mimic real-world incentives. Data collected in experiments are used to estimate effect size, test the validity of economic theories, and make market mechanisms easier to understand (Plott and Smith, 2008).

Social psychologists' fruitful work about conformity phenomenon has evoked economists great interest about conformity. These economists' great experimental work on conformity will be presented in this chapter. Above all, we present some economic conformity examples. First, when choosing assets, investors are influenced by the choices of other investors. Second, the fads in markets of consumer goods. Third, opinion polls influence voters to vote in the way that the opinion polls predict, and so on.

Following the preceding chapter about conformity in social psychology, we make a distinction in this section among informational conformity and normative conformity, to review the evidence from economic experiments on conformity. Particularly, in Section 2.1 (Experiments of informational conformity), we consider those experiments that have focused on decision problems where the behaviour of others gives information about the state of the world and this information affects an individual's decision over how best to satisfy his or her preference. In Section 2.2 (Experiments of normative conformity), we discuss normative conformity experiments where the behaviour of others affects individual behaviour because social pressure or conformist tendency. Accordingly, we review separately those experiments in two subsections: compliance conformity and internalization conformity. The last section of this chapter

is a conclusion.

2.1 Information cascades and financial herding

Choosing a fashionable restaurant or a popular movie are most common examples about informational conformity in real life. Banerjee (1992) proposes that informational conformity as herd behaviour will occur in a sequential decision model, i.e., people will be doing what others are doing rather than using their information. In addition to trying to understand theoretically informational conformity, it is important to study its experimental relevance. From informational conformity's definition in social psychology, informational conformity consists of neglecting one's private information to follow previous traders' decisions. Corazzini and Greiner (2007) find no evidence for conformity in an experimental setting with no private information. Therefore, to test for information cascades' presence one would need individuals' private information. But these data on individuals' private information are difficult to obtain. Fortunately, economists have overcome this problem by using laboratory experiments in which practitioners are asked to trade in an artificial experiment; both their behaviour and information set are observed by the researcher. The researcher can directly detect when individuals neglect their private information and follow the actions of their predecessors.

The most important previous experimental paper about informational conformity in economics is Anderson and Holt (1997). In this paper, Lisa R. Anderson and Charles A. Holt experimentally confirm the theoretical predictions from Banerjee (1992) and Bikhchandani, Hirshleifer and Welch (1992) about the emergence of information cascades in their models. Anderson and Holt (1997) use a "ball and urn" setup in order to remove any preference for conformity that is not based on informational considerations. In their experiment, subjects are paid with cash for correctly guessing the urn from which a ball is drawn. All balls are drawn from the same urn. There are two urns: one urn ("urn A") contained two-thirds black balls and one-third white balls; the other ("urn B"), two-thirds white balls and one-third black balls. Subjects are selected in a random order to make their predictions, which are announced by a neutral assistant who does not know the signals or which urn was being used¹. Each subject observes the color of his ball. Subjects could get the prior predictions made by others, but they cannot observe others' private signals if there exist prior predictions. The events are referred to "urn A" and "urn B" (as A and B). A random device is used to select the urn, with each event being equally likely, and therefore, each of the balls listed above is *ex ante* equally likely to be drawn. Therefore, they are two equally likely events. Decision

¹Allowing subjects to announce their own predictions could have given them the chance to convey additional uncontrolled information by the tones of their voices.

makers obtain private signals (the colour of the ball as a for black and b for white), which are correlated with the event. Suppose that the draw is b . Since two-thirds b balls are in urn B , it follows that the *a posteriori* probability of urn B given a draw of b is $2/3$. In particular, $Pr(a|A) = Pr(b|B) = 2/3$. The error rate is $1/3$ for each signal. The key assumption is that each subject's private signal is correlated with the event, but is independent of the others' signals. After all predictions have been announced, a non-decision-making subject serving as a monitor announces which urn has actually been used. Those with correct predictions are paid for that trial, and others earn nothing.

Therefore, the prediction made by the first subject in Anderson and Holt (1997)'s experiment is based only on that his personal signal and hence, will reveal his signal since the signal is more likely to be correct. Suppose the first subject gets a a signal and publicly predicts event A . If the second subject in the sequence gets a a signal too, it is rational for the second subject to predict A also.

Subject number: Urn decision (private draw)								
Period	Urn used	1st round	2st round	3st round	4st round	5st round	6st round	Cascade outcome
5	B	S12:A (a)	S11:B (b)	S9:B (b)	S7:B (b)	S8: B (a)	S10: B (a)	cascade
6	A	S12:A (a)	S8:A (a)	S9: A (b)	S11: A (b)	S10:A (a)	S7:A (a)	cascade
7	B	S8:B (b)	S7:A (a)	S10:B (b)	S11:B (b)	S12:B (b)	S9: B (a)	cascade
8	A	S8:A (a)	S9:A (a)	S12:B* (b)	S10:A (a)	S11: A (b)	S7:A (a)	cascade
9	B	S11:A (a)	S12:A (a)	S8: A (b)	S9: A (b)	S7: A (b)	S10: A (b)	reverse cascade

Notes: Boldface–Bayesian decision, inconsistent with private information.

**–Decision based on private information, inconsistent with Bayesian updating.*

Table 2.1: Data about the results for selected periods of sessions 2 in Anderson and Holt (1997)'s economic experiments

If the second subject gets an b signal, the observed and inferred signals essentially cancel each other, and each state is equally likely for the second person. It can be observed from laboratory experiments' results in figure 3.1 that the second subject almost always predicts events according to his own signal in such cases. Thus, the second decision will reveal the

second subject's private signal, whether or not it conforms to the first prediction. When the first two subjects in the sequence predict the same signal, e.g. a , the information inferred from the matching prior two signals is greater than the information from any one private signal. The third subject should also choose what the first two subjects choose, even that his private signal is different. "Information cascades" form in this manner. Here an "information cascade" refers to the situation where initial decisions coincide in a way that it is optimal for each of the subsequent subjects to ignore his private signals and follow the established pattern. That means that private information is dominated by the signals inferred from the previous decisions of others. The effect of information cascade is that all subsequent decision makers will follow a pattern established by the first ones in the sequence. Conformist followers in an informational cascade contains no informational value.

Of course, information cascades may not form immediately if there is an imbalance in predictions. For example, suppose that the first two predictions are A and B like the 5 period in figure 3, so the third subject would consider each urn to be equally likely, prior to getting his private signal. If the third and fourth decision makers both predict B , then this imbalance in favour of B would cause the fifth subject to predict B , regardless of his private signal.

In summary, the general tendency is for subjects to correctly use the information implied by previous decisions, which produces rational information cascades with considerable frequency. It is possible, however, that initial predictions to be incorrect, which is called a reverse information cascade, i.e., the initial decision makers are unfortunate to observe private signals that indicate the incorrect state, and then a large number of followers will join the resulting pattern by this "mistakes", despite the fact that their private signals are more likely to indicate the correct state. Let us use a vivid example in society to explain "reverse information cascade". Suppose that a worker is not hired by several potential employers because of his poor interview performances. An employer approached subsequently and knowing this may not hire the worker even if the employer's own assessment is favourable since this information may be dominated by the unfavourable signals inferred from the worker's previous rejections. So even for a qualified worker who sometimes makes bad impressions in his job interviews, many future job opportunities are eliminated from him because a series of rejections can create a reverse cascade.

Hung and Plott (2001) replicate Anderson and Holt (1997)'s results by exploring information aggregation in a voting mechanism. The voting mechanism includes two aspects: decision rules and voting rules. Majority rule is the most popular and important decision rule, which selects the alternative that has more than half the votes in voting. Voting mechanism generally contains two voting rules: the simultaneous rule which asks all voters vote simultaneously and the sequential rule which allows some voters to know the choices of earlier voters. The voting

rule in Hung and Plott (2001) is sequential. The authors add some interesting treatment variations to consider whether the propensity towards such reverse informational cascades depends on the rules governing individual rewards. In one of their experiments, the incentive structure is altered so that subjects receive a positive payoff only if the majority of the group made the correct prediction². The effect is to reduce conformity for early decisions because individuals have an incentive to signal their information so that others can make better decisions. Because rewards in Hung and Plott (2001)' protocol depend on the quality of the average view within a group, Heap (2014) confirms one reason for Hung and Plott (2001)'s result that objectively correct decisions can be made more often when individuals are asked to give decisions in a group formation. The reason is known as the "wisdom of crowds". In fact, this result is similar to the result in "Beauty contest games" (Kocher and Sutter, 2005)³. Other similar results can be found in Charness, Karni and Levin (2010) and Charness and Sutter (2012)⁴. From these similar results, Heap (2014) gives an interesting viewpoint: centralization can be better than decentralization in some cases having informational cascades because it is more efficient in sharing information.

Celen and Kariv (2004b) also report an experimental test enriching the ball-and-urn experiments of Anderson and Holt (1997). They estimate a model that allows for the possibility of errors in earlier decisions to understand their subjects' behaviour. They find that subjects give excessive weight to their private information relative to the public information revealed by the behaviour of others, and the subjects tend towards Bayesian updating over time. Here Bayesian updating, as known as "conditionalization", is a rule specifying how a prior probability distribution should be updated to a *a posteriori* distribution in the light of new information. Bayesian updating specifies how an individual should change their epistemic state over time in response to new evidence, where an "epistemic state" is represented by a probability distribution over some specified set of alternatives. Actually, they find that informational cascades behaviour develops frequently and all these informational cascades behaviour except one turn out to be correct.

²This is somewhat like a jury whose decision is determined by the majority.

³In a Beauty contest, individuals or groups are asked to choose a number between 0 and 100. The individual or group who is closest to $2/3$ of the average number chosen, win in the beauty contest and has the prizes. Groups choose a smaller number and exhibit a higher level of iterated reasoning than do individuals in beauty contest experiments.

⁴In Charness and Sutter (2012)'s Linda experiment, subjects are given a description of Linda, that includes her concern for discrimination and social justice, and they must choose whether it is more likely that a) Linda is bank teller or b) Linda is a bank teller and an activist in the feminist movement. Because b) involves an extra restriction, b) must be less likely. However, a strikingly large number of individuals declare that b) is more likely. This number falls when the same question is asked of groups of individuals in Charness et al. (2010).

Different from Anderson and Holt (1997), SgROI (2003) allows subjects to delay their decision-making in order to benefit from observing others actions. Their results suggest that subjects will indeed delay when their private information is not sufficiently strong. Despite this ability to wait, informational cascades remain ubiquitous. Among the informational cascades, reverse informational cascades still occur.

As we all know, Financial Market is an important place where informational conformity manifests itself. Following Anderson and Holt (1997), Cipriani and Guarino (2005) study informational conformity in a laboratory financial market. In the laboratory of Cipriani and Guarino (2005), subjects receive private information on the value of a security and observe the history of past trades. Given these two pieces of information, they choose, sequentially, if they want to sell, to buy, or not to trade one unit of the asset. By observing the way in which they use their private information and react to the decisions of the previous traders, the authors detect the occurrence of informational cascades. They compare two cases, one in which the price is fixed and one in which it is flexible. They implement the flexible-price case in two ways: in one the price is updated according to a deterministic rule based on the order flow, and in the other it is set by experimental participants. They find that, with either price-updating mechanism, when the price is flexible, subjects disregard their private information and herd much less frequently than when the price is held constant. The behaviour observed in the laboratory is in line with the theoretical predictions (Bikhchandani, Hirshleifer and Welch, 1992; Avery and Zemsky, 1998): informational cascades occur in a setup with fixed prices, but not in one with flexible prices. In a related paper, Cipriani and Guarino (2009) study informational conformity using a sample of financial market professionals instead of students. Students as subjects are used in most of the experimental literature, because of convenience and lower cost of recruiting them. An obvious concern, however, is the external validity of the results, since students are not representative economic individuals. This is particularly important in financial markets, where traders are assumed to be very sophisticated. However, the results of this paper show that financial market professionals behave quite similarly to students.

Neuro-economists argue that understanding brain organisation can help us to understand economic and financial behaviour (Baddeley, 2010). In experimental neuro-economics, Baddeley, Burke, Schultz and Tobler (2012) analyse financial herding. The authors adopt a similar task design that used by Berns et al. (2005). Each experimental subject has to decide whether or not to buy a particular stock. Each trial of the task consists of three stage. First, he is given private information in the form of a chart of past performance of the stock in the form of an artificially generated time series of daily stock returns over a year. These charts are presented to all subjects in four combinations of high/low mean and high/low variance stocks. Then, he is given social information about the herd choices with 4 faces on the computer screen

where a tick mark (“buy”) or a cross (“reject”) is represented above each face photo. There are four types of herd decision: $+4$ (all decided to buy), $2 - 2$ (half of the herd buy, the other half reject), -4 (all reject), and a control scenario in which no group decision is conveyed. Moreover, each experimental subject is told that the people presented by these faces have been involved in a pilot experiment and that their choices are real, informed choices based on the same information shown to each experimental subject. At last, each experimental subject is then asked to decide whether or not to buy the stock by pressing one of two buttons on a button-box. The authors using evidence from a functional magnetic resonance imaging (fMRI) confirms that experimental subjects’ financial choices are affected by herd decisions and that the propensity to herd is not homogenous but varies by gender, age and various personality traits.

In all the above papers, the authors describe informational conformity situations where individuals learn by observing the behaviour of others. In the real world, however, individuals learn not just by observing the actions of others but also from seeking advice. For example, Kübler and Weizsäcker (2004) give participants the chance to pay a fee to see a private signal as asking for advice. In their experiment, the rational equilibrium is obtained when the first person in the sequence purchases private information and makes a decision based on this information, whereas all following players do not buy a signal and herd behind the first player. However, they find that the experimental data exhibiting the equilibrium prediction performs poorly. In fact, too many players who have to decide early (but not first) make too many signal purchases. Players who decide toward the end of the games seem confident that previous decisions are based on private signals and buy fewer signals themselves, and herd. Kübler and Weizsäcker (2004) provide two reasons for the divergence from equilibrium prediction. First, players may attribute an error rate to their opponents that is higher than their own. This bias leaves each player to rely too little on their predecessors and acquire too many signals themselves. Second, players do not consider what their predecessors thought about their respective predecessors. Thus, each player does not note that some of the decisions he observes have been herding decisions and the decisions do not base on any private information. Therefore, when the majority is sufficiently strong for them, many players at the end of the games herd. Simultaneously, Kübler and Weizsäcker (2004) give an error-rate model, which allows for false beliefs about predecessors’ behaviour, to explain their experimental findings because of limited depth of reasoning. Similarly, in the experimental paper of Çelen, Kariv and Schotter (2010), they introduce advice giving into a standard informational conformity situation that has been already investigated theoretically by Çelen and Kariv (2004a) and experimentally by Çelen and Kariv (2004b, 2005). Particularly, the experiments are designed so that both pieces of information (action and advice) are equally informative in equilibrium. Despite the informational equivalence of advice and actions, they find that subjects appear

to be more willing to follow the advice given to them by their predecessor than to copy their actions. These results show that the presence of advice increases subjects' welfare.

2.2 Normative conformity in economic experiments

Informational conformity in economics embodies the updating of the true opinions on Bayesian learning in opinion formation and make individuals take blindly following their peers as their own best responses. In contrast, normative conformity is an effect such that we view a behaviour as correct in a given situation to the social norms or the degree that we see others performing it (Bardsley and Sausgruber, 2005; Zafar, 2011). From this interpretation, normative conformity is a social phenomenon, which predicts that people may conform independently of the material consequences of doing so. People adjust their behaviour, because of social pressure or conformist tendency on preference, which corresponds to compliance conformity and internalization conformity in normative conformity of social psychology. We sum up the two kinds of normative conformity in economics in the following table.

Two kinds of normative conformity in economics:	Because of social pressure with stable preference	Because of conformist tendency with unstable preference
(1) Compliance conformity	Yes	No
(2) Internalization conformity	No	Yes

Table 2.2: Two kinds of normative conformity in economics.

2.2.1 Compliance conformity: arising from social pressure

Compliance conformity, which belongs to normative conformity, refers to compliance with a social norm as a matter of motivation to conform. Compliance conformity makes endogenous mechanism become effective when the description of the social norm has been cleared though they remain not binding in any sense. Experimental economists have attempted to distinguish compliance conformity from reciprocity and awareness effect. First, for reciprocal motives, it must be the case that others' behaviour matters through its effect on the individual's payoff. Compliance conformity differs from reciprocity because conformist behaviour

does not depend on the welfare effects of the stimulus behaviour. For example, a compliance conformist individual will contribute to a useless public good which benefits no one if he observes others making contributions, but a reciprocity-motivated individual will not contribute since he does not have benefits from the contribution behaviour. Bardsley and Sausgruber (2005) propose an innovative design of a public-good game that allows them to distinguish between reciprocity and compliance conformity in which individuals use the behaviour of others as a reference point for decisions. Individuals are given the opportunity to react to the contributions of a payoff-irrelevant group, in addition to their own group. In this test condition, these individuals have full information about the contributions of all other subjects in their own group. Hence, there is no imperfect information problem, and because of social pressure, here conformity is compliance conformity. They find that compliance conformity accounting for around one-third of the increase in contributions due to an increase in the payoff-irrelevant contributions.

Second, normative conformity and the awareness effect confuse the decision process in ethical dilemmas, for example, corporate frauds, tax evasion, theft and so on. Fosgaard, Hansen and Piovesan (2013) investigate if people cheat more when they observe their peers cheating because they conform or because they become aware that cheating is one of their options. In their experiment, subjects toss a coin privately and report the outcome (white or black). They reward only those who report white and leave the subjects the possibility to cheat without being discovered. They manipulate subjects' report sheet to (i) suggest (or not) that cheating is an option; (ii) suggest that their peers were honest (or not). They find that among the subjects who are not significantly affected by increasing awareness of cheating as an option, they cheat more (almost all of them cheat) when they are shown that their peers have cheated. This experiment shows that these subjects conform to cheat because cheating is the norm. These results highlight some compliance conformity's obvious negative effects.

A long time ago, Venkatesan (1966)'s laboratory experiment results indicate that in consumer decision-making situation where no objective standards are present, individuals who are exposed to a group norm will tend to conform to that group norm. Actually, compliance conformity has been a fertile research in economic experiments, for example, in the public good game⁵ (Carpenter, 2004), in the dictator game⁶(Krupka and Weber, 2009), in the ultimatum game⁷ (Bohnet and Zeckhauser, 2004), in jury-like settings (Baddeley and Parkinson,

⁵The public good game is an experimental games in which there are four player, for each player have the same money initially, his final income is decided by the part of money he kept and the sum of the money that they four decide to give for the public multiplied by a coefficient between 0 to 1.

⁶The dictator game is an experimental economic game in which one of the players makes an offer that the other can do nothing but accept. Precisely, the dictator has to decide alone how to split a sum of money between him/herself and another person who is called the receiver.

⁷The ultimatum game is also an experimental economic game in which one of the players makes a

2012), in charitable contribution experiments (Alpizar, Carlsson and Johansson-Stenman, 2008; Zafar, 2011) and so on. Specifically, Carpenter (2004) shows in an experiment that players react significantly to the number of free riders in their groups. Krupka and Weber (2009) report an experiment examining the effect of social norms on pro-social behaviour. They find support for a direct effect of norms on behaviour. Bohnet and Zeckhauser (2004) inform responders about the average offer before they decide whether to accept or reject their specific offer. This information significantly increases offers and offer-specific rejection probabilities. Their results are consistent with people's dislike for deviations from the norm of equity. Baddeley and Parkinson (2012) present experimental data showing that groups do converge towards others' viewpoints in jury decision-making settings whose norm is that individual viewpoints must converge to reach a group consensus. Designing a field experiment, Alpizar et al. (2008) investigate the conformity role for voluntary contributions at a national park in Costa Rica. They show that when the subjects are told that the typical contribution of others is small, the probability of contribution increases and the conditional contribution decreases, compared with providing no reference information. And providing a high reference level increases the conditional contributions. Using the fact that image-related concerns can only be present if actions are publicly observable, Zafar (2011) empirically disentangles the descriptive norm (i.e., what others are doing) as social comparison concerns and the image-related concerns in a charitable contribution experiment to investigate why individuals conform. His results show that because disagreement entails uncomfortable feelings, individuals change their contributions in the direction of the descriptive social norm even when their identities are hidden (no image-related concerns). He also finds that social ties affect the descriptive social norm influence: subjects only respond to the choices of group members they are friends with. Especially, a high charitable contribution norm may not cause subjects to contribute more when members in the group are not friends.

Recently, Carlsson and Qin (2010) present results of an experiment where conformity in green consumption is tested. They show that women have higher willingness to pay when they are asked to consider that a large share of consumers choose the ecologically friendly alternative. Sacconi and Faillo (2010) present an experimental study based on a simple experimental three person game called the "exclusion game"⁸. The experimental data show compliance conformity as a dramatic change in the participants' behaviour pattern if the players partici-

"take-it-or-leave-it" offer. Then, the other player can accept or reject this offer.

⁸ Exclusion game is a simple three person game with two active players and one dummy player who can only receive the consequences of the active players decisions. The purpose of the exclusion game is to grasp some features of social situations where strong players decide and put into practice social institutions affecting not only their own well being but also that of weaker players, for example, rules for admittance into the distribution of a given social surplus.

pate in a “constitutional stage” where they decide the rule of division unanimously. In other words, the experimental results present that most of the participants conform to a fair rule of division to which they have agreed in the “constitutional stage”, whereas the participants behave more egoistically when there is no such “fair” rule of agreement.

More recently, Faillo, Ottone and Sacconi (2015) also show compliance conformity from a non-self-interested norm because of “sense of justice”. Here, compliance conformity means to comply with the norm “fair” that dictates a choice in contrast with self-interest. Similarly, Goeree and Yariv (2007) use a revealed preference approach to disentangle compliance conformity from inequality aversion and information-based decision-making (informational conformity), under the basic structure designed by Anderson and Holt (1997) and Hung and Plott (2001). They provide subjects two signals: a private statistically informative signal and the history of play of predecessors, i.e., a statistically uninformative word-mouth signal. They let subjects choose one of the two signals to observe before making their decisions. In their setup, subjects choose the statistically uninformative word-mouth signal 34 percent of the time, and 88 percent of these subjects follow their observed predecessors’ actions. The results from experimental evidence show that choices of others matter to subjects, independently of their statistical information, because herding reduces expected inequality among subjects. The “fair” norm plays a role as compliance conformity.

And last, but not the least, “bandwagon effect” is an obvious evidence of compliance conformity when voters vote in order to be the winner’s side. Concretely, “bandwagon effect” means that conformist voters want to vote for a candidate just because she is likely to win the election, which is thought to be the result of social pressure. Therefore, we present some experimental evidence about the bandwagon effects. Skalaban (1988) suggests that the bandwagon effect is most pronounced among voters who have the weakest prior political opinions and hence are most susceptible to suggestion through the media. The author finds that the relatively favourable standing of Ronald Reagan in the pre-election polls help to generate a bandwagon effect in the 1980 presidential election of USA. McAllister and Studlar (1991) also present evidence for the bandwagon effect in elections in Great Britain and in the United States. Their findings suggest that pre-election polls persuade some voters to switch their votes to whichever candidate is ahead. Herron (1998) provides evidence consistent with a desire to vote for the winning candidate in a study of the 1992 U.S. presidential election. He analyzes micro-level data from the 1992 United States presidential election and finds that Clinton supporters are inspired to vote for a winner and Bush supporters are inspired to abandon a loser. In France, concern about the relationship between polls and the election outcome has led to a ban on publication of pre-election polls in the week prior to the election. Dorff and Brenner (1992) examine “conformist voting” on the U.S. Supreme Court from 1946 to 1975. The judges vote on the merits at least twice in the U.S. Supreme Court. The first

vote, called the original vote on the merits, is a cast in secret within 24 to 120 hours after oral argument. The second is known as the final vote on the merits. They compare pairs of votes in which a judge switches from the minority at the first vote to the majority at the second vote with pairs of votes in which a judge votes with the minority at both votes. They find the size of the majority of the original vote associated with switching.

Except the above form for compliance conformity where individuals conform to a norm with no deviation, which corresponds to normative conformity's average effects in social psychology, compliance conformity can appear in another form where individuals conform to a norm with one direction's deviation valued, which corresponds to normative conformity's extremity effects in social psychology. For instance, when I run the 100 meters in 12 seconds, is this good or bad? This is hard to answer when there is no absolute standard for running the 100 meters, but when I know what others do in my position then I could form some judgments. The behaviour of others provides information that matters as a reference point. The running results are more valued if more less the reference point. Here we respond to the knowledge of what others do because we have a psychological propensity to acquire self-esteem from doing better than others even when material pay-offs do not depend on this comparison (Azmat and Iriberry, 2010; Heap, 2014).

2.2.2 Internalization conformity: preference conformity

Conformity behaviour might not come from information sharing and chasing social status, but from individual preference bending towards the norms of a group because of conformity tendency on preference which is a social psychology definition from Claidière and Whiten (2012). In this case, an individual's preferences are not taken as given (Mas and Moretti, 2009; Abeler, Falk, Goette and Huffman, 2011; Cooper and Rege, 2011; Heap, 2014). In our real society, individual present preference conformity in many situations. For example, when U.S. culture switches from favouring smoking as a social activity to treating smokers as pariahs, some individuals are able to quit their smoking habits quickly. Another example is individual' allegiance to sports teams. Some individuals after moving to a new locality, are able to quickly abandon their allegiance to their previous hometown sports team and embrace their new local team. Other examples of preference conformity can be found in the field of sexual preference (homosexuality/heterosexuality) and political attitudes (Lieberman, 1956). Because attitudes towards sexuality and politics vary greatly from place to place, an individual who leaves his home town and relocates to a new environment may face high social costs if he expresses views on such topics that are against the dominant local views. Such costs can be avoided through conformist tendency on preference.

In experimental economics, Mas and Moretti (2009) investigate how and why the productivity

of a worker varies as a function of the productivity of her co-workers in a group production process. Using scanner level data about the checkers for a large grocery chain, they show that the high productivity workers do not improve significantly, but the low productivity workers redouble their efforts to mitigate the negative impact of the relative comparison with the result that performance becomes closer among the group. In the experiment of Falk and Ichino (2006), subjects are asked to fill letters into envelopes with a remuneration independent of output in the paired treatment where two of the subjects work at the same time in the same room, and in the single treatment where the subjects work alone. This experiment presents a finding which is similar to the finding of Mas and Moretti (2009): average productivity is improved by the appearance of high productivity co-worker and low-productivity workers raise productivity obviously. Heap (2014) argues that these findings reveal individuals have a “preference for conformity”, possibly because of the norm of reasonableness with a group (Bernheim, 1994). Shiller (1995) has suggested that an irrational, loyalty-induced psychological motivation to copy others could explain much conformity behaviour, which is consistent with Heap (2014)’s arguments about the preference for conformity.

People by intrinsic interactions will have a “conformity preference”, and the conformist tendency varies positively with the prevalence of this behaviour in their group. In the voluntary contribution public good game, Keser and Van Winden (2000) show that if one player observes the level of contribution about others in the group goes up (down), this player will also have the tendency to adjust to the top (bottom) about his own contribution level. Here the tendency to adjust contribution level can be called the preference for conformity. Similarly, Bohnet and Zeckhauser (2004) show the preference for conformity by the findings that informing respondents about the average level of offers in an ultimatum bargaining game significantly increases offers. Frey and Meier (2004) analyse the behaviour of students in Zurich who have the opportunity to contribute to two social funds. Students’ preference for conformity can be used to explain the result that the contribution is higher when they were informed that many other students were contributing. Potters, Sefton and Vesterlund (2005) find that sequential moves in a public good game result in a larger provision of the good, because the follower has the preference for conformity and mimics the action of the leader. Heldt (2005) finds that Swedish cross-country skiers are more likely to contribute to the track maintenance if many others contributed, which can be explained by person’s preference for conformity. Another example to show the preference for conformity’s existence is Martin and Randal (2005) which find that visitors to a museum put more money into a transparent box, thereby donating money to the museum, when there is money in the box compared to when the box is empty.

Recently, Yao, Ma and He (2014) examine the investment behaviour of market participants within the Chinese stock market, especially regarding their preference for conformity towards

the market consensus. Their findings suggest that investors display a preference for conformity to the market consensus when trading growth stocks. Lahno and Serra-Garcia (2015) vary experimentally whether individuals can condition a simple lottery choice on the lottery choice (Random treatment) or the lottery allocation of a peer (Choice treatment). Their comparative static analyses and structural estimation results suggest that decision makers choose not to stay with their individual choices in 18 % of the cases in Random and in 33% of the cases in Choice. Conformity dominates in both the Random treatment and the Choice treatment. Furthermore, the likelihood of conformity increases in Choice compared to Random, more precisely doubles. Since there is complete information on their experiments, the conformist phenomenon in their experiments cannot be explained by a model of rational social learning about informational conformity. It is because in the presence of complete information, under standard assumptions of rationality and self-interest, decision makers do not learn from others in their group. The fact that individuals have the preference for conformity is a good explanation for Lahno and Serra-Garcia (2015)'s experimental results.

Go back to the conformist tendency in social psychology (Claidière and Whiten, 2012) which related to the preference for conformity in internalization conformity of experimental economics, we realize that the conformity tendency in social psychology leads to the preference for conformity in internalization conformity in experimental economics, and the internalization conformity's existence in economics shows individual's conformity tendency in social psychology. They describe the same performance from a different point of view.

2.3 Conclusion

This chapter has presented economic experimental evidence about informational conformity and normative conformity separately. First, we focus on information cascades that is an obvious expression of informational conformity in economic experiments. We detail the important paper of Anderson and Holt (1997) and its related references, for example, Cipriani and Guarino (2005) in financial markets. One interesting point of view about information cascades from Heap (2014) is that centralization can be better than decentralization in some cases having informational cascades. Second, we review the economic experimental literature about compliance conformity that is normative conformity from social pressure. Especially, "bandwagon effect" is an obvious compliance conformity in voting, where voters want to vote for the winner. Finally, we give much experimental evidence about internalization conformity that is normative conformity from a preference for conformity. Noting that the preference for conformity corresponds to the conformist tendency of social psychology. The relationship between conformity tendency in social psychology and internalization conformity in economics

are the cause and the effect. Moreover, internalization conformity suggests individual's preference cannot be taken as given, which is essentially different from compliance conformity whose preference is exogenous. On the basis of chapter 1 and this chapter, we are going to review the important literature about theoretical models on conformity in behavioural economics.

In addition, the fact that informational conformity and normative conformity are always interrelated has been mentioned in social psychology, which has been noted by economists too. Economists always make empirical not experimental research to discuss the two kinds of conformity simultaneously. For example, Li, Zang and Tang (2015) make an empirical research on the relationship of conformity in social psychology (informational conformity and normative conformity), consumer knowledge and country-of-origin effect. The authors verify two interesting results : (1) consumer knowledge has significant negative impact on informational conformity and normative conformity; (2) informational conformity has a significant negative influence on country-of-origin effect and normative conformity has a significant positive influence on country-of-origin effect.

Chapter 3

Theoretical models on conformity in behavioural economics

Starting with Sen (1977), which criticizes standard economics for neglecting the importance of individuals' social attributes, behavioural economic economists extend the standard economic framework to account for relevant features of human behaviour that are absent in the standard economic framework. Thus, behavioural economics introduces more realistic psychological foundations. Compared with standard economics, behavioural economics assumes that individuals are not totally rational and have social preferences in economic models, which increases their explanatory power. In particular, behavioural economics acknowledges the importance of social preferences. The social preferences refer to the fact that individuals care about certain social goals in addition to their own material benefits. For example, a goal about in accordance with the majority's opinion, a goal about caring the well-being of others, a goal about a fairness of allocation, a goal of rewarding kindness and punishing unkindness, and so on.

As an important social preference, conformity has received substantial attention in the theoretical literature of behavioral economics since the initial research papers, such as Akerlof (1980), Jones (1984), and Bernheim (1994). In a link to the social psychology literature (Cialdini and Trost, 1998; Cialdini and Goldstein, 2004), behavioral economists have increasingly introduced conformity. Accordingly, conformity is studied in crime (Patacchini and Zenou, 2012), ethnographic research (Akerlof, 1997), voluntary contributions to public goods (Carpenter, 2004; Bardsley and Sausgruber, 2005), group welfare (Grajzl and Baniak, 2012), cooperation (Mengel, 2009), tax avoidance (Balestrino, 2010), labor supply (Grodner and Kniesner, 2006), social transitions (Levy, 2005), tipping (Azar, 2004), voting (Coleman, 2004; Callander, 2007, 2008), formation of culture (Bednar, Bramson, Jones-Rooy and Page,

2010) and so on.

In this chapter, we divide economic theoretical literature of conformity into three main sections according to different conformity types, which has been presented in economic experiments (Heap, 2014). Accordingly, in Section 3.1 we present the models of informational conformity. In this section, conformity theoretical literature focuses on individuals' decision problems, where others' actions give information about the world state, and affect the individuals' decision over how best to satisfy their expected utility. We divide this section into three subsections according to decision order. They are exogenous sequential decisions (Subsection 3.1.1), endogenous sequential decision (Subsection 3.1.2) and non-sequential decision (Subsection 3.1.3).

In Section 3.2 we analyse models of compliance conformity. In particular, we review economic theoretical literature about conformity as a result of external social pressure, i.e. compliance conformity. First, compliance conformity is assumed to be endogenous, and discussed with well-established social norms or with endogenous social norms (references' average action), separately. At the equilibrium, compliance conformity represents itself either as individuals behave identically or individuals have conformist tendency in the change of references' average action. Second, compliance conformity is assumed to be exogenous, where a conformity preference term from a desire to be emulated is included in individual utility functions. Furthermore, we review simultaneous and sequential voting models with exogenous compliance conformity. The difference between the above two subsections is that compliance conformity is produced endogenously from social pressure in the first one and given exogenously from a desire to be emulated in the second one. In Section 3.3, we study the models of internalization conformity. In this section, we review economic theoretical model literature about conformity where individuals' preference is not taken as given in models. In Section 3.4, we conclude.

For convenience, we use the following graph to describe how we study economic theoretical literature on conformity in this chapter.

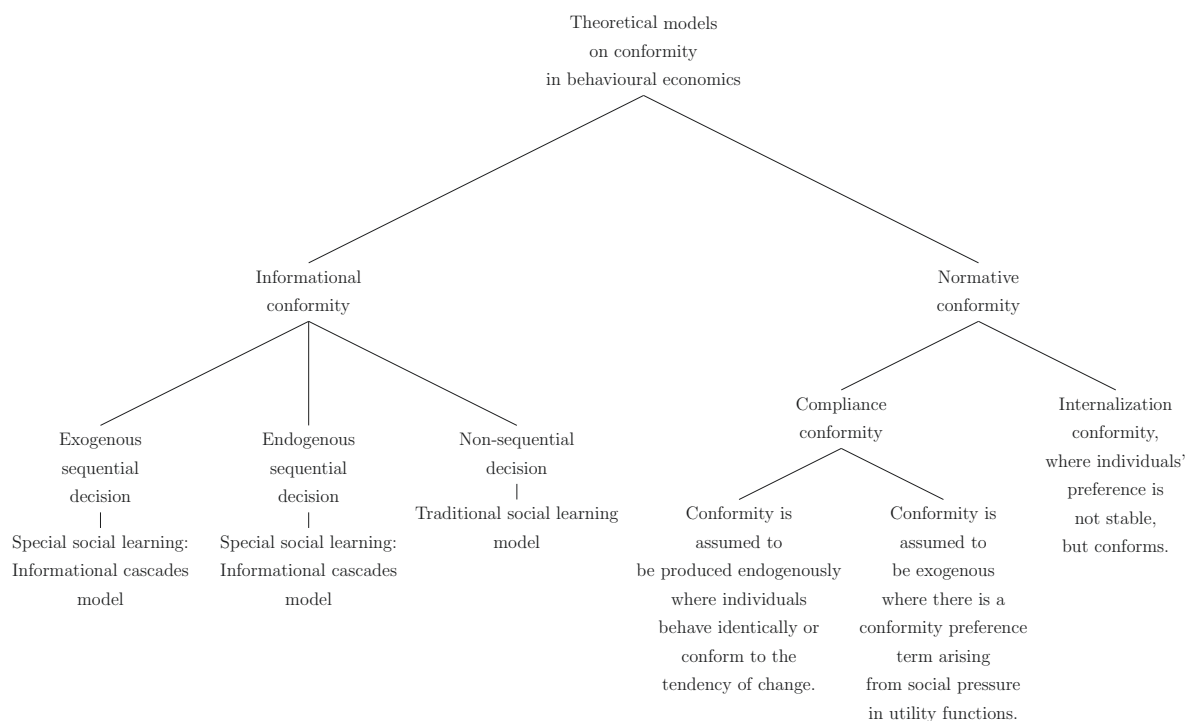


Figure 3.1: A graphic presentation of theoretical models on conformity in behavioural economics.

3.1 Models of informational conformity

The most common example in real life about informational conformity is when we need to decide on what stores (or restaurants) to patronize or what schools to attend, our decisions are based on how popular they seem to be.

We have presented the relationship between conformity and social learning in Section 1.1 which named as “what is conformity in social psychology?”. We recall what is social learning. Social learning is a phenomenon where an individual must learn something new from others by observing actions of others. Its broad definition encompasses all asymmetric information situations. While the economic theoretical literature on informational conformity has focused on a more specialized situation where individuals lack information about what the most beneficial action to take is and where there is no any obvious punishment for deviations. Therefore, informational conformity as one important type of conformity belongs to social learning.

Models of informational conformity assume that there is a Bayesian reasoning process where individuals adjust their *a posteriori* probability when new information about others’ decision arrives. Informational conformity is defined as “informational cascades” or “herd be-

haviour” (Banerjee, 1992; Bikhchandani, Hirshleifer and Welch, 1992; Lee, 1993)¹. It refers to a phenomenon where, when individuals announce public predictions, later predictions match the early announcements among them. Informational cascades explain why conformist behavior is prone to be a fragile error in “reverse information cascade”. It refers to a special phenomenon where the initial decision makers are unfortunate and observe private information that indicates the incorrect state. Then, a large number of followers will join the resulting pattern because of this unfortunate mistake, though their private information is more likely to indicate the correct state (Banerjee, 1992; Bikhchandani, Hirshleifer and Welch, 1992).

In this section, all models are divided into three types according to the fact that the decision process is sequential or not. Therefore, firstly, we present the models of exogenous sequential decisions; secondly, the models of endogenous sequential decision; and thirdly, the models of non-sequential decision. In addition, the definition of exogenous (endogenous) sequential decision process is that individuals enter decision process one by one which is decided exogenously (endogenously), individual decision is irreversible, and each individual only observes the decisions of his predecessors. The decision of non-sequential decision process is that every individual is present and tries to learn information before making his decision.

3.1.1 Models of exogenous sequential decision

There are many models of informational conformity with the exogenous sequential decision, for example, Banerjee (1992), Bikhchandani, Hirshleifer and Welch (1992), and Lee (1993). These models state that informational conformity is a rational phenomenon, where a finite number of individuals have made their decisions, all following individuals will find it optimal to disregard their private information and imitate the predecessors.

Because Banerjee (1992)’s model is original and has very important influences, we present this model briefly. In Banerjee (1992), there are a population size N of individuals. Each individual maximizes the identical risk-neutral utility function defined on the space of asset returns. The decision making in this model is sequential and exogenously fixed, i.e., an individual is chosen at random to make his decision firstly (he cannot decide to delay his decision) and the next person chosen randomly once again, takes his decision next. The next individual is allowed to observe the decisions made by the previous individuals and can benefit from the information contained in them. However, he is not allowed to find out the actual private information of the individuals before him. Each individual would use the new information by Bayesian rules to revise his *a posteriori* probability. The game’s structure and the Bayesian rationality are common knowledge.

¹In behavioral economics, these two terms, informational cascades and herd behaviour, are used interchangeably.

The authors give an example for a more clear explaining, in which 100 individuals as a group have options to buy a particular stock. The “buy” decision versus the “reject” decision are favoured with a *a priori* probability ² such as 51% and 49% respectively. Under a fixed sequential order, each individual chooses whether to buy the stock or not. First, in the case of complete access to any private information, the authors assume that 99 out of 100 individuals have private adverse signals from investment advisors. It indicates that the stock price is likely to fall. Basing on the aggregate evidence, it is inferred that each individual should reject the stock. Second, the authors assume that individual 1 who is the only one person with misleading private information, receives the “buy” decision. Because he is the first to give decision, the main conclusion of the second case is that the decision rules chosen by optimizing individuals are to herd, i.e., each individual does what the first person does, rather than using his private information. It is an inefficient equilibrium. The sequence of events that generates this equilibrium is as follows.

Individual 1 buys the stock on the basis of his misleading private signal. Individual 2 is the next person to choose. He knows a *a priori* probability (favouring a “buy” decision), has a correct private signal favouring a reject decision, and gets public information about the prior action of Person 1. Applying Bayes’s rule two times by assuming that individual 2 weights the last two pieces of information equally, we get the following function:

$$\frac{A \times 49\%}{A \times 49\% + (1 - A) \times 51\%} = 51\%,$$

where $A = \frac{51\% \times 51\%}{51\% \times 51\% + 49\% \times 49\%}$.

The above equation tells us that the information about individual 1’s choice will cancel out individual 2’s private signal. Thus, individual 2 would rationally choose to buy the stock according to his *a priori* probability . Because 51 % is more than 49 % , individual 2 favours a “buy” decision. Similarly, individual 3 would decide to buy on the basis of the choices of individual 1 and 2. This herd behavior moves towards a “buy” decision, even though 99 % of private signals favour the “reject” decision. Each individual does what others have done, rather than using his private information. It shows that individual 1’s wrong action leads to an informational cascade. Thus, the informational value from 99 pieces of private signals recommending that the stock should be rejected is lost. It shows that the impact of relevant private information has been limited even though individual behaviour is Bayes rational.

² a *a priori* probability is a probability that is derived purely by deductive reasoning. The deductive reasoning is the process of reasoning from one or more statements to reach a logically certain conclusion.

Equally, when another individual is the first one to choose, the herd behaviour would head in the right direction.

Pointing out that Banerjee (1992) models informational conformity just independently, Welch (1992) consider how a seller reacts when he is faced with a cascade situation among buyers about IPO (initial public offering) shares, that are sold sequentially. Welch (1992) argues that the issuers' pricing decisions can reflect informational cascades where later investors rely completely on the earlier ones' purchasing decisions and ignore their own information. As another important variation of Banerjee (1992), Bikhchandani, Hirshleifer and Welch (1992) model the dynamics of imitative decision processes as informational cascades. Being different from Banerjee (1992), Bikhchandani et al. (1992) emphasize the fragility of informational cascades with respect to different types of shocks, and state that informational cascades can explain drastic change, for example, fads ³.

Following Bikhchandani et al. (1992), Lee (1993) investigates the problem of information aggregation where individuals sequentially take actions after observing all previous decisions and a private signal. In order to represent the accurate aggregation of information, the author gives the definition of a fully revealing informational cascade, which is that "the convergence of the limit that is the optimal action under the true state". The author shows that an information cascade in the sense of Bikhchandani et al. (1992) has a positive probability of being non-fully revealing. Then, the author presents the necessary and sufficient conditions for the occurrence of the fully revealing informational cascade. Similarly, by developing an informational cascade model based on Bikhchandani et al. (1992), SgROI (2002) evaluates the strategy of forcing a subset of individuals to make their decision early from the perspective of a social planner. For example, supposing that the social planner is a firm with a valuable or valueless product, the author states that promotional activity by the firm can be explained as a reaction to concern about information cascade. Through a special promotion about new products, the firm uses early decision-makers in markets to raise the chance that an information cascade favours the new products.

Financial markets are an important economic environment where informational conformity manifest itself in exogenous sequences (Park and Sabourian, 2006). The informational conformity models about financial markets specially assume that the investment decisions of early individuals are reflected in the investment's subsequent price. The reason is that prices in financial markets are flexible and react to the order flow. For example, Avery and Zemsky (1998) have tackled the relationship between asset prices and herd behaviour in a stock market. Here, herd behaviour means traders follow the trend in past trades. In this model, where trade is exogenous sequential, the price is set by a market maker and adjusts to the order

³ A fad is something that people are interested in for only a short period of time.

flow. The authors show that when traders have uncertainty about the new asset value on a single dimension (the effect of a shock to the asset value), price adjustments prevent any herd behaviour. When the traders have uncertainty on two dimensions (the shock's existence and the shock's effect), the herd behaviour arises. When the traders have a third dimension of uncertainty (the quality of traders' information, i.e., whether traders are well or poorly informed on average about the new asset value), the herd behaviour can be significant. These results indicate that multiple dimensions of uncertainty overwhelm the price mechanism, then herd behaviour becomes possible. The authors suggest that multi-dimensional prices can make the herd behaviour less compared to a single dimension price.

Recently, Cipriani and Guarino (2008) study an exogenously sequential trading financial market where there are gains from trade. The authors show that there is an informational cascade where all traders with the same preference choose the same action. As a result, prices fail to aggregate information that is dispersed among traders. The results show that informational cascades generate long-lasting misalignments between prices and the fundamental value of assets, and the misalignments can provoke financial crisis. Similarly, Akerlof and Shiller (2010) explain that informational cascades are a key ingredient in the explanation of damaging asset price bubbles.

3.1.2 Models of endogenous sequential decision

Decisions may occur in sequence in some applications, for example, stock purchases coming across a ticker tape, but the order of decisions is not exogenously specified as it is in Subsection 3.1.1. In reality, there is usually no rule which specifies that players have to make decisions in an exogenous order. A more realistic setting would allow sequentiality to be endogenously defined though letting individuals choose the timing of their decisions.

Obviously, if individuals can choose the time when they can take their decisions, they would learn information from individuals' actions as in the case of exogenous timing, but they would also learn information from individuals' inaction. Because inaction as waiting gives information, the result that information cascades can lead to an inefficient social outcome may no longer hold. Endogenous timing therefore may change the model predictions of the above subsection. For example, it can be the case during a negotiation process between a potential borrower and different banks. One of the banks usually has better private information because of his thorough research. All other banks who are identical would want to wait for watching this bank's actions. If this bank is willing to lend money at some specific conditions, they will follow even at somewhat inferior conditions. Therefore, when timing is endogenous, it happens that one does not observe a sequence of choices, but a cluster of simultaneous choices.

As pioneers of the introduction of the endogenous timing of decisions, Chamley and Gale (1994) and Gul and Lundholm (1995) explain why some individuals act as leaders and others as followers on the basis of informational differences. Similarly, Plott, Wit and Yang (2003) theoretically analyse “parimutuel” betting⁴ experiments with an endogenously determined order of play.

Concretely, Chamley and Gale (1994) offer a model of irreversible investment where individuals with private signals about a project have a choice as whether to invest or to delay. This model is similar to that of Bikhchandani et al. (1992), but in Chamley and Gale (1994)’s model the timing about investors to choose their actions is endogenous. The authors find that in equilibrium there is a delay. The advantage of the delay is that an investor can gain information by observing the actions of other investors. But if every investor chooses to wait, there would be no advantage to delay. Thus, in equilibrium investors follow randomized strategies in deciding how long to delay before being the first to invest. Because delay is costly, more informed investors tend to decide earlier than less informed investors. Because choices over time are ordered in this way, information is revealed by earlier choices and the reverse informational cascade is less likely. The authors establish that when the period length is short, the game ends quickly and there is a form of informational cascade which results in a collapse of investment; and when the period length increases, the possibility of informational cascades disappears.

Compared with Chamley and Gale (1994)’s discrete time framework, Gul and Lundholm (1995) develop a similar model with continuous time. The authors show that continuous timing would perfectly reveal signals and therefore ensure that the optimal choice is made with perfect information revelation and minimal delay. Being closely related to Chamley and Gale (1994) and Gul and Lundholm (1995), Zhang (1997) study the phenomenon of informational cascades in a continuous time framework, where individuals can endogenously choose both the actions and the timing of their actions. In contrast to Chamley and Gale (1994), the author assumes that individuals may privately know not only about the contents of their private information, but also about its precision. This additional information generates a pure strategy equilibrium. An informational cascade about investment with a strategic delay occurs in the equilibrium. Chamley and Gale (1994) do not have an immediate onset of information cascade, while Zhang (1997) gets a sudden onset which illustrates the rapid nature of information cascades, and shows that a strategic delay exist before the sudden onset. Contrasted with the results of Gul and Lundholm (1995) about efficiency, Zhang (1997) examines the loss of welfare from delay and information cascades. The loss lies on

⁴Parimutuel betting (from the French: *Pari Mutuel* or mutual betting) is a betting system in which all bets of a particular type are placed together in a pool, when taxes and the “house-take” are removed, payoff odds are calculated by sharing the pool among all winning bets.

the assumptions of discrete investment choice and uncertainty about the precision of private information.

More recently, Chari and Kehoe (2004) show that when there is a binary decision between whether or not to invest and an endogenous choice of timing which is consistent with Chamley and Gale (1994), information cascades remain in which the reverse informational cascades still occur even when individuals have the opportunity to share information, because individuals do not have an incentive to communicate truthfully. As another example, Chamley (2004) presents a model based on social learning with irreversible investment and endogenous timing to analyze the aggregation of information for any distribution of private information. The author finds that multiple equilibria and strategic complementarities arise, which are generated by informational externalities. The equilibria generate significantly different amounts of information separately. In the previous study such as Chamley and Gale (1994) which assumes that all individuals have the same beliefs, the multiple equilibria could not appear, because the multiple equilibria appear only at different points of the distribution of beliefs.

3.1.3 Models of non-sequential decision

The assumption about sequential process in which (i) individuals enter the market one by one whose order is decided exogenously or endogenously, (ii) individual decisions are irreversible, and (iii) each individual only observes his predecessors, is quite unrealistic most of the time. The more realistic assumption should be that each individual is present and decisions are reversible. Thus, many papers propose a new framework assuming non-sequential decision (Froot, Scharfstein and Stein, 1992; Hirshleifer, Subrahmanyam and Titman, 1994; Orléan, 1995; Bala and Goyal, 2001). In these models, individual beliefs are modified endogenously as a result of interaction between them.

Concretely, Froot, Scharfstein and Stein (1992) indirectly introduce the non-sequentiality assumption assuming that individuals plan not to hold assets forever. Each individual tries to learn information from others with short horizons. The authors show that individuals may herd on the same information, when they want to learn what other informed traders know. There can be multiple informational cascades equilibria where herding individuals choose to study the completely unrealistic information. Hirshleifer, Subrahmanyam and Titman (1994) analyse information acquisition equilibria about a non-sequential trading behaviour when some investors receive common private information before others. It is contrary to the existing model of information acquisition in which all informed investors receive their information simultaneously. The authors show that, under some conditions, investors will focus on a subset of securities (“information cascades”), while neglecting other securities with identical exogenous characteristics. In this model, the sequential nature of information arrival

has a significant effect on both the trading decisions and the types of information collected by investors: high-ability investors uncover the payoff-relevant information early, while low-ability investors uncover the information later. More importantly, Orléan (1995) analyzes informational cascades through dropping the assumption of sequential decision directly, and generalizes his results in non-sequential contexts, where individuals are simultaneously present, make a decision and, some time later, can change it. The author studies the collective learning process through which a group of interacting players deal with environmental uncertainty. The key point is the relative weight which is given by each player to his private information and his observation of the group opinion. When the individuals give greater weight to his observation of the group opinion, the process of collective decision will converge on an informational cascade through learning information.

3.2 Models of compliance conformity

After reviewing models of informational conformity, we begin to review models of compliance conformity through two subsections. In the first subsection, compliance conformity is produced endogenously in equilibria. This endogenous compliance conformity is used as a strategy by people consciously for purposes, such as avoiding punishments, gaining reputations, and so on. In the second subsection, compliance conformity is assumed to be exogenous as a conformity preference term in individual utility functions arising from a desire to be emulated. This exogenous compliance conformity is unconscious and untended, i.e., people with the exogenous compliance conformity are conforming purely and truly. Especially, in the second subsection, we underline some papers about exogenous compliance conformity in voting contexts, because our two models in Chapter 4 and Chapter 5 concern voters with conformity preference that is exogenous compliance conformity.

3.2.1 Compliance conformity is produced endogenously from external pressure

An indirect preference for conformity as endogenous compliance conformity is produced by individual's rational responses to external pressure because of social norm. Being opposed to legal rules which are formal rules and promulgated by the court, social norms are informal rules that indicate individuals to take actions. For example, we give tips at restaurants, we offer our seats to children and the elderly in public transportation, we follow local rituals for tourists touch the left foot of John Harvard's statue in Harvard University for good luck, and so on. In fact, many social norms are inconsistent with selfish actions, for examples,

“a norm of fairness”, “a norm of tipping”, “a norm of donation to a public charity”, and “a norm of not cheating in a business transaction, may contradict private self interest (Elster, 1989; Fershtman, Gneezy and List, 2009). However, some norms are socially undesirable, for example, in some communities, social norms encourage a lack of education, promiscuity, abuse of alcohol, or unlawful drugs (Sunstein, 1996).

External pressure from social norms are often powerful, very substantial, and cannot be ignored (Evans, Oates and Schwab, 1992; Sunstein, 1996). Concretely, having arisen from either deviating from well-established social norms (Kandel and Lazear, 1992) or acting differently from social norms as average action (Akerlof, 1980; Bernheim, 1994), the external pressure can be strong enough to coerce individuals to conform. Such examples about well-established norms in some communities are no littering, no race discrimination and no parenthood out of wedlock. Social norms as average action manifest itself when we buy a certain book or a piece of clothing because we think that many other people are reading that book or wearing that piece of clothing.

In sum, theoretical studies in economics use two different mechanisms to explain endogenous compliance conformity: (1) endogenous compliance conformity with a well-established group norm, and (2) endogenous compliance conformity with an endogenous social norm (i.e. average action).

3.2.1.1 Endogenous compliance conformity from a well-established group norm

Individuals are taught to adhere to well-established group norms from early ages from sources such as parents, peers and the media (Good and Sanchez, 2010). For example, leaving a tip for the waiters, wearing formally in a fine dining restaurant, being kind to old persons (like opening a door or giving up your seat), not smoking in public, no ethnic prejudice, and so on. Why do people adhere to well-established group norms? The reason is that when individuals deviate from a well-established group norm, external pressure as peer pressure arises. For example, individuals are penalized as feeling ashamed from peer pressure for working less than the group norm. Alternatively, a teenager observing many peers smoking may be more inclined to smoke himself (Krauth, 2006). While immediately costly, conforming caused by peer pressure because of a well-established group norm is better than non-conforming because such conformity leads to better treatment by others (Kreps, 1997) and creates mutual positive externality (Katz and Shapiro, 1986; Banerjee and Besley, 1990). Moreover, such conformity can give rise to multiple equilibria and coordinate the selection of some particular equilibria (Kandori, Mailath and Rob, 1993).

Mengel (2009) introduces a social norm that each individual is more accepted by his group when his choice is a more “popular” action. The author analyzes a local interaction model where individuals play a bilateral prisoners dilemma game with their neighbors, and identifies that endogenous compliance conformity from a well-established group norm is a new mechanism that can stabilize cooperation. In order to present a simple example for the Mengel (2009)’s model, we look at a standard prisoners’ dilemma from Luzzati (1999) in the following strategic form in Table 3.1:

	Cooperation	Non-cooperation
Cooperation	4, 4	-3, <u>5</u>
Non-cooperation	<u>5</u> , -3	<u>0</u> , <u>0</u>

Table 3.1: The standard prisoners’ dilemma in Luzzati (1999).

In Table 3.1, when individuals who play the bilateral prisoner’s dilemma game are only payoff-biased, the unique stable outcome is one where each individual chooses non-cooperation.

Now the author adds a conformist-bias into the game by supposing that a well-established group norm makes each individual feel uneasy when his choice is different from the other, because of peer pressure, and has a loss of 2 in each person’s utility. The new payoffs give a qualitatively new output where the mutual cooperation becomes a possible Nash equilibrium (see Table 3.2):

	Cooperation	Non-cooperation
Cooperation	<u>4</u> , <u>4</u>	-5, 3
Non-cooperation	3, -5	<u>0</u> , <u>0</u>

Table 3.2: The standard prisoners’ dilemma with the mutual cooperation in Luzzati (1999).

This example shows that introducing a well-established group norm which motivates people want to act similarly, can be interpreted as a mechanism that is able to solve prisoners’ dilemmas situation. In conclusion, Mengel (2009) finds that full cooperation always emerges and conformism is thus identified as a new mechanism that can stabilize cooperation.

Endogenous compliance conformity has been considered initially with a well-established group norm as the fairness norm in Akerlof (1980). In short, a non-individualistic individual’s utility in Akerlof (1980) depends on five arguments:

$$U = U(G, R, A, d^C, E),$$

where G is a vector representing his consumption of material goods and services, R represents his reputation in the community, A is a dummy variable representing his obedience or disobedience of the fairness group norm (Particularly, if the agent obeys the norm, A zero, and if the agent fails to obey the norm, A equals unity.), d^C is a dummy variable representing his belief or disbelief in this well-established group norm (Particularly, if the agent believes in the norm, d^C equals unity, but if the agent does not believe in the norm, d^C equals zero.) and E represents his personal tastes.

Furthermore,

$$R = R(A, \mu),$$

where μ is the the portion of the population who believe in the fairness norm. This formulation means that the reputation of an individual depends on his obedience of the code of behavior of the community and on the fraction of persons who believe the fairness group norm. The larger the number of believers, the more reputation is lost by disobedience of the code. Accordingly, R can be rewritten more concretely as

$$R = -A\mu\bar{R},$$

where A is a dummy variable earlier defined, μ is also a earlier defined variable, i.e., the fraction of persons who believe in the norm, \bar{R} is a positive constant.

Akerlof (1980) uses his model show that even though a norm is disadvantageous to each individual, it persists without erosion in multi-equilibria: short-run equilibrium and long-run equilibrium. The short-run term means that the fraction μ is fixed. The long-run term means the fraction of persons who obey the norm in the long run must equal the fraction μ . The fairness norm is one example of such a norm. Individuals may adhere to the fairness norm with considerations of peer pressure, though they can obtain pecuniary gains which are derived from violation of the norm, when the costs of violation in the utility function of Akerlof (1980)'s model outweigh the pecuniary gains at the margin. Consequently, the fairness norm can persist and implies a stable equilibrium with a stable number of individuals believe the norm and a stable number of individuals who obey the norm. In this fashion, the author provides an explanation for involuntary unemployment. The model also admits another stable equilibrium, where individuals neither believe in nor adhere to the group norm. In this case, the group norm violation is so widespread that the utility cost of further violation from external pressure because of social fairness norm is minimal.

Following Akerlof (1980), Azar (2004) claims that endogenously conforming to the social norm is undoubtedly a major reason for tipping. In his model, he assumes that a social norm of tipping exists, and that each consumer's utility function is additively separable with respect to both its traditional components and its social-norm components. More specifically, the

utility function is given by

$$u(g; n_t, \theta) = d(g - n_t) + \theta p(g) - bg,$$

where g is the tip in percentage of the bill, n_t is the well-established group norm of tipping (as a percentage of the bill) in period t , d is a function representing the disutility from social disapproval, p with $p' \geq 0$ is the utility from tipping that arises from feeling generous, $\theta \geq 0$ captures the degree of positive feelings that the customer gains from tipping, and b is the bill size ($b > 0$). Thus, when given the values of n_t and θ , the consumer maximizes his utility by choosing g under the obvious constraint $g \geq 0$.

Azar (2004)'s model suggests that if all consumers derive no benefits from tipping (i.e., $\theta = 0$) and tip only because this is a norm, any tip percentage as the norm decreases to zero over a finite number of periods. However, we usually tip taxi drivers and waiters of restaurants. Historical evidence from reality suggests that tipping is popular. This shows that the condition $\theta > 0$ is necessary in this model. It implies that consumers have got benefits to follow the social norm of tipping, therefore increase their utility. For example, the benefits may be the improving self-image as being generous and good-hearted. For another example, the benefits may be a desire for reciprocity and fairness. Thus, we reward people who help or serve us.

Bernheim (1994) gives a seminal model of endogenous compliance conformity considering a well-established group norm from social pressure for seeking reputations. Compared with Akerlof (1980), Bernheim (1994) at least has two important differences. First, in Akerlof (1980) there is always an equilibrium in which no one adheres to any well-established group norms. Akerlof (1980) doesn't explain how well established group norms come into being in the first place. In Bernheim (1994), the existence or nonexistence of well-established norms is explained by identifiable preference parameters. Second, Akerlof (1980) simply assumes that utility changes discontinuously when one departs from the well-established norm. In contrast, Bernheim (1994) assumes that when one departs from the norm, his utility changes continuously. Under some circumstances in Bernheim (1994), popularity does vary discontinuously with actions. Thus, this is obviously not assumed, and this is derived as a consequence of equilibrium. Moreover, Bernheim (1994)'s model is characterized by assuming that an individual cares for his intrinsic utility, determined by his own action and his status. The status is determined by the type others infer him to have and is taken as an endogenous conformity measure. It depends on the type others infer him to have rather than on his actions. The author states that there are four separate justifications for defining preference directly over a social status variable. First, the assumption that individuals care about status is consistent with social psychological evidence. Second, evolutionary pressure could well produce preference of this form. On a purely biological level, individuals who are more highly regarded have

greater opportunities to reproduce or to be protected by social groups. Third, behavioural conditioning may foster the development of preference for normal status. If individuals with social status generally receive better treatment, then the status-enhancing activities will be reinforced. Individuals may come to desire social status, even when the enhancement of status serves no concrete purpose. Finally, although having heterogeneous status, all individuals prefer to be perceived having a “normal” status that is a well-established norm.

More specifically, in Bernheim (1994)’s model each individual chooses a publicly observable variable x from the set $X = [0, 2]$ and has a type t from the set of individual types $T = [0, 2]$. An individual’s type t indicates his intrinsic bliss point (IBP). Specifically, there is a utility function $g(x - t) : [0, 2] \rightarrow \mathbb{R}$ and an individual of type t receives intrinsic utility $g(x - t)$ from playing action x . First, the author assumes that the function g is twice continuously differentiable, strictly concave, symmetric ($g(z) = g(-z)$) and achieves a maximum at $z = 0$. Second, the author assumes that the actual population is a continuum. The distribution of types within the population is described by a cumulative density function F defined on set T and a corresponding probability density function f . This assumption means that the value domain $[f] = T$ and f is continuous. Finally, the author assumes that an individual’s type is private information and individuals care about high esteem (i.e. social status) according to the type that they are inferred to be, in addition to their intrinsic preferences. Specifically, there exists an esteem function $h(b) : [0, 2] \rightarrow \mathbb{R}$, where $h(b)$ is the esteem accorded to an individual who is perceived to be of type b . The author assumes that the function $h(\cdot)$ is twice continuously differentiable, strictly concave, symmetric ($h(1 + z) = h(1 - z)$) and achieves a maximum at $b = 1$.

Because an individual’s type is private information, others must use his action as a signal of his type. Specifically, let $\phi(b, x)$ be the inference function where $\phi(b, x)$ denotes the probability that an individual whose action is x is inferred to be of type b . More formally, the function $\phi(\cdot, x)$ must satisfy

$$\int_T \phi(\cdot, x) db = 1, \forall x \in X.$$

The payoff of an individual in Bernheim (1994) is a weighted sum of intrinsic utility and reputation. Specifically, given inference function $\phi(b, x)$, the payoff of an individual of type t from playing action x is

$$U(x, t, \phi) = g(x - t) + \lambda \int_T h(b) \phi(b, x) db,$$

where the scalar λ summarizes the weight that each individual attaches to reputation, relative

to intrinsic utility. In short, each individual chooses an action x to maximize $U(x, t, \phi)$ where x is the playing action, t is the individual's type, and $\phi(b, x)$ is the probability that an individual whose action is x is inferred to be of type b .

After giving the model, Bernheim (1994) first analyzes fully separating equilibria, where no conformity occurs. Second, the model characterizes incomplete separation equilibria, where conformity occurs. Using an incomplete separation equilibrium, the model shows that when status is sufficiently more important compared with intrinsic utility, many individuals conform to a single, homogeneous standard of behavior, despite heterogeneous preferences. Here, the single, homogeneous standard of behavior is settled as an average of all possible status. It is because the fact that even small departures from the social norm standard can seriously impair individuals' status. It worth noting that the fact is produced endogenously in the model. Besides, the author identifies the role of independent individuals, who have extreme preferences. Even though the penalty for refusing to conform is harsher, they do not conform. It suggests the distribution of individuals' intrinsic preferences affects how social standards of behavior involve.

Being similar in spirit with Bernheim (1994), Prendergast (1993) illustrates that a desire of workers to conform arises endogenously by relative-performance nature of incentive contract. There are two individuals in a firm, a manager and a worker. Both them observe imperfectly the true value of a parameter about whether a project is profitable, and estimate it. Then the worker reports his estimation to the manager. An incentive contract states that the performance of the worker is evaluated only using the manager's opinion about him. Because of the incentive contract, the worker' incentive is to distort his report in the direction of what he believes that the manager wants to hear. The author shows that communication between the manager and the worker makes the worker conform endogenously, and illustrates that the endogenous conformity implies inefficiencies. Therefore, the incentive contract can be optimal for the manager because he wants to induce the worker to make effort, but the manager cannot make the contract contingent on the true state.

Brock and Durlauf (2001) provide an analysis of aggregate behavioural outcomes where individuals face incentives to conform their behaviour to the mean of a common reference. The authors capture a pure conformity effect of the type studied by Bernheim (1994). In Brock and Durlauf (2001), the population of individuals is I and each individual i must choose a binary action w_i from the set $\{-1, 1\}$, where w denotes (w_1, \dots, w_I) and w_{-i} denotes $(w_1, \dots, w_{i-1}, w_{i+1}, \dots, w_I)$. Individual utility is assumed to consist of three components

$$V(w_i) = u(w_i) - \frac{J}{2}(w_i - \bar{m}_i^e)^2 + \varepsilon(w_i),$$

where the constant $J > 0$ and $\bar{m}_i^e = (I - 1)^{-1} \sum_{j \neq i} m_{i,j}^e$. The first term $u(w_i)$ is the private utility of individual i with his choice w_i . The second term $-\frac{J}{2}(w_i - \bar{m}_i^e)^2$ embodies conformity

effects. The last term $\varepsilon(w_i)$ is a random utility term, which is independently and identically distributed across the individuals and known by individual i at the time of his decision. The authors show multiplicity of equilibria exist when conformity effects are large enough and decision-making is noncooperative.

Cartwright (2009) recently analyzes a model based on the model of Bernheim (1994) with contrasting references. The author assumes that, when they are given a strong form of references, all non-conforming individuals have extreme preferences and can expect to receive low esteem. But when they are given a weaker form of references, all non-conforming individuals are inferred to have average preference and can expect a smaller fall in esteem. The implication of the model is that the type of references does not influence whether a conformist equilibrium exists. But the type of references has an impact on the size of the set of conformist equilibria. Therefore, a weakening of references is an equilibrium selection device. In voting, Schmidt (2013) examines whether survey data supports that group association influences the individual's stated beliefs. In this model, individuals may choose to state opinions which are contrary to their true beliefs in order to fit in when the decision of the individuals to join the group is made. Here, the issue is the need to fit in or the search for reputation. The theory of conformity of Bernheim (1994) gives a good explanation for Schmidt (2013)'s results.

3.2.1.2 Endogenous compliance conformity from the endogenous social norm (average action)

Except for well-established group norms, economists have also considered endogenous compliance conformity with endogenous social norms (i.e. average action). For instance, Clark and Oswald (1998), Gangopadhyay, Rahman and Bhattacharya (2014), and Gillen (2015). Examples about endogenous social norms are eating with forks or chopsticks or even hands, wearing clothing being similar to a similar style that others wear, salutes with shaking hands or kisses when meeting someone, and so on.

Inspired by Bernheim (1994), Gillen (2015) analyses endogenous compliance conformity for a population in which individuals gain utility by mimicking the endogenous social norm (average action) rather than average status as a well-established group norm in Bernheim (1994). Modeling the endogenous social norm as the average action reflects the social desire to be a trendsetter whose preference defines social norms rather than a mere norm follower. Gillen (2015) illustrates how adding structural features of the model to help identify social norms from observed behaviors.

Concretely, the model follows Bernheim (1994). A large number, I , of individuals, are indexed by i , who are each privately assigned a type $t \in [0, 2] \equiv T$. Players' types are privately

observed, but each player chooses a publicly observable action, $a_i \in [0, 2] \equiv A$, that may depend on their true type. The types are drawn independently from T according to the distribution $F(\cdot)$, with continuous density $f(\cdot)$ bounded away from zero, and $F(2) = 1$. The individual's type (t) represents their "Intrinsic Bliss Point" (IBP), which implies the function $g(a - t)$ is maximized at $a = t$. Accordingly, the model assumes that intrinsic utility rewards actions close to an individual's IBP. An individual's social utility is maximized when their perceived type, based on their action, is near a "Social Bliss Point" (SBP) denoted by α . Let b_i represent the individual i 's perceived type. His preference is reflected in the function $h(b_i - \alpha)$. Both g and h are maximized at zero, twice continuously differentiable, strictly concave, and symmetric, mainly to ensure the conformity result is not driven by a discontinuity in preference.

With social bliss point α , a player's total utility given their type t , action a , and perceived type b , combines intrinsic and social utility:

$$u(a, t; b; \alpha; \lambda) = g(a - t) + \lambda h(b - \alpha).$$

where λ as the weight on an individual's social utility is referred to as the social preference intensity.

To link the SBP to players' behaviours, the author assume that the *SBP* matches the expected action, i.e., $\alpha = E_f[a(t)]$ ⁵. An inference function $\phi(b, a; \alpha; \lambda)$ represents the probability a player assigns to being perceived as type b when taking the action a . As the *SBP* is influenced by others' behaviour, players also form beliefs about α , here represented by the distribution $\pi(\alpha; \lambda)$. Given all these beliefs, an individual's utility maximization problem is presented:

$$\max_{a \in A} E[\mu(a, t; \alpha, \lambda)] = g(a - t) + \lambda \int_{\hat{\alpha} \in T} \left(\int_{b \in T} h(b - \hat{\alpha}) \phi(b, a; \hat{\alpha}, \lambda) db \right) d\pi(\hat{\alpha}; \lambda).$$

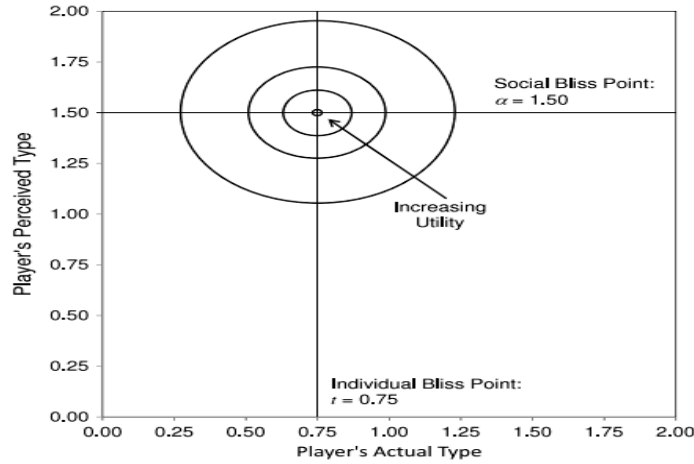
With the social bliss point matching the population expected action, the beliefs $\pi(\alpha, \lambda)$ reduce to a degenerate point distribution and the double integral becomes a single expectation. The author fixes $\hat{\alpha} = E_\pi[\alpha]$, and the optimization problem becomes:

$$\max_{a \in A} E[\mu(a, t; \hat{\alpha}, \lambda)] = g(a - t) + \lambda \int_{b \in T} h(b - \hat{\alpha}) \phi(b, a; \hat{\alpha}, \lambda) db.$$

The Figure 3.2 below illustrates individual preference in a quadratic example. The most interesting result is that this extension does not alter the properties of equilibria established in Bernheim (1994)'s initial development: social preference generally implies more concentrated behaviours and a conformist pool form when social preference is sufficiently prominent.

⁵With many players, the SBP could be a measurable function of players' observed actions, such as the average action actually chosen by players in the game.

Further the extension introduces no new equilibria, because though Bernheim (1994)'s development included a multiplicity of locations for conformist outcomes, these outcomes are identified exactly by the location of the social norm within the extended model. In addition to illustrating the determinants of conformist behaviour with an endogenous reference point, Gillen (2015)'s findings support applied work inferring social norms from average behaviour.



An individual's indifference curves in the (a, b) plane appear as concentric circles centred on the point (t, α) (Figure 3.2 is from Gillen (2015)).

Figure 3.2: The Bernheim (1994)'s individual with preference in “spherical case” sets $g(z) = -z^2$ and $h(b; \alpha) = -(b - \alpha)^2$.

Different from Gillen (2015), whose work represents a typical model which includes conformity phenomenon under an endogenous social norm, Clark and Oswald (1998) considers conformity as conformist tendency in change of reference's average action under an endogenous social norm. Clark and Oswald (1998)'s endogenous social norm is that an individual has higher status when his action is higher than the mean of other people's actions. Furthermore, Clark and Oswald (1998) assume that utility depends partly upon status and it does so in a concave way. Because concern about relative status may be insufficient to bring about competitions, the authors show that individuals who want to be different from one another will, paradoxically, find it rational to imitate other people (conformity).

Let a be an individual economic action. The authors assume that this action gives utility both directly $u(a)$ and indirectly through status $v(a)$. The authors assume that action a is costly, and a^* is the mean of other people's actions. Individual utility is given by

$$U = sv(a - a^*) + (1 - s)u(a) - c(a).$$

Recall that the function v is capturing the utility from status comparisons. Its first derivative

will be taken to be positive ($v' > 0$); its second derivative may be positive or negative (corresponding to comparison-convex or comparison-concave utility). Thus, people enjoy surpassing others actions for status. The function u is increasing and concave in a . The cost function $c(a)$ is increasing and convex in a . The variable s is a parameter in the unit interval. To choose his or her optimal action, each individual maximizes his utility function. Thus, for an interior maximum,

$$sv'(a - a^*) + (1 - s)u'(a) - c'(a) = 0,$$

where the first term is the marginal benefit from status, the second is the direct marginal benefit from action a , and the third is marginal cost. The first analytical result stems from differentiating implicitly in $sv'(a - a^*) + (1 - s)u'(a) - c'(a) = 0$ to give the individual's response to others:

$$\frac{\partial a}{\partial a^*} = \frac{sv''(a - a^*)}{sv''(a - a^*) + (1 - s)u''(a) - c''(a)}.$$

The denominator on the right-hand side of this above equation is negative by the requirement from the second order condition of maximisation of utility. Hence the sign of the response of a to a^* depends upon the negative of the numerator. Therefore, comparison-concave utility, defined as $v''(a - a^*) < 0$, implies that a rise in others' actions leads the individual to increase his own action, a . The phenomenon, where individuals with comparison-concave utility follow the change of others' actions, presents conformity. The conformity phenomenon in Clark and Oswald (1998) is different from behaving identically.

Gangopadhyay, Rahman and Bhattacharya (2014)⁶ posit the elegant model of Clark and Oswald (1998) and explain why some households choose to copy others in acquiring education for poverty reduction in Bangladesh. In their model, the utility function of the household i is given by

$$\prod_i(K_i, K^*) = wV(K^* - K_i) + (1 - w)U(K_i) - L(K_i).$$

The overall utility function of the household is \prod_i , K_i is its educational expense and K^* is the educational expense of the reference group, V is the comparison utility, U is the direct utility from education, $L(K_i)$ is the cost of education of the household welfare, w is the weight that a household accords to status, or comparison. They assume a simple cubic function to represent the comparison utility as

$$V(K^* - K_i) = [(K^* - K_i)^3/3] + K_0$$

⁶The authors of Gangopadhyay et al. (2014) gain invaluable empirically findings from a field study conducted in Bangladesh. The findings show that subjects adopt conformity behaviour in educational investment. Furthermore, the findings observe several important variables which have statistically significant effects on the conformity behaviour, for example, age, marital problems, education of household head, gender and so on.

where K_0 is a constant. For simplicity, the authors set $K_0 = 0$ when deriving the following first and second order conditions.

The first-order condition to maximise utility is given by

$$\frac{\partial \Pi_i(K_i - K^*)}{\partial K_i} = wV'(K^* - K_i) + (1 - w)U'(K_i) - L'(K_i) = 0.$$

By applying the implicit function theorem, we know that

$$\frac{\partial K_i}{\partial K^*} = \frac{2w(K^* - K_i)}{[wV''(K^* - K_i) + (1 - w)U''(K_i) - L''(K_i)]}.$$

The denominator of the right hand side of above equation is negative by the requirement from the second order condition of maximisation of utility. Thus,

$$\frac{\partial K_i}{\partial K^*} > 0 \text{ if } K^* < K_i.$$

The above equation means that when $K^* < K_i$, household i follows the educational expense change of others. This is the endogenous compliance conformity with extremity effect behaviour in Clark and Oswald (1998)⁷. The endogenous conformity phenomenon in Gangopadhyay et al. (2014) is as special as in Clark and Oswald (1998), rather than behaving identically in equilibria as in Gillen (2015).

Woo (2012) uses endogenous compliance conformity's extremity effect in an inverted-U shaped model. In his model, the middle-status people present the special conformity phenomenon as Clark and Oswald (1998) and Gangopadhyay et al. (2014). In his model, individuals with an endogenous social norm are assumed to make a trade-off between something that can enhance status (positional consumption) and something that cannot (non-positional consumption). The identical utility function form is

$$u = U(c, r, l)$$

where $U_c > 0, U_r > 0, U_l > 0$.⁸ In the utility function, c is individual positional consumption (or status consumption), which generates utility gains from improving status, such as making a generous donation. $r = R(c, x)$ is status of an individual where x is the average Joneses

⁷We think that Gangopadhyay et al. (2014) have made some mistakes in explaining Equation (5a) with social conformity and Equation (5b) with social deviance. In our opinion, their Equation (5a), i.e., $\frac{\partial K_i}{\partial K^*} < 0$ if $K^* > K_i$, implies social deviance, while their Equation (5b), i.e., $\frac{\partial K_i}{\partial K^*} > 0$ if $K^* < K_i$, implies social conformity.

⁸We recall that notations about partial derivative in mathematics. U is a function in c, r and l . First-order partial derivatives: $\frac{\partial U}{\partial c} = U_c$. Second-order partial derivatives is $\frac{\partial^2 U}{\partial c^2} = U_{cc}$. Second-order mixed derivatives is $\frac{\partial^2 U}{\partial c \partial l} = \frac{\partial}{\partial c} \left(\frac{\partial U}{\partial l} \right) = U_{lc}$. Especially, when $U = U(c, r, l)$, $U_1 = U_c$ and $U_{12} = U_{cr}$, et cetera. Of course, the rest notations in our thesis about partial derivatives are deduced by analogy.

consumption⁹ (the average consumption level in a society) and is taken as given, $R_1 > 0, R_2 < 0$, and l is non-positional consumption (such as leisure). Normalizing the price of non-positional goods as unity, the budget constraint of an individual is $n, n = pc + l$. Substituting for l by the budget constraint, the consumer problem is to effectively maximize $U(c, r, n - pc)$ by choosing c . The first-order condition is

$$U_c + U_r R_1 - pU_l = 0.$$

The equilibrium positional consumption, non-positional consumption and status are functions of n . Thus, they are written as $c(n)$, $l(n)$ and $r(n)$. A standard comparative static exercise gives rise to

$$\frac{\partial c}{\partial x} = - \frac{U_{cr} R_2 + U_{rr} R_1 R_2 + U_r R_{12} - pU_{lr} R_2}{U_{cc} + 2U_{cr} R_1 - 2pU_{cl} - 2pU_{lr} R_1 + p^2 U_{ll} + U_{rr} R_1^2 + U_r R_{11}}.$$

Since the denominator is negative by the requirement from the second order condition of maximisation of utility, the sign depends on the nominator. By manipulation, the author gets

$$\frac{\partial c}{\partial x} > 0 \Leftrightarrow -\frac{U_{rr}}{U_r} > \frac{U_{cr} - pU_{lr}}{U_r R_1} + \frac{R_{12}}{R_1 R_2}.$$

The above function shows that Woo (2012) bring some assumptions to get $\frac{\partial c}{\partial x} > 0$, when the $r(n)$ is neither sufficiently high nor sufficient low, which is one of middle-status people. Going back to the the definitions of the variables c and x , the finding implies that the model produces an inverted-U shaped curve (see, Figure 3.3) r_{M_1} (c_{M_1}) is the coordinate of point M_1 in the r -axis (c -axis). The coordinates of other points are labeled similarly. For clarity, we only mark the coordinates of three points in the r -axis: r_{L_1} , r_{M_1} and r_{H_1} . The other coordinates of points in the r -axis and the c -axis are similarly available. When the status distance $|r_{M_2} - r_{M_1}|$ equals to $|r_{L_2} - r_{L_1}|$ (or $|r_{H_2} - r_{H_1}|$), the individual positional consumption distance $|c_{M_2} - c_{M_1}|$ is more than $|c_{L_2} - c_{L_1}|$ (or $|c_{H_2} - c_{H_1}|$). Thus, there is a conformity performance among the middle-status people.

⁹ Jones is a very common name and "the joneses" is merely a generic name for "the neighbours".

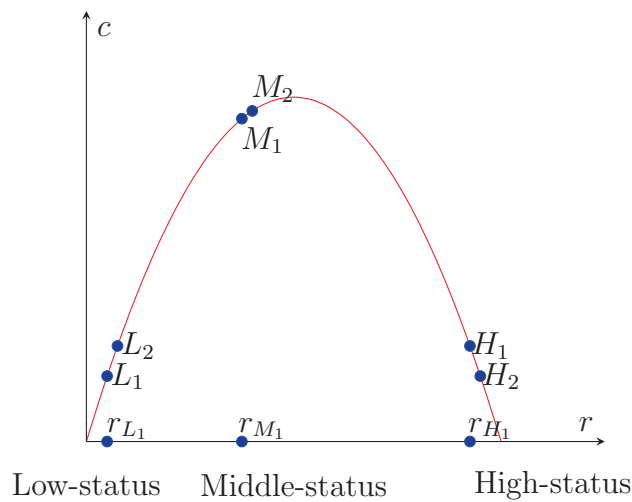


Figure 3.3: The inverted-U shaped curve showing conformity among the middle-status people.

The model explains sociologists' findings that middle-status people are "keeping up with the Joneses" while both the highest-status and lowest-status people are "running away from the Joneses". It is clear that this inverted-U shaped curve is different from the above two models (Clark and Oswald, 1998; Gangopadhyay et al., 2014), but both them present an endogenous conformist tendency about reference's action change.

Another different theory of endogenous compliance conformity is based on fund managers' reputation concerns (Scharfstein and Stein, 1990; Trueman, 1994; Graham, 1999). Because of career concerns, the question of reputation arises for a manager when the society is uncertain about his ability. One influential paper is Scharfstein and Stein (1990). The basic idea of the model is that the manager conforms with other investment professionals, if an investment manager's employer is uncertain of a manager's ability to pick the right stocks. And if professionals are in a similar situation, conformity phenomenon occurs endogenously.

Specifically, Scharfstein and Stein (1990) model a sequential investment. In the model, individuals are concerned with their reputation as good forecasters in the labor market. The authors assume that there are two types of individuals: the "smart" ones, who receive informative signals, and the "dumb" ones, who receives purely noisy signals. At first, neither the individuals themselves nor the society can identify the types. The individuals act sequentially, i.e, an individual has made an investment decision after observing the behaviour of another ex-ante identical individual. Therefore the society could update its beliefs based on two things: 1) whether the individual made a good decision, and 2) whether the individual's behaviour was similar to or different from that of others. Therefore, when a manager invests

in an *ex post* bad product, it reveals his poor quality only if the other managers did not invest in the same product. As a result, even “smart” managers prefer to follow the crowd. That is to say, if enough “dumb” managers herd on a poor decision, the “smart” managers herd instead of taking the risk with an *ex ante* better project being the only manager investing into what might turn out to be an *ex post* bad decision. Scharfstein and Stein (1990) show that because managers rationally attempt to enhance their reputation in the labour market, herd behavior arises, which is inefficient from a social point of view.

Trueman (1994) demonstrates the assumption that the forecasts publicly released by analysts reflect their private information in an unbiased manner to be not necessarily valid. The analysis shows that when analysts are given private information, they tend to release forecasts closer to prior expectations, even though their private information justifies more extreme earning forecasts. Analysts’ forecasts that are similar to prior expectations, can help him to have a better social assessment of his forecasting ability. Furthermore, the analysts exhibit herd behaviour in Scharfstein and Stein (1990), whereby they release forecasts similar to those previously announced by other analysts, even when this is not justified by their information. As another example following Scharfstein and Stein (1990), Graham (1999) builds a reputation model of herd behavior among investment newsletters. In Graham (1999)’s model, if an analyst has high reputation or low ability, or if there is strong public information that is inconsistent with the analysts private information, the analyst is likely to herd ¹⁰.

Recently, though assuming each individual cares for reputation as Scharfstein and Stein (1990), Dasgupta and Prat (2008) modify the standard sequential trading model about informational conformity from Avery and Zemsky (1998). The authors provide a clear theoretical link between the results from Scharfstein and Stein (1990) and Avery and Zemsky (1998). On the one hand, individuals in Scharfstein and Stein (1990) care only about *ex post* reputation about ability and economies prices are assumed to have no information. On the other hand, individuals in Avery and Zemsky (1998) care only about trading profits rather than reputation and economies prices play an informational role. The authors state that when individuals care only slightly about reputation in Avery and Zemsky (1998), economies prices will have only a limited information. In order to converge on true value, the economies prices need to be close to true value. However, when the economies prices is close to true value, trading profits become unimportant and reputation concerns become predominant. Then, the economy of Avery and Zemsky (1998) metamorphose into the economy of Scharfstein and Stein (1990). Because herd behaviour arises in Scharfstein and Stein (1990), the economies

¹⁰The model is tested using data covering the period 1980-1992 period and contains 5,293 recommendations made by 237 newsletters. Consistent with the model’s implications, the empirical results indicate that a newsletter analyst is likely to herd on Value Lines recommendation if her reputation is high, if her ability is low, or if signal correlation is high.

prices will have no further information. Therefore, the paper shows that there is no equilibrium where the economies prices converge to the true value. Meanwhile, the paper shows that individual reputation concern has a negative effect on the extent of information that can be revealed in equilibrium.

3.2.2 Compliance conformity is assumed to be exogenous

Though many economists assume compliance conformity endogenously, many other economists model compliance conformity exogenously within the standard theoretical economic frameworks (Jones, 1984; Akerlof, 1997). In this chapter, we review these important papers who consider the compliance conformity exogenously.

Exogenous compliance conformity is truly and unconsciously conformist, rather than as a strategy used by people consciously in endogenous compliance conformity for avoiding conflicts and gaining reputations. In exogenous compliance conformity, heterogeneous individuals need not to behave identically. There is always a conformity preference term in utility functions. Jones (1984) suggests that the term arises from a desire to be emulated (or a desire to conform). The assumption about “a desire to conform” in exogenous compliance conformity is different from the findings of “conformity preference” in experimental internalization conformity in Chapter 2. It is because that “desire to conform” is used to try to solve compliance conformity in models where individual preferences are stable, but “conformity preference” concerns internalization conformity where individual preferences can be changed.

Jones (1984) is an important book about modelling compliance conformity exogenously, where workers inherently have a desire to conform with the behavior of others in their decisions. The author assumes that there is a group of workers, indexed by i , who produce q_i . q_i depends on individual effort e_i . The workers who are assumed to have a desire to conform would be penalized for working less or more than the group norm. The penalty depends on the distance between each worker’s choice and that of all the other workers. Therefore, worker i is assumed to choose e_i for maximizing his utility function

$$U^i = U^i[W(q_i), e_i, d(q_i, q_{-i})],$$

where the first term is the utility resulting from his wages, the second term is his distaste of effort, the third term is his disutility resulting from supplying an output level far from that of the other group members. Furthermore,

$$U_1^i > 0, U_{11}^i \leq 0; U_2^i < 0, U_{22}^i \leq 0; U_3^i < 0, U_{33}^i \leq 0.$$

We recall the notations about partial derivatives¹¹. The intuition is that, firstly, the utility function is increasing and convex (at a declining rate) in the wages; secondly, the utility function is decreasing and concave (at a declining rate) in the effort and in the average distance with the groups. For ease of exposition, the author assumes that $w(e_i) = we_i$ where w is the pure price rate, individuals differ in their disutility of effort ($b_i > 0, b_i \neq b_j$), and $c \geq 0$ is identical for all workers and represents the conformity element.

Thus, each worker i chooses e_i , his effort supply, to maximize

$$U^i = we_i - b_i e_i^2 - c \sum_{j=1}^n (e_i - e_j)^2.$$

Initially, if $n = 2$, there is a non-cooperative Nash equilibrium in the model, where

$$e_1^* = \frac{(b_2 + 2c)w}{2[b_1 b_2 + (b_1 + b_2)c]},$$

$$e_2^* = \frac{(b_1 + 2c)w}{2[b_1 b_2 + (b_1 + b_2)c]}.$$

The above two functions illustrate interactions of workers in social connections through conformity, where each worker's action depends upon not only his tastes but also on his social environment i.e. who is the other worker. The fact that $e_1^* \neq e_2^*$ means that workers chose different effort levels. The conformity phenomenon where each vote chooses the same effort levels is not an endogenous result in equilibrium in Jones (1984). Furthermore, conformity phenomenon in Jones (1984) is illustrated in the following function:

$$\frac{\partial |e_1 - e_2|}{\partial c} = \frac{-(b_1 + b_2)|b_1 - b_2|w}{2[b_1 b_2 + (b_1 + b_2)c]^2} \leq 0,$$

where $|e_1 - e_2|$ is a measure of the distance between e_1 and e_2 . The reason is that this function shows that a larger degree of exogenous compliance conformity c makes $|e_1 - e_2|$ become smaller in equilibrium.

Jones (1984) as the pioneering paper that gives a basic model method to embody conformity, gives a reasonable explanation for the Hawthorne Puzzle in economic activities. The

¹¹ We present again the notations about partial derivative in mathematics. U is a function in c , r and l . First-order partial derivatives: $\frac{\partial U}{\partial c} = U_c$. Second-order partial derivatives is $\frac{\partial^2 U}{\partial c^2} = U_{cc}$. Second-order mixed derivatives is $\frac{\partial^2 U}{\partial c \partial l} = \frac{\partial}{\partial c} \left(\frac{\partial U}{\partial l} \right) = U_{lc}$. Moreover, when $U = U(c, r, l)$, $U_1 = U_c$ and $U_{12} = U_{cr}$, et cetera.

Hawthorne Puzzle ¹² is that, when a non-competitive firm implements a particular wage schedule, workers of medium output level put pressure on the lower workers of the group to increase and on the higher workers of the group to decrease. In the light of his basic model, Jones (1984) also develops a model of tradition. Here, a tradition is a pattern of behaviour, a belief, or a practice, which persists through time as a result of normative social pressure. In the model of tradition, Jones (1984) presume that half of the population of workers is new in each generation, and each new generation finds itself conforming to the traditions of the older who are the inflexible half of the population. The model of tradition shows that a good working tradition benefits firms. In addition, Jones (1984) considers another variety from his basic model as an approach to show internalization of attitudes effort.

Assuming that compliance conformity is exogenous as in Jones (1984), Akerlof (1997) discusses a simple model of conformity on the basis of a status model, in which the individual wants to minimize the social distance between himself and others. Concretely, each individual chooses his choice x . For example, x represents education consumption. The intrinsic value of x is $-ax^2 + bx + c$. \bar{x} is the average consumption of others. The parameter d describes the taste for exogenous conformity. Each individual loses utility $d|x - \bar{x}|$ from failing to conform. Therefore, the utility function of each individual is $U(x)$,

$$U(x) = -ax^2 + bx + c - d|x - \bar{x}|.$$

Each individual wants to maximize $U(x)$ through his choice x . We can see that, through $d|x - \bar{x}|$ representing exogenous compliance conformity, the endogenous social norm as \bar{x} alters individual's optimal actions in equilibrium. It may encompass sacrifices to individual's own well-being.

Following this above discussion, the author describes a generalization using the Newtonian gravity model. First, individuals inherit positions in social space. Second, individuals have static expectation as Jones (1984)'s tradition model, which is that the expected social position of all the other individuals coincide with their initial positions. Individual i then chooses x_{1i} , his new social position that is an acquired social position, to maximize

$$U_i = \sum_{j \neq i} \frac{e}{(f + |x_{0i} - x_{0j}|)(g + |x_{1i} - x_{1j}|)} + (-ax_{1i}^2 + bx_{1i} + c),$$

¹²One particular observation from the Hawthorne study is that, in the context of a particular wage schedule implemented by a non-competitive firm (such as the Western Electric Company), workers put pressure on the slower members of the working group to speed up, and the faster members of the group to slow down. Under the supposition that each worker cares only about his or her wage and disutility of effort, such "two-sided pressure" is difficult, although not impossible to explain. The fact that a straightforward interpretation cannot explain this two-sided pressure constitutes the "Hawthorne puzzle" Jones (1984).

where x_{0i} (x_{0j}) is the inherited or initial social position for individual i (j), and, similarly, x_{1j} is individual j ' new acquired social position. e , f and g are constants that describe the environment of generations.

Using the generalization, the author states that, because of the exogenous compliance conformity, individual inherited positions in social space play a dominant role in the individual choices of educational attainment and childbearing in the ethnographic contexts.

Following Jones (1984) and Akerlof (1997), recently, Patacchini and Zenou (2012) study whether exogenous compliance conformity affects criminal's activities in a social network model, where each criminal belongs to a group of best friends. Each criminal's utility function has a term $-d(e_i - \bar{e}_i)^2$, where d is the parameter describing a desire to conform, e_i is the crime effort level of criminal i , and \bar{e}_i is the average crime effort level of the best friends of i . The term reflects the influence of friends' behaviour on own action. For example, if there are three individuals in a network, individual 1 has two friends, whereas the two other individuals have only one friend who is individual 1. The conformity effect for individual 1 is $-d[e_1 - (\frac{e_2+e_3}{2})]^2$, whereas for individuals 2 and 3, respectively, we have $-d[e_2 - (\frac{e_1}{2})]^2$ and $-d[e_3 - (\frac{e_1}{2})]^2$. The authors show that conformity affect criminal activities. When criminals are *ex ante* heterogenous, in a Nash equilibrium they provide effort proportional to that of their reference group. Thus, there is no conformity phenomena. When criminals are *ex ante* identical and only different in their location of the network, under the condition that the cost of deviating from the norm is sufficiently high, all criminals provide the same effort level in equilibrium ¹³. There is conforming phenomena.

Similarly, Grajzl and Baniak (2012) assume that individuals with a desire to conform are trying to match the mean behavior of their reference group. Being different from Patacchini and Zenou (2012) who focus on conformity effects in equilibria, Grajzl and Baniak (2012) explore a framework of social interaction among individuals who have desires to conform to find when mandating behavioural conformity (centrally imposing a common expected group welfare-maximizing action) improves group welfare. Concretely, a_i denotes individual i 's action. In individual i 's utility function, $-(a_i - \bar{a}_{-i})^2$ captures i 's disutility whenever his action does not conform with the mean action \bar{a}_{-i} of the rest of the group, $\bar{a}_{-i} = (n - 1)^{-1} \sum_{j \neq i} a_j$. They find that mandating behavioral conformity is not desirable in social groups where individuals are *ex ante* homogeneous in their types and their desires to conform. On the contrary, mandating behavioral conformity is desirable in the *ex ante* heterogeneous

¹³The author brings the model to the data by using a very detailed data set of adolescent friendship networks. He finds that conformity plays an important role for all crimes, especially for petty crimes. He suggests that an effective policy should be measured by the group interactions it engenders, in addition to the possible crime reduction it implies.

social groups where the individuals who exhibit the strongest desire to conform also contribute most to group welfare.

Different from the above papers who discuss exogenous compliance conformity in quadratic functions, Carpenter (2004) models compliance conformity exogenously in “cubic functions” on the provision of a public good¹⁴. Concretely, there are a group of individuals whose size is n . Each individual is endowed with resource units e . When contributed to the public good, each unite returns benefits of m , $m \in (0, 1)$ to each individual. But if it is kept, each unite only benefits the free rider as a unit. The author assumes that p denotes the fraction of free riders in the whole group. Thus, the payoffs to contributing individual is $\pi_c = em + em(n-1)(1-p)$, and the payoffs to free riders π_{fr} is $\pi_{fr} = e + em(n-1)(1-p)$. According to the standard replicator dynamic (Taylor and Jonker, 1978; Smith, 1982), the author assumes that the growth of free riders in the population in discrete time t and $t-1$ follows:

$$p_t = p_{t-1}(\pi_{fr} - \bar{\pi}) + p_{t-1}$$

where $\bar{\pi} = p_{t-1}\pi_{fr} + (1-p_{t-1})\pi_c$. From this assumption, the growth rate depends on the differential benefit that the strategy of free rider confers on individuals when compared to the average payoff.

When the individuals are assumed to have exogenous compliance conformity preference, they have the tendency to copy the most prevalent behavior in a population. Thus, the author needs to have $\Delta p < 0$, when free riders represent less than half of the population, and $\Delta p > 0$, when free riders make up more than half of the population. Therefore, the author considers what he calls the class of “cubic” functions $c(p_{t-1})$ drawn in Figure 4.2 representing that individuals conform in time period $t-1$. For example, $c(p_{t-1}) = 60p_{t-1}^2 - 20p_{t-1} - 40p_{t-1}^3$.

Furthermore, in order to combine the incentive to conform with the incentive to free ride, the author lets the strength of conformity is measured by $0 \leq \alpha \leq 1$ compared with incentive payoff of free ride. Thus, the population evolves according to

$$p_t = (1 - \alpha)[p_{t-1}(\pi_{fr} - \bar{\pi})] + \alpha c(p_{t-1}) + p_{t-1}.$$

As a result, the author suggests that if the exogenous compliance conformity is sufficiently widespread at the beginning of a voluntary contribution game, it has an important function in accelerating the rate of free riding.

¹⁴In economics, a public good is a good that is both non-excludable and non-rival in that individuals cannot be effectively excluded from use and where use by one individual does not reduce availability to others, such as a fireworks display, street cleaning, flood control systems, national security and so on. Public goods are often related to the “free-rider” problem where people not paying for the good may continue to access it and the good may be under-produced, overused and degraded.

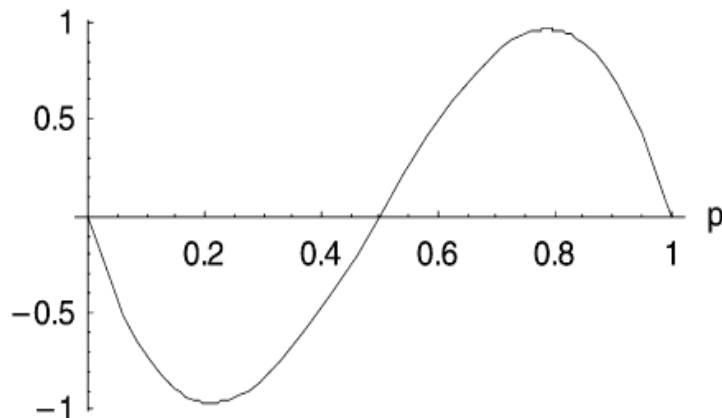


Figure 3.4: A cubic conformist dynamic (from Carpenter (2004)).

Recently, Dasgupta, Southerton, Ulph and Ulph (2015) embeds individuals in social context. It deals with consumer behaviour about a desire to conform to others' behaviour for gaining a sense of community solidarity within them, which is a pure psychological benefit. In this paper, socially embedded preference is linked to exogenous compliance conformity through consumption norms in behavioural economics. It allows that an individual's feeling of status depends on some measure of their consumption of good, c_k , and is relative to the average consumption of the reference group, \bar{c}_k . Let $f_k(c_k, \bar{c}_k)$, where $k = 1, \dots, n$, be a variable that captures the relevant status-inducing indicator of a representative individual's consumption of good k relative to the average consumption of good k . They consider individuals' exogenous compliance conformity in consumer behaviour through the assumption functions:

$$\begin{aligned} \frac{\partial f_k}{\partial c_k} &> 0, \frac{\partial f_k}{\partial \bar{c}_k} < 0, \text{ if } c_k < \bar{c}_k; \\ \frac{\partial f_k}{\partial c_k} &< 0, \frac{\partial f_k}{\partial \bar{c}_k} > 0, \text{ if } c_k > \bar{c}_k. \end{aligned}$$

The two functions give incentive for each individual to raise his own consumption towards the norm (i.e., the average), if his own consumption is below the norm, and to cut his own consumption to close the norm if his own consumption is above the norm. In addition to the consumption that individual consumption behaviour is influenced by the consumption decisions of others, the authors maintain the traditional assumption that individuals maximise their individual well being. They explain how endogenous consumption norms change individual consumer behaviour, which norms can emerge as equilibrium norms, and how many norms there may be. With respect to environmental policy which concerns environmental damages caused by individual consumptions, the implication of this paper is plain, even if left unstated.

In addition, Buechel, Hellmann and Klößner (2015) give a dynamic model of opinion formation in social networks about exogenous compliance conformity. In the model, there are leaders, conformist, and honest agents. The agents express their decision according to their true opinions and their preferences for conformity (i.e., exogenous compliance conformity). The conformist agents update opinions by averaging over their neighbors expressed opinions, but may misrepresent their own opinions by conforming with their neighbors. The paper shows that reducing prominence of individuals increases the accuracy of information aggregation. The paper also shows that an individual's social influence on the long-run group opinion is decreasing in exogenous compliance conformity. Moreover, the paper turns out that misrepresentation of opinions may enhance the efficiency of information aggregation. Given the network, the paper provides us with the optimal distribution of conformity levels in the society and shows which individuals should be more conforming in order to increase wisdom. In sum, the paper is the first contribution to incorporate misrepresentation of opinions among naive individuals by assuming that individuals depart from their true opinion because of their exogenous compliance conformity preference, i.e., to conform with their peer group's opinion.

Going back to read the above two sections, we note that the big difference between informational conformity and compliance conformity in models is timing. Because of the need to exchange the information among the individuals, informational conformity is always found in a dynamic process. On the contrary, the compliance conformity can be captured in a static process, because the feature of compliance conformity is the unwillingness to deviate from something.

3.2.3 Economic voting models with exogenous compliance conformity

Economic voting models are very different from other economic models. It is because each decision maker's action determines the outcome for himself in the other economic models, but each voter in economic voting models knows that the outcome will be determined by the electorate jointly. In this subsection, we specifically show the work of economists who model compliance conformity as an exogenous variable in voting models. Specifically, we first review economists' work in voting models, then we concentrate on economists' modelling work about exogenous compliance conformity in voting.

3.2.3.1 Standard economic voting models

In standard voting environment, voters are assumed to care only about the identity of the winning candidate. Theoretical economic research about standard voting models has focused

on two cases. In one case, voting models are about simultaneous voting, where voters vote simultaneously and know nothing about any votes when they vote (Austen-Smith and Banks, 1996; Feddersen and Pesendorfer, 1998). In the other case, voting models are about sequential voting, where voters vote following a fixed ordering rule that specifies which voter votes first, second, and so on. Therefore, voters know how those preceding him have voted when they decide themselves to vote (Sloth, 1993; Fey, 1996; Wit, 1997; Dekel and Piccione, 2000).

It is no doubt that simultaneous voting is used widely in real world, such as in many electoral and legislative settings. But being contrary to popular perception, sequential voting is also used everywhere. For example, voting about presidential primaries¹⁵, voting about roll-call in legislatures (i.e., voting in some aspects of deliberation in the US Senate, the US Supreme Court, the UN Security Council, some city councils), and so on. Many economic experimental papers have contrasted voters' behavior between in sequential voting and in simultaneous voting (Morton and Williams, 1999; Battaglini, Morton and Palfrey, 2007; Dasgupta, Ranzazzo, Sheehan and Williams, 2008). More importantly, many economic theoretical papers have separately discussed simultaneous voting and sequential voting, or focused on comparing them. Below, we present these theoretical papers in detail.

Austen-Smith and Banks (1996) present a standard theoretical simultaneous model about strategic voting and incomplete information. In the model, there is a pair of candidates (A and B), and two possible states of the world labeled A and B . There are n voters ($n \geq 5$) and n is odd. The voters possess a common preference for selecting the correct candidate, represented by

$$\forall i \in N, N = \{1, \dots, n\}, u_i(A, A) = u_i(B, B) = 1 \quad \text{and} \quad u_i(A, B) = u_i(B, A) = 0.$$

The first argument of u_i describes the candidate selected by voter i . The second argument of u_i describes the state. The voters are imperfectly informed about the true state of the world. The common prior probability that the true state is A is denoted by π , $\pi \in (0, 1)$. Before making voting decision over the two candidates, voter i receives a private signal s_i , $s_i \in \{0, 1\}$, about the true state of the world. s_i is independently drawn from a state-dependent distribution satisfying

$$Pr[s_i = 0|A] = q_a \in \left(\frac{1}{2}, 1\right) \quad \text{and} \quad Pr[s_i = 1|B] = q_b \in \left(\frac{1}{2}, 1\right).$$

After observing the signal s_i , voter i updates her prior belief, π , using Bayes' rule¹⁶. Voter i votes with a strategy $v_i(s_i) : \{0, 1\} \rightarrow \{A, B\}$, and $v(s) = (v_1(s_1), \dots, v_n(s_n))$.

¹⁵The American presidential nomination process consists of a series of elections (primaries) which are held across many states and territories at different times. Thus, the primaries have sequential nature.

¹⁶Bayes' rule helps us update our belief about a hypothesis A in the light of new evidence B : $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$.

Austen-Smith and Banks (1996) define sincere voting means “when each voter i as a member of a collective decides which of the two outcomes to select, he behaves in exactly the same manner as when that he alone selects the outcome”. When a voting profile $v(s)$ constitutes a Bayesian Nash equilibrium, the authors define $v(s)$ is a rational voting. Assuming each voter i votes sincerely, they find that sincere voting, in which each voter selects the alternative yielding his highest expected payoff conditional on their signal or he votes as he is alone, does not constitute a Bayesian Nash equilibrium. In short, that is, if given other voters vote sincerely, the voter i does not vote as he is alone. Therefore, the authors doubt the statement from Condorcet Jury Theorem ¹⁷ that majorities invariably do better than any single individual, because this statement is based on the assumption that voters vote sincerely in the collective decision making.

Feddersen and Pesendorfer (1998) examine the implication of the incentive to vote insincerely which is demonstrated by Austen-Smith and Banks (1996). More precisely, the authors construct a model of jury decision making based on Austen-Smith and Banks (1996). Each juror must vote simultaneously either to convict or to acquit. Their model requires a unanimous verdict with a basic intuition that the unanimous verdict reduces the probability of convicting an innocent defendant. The authors demonstrate that this basic intuition is undermined by requiring the unanimous verdict. The unanimity verdict rule can lead to a high probability of convicting an innocent defendant, because voters vote strategically.

After presenting the classic economic papers about modeling simultaneous voting, we begin to present important economic papers about modeling sequential voting. Models of sequential voting seem similar to models of informational cascades (Banerjee, 1992; Bikhchandani et al., 1992). The only difference is that in informational cascades models the future choices of other players are irrelevant to the present player’s choice, but in simultaneous voting models the future voters’s choices can affect the present voter’s payoff, furthermore, the present voter’s choice. Sloth (1993) focuses on the subgame perfect Nash equilibria of roll-call voting games, where each vote is assumed to know the votes of the voters who have voted before him. The author shows that sequential voting works as a refinement (like subgame perfect equilibria) in a perfect information environment. Being different from Sloth (1993)’s interests, Wit (1997) is only interested in equilibria of sequential voting. He examines a special case of the two-option, two-signal, common-value environment. He shows that in the standard sequential voting models informative voting is a perfect Bayesian equilibrium, where each voter votes for an option if and only if the option is preferred following his private signal.

¹⁷The Condorcet Jury Theorem states that majorities are more likely than any single individual to select the “better” of two alternatives when there exists uncertainty about which of the two alternatives is in fact preferred.

Wanting to relate simultaneous voting to sequential voting, Dekel and Piccione (2000) explore sequential voting in symmetric two-option environments. They show that any equilibrium to the simultaneous voting game is also an equilibrium when voting is sequential. This follows from the fact that voters' focus on being pivotal and hence behave as if exactly half of the other voters favor one option over the other. Thus, the early voters' identity is irrelevant, and voters vote without being influenced by the behaviour of the early voters in the sequence. This result implies that the information aggregation obtained in simultaneous voting case from Feddersen and Pesendorfer (1998), extend immediately to all sequential voting cases. However, Ali and Kartik (2012) construct equilibria where late voters vote with being affected on the behavior of early voters, which implies that the converse of Dekel and Piccione (2000)'s conclusion is not always true, i.e, each equilibrium of the sequential voting is not necessarily an equilibrium of the simultaneous voting. Moreover, Battaglini (2005) show that when voters can abstain, Dekel and Piccione (2000)'s results are sensitive to the introduction of an arbitrarily small cost of voting: the equilibrium sets between sequential voting and sequential voting are generally disjoint, and it is possible to rank the equilibrium sets according to their informative properties.

Another interesting theoretical paper is Selman (2010). The paper investigates the issue of competition in simultaneous voting and in sequential voting. In the model, there are two candidates competing for a party leader, one is high quality and the other one is low quality. Nature chooses which one of the candidates is high quality. All voters are assumed to be either partisans of one of the candidates or uncommitted voters who support the candidate of higher expected quality. Voters receive private information about which candidate is high quality. The author shows that a sequential election outperforms simultaneous voting when partisans are imbalanced (one candidate has more partisan support). It implies that information cascade is beneficial. This result contrasts with the socially inefficient cascades in the standard herding literature.

In addition, using a model of voting and social learning, Hummel and Knight (2015) recently illustrate that simultaneous elections are preferred if the front-runner is initially only thought of as a slightly better candidate, but sequential elections are preferred if the front-runner is initially thought of as significantly stronger candidate. It is because that simultaneous elections equally weigh votes, but sequential elections place more weight on early votes.

3.2.3.2 Economic voting models with exogenous compliance conformity

Motivated by Asch (1951), Newcomb (1943) and Noelle-Neumann (1977) show that political ideologies are malleable to group social pressure. These pressure may apply *a fortiori* to vote decisions as conforming with a majority choice under simple majority voting rule in order

to join the winner, because the winner controls the government and holds some degree of arbitrary power to reward her supporters by jobs and contracts (Hinich and Pollard, 1981; Noelle-Neumann, 1983). Thus, many voters in elections care not only for the quality of the candidates but also who will win. Being similar to the economists Sunstein and Thaler (2008), we quote a passage at length below from the work of sociologist Watts (2004) about the democratic nomination of John Kerry in 2004.

A few weeks before the Iowa caucuses, Kerry's campaign seemed dead, but then he unexpectedly won Iowa, then New Hampshire, then primary after primary. How did this happen? ... For example, when New Yorkers go to vote next Tuesday, they cannot help but be influenced by Kerry's victories in Wisconsin last week. Surely those Wisconsinites knew something, and if so many of them voted for Kerry, then he must be a decent candidate. But the voters in Wisconsin were just as influenced by the decisions of voters from the previous round of primaries, who were in turn influenced by the round before theirs, and so on. ... But maybe the Dean campaign wasn't hopeless at all. Had Dean won in Iowa, he might very well have won in New Hampshire, which would in turn have dramatically improved his chances in the next,

This passage talks about an experience that each democratic voter shifted from Howard Dean to John Kerry because of a widespread perception that other people were flocking to Kerry. Similarly, empirical economic work of Niemi and Bartels (1984) and Experimental economic work of Bartels (1985) present that, regardless of their intrinsic preference, voters derive pleasure simply by being on the winning side. Furthermore, Bartels (1988) shows that the will to vote for the winner influence voters' vote choices. In Herron (1998), which is a study of 1992 U.S presidential election, when Clinton supporters think Clinton is going to win, they are significantly more likely to turn out and vote for the winner. By contrast, when Bush supporters have the same beliefs, they are less likely to turn out and abandon the loser. It is consistent with "the will to vote for the winner" among voters.

Several papers have modeled voters' desire to win. For example, Meirowitz and Wiseman (2005) consider a simultaneous voting game about campaign contribution where the contributors are assumed to have a desire to vote for the winner in addition to vote for their ideologically more preferred candidate through her policy announcement. The authors describe a contribution game where a continuum contributors ($I := [0, 1]$) decide which of two candidates ($j \in \{0, 1\}$) to announce the policy about contributions. $x(i) \in [0, 1]$ presents contributor i 's ideal point. $c_j \in [0, 1]$ ($c_0 < c_1$) is the candidate's policy stance. Contributor i 's choice is denoted by $b(i) \in \{0, 1\}$. The winner of election is denoted by $w \in \{0, 1\}$.

Thus, the contributor i 's utility function is assumed in the following form:

$$u(x(i), b, w) = -k|x(i) - c_b| + (1 - k)I_{\{w=b\}}$$

where $k \in (0, 1)$, which captures that contributor i cares about whether he donates to a winner and what is the policy announcement of the winner, and

$$I_{\{w=b\}} = \begin{cases} 1, & \text{if } w = b, \\ 0, & \text{otherwise.} \end{cases}$$

In this campaign contribution game, the authors prove that symmetric pure strategy Nash Equilibria exist. In equilibrium, contributors balance their two incentives: to donate a candidate with a desirable policy and to donate the winner. Thus, when candidate's position is exogenous, in equilibrium, contributors donate to the candidate whose policy is less desirable for them because their concerns of winning candidate. When candidate's position is endogenous, when median policies are adorable as equilibrium, any pair of candidate locations in equilibrium is adorable. In brief, their results suggest that median policy interests may not be represented in settings where the voters have substantial preference over the electoral success of the candidate they support in addition to preference over policy.

As a companion to Meirowitz and Wiseman (2005), Callander (2008) investigates simultaneous elections with incomplete information and establishes that an exogenous compliance conformity as a tendency to conform with group behaviour. Because voting rule is majority rule, the tendency to conform is called a desire to win. More precisely, in the model, $2n + 1$ voters simultaneously cast ballots for one of two candidates, A or B , where n is any positive integer. The winning candidate is determined by majority rule. Abstention is not allowed. There are two possible states of the world, A and B . Voters have identical preference dependent upon whether the better candidate is chosen, i.e., candidate A in state A and candidate B in state B , and whether they vote for the winner. The author assumes that the reward for choosing the better candidate is 1 and the reward for voting for the winner is $k(k \geq 0)$. The relative size of the utility from voting for candidate A and candidate B drives the behavior of voters. When $k = 0$, the model corresponds to the standard simultaneous model with incomplete information studied by Austen-Smith and Banks (1996) and Feddersen and Pendorfer (1998). The author finds the addition of a desire to win creates multiple equilibria. Some of the equilibria exhibit negative information aggregation, i.e., information aggregated in equilibrium helps the worse candidate get elected. It implies that voting with majority rule can produce bad outcomes in some circumstances and should not be used.

Going back to Dekel and Piccione (2000)'s sequential voting model, the author implies that some conditions are needed to make the timing mechanisms from sequential voting matter.

Callander (2007) shows that voters' desire to win is just such a condition. More precisely, Callander (2007) studies a sequential model of voting where information is incomplete and asymmetric. Each voter observes the votes of all those preceding him in the sequence and weighs that information against his private information as to which candidate is better. The author shows that in addition to desiring that the better candidate be elected, when and why that the novel assumption that voters possess a desire to vote for the winner induce conformity as the bandwagon on the equilibrium path. Here, the bandwagon refers to when voters disregard their private information in making their vote choice, and instead follow earlier voters and vote for the leading candidate. When there are many voters, each voter assigns only a negligible probability to being pivotal. The incentive to vote according to one's personal bias is completely crowded out by the desire to vote for the winner which is critical to the existence of the bandwagon. To obtain some intuition for his model, Callander (2007) considers a simple example. He supposes there are three voters, 1, 2 and 3, whose prior beliefs are neutral. They vote sequentially. Voter 1 vote firstly. Voter 3 vote lastly. Therefore, voter 1 votes informatively, because he has no previous votes to conform. Voter 3 votes informatively, because he must confront an even contest if his vote is still relevant to the electoral outcome. Voter 2 is the only voter who have the opportunity to conform. When voters are only concerned with the aggregation of information, voter 2 votes informatively. It is because that if voter 1's choice and voter 2's signal are different, voter 2 is not sure who is the better candidate and prefers to vote informatively for using voter 3's informational signal; and if voter 1's choice and voter 2's signal are the same, which reflects that his signal appears at least two time out of three chances, voter 2 prefers to vote informatively for the aggregation of information. In short, there is an equilibrium where all voters vote informatively. However, if voter 2 has a desire to vote for the winner and if the desire dominates his desire for the aggregation of information, voter 2 would follow the voter 1's choice for ensuring that he votes for the winner. Thus, there is a bandwagon.

Barucci and Tolotti (2012) study a binary choices in a dynamically random utility model about the interplay between coherence (with respect to identity) and the desire to vote with the perceived majority, in which individual's behavior who gets a benefit in agreement with his signal, his ideology and the majority. They apply their analysis to the sequential voting of Callander (2007), and enrich his model by assuming that each voter is also endowed with an ideology. Barucci and Tolotti (2012) show that multiple stationary equilibria may arise and the outcome looks very different from a society where all the individuals take their decisions in isolation, for example, less informative bandwagon are more likely when private signals about the value of the candidates are precise.

We have presented the papers that model exogenous compliance conformity as "voters' desire to win". In the following discussion, we focus on the papers that model exogenous compliance

conformity as “identification” in groups ¹⁸. The identification in groups has been stated in Sunstein and Thaler (2008):

People become more likely to conform when they know that other people will see what they have to say. Sometimes people will go along with the group even when they think, or know, that everyone else has blundered. Unanimous groups are able to provide the strongest nudges –even when the question is easy, and people ought to know that everyone else is wrong.

Herrera and Martinelli (2006) focus on exogenous compliance conformity as identification in voter groups when they participate in large elections. The formation of voter groups is endogenous i.e. the partisan voter groups have endogenous leaders. In the model, partisans decide whether to become leaders of groups to persuade many uncommitted influenceable voters (i.e., followers) to vote for the leaders’ preferred party. Especially, the “identification” is presented through conforming to the leader in each group. In the unique pure strategy equilibrium, the number of leaders favoring each party depends on the cost of being a leader and the importance of the election. They emphasize identification in groups as an explanation of why individual voters follow group leaders. They predict a non-monotonic relationship between the expected turnout and the expected winning margin (the difference between the numbers of votes for the two parties) in large elections, which depend on the number of leaders and the strength of social interactions. As Herrera and Martinelli (2006), Compains and Alvarez (2014) distinguish between leaders and followers (conformists). The paper show that the introduction of a leader affects information revealed by followers, who misreport the information by conforming to the leader.

Interestingly, Moreno and del Pino Ramos-Sosa (2015) introduce conformity as “identification” among voters more generally involving voting rule with different quotas, which lets a proposal be accepted if the number of voters in the group in favor of it is more than a certain quota. In the model, a finite set of individuals $N = \{1, \dots, n\}$ votes to decide whether to accept a proposal or not. The certain quota is q , ($q \in \{1, 2, \dots, n\}$). There are two kinds of individuals: independents and conformists. Independents only care about their opinion. Conformists vote are based not only on their opinion but also on the votes of others. Furthermore, conformity is relative to a committee structure W_i^h , $h \in N, i \in N$. It means that under the committee structure W_i^h , when voter i compare two different pairs of alternatives with identical decision, he prefers the alternative where the number of voters with the same message as

¹⁸Reviewing identification conformity in social psychology, which means individuals conform to the expectations of a social role, “identification” in groups here does not relate to social roles, and rather results from social pressure. Though there is a common word “identification”, “identification” in groups represents compliance conformity instead of the identification conformity in social psychology.

him is greater or equal to h . For example, we assume that $N = \{1, 2, 3, 4\}$ and $i = 1$. When $h = 3$, the admissible committee structure is $W_1^3 = \{\{1, 2, 3\}, \{1, 2, 4\}, \{1, 3, 4\}, \{1, 2, 3, 4\}\}$. That is, agent 1 is assumed to be conformist, who has to conform to at least two agents out of the other three voters for her utility from conformity. When $h = 4$, $W_1^4 = \{\{1, 2, 3, 4\}\}$. That is, agent 1 is assumed to be conformist, who has to conform to all the three other voters for her utility from conformity. Thus, if and only if $h = N$ and $q = N$, the model is a traditional model where voting rule is unanimity rule. They find a negative result that asking the voters about their opinions may not lead all individuals vote truthfully in simultaneous voting when all individuals are conformist. The authors also show that introducing independent individuals in simultaneous voting helps to mitigate the negative effect from conformity. However, when the voting is sequential, the decision where all individuals vote truthfully is obtained in any subgame perfect Nash equilibrium.

In the following chapters (Chapter 4 and Chapter 5), we present two simultaneous voting models with exogenous compliance conformity preferences. In Chapter 4, our model considers a re-election. Our conformist voters have desire to win, which is related to Callander (2008). In the light of Herrera and Martinelli (2006), our model adopts partisans for our candidates (the incumbent and a challenger). Being different from the standard simultaneous model from Austen-Smith and Banks (1996), our voters have common informative signals to update their belief. The signals are given as our incumbent's actions. Thus, equilibria in our model are Bayesian Nash equilibria. In the equilibria, we consider incumbent's actions. That is our key innovations. In chapter 5, we give a model about collective decision making between two conformist voters under unanimity rule. In fact, the unanimity rule is considered by Moreno and del Pino Ramos-Sosa (2015) as a special case. The assumption that our voters have exogenous compliance conformity preference (want to vote as the majority) is the same as many above discussed papers in this section.

3.3 Models of internalization conformity

Although economists often assume stable preference (Stigler and Becker, 1977), it is clearly an assumption of idealism. Throughout an individual's life, there are many changes that occur in terms of changing preference for goods and services that are unrelated to exogenous changes in relative prices and disposable income. For instance, many children enjoy eating cotton candy, but few have this preference after becoming adulthood. Similarly, there are many goods enjoyed by adults that are unattractive to children, such as fine arts or jewellery. Many neoclassical economists have acknowledged the importance of preference's change (Becker and Murphy, 1988; Thaler and Shefrin, 1981; Laux, 2000; Elster, 2000).

In the section we focus on some economic models about social psychology's internalization conformity that is an important feature of human behaviour. Internalization conformity in economics, which indicates that individuals' preference has the conformist character, shows an idea that the best life is attained by changing one's personal preferences to blend in with one's surroundings. Bowles (1998) considers conformity as an endogenous formation of preference in economic models which focus on the pursuit of material well-being. Internalization conformity as how a trait may be advantaged in Bowles (1998) has evolved under the influence of cultural inheritance. Concretely, the author assumes that x and y are mutually exclusive culture traits. Each individual in a large population is a "cultural model" with replication propensities, γ_x or γ_y , defined as the number of copies of each model made at the end of each period, possibly a generation. Individuals implement the strategy dictated by their trait in a game which assigns benefits to themselves, following which the traits are replicated through an updating process described below, generating a new population frequency. For example, the population is composed by single parents each with a single child. Each child is in the process of growing up. He may or may not adopt the traits of his parent. The equilibrium is defined as a frequency of traits that is stationary. The individuals of the population are paired to play a two-person game. The game's payoffs $\pi(i, j)$ denotes the payoff to playing trait i against a j playing partner. The "game" is one of the familiar interactions of the prisoners' dilemma (or coordination) game type. Let $p \in [0, 1]$ be the population frequency of the x trait. Let $\mu_{ij} = \mu_{ij}(p; \delta)$ be the probability of being paired with a j type conditional on being an i type, where $\delta \in [0, 1]$ is a measure of the exogenous determined extent. The expected payoff for the x trait individual is

$$b_x(p; \delta) = \mu_{xx}\pi(x, x) + \mu_{xy}\pi(x, y).$$

And the expected payoff for the y trait individual is

$$b_y(p; \delta) = \mu_{yx}\pi(y, x) + \mu_{yy}\pi(y, y).$$

The author assumes that internalization conformity in frequency of cultural trait x (trait y) is described by the function $\sigma_x(p - k)$ (the function $\sigma_y(p - k)$). When $k \in [0, 1]$ is the value of p , the author assumes that no internalization conformity operates. Because x and y are mutually exclusive culture traits, it is obvious that $\sigma_x(p - k) + \sigma_y(p - k) = 0$. For simplicity, the author lets $\sigma_y(k - p) \equiv -\sigma_y(p - k)$ and $\sigma_x(p - k) \equiv \sigma(p) > 0$, thus $\sigma_y(k - p) \equiv \sigma_x(p - k) \equiv \sigma(p) > 0$. Further, the author defines $\alpha \in [0, 1]$ as the weight placed on the extrinsic payoff $\sigma(p)$ as opposed to the intrinsic payoff $b(p; \delta)$ during the internalization conformity process. Thus, the replication propensities γ_x and γ_y are updated:

$$\gamma_x = \alpha\sigma(p - k) + (1 - \alpha)[b_x(p; \delta) - b_y(p; \delta)] + 1,$$

$$\gamma_y = \alpha\sigma(k - p) + (1 - \alpha)[b_y(p; \delta) - b_x(p; \delta)] + 1.$$

If $p = k$ or if $\alpha = 0$, conformist transmission does not operate and replication depends solely on payoffs, which is the conventional evolutionary game theoretic model. The model's equilibrium is defined by $dp/dt = 0$, which requires that the effects of extrinsic conformist payoff offset the intrinsic effects of the unequal game outcomes, so that $\gamma_x = \gamma_y$ (see Figure 3.5):

$$\alpha\sigma(p - k)/(1 - \alpha) = b_y(p; \delta) - b_x(p; \delta).$$

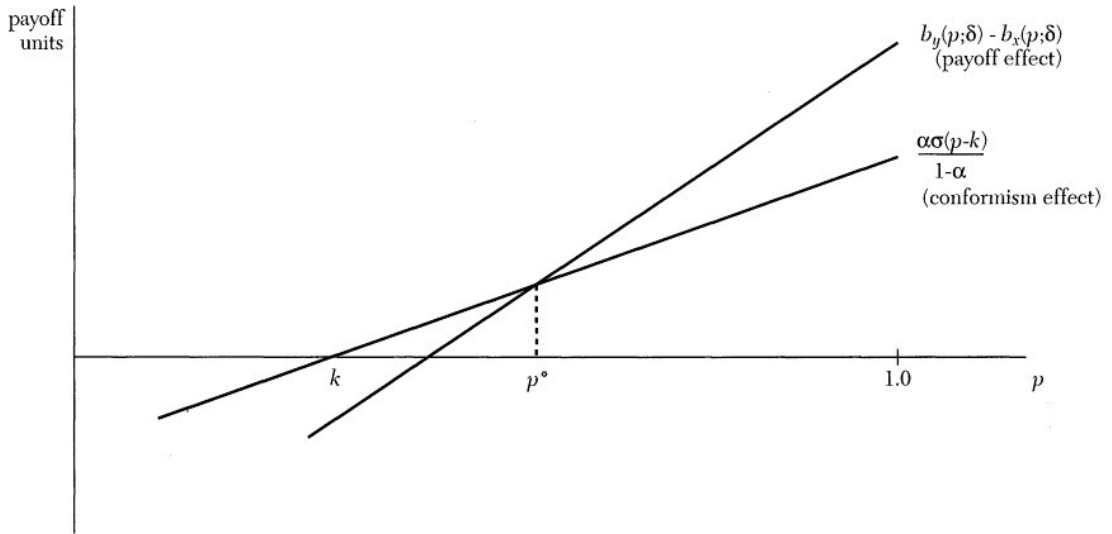


Figure 3.5: Cultural equilibrium with internalization conformity (from Bowles (1998)).

Figure 3.5 illustrates the equilibrium condition for an interior stable equilibrium that is marked by p° in the p -axis. In other words, in this equilibrium, p° is the frequency of the x trait for any population and is seen to be stable over generations. In sum, the equilibrium with internalization conformity in Bowles (1998) accepts unequal payoffs among individuals with different traits. The equilibrium implies that economic institutions (such as markets) will affect the distribution of cultural traits in the population because they influence the determination of the exogenous variables in the above model. For example, the rules governing who interacts with whom, the payoffs to any given interaction, and the internalization conformity process structure itself.

Being different from Bowles (1998), Sliwka (2007) presents a model that considers internalization conformity in another way. The way is more direct. In the model, a principal employs an individual. The individual's effort generates a payoff π_A for the individual and π_P for the principal. The individual can be one of three different types: selfish individuals, fair (or altruistic) individuals, and conformist individuals. First, selfish individuals care only about their own well-being, whose utility function is $U_S(\pi_A)$. Second, fair individuals have some

form of a social preference. Thus, they care for the principal's payoff to some extent beside their own well-being, whose utility function is $U_F(\pi_A, \pi_P)$. Third, conformist individuals is uncertain about the "appropriate" behavior in a certain situation and therefore conform. Conformist individuals' utility is either U_S or U_F , depending on which type she thinks is more frequent in the population. Using the model, the author develops an explanation for motivation crowding-out effect¹⁹ in a social preference framework. When there is asymmetric information about the distribution of preferences (the "social norm"), the principal using the high-powered incentives signals distrust in the norm, which crowds out motivation.

Klick and Parisi (2008) give an adaptive mechanism for internalization conformity. Being similar to Sliwka (2007), individuals change their inherent preference directly with "preference adaptation". By modifying their preference, individuals decrease their disutility from the consumption of his dislike. Being different from Sliwka (2007), this adaptation in Klick and Parisi (2008) is not considered as free. For simplicity, there are only two periods for an individual. x_{i1} is the individual i 's exogenously initial value of a consumption goods x in period 1. x_{G2} is the network's favoured value of x in period two. And x_{i2} is the individual's effective desired level of x in period 2. The authors assume that the network sanction S is proportional to the square of the differential between x_{G2} and x_{i2} , and the adaptation cost C is proportional to the square of the differential between the individuals inherent preference x_{i1} and his induced preference x_{i2} . Further, the networks favoured value of consumption goods is stochastic, such that $x_{G2} = x_{G1}$ with probability p and $x_{G2} = x_{i1}$ with probability $1 - p$. The cost minimization problem is to minimize the following function through x_{i2} :

$$pS(x_{G1} - x_{i2})^2 + (1 - p)S(x_{i1} - x_{i2})^2 + C(x_{i1} - x_{i2})^2.$$

If the minimization problem can be solve, it generates the following first order condition through an interior solution:

$$\frac{x_{i2} - x_{i1}}{x_{G1} - x_{i1}} = \frac{pS}{S + C}.$$

The left hand side of the first order condition can be interpreted as the degree of individual's internalization conformity, which show individual i adapts his preference to what extent. From the above equation, we get that three attractive implications. First, if the adaptation cost C for individual i increases, his internalization conformity degree decreases. Second, the probability p that the group preference in period 2 will be the same as in period 1 is higher,

¹⁹ The theoretical possibility of motivation crowding has been the main subject of discussion among economists. The crowding-effect is that raising monetary incentives reduces supply. It suggests the opposite of the fundamental economic law that raising monetary incentives increases supply. It is an important anomalies in economics. The survey from Frey and Jegen (2001) demonstrates that strong empirical evidence for the crowding-out effect indeed exists.

his internalization conformity degree increases. Third, for any positive probability p , if the network sanction S increases, his internalization conformity degree increases.

Overall, we have just presented three models which try to model internalization conformity. In fact, internalization conformity is not deeply researched by economists, because it is difficult to assume that individuals have variable preferences in economic models.

3.4 Conclusion

The main objective of the chapter has been to examine theoretical models literature on conformity in economics. Informational conformity and normative conformity are two main classifications of conformity in social psychology. Inspired by the social psychologist's work, we review models of informational conformity in the first section, which require individuals to be selfish and fully rational as traditional economic models. We focus on "information cascades" that is said to occur when an infinite sequence of individuals ignore their private information when making their own decisions. All these models of information cascades are divided by whether the decision process is in sequence or not. Concretely, we present the models of exogenous sequential decision first, the models of endogenous sequential decision second, and the models of non-sequential decision finally.

In the second section, we review behavioural economic models about social psychological compliance conformity. Here, compliance conformity is normative conformity from social pressure. We divide this section into two subsections following two different results by modeling compliance conformity. First, compliance conformity is produced endogenously in equilibria using traditional economic models. Second, compliance conformity is assumed as an exogenous conformity preference term in models' utility functions, where individuals are not fully rational any more. Compared to the traditional economic models, this assumption, which is common in behavioural economic models, greatly extends the range of phenomena that are subject to economic analysis, and is likely to lead to more correct predictions. After having reviewed economic models about compliance conformity, we briefly review the economic models about internalization conformity, where individuals' preferences are not taken as given.

In general, informational conformity have bad effects (Banerjee, 1992) since individual private information is ignored. Similarly, many economists believe that compliance conformity is disadvantageous to our society. For example, Zafar (2011) shows that social comparison from the descriptive norm cause individuals to conform in actions. A low contribution norm causes individuals to contribute less in a charitable contribution. This suggests that compliance conformity leads to lower contributions. For another example, asking the individuals in Moreno and del Pino Ramos-Sosa (2015) about their honest opinions by voting, if there are

conformist individuals whose votes are based not only on their opinion but also on the vote of other individuals, it is difficult to obtain the socially optimal decision.

However, some other economists believe that compliance conformity could improve welfare. For example, Ellison and Fudenberg (1993) examine the role of exogenous compliance conformity as a conformist bias in imitation. In some cases, the conformist bias can lead to a fairly efficient decision in a one person decision problem. For another example, Mengel (2009) analyzes a local interaction model and finds that compliance conformity is a new mechanism that can stabilize cooperation in a bilateral prisoner's dilemma game with their neighbors. In sum, to the best of our knowledge, voters' compliance conformity effect remains hotly debated in theoretical literature as well as in experimental literature.

However, despite a widespread study of conformist voters (Callander, 2007, 2008), it is still not well known what is the conformity effect within re-election environment when incumbents face conformist independent voters and have two goals (winning and better policy). It is the main contribution of our Chapter 4. In Chapter 4, our re-election model with conformist voters belongs to the simultaneous voting models with exogenous compliance conformity as desire to win in economics under majority rule. This model adapts incumbents whose actions give the conformist voters a common information signal to update their belief. Thus, equilibria in the model are Bayesian Nash equilibrium. Furthermore, our re-election model in Chapter 4 have no conformity performance in the sense that heterogeneous voters behave identically in equilibrium. In Chapter 5, we give a simple model about collective decision making through voting between two conformist voters. We point out in advance the model with conformist voters in Chapter 5 belongs to simultaneous voting models with exogenous compliance conformity as desire to make the same vote as the majority in economics under unanimity rule. Equilibria in the model are Nash equilibria.

Part III

Economic models with conformist voters

Chapter 4

Independent voters' desire to win
can deter incumbents from
inefficient decisions

4.1 abstract

We study a model focusing on a re-election seeking incumbent's pure policy-making strategy with conformist voters. Because of re-election pressure, our incumbent takes care of her reputation when making her policy decision before voting. It leads to incumbent's pandering. We focus on conformity effects on pandering through two Pure Perfect Bayesian Equilibria. One is the social efficient strategy equilibrium (shortened to **S**) in which the incumbent uses her information to promote social interests efficiently, and the other one is the office-seeking strategy equilibrium that is a pooling equilibrium (shortened to **P**), where the incumbent makes her decision as an office seeker. Compared to the present literature, we enrich the setting by assuming that candidates face three kinds of voters, instead of a single representative voter. They are incumbent partisans, challenger partisans and independent voters. The independent voters are conformists, who not only wish to vote for the better candidate but also to pick the winner. We show that a strong desire to win (i.e., strong conformity) reduces incumbent's pandering (i.e., deters incumbents from inefficient decisions) through promoting **S** and restraining **P**. However, we also find that a weak desire to win (i.e., weak conformity) induces incumbent's pandering through restraining **S** and promoting **P**.

Keywords: Majority rule Conformity Desire to win Partisans Office-motivation
Policy-motivation Incumbent advantage Pandering

4.2 Introduction

Conformity is a behavior to conform when an individual in a group displays that behavior because it is the most frequent the individual witnessed in others (Claidière and Whiten, 2012). Conformity as one emotional factor has been a central researching domain of social psychology, since the pioneering experiments in Asch (1951). In social psychology, Deutsch and Gerard (1955) distinguish between informational and normative conformity motivations, the former based on the desire to form an accurate interpretation of reality and behave correctly, and the latter based on the goal of obtaining social approval from others (Cialdini and Goldstein, 2004).

Election is an important environment where normative conformity manifests itself as “bandwagon effect”. The “bandwagon effect” refers to the notion that voters are more likely to vote for a candidate if they expect the candidate to win (Lee, 2011). Many authors affirm the “bandwagon effect” empirically (Hodgson and Maloney, 2013; Kiss and Simonovits, 2014) and experimentally (Forsythe, Myerson, Rietz and Weber, 1993; Morton, Muller, Page and Torgler, 2015). In the theoretical respect, Callander (2007) develops a model of sequential voting to argue that voters’ desire to win is critical to the existence of bandwagon. Callander (2008) analyses simultaneous elections under the simple majority rule when voters, in addition to wish for the better candidate to be elected, care about winning. The author establishes that a desire to win creates multiple symmetric Bayes-Nash equilibria, some of which exhibit negative information aggregation. Lee (2011) studies the bandwagon effect in two-party competition models. The author finds that the voters’ normative conformity preference significantly affects the nature of political competition, and this effect on political equilibrium is quite different between two models, i.e., one assumes that parties maximize their probabilities of victory and another assumes that parties maximize the expected utilities of their key constituents.

Except voters in election, the incumbent ¹, who is appointed to choose policy for the society, such as monetary policy and fiscal policy, is another important “actor” (Rogoff and Sibert, 1988). Though the incumbent’s tenets are well understood before she gets to office, her abilities as a policy-maker are often unknown². Voters would potentially decide whether or not to retain an incumbent on the basis of her actions. Her actions while in office can define voters’

¹For convenience, we refer to the incumbent as “she” and each voter as “he”.

² There are three reasons for this fact. First, the variable the policy tries to affect is subject to exogenous shocks of which the size is not perfectly known by voters, for example, policy about reducing unemployment or boosting economic growth. Second, some policies (such as public insurance policies for all voters) are *ex ante* in all voters’ interest, but actually only a small proportion of the voters experience the effect of the policy, and thus a large proportion of the voters do not informed about this policy’s effect. At last, some policy affects the voters’ welfare under certain circumstances or after

perceptions about her competence and influence her re-election chances. The incumbent is usually assumed to respond to her anticipations of the voters' decisions just for maximising her possibility of being re-elected in re-election (Harrington Jr, 1993; Heidhues and Lagerlöf, 2003; Laslier and Van der Straeten, 2004; Gratton, 2014). Thus, the incumbent panders to voters, even though she knows that a different choice is actually better for social benefits (Wirl, 1991; Martinelli, 2001; Heidhues and Lagerlöf, 2003; Jensen, 2015). However, many other authors argue that the incumbent has two goals (winning and better policy), who receives "ego rents" from being in office and also utility from policy outcomes (Schlesinger, 1975; Wittman, 1990; Ball, 1999; Canes-Wrone, Herron and Shotts, 2001; Dur, 2001; Casamatta and De Donder, 2005; Duggan and Fey, 2005; Dominguez-Martinez and Swank, 2006; Dellis and Oak, 2007; Ashworth and Shotts, 2010; Peress, 2010). Many papers demonstrate many conditions under which the incumbent with two goals has incentives for pandering (Canes-Wrone et al., 2001; Maskin and Tirole, 2004; Stasavage et al., 2004; Fox, 2007; Fox and Shotts, 2009; Woon, 2012). The pandering shows that asymmetric information produces a problem: an incumbent with two goals, can use her information to benefit the society, but she may fail to do so because voters reward her more for demonstrating that she is good type than for producing a good policy.

Inspired by all these above articles, we have an interesting question: "whether an incumbent facing conformist voters panders to them?" As far as we know, we are the first one to understand the effects of voters' desire to win on the pandering problem about the incumbent, who has two goals: winning and better policy. We focus on the incumbent's socially efficient strategy and the incumbent's office-seeking strategy. Concretely, we consider two Pure Perfect Bayesian Equilibria. One is the social efficient strategy equilibrium (shortened to **S** for social), where the incumbent uses her information to promote the social interests efficiently. The other one is the office-seeking strategy equilibrium which is a pooling equilibrium (shortened to **P** for private interests or pooling), where the incumbent ignores her information and makes her decision as an office-seeker. We analyse the conditions for the two "equilibria" from incumbent's "ego rents" point of view.

Our model is a variant of Dur (2001)'s model. Dur (2001) considers a model where repealing a implemented policy is a bad signal to voters about an incumbent's policy competence when voters do not have perfect knowledge about her policy competence. Given that imperfect informational voters' beliefs about the policy competence are updated according to Bayes' rule, the author shows the conditions under which the incumbent's optimal policy is always to continue her policy even if her implemented policy is a failure. We alter Dur (2001)'s model from four aspects. First, voters in Dur (2001)'s model have common interests and be

the elections, for example, defence policies and public investments.

formally treated as a single representative voter³. In the real world, partisans are everywhere (Swank, 1995; Bartels, 2000, 2002; Brader and Tucker, 2009; Anduiza, Gallego and Muñoz, 2013; Klar, 2014; Helland and Sørensen, 2015). The extensive research shows that partisanship affects a wide range of political evaluations. Accordingly, our analysis modifies the model by assuming that the incumbent faces three types of voters instead of a single representative voter: incumbent's partisans, anti-incumbent's partisans (i.e., challenger's partisans) and independent voters who are conformist (Bartels, 2000). Second, compared with the incumbent's information in Dur (2001), we make the change that our incumbent has known well about her policy competence as her private information. Third, compared with the effects of policy in Dur (2001), we make the change that the implemented policy effects only exist in that period when it starts to be implemented. At last for convenience, we assume that the incumbent's strategies in period 2 are efficient. In brief, our model is a dynamic game of incomplete information.

Our game takes place over two periods. At the beginning of the first period, an incumbent is determined by Nature. At the end of the first period, there is a re-election. At the end of the second period, the game is over. The incumbent in each period must design and implement a policy. The policy may be a success. In this case her optimal policy is to continue implementing the policy for getting the benefits at the end of the period. But the policy may be a failure. In this case her optimal policy is to repeal the policy for reducing the loss. The incumbent's policy competence can be two kinds: High (H) type and Low (L) type. The H (L) type faces a probability h (l) that her policy is a success, where $1 > h > l > 0$. After her policy is implemented, she gets a fully informative signal about the policy's effects. Then she chooses to continue or to repeal it. After this, a challenger will be chosen by nature to compete against the incumbent for the re-election. The winner as the incumbent of period 2 is assumed to work effectively. It means that after the incumbent of period 2 implements her policy and receives her fully informative signal, she continues her policy if it is a success. Otherwise she repeals it.

We assume that the actual result of the incumbent's implemented policy will be not observed by voters before the re-election closes. Thus, it can not influence the re-election. Because the H type without re-election pressure has more chances to be a success in the second period, it is socially preferable for independent voters to choose the H type in the re-election. Before the re-election, independent voters observe the incumbent's decision about whether she has continued or repealed her policy and the *prior* probability that the challenger is H type, then decide whether to appoint the incumbent for the second period or instead appoint the challenger. Moreover, when making her decision to continue or to repeal her implemented

³ In the existing papers, voters are always assumed to have common interests and thus be formally treated as a single representative voter for convenience (Canes-Wrone et al., 2001).

policy, the incumbent wanting “ego rents” has to consider her partisans percentage of all voters with independent voters' voting strategy. Virtually, both kinds of incumbents may face a trade-off between two actions when they are different. One action is achieving to maximize the outcome of her policy, which is based on her fully informative signal. Another action is continuing her policy, which allows her to have more chance of being re-elected.

Our analysis produces two main contributions. First, we consider the benchmark situation where the incumbent faces independent voters who are nonconformist. Our results are confirmed to be similar to Dur (2001)'s results, which shows that the incumbent panders to voters as never repealing her policy if she cares sufficiently about the re-election. Second, we present the conditions about \mathbf{S} and \mathbf{P} from the incumbent's “ego rents” point, when independent voters are conformist. Compared to the nonconformist case, when the voters have a weak desire to win, the conditions from the “ego rents” point of view have become more restricted in \mathbf{S} and less restricted in \mathbf{P} . It suggests that because the weak desire to win induces more incumbents to pander, the incumbent's re-election pressure undermines social interests, which is similar to Callander (2007)'s conclusions. When they have a strong desire to win, there is \mathbf{S} but no \mathbf{P} no matter what the “ego rents” is. Contrasting with the above case with a desire to win, the strong desire to win eliminates incumbent's pandering, thus effectively utilizes her policy competence. In sum, the re-election pressure in our model hurts social interests through incumbent's pandering only when independent voters have a weak desire to win.

ROADMAP The rest of the paper proceeds as follows. In section 2, we set up the model. In section 3, we characterise \mathbf{S} and \mathbf{P} with nonconformist voters. In section 4, we consider \mathbf{S} and \mathbf{P} when independent voters are conformist. We do comparative analysis in section 5. We conclude in section 6. Except for the omitted proofs, all the rest proofs can be found in the appendix.

4.3 The model

4.3.1 Setup

Incumbents

We consider a simple framework of re-election game with two policy-making periods ($t, t \in \{1, 2\}$). Majority rule is the voting rule. There are three kinds of players: an incumbent, a challenger and voters. Among the voters we divide them into three different parts: incumbent's partisans, challenger's partisans and independent voters. At the beginning of period 1, Nature determines an incumbent. At the end of period 1, there is a re-election between two candidates: the incumbent (I) and a challenger (G). During each period, the incumbent implements a policy. The policy will be proved to be either a "success (S)" or a "failure (F)" to the incumbent secretly and fully informatively. But before her policy's implementation, the incumbent is uncertain her policy will be a S or a F . Her signal (S or F) cannot be transmitted to voters. The incumbent having the fully informative signal⁴ decides d , which is either to continue (C) or to repeal (R) her policy, $d \in \{C, R\}$.

- 1. We assume that in period 2 if the policy is a S and is continued, expected social welfare increases by $b_2 > 0$, where the subscript denotes the period when the policy is implemented. For simplicity, we equal b_2 and 1 unit in social welfare (i.e. $b_2 \equiv 1$).

Correspondingly in period 1, if the S policy is continued, the expected social welfare increased by $b_1 > 0$. If the policy is a F , there are no benefits and no costs when the policy is repelled during that period. Corresponding to b_2 where $b_2 \equiv 1$, when this failing policy is continued, expected social welfare decreases by $c_t > 0$, where the subscript denotes the period when the policy is implemented.

- 2. We assume that candidates care social welfare and have "ego rents X_t " if she is in office in period t , but may differ in their policy competence⁵.

This assumption means that some can better ascertain the world and others are less able to do so. For simplify, each candidate will be referred to one of two types. We denote each type

⁴We assume that the first-period state policy effect is not revealed to the voters until after they have voted on whether to retain the incumbent (Canes-Wrone et al., 2001; Dur, 2001).

⁵Our assumptions about candidates' policy competence reflect the fact that, "though some sources of expertise are institutional, others are unique to the candidates. For example, when candidates become the incumbents, all the incumbents have advisors and a bureaucracy that can generate policy expertise, but the incumbents differ in their abilities to choose competent advisors and manage this bureaucracy (Canes-Wrone et al., 2001)".

with H or L . A H type candidate faces the probability h that her policy is a success, while a L type candidate faces the probability l that her policy is a success, where $1 > h > l > 0$. Voters do not know with certainty about the type of the candidates, but each candidate knows her own type.

- 3. We assume that the incumbent in period 2 continues her policy if it is a success and repeals it if it is a failure, no matter what her type is.

It is because that when re-election is impossible for the incumbent, continuing her failed policy is not valuable and the incumbent implements her policy efficiently. Because of this assumption, we focus on incumbent's strategies only in period 1. Therefore, although our model is multi-period, time subscripts about incumbent's strategies in period 1 are omitted for notational simplicity.

Challengers

The *prior* probability that the challenger is H type, is denoted by $\kappa_G \equiv Pr(G = H)$, $\kappa_G \in [0, 1]$.

- 1. We assume that κ_G is randomly drawn from $[0, 1]$ according to a well-known *prior* cumulative distribution function $\mathbf{G}(\cdot): [0, 1] \rightarrow [0, 1]$, which has a uniform distribution on the interval $[0, 1]$, i.e.,

$$\mathbf{G}(\kappa_G) = \begin{cases} 0, & \kappa_G < 0, \\ \kappa_G, & \kappa_G \in [0, 1], \\ 1, & \kappa_G > 1, \end{cases}$$

and the probability density function of $\mathbf{G}(\cdot)$ is

$$g(x) = \begin{cases} 1, & x \in [0, 1], \\ 0, & x \notin [0, 1]. \end{cases}$$

Thus, $\mathbf{G}(\kappa_G)$ denotes the probability that x is smaller than κ_G . We assume that the identity of the challenger becomes known just before the re-election as in Dur (2001)⁶. In the re-election, κ_G is unknown to the incumbent when she decides her decision, but κ_G is known to

⁶ "This assumption is made in order to exclude cases in which the incumbent is sure to win or lose the elections whichever decision he takes, when deciding on continuation of the implemented policy. In such cases, the incumbents decision is of course not distorted by electoral motives. Alternatively, one could assume that the independent voters' belief about the challenger's competence is not too far from the independent voters' belief about the incumbent's competence such that the incumbent's decision matters for the election outcome (Dur, 2001)."

voters when they vote. From the incumbent's viewpoint, this makes the re-election's outcome probabilistic, even though the voters' decisions are deterministic.

Voters

- 1. We assume that more than half of our voters are partisans who always vote for their preferred candidate independent of incumbent's policy performance and other voters' actions. Of course, we assume that it is impossible that all the partisans prefer the same candidate. The remaining voters are independent voters who are assumed to be conformists, i.e., they have desire to win as well as voting for the better candidate.

The independent voters' *prior* probability that the incumbent is H type at the beginning of period 1 is indexed by $\varphi, \varphi \in [0, 1]$ identically. When the incumbent's decision d in period 1 is observed by independent voters, we assume that they revise their belief about her type using Bayes' rule. We write $\varphi(d)$ as one independent voter uses Bayes' rule to update of his *prior* probability φ that the incumbent is a H type when he observes d . We will present $\varphi(d)$ in details later. In brief, their preferred candidate in re-election depends on not only the comparison between the *a posteriori* probability $\varphi(d)$ that I is H type and the prior probability κ_G that G is H type, but also their expectations about the re-election's winner.

Recent empirical work shows incumbent advantage is common to congressional elections and all state-wide offices (Erikson, 1971; Cover, 1977; Ansolabehere and Snyder Jr, 2002). The incumbent advantage means incumbent's use office to deter challengers and to maximize the incumbent likelihood of winning in re-election⁷. For example, doing favors for individual constituents, increasing incumbent visibility among the general public, and generating additional financial support for incumbent campaigns.

- 2. In the light of incumbent advantage, we assume that it is common knowledge that challenger's partisans percentage of all voters is always less than $\frac{1}{2}$. Moreover, the incumbent's partisans percentage of all voters is decided by the incumbent's competence.

Especially, when incumbent is H type the re-election can be decided by the incumbent's partisans with the probability $p_H, p_H \in (0, 1)$, i.e. the probability that the incumbent's partisans percentage of all voters is more than half is p_H , and when the incumbent is L type the re-election can be decided by the incumbent's partisans with probability p_L where $p_L \in (0, 1)$ and $p_H > p_L$. The assumption that

$$p_H > p_L$$

⁷Since Erikson (1971)'s seminal article, numerous scholars have a substantial explanations for the incumbency advantage (Gelman and King, 1990; Ashworth and De Mesquita, 2008). Moreover, Hood and McKee (2010) is a summary about the incumbent advantage.

is in accordance with incumbent's policy competences. The reason is that the incumbent has her partisans through a process where she aggregates policy preferences of voters and even shapes their preferences (Levendusky, Druckman and McLain, 2016). Thus, the process has nothing to do with her policy performance⁸, but is determined by her ability as policy competence.

- 3. The following table sums the assumptions about partisans' structure:

The incumbent's type with $p_H > p_L$:	H	L
The probability about that I's partisans percentage is more than $\frac{1}{2}$:	p_H	p_L
The probability about that C's partisans percentage is less than $\frac{1}{2}$:	1	1

- 4 Each voter casts one vote for I or C in the re-election and abstention is forbidden (Callander, 2008). If there is a tie, our game sets that the winner is the challenger.

Overall, there were only two mutually exclusive states. First, if more than half of all voters are incumbent's partisans, the incumbent wins regardless of independent voters. Second, if no more than half of all voters are incumbent's partisans, the independent voters determine the winner. In other words, when the incumbent voters vote for the incumbent, the winner must be the incumbent. Whereas when they vote for the challenger, the winner might be not the challenger. For this reason, independent voters vote according to two possibly conflicting criteria. Firstly, they have an intrinsic preference for one candidate between the incumbent and the challenger. The intrinsic preference is decided by comparing the *a posteriori* probability that her type is H type following her policy decision in period 1 to the *prior* probability that the challenger is H type. Secondly, they prefer to vote for the winner. However, when the winner is decided by the incumbent's partisans independently, the winner must be the incumbent, but may be not the candidate the independent voters want to vote following the first criterion. Thus, there is a possible conflict. Of course, when the incumbent's partisans are no more than half of all the voters, because of the fact that the challenger's partisans has been assumed less than half of all the voters, independent voters would determine the winner. The above possible conflict disappears.

⁸ Studies show partisans do not interpret government action objectively but let their partisan identity as a guide (Campbell, 1980). In other words, people who identify with the governing party perceive the results of economic policy as better compared to subjects who identify with the opposition (Conover, Feldman and Knight, 1986, 1987; Bartels, 2002; Gerber and Huber, 2009).

4.3.2 Timeline

Table Timeline
<p>Period 1</p> <ul style="list-style-type: none"> • $t=1$ <p>Nature determines an incumbent (I) whose type is her private information.</p> <ul style="list-style-type: none"> • I implements a policy. • I observes a fully informative signal about the effect of the policy. • I chooses to continue or to repeal the policy. • Nature draws a challenger (C) for re-election. • Re-election is held. Each voter simultaneously casts his vote. • C (I) is (re-)elected by majority rule. When there is a tie, C is elected. <p>Period 2</p> <ul style="list-style-type: none"> • The winner (W) of re-election implements her policy. • W observes a fully informative signal about the effect of the policy. • W chooses to continue the successful policy and to repeal the failing policy.

4.3.3 Utility of the incumbent of period 1

For simplicity, there is no discounting. When given her implemented policy in period 1 is d , $d \in \{C, R\}$, her expected utility function is

$$E[u^I(d)] \equiv \sum_{t=1}^2 [V_t(d) + e_t(d)X_t].$$

Here $V_t(d)$ is the expected utility from the implemented policy outcome in period t , and $e_1(d) = 1$, and $e_2(d)$ is the probability that the incumbent wins in the re-election. We recall that X_t are ego rents. The incumbent chooses d for maximising $E[u^I(d)]$. Her expected utility is

$$U^I \equiv \max_{d \in \{C, R\}} \{E[u^I(d)]\}.$$

4.3.4 Utility of each independent voter

Each independent voter is assumed to be risk-neutral, self-interested and conformist. Because the incumbent of period 2 implements her policy efficiently, the two candidates in the re-election do not differ in their decisions on the continuation of policy in the period 2. The

differences between them are their policy competence in designing a successful policy at the beginning of the second period. We recall that $b_2 \equiv 1$. Thus each independent voter has a payoff utility $hb_2 \equiv h$ when he reappoints a H type incumbent and a payoff utility $lb_2 \equiv l$ if he reappoints a L type incumbent in re-election. It is the same for the challenger.

From the payoff utility of each independent voter in re-election, the function (4.1):

$$\begin{aligned} \varphi(d)h + (1 - \varphi(d))l &> \kappa_G h + (1 - \kappa_G)l \\ &\iff \\ \varphi(d)(h - l) &> \kappa_G(h - l), \end{aligned} \tag{4.1}$$

shows the candidate who is more likely to be H type will be preferred by independent voters. Because each independent voter is conformist, we assume that there is a reward $k(k > 0)$ relative to the policy outcome utility in the function (4.1) if he votes for the winner in re-election, and a reward 0 if he does not vote for the winner. Consequently, each independent voter i votes for the candidate ξ ($\xi \in \{I, G\}$) who is expected to maximize his payoff utility function $E[u^v(\xi)]$ in the re-election:

$$U^v(\xi) \equiv \max_{\xi \in \{I, G\}} \{E[u^v(\xi)]\}$$

where

$$E[u^v(\xi)] \equiv (h - l) \times \Pr[\xi \text{ is H type}] + k \Pr[\xi \text{ is the winner}].$$

From the function $U^v(\xi)$, each independent voter re-elects the incumbent iff:

$$\begin{aligned} (h - l)\varphi(d) + k &> (h - l)\kappa_G + k\{(1 - p_H)\varphi(d) + (1 - p_L)[1 - \varphi(d)]\} \\ &\iff \\ \varphi(d) + k \frac{p_H\varphi(d) + p_L[1 - \varphi(d)]}{(h - l)} &> \kappa_G. \end{aligned} \tag{4.2}$$

4.3.5 Definition of equilibrium

Let $\sigma_S \in [0, 1]$ be the probability that in period 1 the incumbent who observes that her policy is a success chooses to continue the policy. Likewise $\sigma_F \in [0, 1]$ is the probability that in period 1 the incumbent who observes that her policy is a failure chooses to continue

the policy. The incumbent's pure strategy (σ_S, σ_F) is a mapping $\{S, F\} \rightarrow \{C, R\}$, where $\sigma_S, \sigma_F \in \{0, 1\}$.

Let $\eta_C \in [0, 1]$ be the probability that each independent voter votes for the incumbent, when he observes that her decision is to continue her policy in period 1. Likewise $\eta_R \in [0, 1]$ is the probability that each independent voter votes for the incumbent, when he observes that her decision is to repeal her policy in period 1. Each independent voter's pure strategy (η_C, η_R) is a mapping $\{C, R\} \rightarrow \{I, G\}$, where $\eta_C, \eta_R \in \{0, 1\}$. In this paper, we focus on independent voter's pure symmetric voting strategy, i.e., the same pure voting strategy (η_C, η_R) across each independent voter. Therefore, our independent voters can be treated as a single representative independent voter.

Definition 4.1 *A pure strategy profile $[(\sigma_S, \sigma_F), (\eta_C, \eta_R)]$ and a belief φ constitutes a **Pure Perfect Bayesian Equilibrium**, if u^I and u^V are maximized by the strategy $[(\sigma_S, \sigma_F), (\eta_C, \eta_R)]$ when given φ and other players' strategies which are $[(\sigma_S, \sigma_F), (\eta_C, \eta_R)]$, and in terms of Bayesian updating φ is consistent with $[(\sigma_S, \sigma_F), (\eta_C, \eta_R)]$.*

We will henceforth use **S** strategy for ease of exposition to denote the incumbent's pure socially efficient policymaking strategy $(\sigma_S = 1, \sigma_F = 0)$, in which the incumbent in period 1 continues her policy if she has observed that it is a success, and repeals it if she has observed that it is a failure. We let **S** note the equilibrium with **S** strategy, $[(\sigma_S = 1, \sigma_F = 0), (\eta_C, \eta_R)]$, which has the normatively desirable property that the incumbent uses her private information optimally to promote social interests in period 1. Similarly, the equilibrium with $[(\sigma_S = 1, \sigma_F = 1), (\eta_C, \eta_R)]$ is called **P**, in which independent voters believe that both two types of incumbents always decide to continue her policy. In this paper, we focus on **S** and **P**.

4.4 Benchmark

In this section, we study the conditions about **S** and **P** when $k = 0$, i.e., independent voters are nonconformist. It would help us understand what happens with conformity. Because $k = 0$, the condition (4.2) is simplified to (4.3):

$$\varphi(d) > \kappa_G. \quad (4.3)$$

The intuition of the condition 4.3 is that each independent voter re-elects their incumbent in period 1 only when his *a posteriori* probability that the incumbent is *H* type, $\varphi(d)$, exceeds his *prior* probability that the challenger is *H* type, κ_G .

4.4.1 Equilibrium is S

We suppose that each independent voter believes that the incumbent in period 1 uses S strategy. After observing the incumbent's decision, each independent voter updates his belief about her type using Bayes' rule. Thus, if the policy is continued, the *a posteriori* probability that the incumbent is H type is:

$$\varphi(C) = \frac{\varphi h}{\varphi h + (1 - \varphi)l}. \quad (4.4)$$

If the policy is repealed, the *a posteriori* probability that the policy maker is H type is:

$$\varphi(R) = \frac{\varphi(1 - h)}{\varphi(1 - h) + (1 - \varphi)(1 - l)}. \quad (4.5)$$

Because of $h > l$, it follows that $1 > \varphi(C) > \varphi > \varphi(R) > 0$, i.e., continuing (repealing) the implemented policy increases (decreases) each independent voter's *a posteriori* probability about that the incumbent is H type.

We suppose that the incumbent in period 1 maximizes her utility function U^I , where e_2 is decided by partisans and independent voters. Under what conditions will she follow the S strategy? Theorem 4.1 gives the conditions. Before presenting Theorem 4.1, we give the following two notations.

Given the incumbent's decision d , $d \in \{C, R\}$, when she may lose in the re-election (i.e., $1 > \varphi(d) > 0$), the expected value of the *prior* probability that a challenger is H type is updated by herself as $\bar{\kappa}_d$. Given $1 > \varphi(d) > 0$ and $d \in \{C, R\}$,

$$\bar{\kappa}_d \equiv E[\kappa_G | \kappa_G > \varphi(d)] = \frac{\int_{\varphi(d)}^1 xg(x)dx}{1 - \varphi(d)} = \frac{1 + \varphi(d)}{2}.$$

The cut-off point for the *a posteriori* probability difference from the effect of incumbent's decisions is symbolized by Θ , where

$$\Theta \equiv \frac{c_1(p_H - p_L)}{(h - l)(1 - p_H)(1 - p_L)}.$$

$\bar{\kappa}_d$ and Θ will be used in the proof of Theorem 4.1. We now describe Theorem 4.1.

Theorem 4.1 *When $k = 0$, S appears iff:*

$$X_2 < \Phi, \quad (4.6)$$

and

$$\Phi = \begin{cases} \Phi_1, & \Theta > \varphi(C) - \varphi(R), \\ \Phi_2, & \Theta \leq \varphi(C) - \varphi(R). \end{cases}$$

where

$$\Phi_1 \equiv \frac{c_1}{(1-p_L)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h+l),$$

$$\Phi_2 \equiv \frac{c_1}{(1-p_H)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h+l) - (h-l).$$

Theorem 4.1's explanation is that facing independent voters who are nonconformist, when the condition (4.6) is satisfied, **S** exists where the incumbent uses her private information optimally to promote social interests in the period 1. The condition (4.6) places restrictions on incumbent's "ego rents" X_2 in **S**. The restrictions bear on incumbent's decisions with the cut-off point Θ .

Theorem 4.1's intuition is simple. In our model, when there is no conformity, independent voters' information about the incumbent is adequately transferred into voting, which has a disciplining effect: the incumbent prefers to use her own information as to the best policy in the socially efficient way, in the separating equations.

4.4.2 Equilibrium is **P**

We suppose now that independent voters believe that both two types of incumbents always decide to continue her policy (**P** strategy). If the incumbent follows **P** strategy, a decision to continue her policy does not provide information about the effects of the policy to independent voters. Therefore, **P** is a pooling equilibrium where each independent voter does not adjust his belief about the incumbent's type in response to a decision to continue the policy and his *a posteriori* belief about the incumbent type is equal to his *prior* belief φ .

To derive the conditions of **P**, we need an assumption about the independent voters' belief if the incumbent unexpectedly repeals her policy. As Dur (2001), we assume that when the incumbent repeals her policy, each independent voter concludes that the policy has been a failure and updates the probability that the incumbent is **H** type as in the function (4.5). Because of this assumption about out-of-equilibrium beliefs, the difference between this subsection and subsection 4.4.1 is that voters' *prior* belief in this subsection about the incumbent's type is no longer affected by the decision to continue the implemented policy. Thus, being similar to $\bar{\kappa}_d$, when $1 > \varphi > 0$ and the incumbent's decision is $d = C$, the expected value of the *prior* probability that a challenger is **H** type is updated by the incumbent herself as $\bar{\kappa}$ and

$$\bar{\kappa} \equiv E[\kappa_G | \kappa_G > \varphi] = \frac{\int_{\varphi}^1 xg(x)dx}{1-\varphi} = \frac{1+\varphi}{2}.$$

$\bar{\kappa}$ will be used in the proof of Theorem 4.2. Being similar to Theorem 4.1 about **S**, we give Theorem 4.2 about **P**.

Theorem 4.2 *When $k = 0$, P appears iff:*

$$X_2 > \Psi, \tag{4.7}$$

and

$$\Psi = \begin{cases} \Psi_1, & \Theta > \varphi - \varphi(R), \\ \Psi_2, & \Theta \leq \varphi - \varphi(R). \end{cases}$$

where

$$\Psi_1 \equiv \frac{c_1}{(1 - p_H)[\varphi - \varphi(R)]} - \frac{\varphi + \varphi(R)}{2}(h + l) - (h - l),$$

$$\Psi_2 \equiv \frac{c_1}{(1 - p_L)[\varphi - \varphi(R)]} - \frac{\varphi + \varphi(R)}{2}(h + l).$$

Theorem 4.2's explanation is that if the incumbent cares sufficiently about holding office relative to social welfare, she never repeals her policy. The condition 4.7 in Theorem 4.2 only bears on incumbent's decision R with the cut-off point Θ .

Theorem 4.2's intuitions are simple. When there is no conformity, independent voters' information about the incumbent is unsatisfactorily transferred into voting. It has a harmful effect in the separating equations: the incumbent prefers to ignore her private useful information about social interests and always continue her policy as an absolute office-seeker.

4.4.3 Conclusion

Our results in this section are similar to Dur (2001)'s. However, we are interested in the differences between ours and theirs. We are aware that these differences come from our changes in model's assumptions. First, we assume that the incumbent has known well about her type as private information. Neither the incumbent nor the voters are certain of her type in Dur (2001) where the incumbent and the voters have the same *prior* probability that the incumbent in period 1 is H type and this *prior* probability is common knowledge. Second, we have partisan voters. The partisan voters are presented by the probabilities p_H and p_L . We note that p_H and p_L have effects on the conditions about **S** and **P**. Removing these changes, our results and Dur (2001)'s are the same. We do these modifications for considering conformity which will be detailed in the next section.

4.5 Conformity case

Above all, as what we have done in the subsection 4.4.1, if the incumbent's policy is continued, the *a posteriori* probability that she is H type is the same as the function (4.4); if her policy is repealed, the *a posteriori* probability that she is H type is the same as the function (4.5). We mark the left term in the condition (4.2) as $\varphi'(d)$, i.e.,

$$\varphi'(d) \equiv \varphi(d) + k \frac{p_H \varphi(d) + p_L [1 - \varphi(d)]}{h - l}.$$

Thus, the condition (4.2) is rewritten as

$$\varphi'(d) > \kappa_G \quad (4.8)$$

Similarly, as what we have done in Subsection 4.4.2 about **P**, we suppose that each independent voter does not adjust his belief about her type in response to the incumbent's decision to continue her policy. But if she repeals her policy, he adjusts the probability that she is H type given by the function (4.5). Correspondingly, we give φ' where.

$$\varphi' \equiv \varphi + k \frac{p_H \varphi + p_L (1 - \varphi)}{h - l}.$$

Therefore, when incumbent's decision is *C*, independent voters with $k \neq 0$ in **P** vote for her iff,

$$\varphi' > \kappa_G. \quad (4.9)$$

Overall, we recall that $\varphi(C) > \varphi > \varphi(R)$, thus

$$\varphi'(C) > \varphi' > \varphi'(R).$$

Correspondingly, when the incumbent's decision is *d* and $1 > \varphi'(d) > 0$, she updates the expected value of the *prior* probability that a challenger is H type as $\overline{\kappa'_d}$ and

$$\overline{\kappa'_d} \equiv E[\kappa_G | \kappa_G > \varphi'(d)] = \frac{\int_{\varphi'(d)}^1 x g(x) dx}{1 - \varphi'(d)} = \frac{1 + \varphi'(d)}{2}.$$

Moreover, given $\varphi'(d) \geq 1$, because of $\kappa_G \in [0, 1]$, it is obvious that

$$\overline{\kappa'_d} \equiv 0.$$

Similarly, we give $\overline{\kappa^J}$, i.e.,

given $1 > \varphi' > 0$,

$$\bar{\kappa}' \equiv E[\kappa_G | \kappa_G > \varphi'] = \frac{\int_{\varphi'}^1 xg(x)dx}{1 - \varphi'} = \frac{1 + \varphi'}{2};$$

given $\varphi' \geq 1$,

$$\bar{\kappa}' \equiv 0.$$

4.5.1 S with conformity

Let us restart with S strategy, ($\sigma_S = 1, \sigma_F = 0$). Being similar to Theorem 4.1, we get Theorem 4.3 below.

Theorem 4.3 a) When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$,

S exists for $\forall X_2 > 0$.

b) When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, *S exists iff*

$$\Phi'_b < X_2 < \Phi', \quad (4.10)$$

and

$$\Phi' = \begin{cases} \Phi'_1, & \Theta > 1 - \varphi'(R), \\ \Phi'_2, & \Theta \leq 1 - \varphi'(R), \end{cases}$$

where

$$\begin{aligned} \Phi'_1 &\equiv \frac{c_1}{(1-p_L)[1-\varphi'(R)]} + \frac{1+\varphi'(R)}{2}(h-l), \\ \Phi'_2 &\equiv \frac{c_1}{(1-p_H)[1-\varphi'(R)]} - \frac{1-\varphi'(R)}{2}(h-l), \\ \Phi'_b &\equiv \frac{-b_1}{(1-p_L)[1-\varphi'(R)]} + \frac{1+\varphi'(R)}{2}(h-l). \end{aligned}$$

c) When $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, *S exists iff*

$$X_2 < \Phi', \quad (4.11)$$

and

$$\Phi' = \begin{cases} \Phi'_3, & \Theta > \varphi'(C) - \varphi'(R), \\ \Phi'_4, & \Theta \leq \varphi'(C) - \varphi'(R). \end{cases}$$

where

$$\begin{aligned} \Phi'_3 &\equiv \frac{c_1}{(1-p_L)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h+l), \\ \Phi'_4 &\equiv \frac{c_1}{(1-p_H)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h+l) - (h-l). \end{aligned}$$

Theorem 4.3's explanation is simple. We recall that when the independent voters vote for the incumbent, the incumbent must be the winner from our model's assumptions, but when they vote for the challenger, the challenger may be the winner. This fact implies that conformity tends to make independent voters prefer the incumbent to the challenger. That is, conformity increase incumbent advantage in our model. Accordingly, the incumbent has more chance to win. That is, e_2 becomes larger with the appearance of conformity.

Especially, in case a) , because of the independent voter's strong desire to win, which is presented by $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, the incumbent wins certainly in the re-election even she repeals the policy. Therefore, no matter what her ego rents X_2 is, there is \mathbf{S} where if independent voters believe that incumbent follows \mathbf{S} strategy and the incumbent has observed her private informative signal about her implemented policy in period 1 is a success, both types of incumbents' optimal decision is to continue the policy; if it is a failure, both types of incumbents' optimal decision is to repeal the policy.

In case b) where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, when independent voters believe that the incumbent follows \mathbf{S} strategy, the incumbent win in the re-election certainly only if she continues the policy. Therefore, if and only if the condition (4.10) is satisfied, \mathbf{S} exists. The conditions (4.10) impose a restriction on incumbent's ego rents X_2 . The restriction is related to the cut-off point Θ .

Similarly, in case c) where $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, when independent voters believe that the incumbent follows \mathbf{S} strategy, the incumbent can lose in the re-election no matter what her decision d is. In this case, there is \mathbf{S} under the condition (4.11). If we replace $\varphi'(C)$ and $\varphi'(R)$ with $\varphi(C)$ and $\varphi(R)$ separately in the condition (4.11), it becomes to the condition (4.6). This shows that conformity affects the condition (4.11) through replacing independent voters' *a posteriori* probability. That is to say, conformity affects the conditions about \mathbf{S} through e_2 .

Overall, theorem 4.3's intuition is that, conformity representing as desire to win make independent voters prefer the incumbent to the challenger in our model. Thus, the independent voters may not want to translate their information about the incumbent into their votes. It has an influence on our incumbent in \mathbf{S} . Concretely, conformity affects the conditions about \mathbf{S} through the incumbent's probability of winning in re-election, e_2 . Moreover, the change in e_2 follows conformity degree k . First, when k equals or exceeds $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, the result is yielded as in case a). Second, when k is inferior to $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$ but superior to $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, the result is yielded as in case b). Third, when k is equal or inferior to $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, the result is yielded as in case c).

4.5.2 P with conformity

Being similar to Theorem 4.2, we get Theorem 4.4 about **P** with conformity.

Theorem 4.4 a) When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$,

P does not exist.

b)⁹ When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, **P** exists iff

$$X_2 > \Psi', \quad (4.12)$$

and

$$\Psi' = \begin{cases} \Psi'_1, & \Theta > 1 - \varphi'(R), \\ \Psi'_2, & \Theta \leq 1 - \varphi'(R), \end{cases}$$

where

$$\begin{aligned} \Psi'_1 &\equiv \frac{c_1}{(1-p_H)[1-\varphi'(R)]} - \frac{1-\varphi'(R)}{2}(h-l), \\ \Psi'_2 &\equiv \frac{c_1}{(1-p_L)[1-\varphi'(R)]} + \frac{1+\varphi'(R)}{2}(h-l). \end{aligned}$$

c) When $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, **P** exists iff

$$X_2 > \Psi', \quad (4.13)$$

and

$$\Psi' = \begin{cases} \Psi'_3, & \Theta > \varphi' - \varphi'(R), \\ \Psi'_4, & \Theta \leq \varphi' - \varphi'(R), \end{cases}$$

where

$$\begin{aligned} \Psi'_3 &\equiv \frac{c_1}{(1-p_H)[\varphi' - \varphi'(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h+l) - (h-l), \\ \Psi'_4 &\equiv \frac{c_1}{(1-p_L)[\varphi' - \varphi'(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h+l). \end{aligned}$$

The explanation of Theorem 4.4 is simple. We recall again that when the independent voters vote for the incumbent, the incumbent must be the winner, but when they vote for the challenger, the challenger may not be the winner. Conformity makes the incumbent have more chance to win, i.e., e_2 increases with the conformity degree k .

⁹ Comparing Theorem 4.3 and Theorem 4.4 we note that $\Phi'_1 \equiv \Psi'_2$ and $\Phi'_2 \equiv \Psi'_1$. Though they are the same separately, we use different notations. The reason is that they are used for sets rather than variables

Concretely, in case *a*) where $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, because of independent voters's strong desire to win, the incumbent wins certainly in the re-election even she repeals the policy. Therefore, no matter what her ego rents X_2 is, she never repel her failing policy. Thus, **P** does not exist.

In case *b*) where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, when independent voters believe that the incumbent follows **P** strategy, the incumbent wins in the re-election certainly only if she continues the policy. Therefore, if and only if the condition (4.12) is satisfied, **P** exists. The condition (4.12) implies that if the incumbent cares sufficiently about holding office relative to social welfare, she never repeals her policy.

In case *c*) where $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, when independent voters believe that the incumbent follows **P** strategy, the incumbent may lose in the re-election no mater what her decision d is. In this case, under the condition (4.13), there is **P**. If we replace φ' and $\varphi'(R)$ with φ and $\varphi(R)$ separately in the condition (4.13), it becomes to the condition (4.7). This shows that conformity affects the condition (4.13) through replacing independent voters' *a posterior* probability. That is to say, conformity affects the conditions about **P** through e_2 .

In brief, Theorem 4.4's intuition is that, in our model, conformity representing as desire to win make independent voters prefer the incumbent to the challenger. Thus, the independent voters may not want to translate their information about the incumbent into their votes. It influences our incumbent in **P**. That is, it affects the conditions about **P** through e_2 . Concretely, the change in e_2 follows the conformity degree k . First, when k equals or exceeds $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, the result is yielded in case *a*). Second, when k is inferior to $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$ but superior $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi(\alpha)+p_L}$, the result is yielded in case *b*). Third, when k is equal or inferior to $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, the result is yielded in case *c*).

4.5.3 Conclusion

Compared to Section 3, case *a*) and case *b*) in Theorem 4.3 and Theorem 4.4 are new things. Their distinguishing features will be detailed in the following section as corollaries through comparative analysis. But Theorem 4.3's case *c*) and Theorem 4.4's case *c*) are formally similar to Theorem 4.1 and Theorem 4.2 separately. If we replace $\varphi'(d)$ and φ' by $\varphi(d)$ and φ separately in Theorem 4.3's case *c*) and Theorem 4.4's case *c*) , Theorem 4.3's case *c*) is the same to Theorem 4.1 and Theorem 4.4's case *c*) is the same to Theorem 4.2. This shows that conformity affects the conditions about **S** and **P** through e_2 (the incumbent's probability of winning in re-election). In the next section, we will detail these conformity effects.

4.6 Comparative analysis

We sharpen our two main questions. First, does conformity induce **S**? Second, does conformity reduce **P**?

4.6.1 **S**

Inspired by Theorem 4.3, we consider the first question in three cases sequentially, i.e., the first case where $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$; the second case where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$; and the third case where $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$.

4.6.1.1 First case

Theorem 4.3 shows that when $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, **S** exists no matter what “ego rents X_2 ” is, which is different from the condition about **S** when independent voters are nonconformist in Theorem 4.1. We present the difference in Corollary 4.1.

Corollary 4.1 *When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, **S** exists for $\forall X_2 > 0$. When $k = 0$, **S** exists iff the condition (4.6) is satisfied. Therefore, conformity induces **S**.*

Because of simplicity, the proof of Corollary 4.1 is omitted. The explanation of Corollary 4.1 is presented below.

When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, the probabilities $\varphi'(d) \geq 1 \geq \kappa_G (\forall d \in \{C, R\})$. Thus, $\mathbf{G}(\varphi'(C)) = \mathbf{G}(\varphi'(R)) = 1$. It means that each independent voter votes for the incumbent no matter what her decisions d is. Thus, the incumbent must be the winner in the re-election. Furthermore, her decision d will not be affected by the re-election pressure. Because of $b_1 > 0$ and $c_1 > 0$, **S** exists no matter what the incumbent's “ego rents X_2 ” is. However, when $k = 0$, $1 > \varphi(d) > 0 (\forall d \in \{C, R\})$. Thus, $1 > \mathbf{G}(\varphi'(d))$. It means the incumbent has the re-election pressure. From Theorem 4.1, **S** exists if and only if the condition (4.6) is satisfied. Altogether, if $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, conformity induces **S**.

4.6.1.2 Second case

When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, $\varphi'(C) > 1 > \varphi'(R)$ and $\mathbf{G}(\varphi'(C)) = 1 > \mathbf{G}(\varphi'(R))$. It means if the incumbent's decision is C , the probability that κ_G is smaller than $\varphi'(\alpha, C)$, is 1; and if the incumbent's decision is R , the probability that κ_G is smaller than $\varphi'(R)$, is smaller than 1. It shows that the incumbent's decision C make certainly each

independent voter's *a posteriori* belief about that her type is H excels his *prior* belief about that a challenger's type is H, but the decision R dose not. We see the condition of \mathbf{S} from the condition (4.6) is $X_2 \in (0, \Phi)$, and from (4.10) is $X_2 \in (\Phi'_b, \Phi')$. Furthermore, we present the relationship between Φ and Φ' in Table 4.1.

The next discussion is to find the conditions under which conformity induce \mathbf{S} , i.e $(0, \Phi) \subseteq (\Phi'_b, \Phi')$. Of course, we need $\Phi'_b \leq 0$, i.e. the condition (4.14) is satisfied:

$$\frac{2b_1}{(1-p_L)(h-l)} \geq 1 - [\varphi'(R)]^2. \quad (4.14)$$

When the condition (4.14) is satisfied, the intuitions is that when independent voters are conformists and $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, continuing the successful policy is preferred to repealing it for L type incumbents no matter what her ego rents X_2 is.

	case a) : $\Theta > 1 - \varphi'(R) \geq \varphi(C) - \varphi(R)$ or $\Theta > \varphi(C) - \varphi(R) \geq 1 - \varphi'(R)$	case b) : $1 - \varphi'(R) \geq \Theta > \varphi(C) - \varphi(R)$	case c): $\varphi(C) - \varphi(R) \geq \Theta > 1 - \varphi'(R)$	case d) : $1 - \varphi'(R) \geq \varphi(C) - \varphi(R) \geq \Theta$ or $\varphi(C) - \varphi(R) \geq 1 - \varphi'(R) \geq \Theta$
Φ_1	$\Phi = \Phi_1$	$\Phi = \Phi_1$		
Φ_2			$\Phi = \Phi_2$	$\Phi = \Phi_2$
Φ'_1	$\Phi' = \Phi'_1$		$\Phi' = \Phi'_1$	
Φ'_2		$\Phi' = \Phi'_2$		$\Phi' = \Phi'_2$

Table 4.1: The relationship between Φ and Φ' when $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$.

Following Table 4.1, we sequentially do the discussions in four cases.

- In case a) of Table 4.1,

$$\Phi'_1 > \Phi_1$$

iff

$$\frac{1 + \varphi'(R)}{2}(h-l) + \frac{\varphi(C) + \varphi(R)}{2}(h+l) > \frac{c_1}{1-p_L} \left\{ \frac{1}{\varphi(C) - \varphi(R)} - \frac{1}{1 - \varphi'(R)} \right\}, \quad (4.15)$$

When the condition (4.15) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, believes that the incumbent uses \mathbf{S} strategy and uses Byes's rule update his belief about her type after observing her decision, when repealing the failing policy is preferred to continuing it for the L type incumbent facing nonconformist independent voters, repealing the failing policy must be preferred to continuing it for the L type incumbent facing conformist independent voters.

Therefore, under the conditions (4.14) and (4.15)

$$(0, \Phi) \subseteq (\Phi'_b, \Phi').$$

It implies that the condition about **S** with conformity become less restricted compared with the case $k = 0$. In other words, conformity induces **S** under the conditions (4.14) and (4.15) in case a) of the table 4.1.

- In case b) of Table 4.1,

$$\Phi'_2 > \Phi_1.$$

iff

$$-\frac{1 - \varphi'(R)}{2}(h-l) + \frac{\varphi(C) + \varphi(R)}{2}(h+l) > \frac{c_1}{(1 - p_L)[\varphi(C) - \varphi(R)]} - \frac{c_1}{(1 - p_H)[1 - \varphi'(R)]} \quad (4.16)$$

When the condition (4.16) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1 - \varphi(R)](h-l)}{(p_H - p_L)\varphi(R) + p_L} > k > \frac{[1 - \varphi(C)](h-l)}{(p_H - p_L)\varphi(C) + p_L}$, believes that the incumbent uses **S** strategy and uses Byes's rule update his belief about her type after observing her decision, when repealing the failing policy is preferred to continuing it for the L type incumbent facing nonconformist independent voters, repealing the failing policy must be preferred to continuing it for the H type incumbent facing conformist independent voters.

Therefore, under the conditions (4.14) and (4.16)

$$(0, \Phi) \subseteq (\Phi'_b, \Phi').$$

Similarly, it shows conformity induces **S** under the conditions (4.14) and (4.16) in case b) of the table 4.1.

- In case c) of Table 4.1,

$$\Phi'_1 > \Phi_2$$

iff

$$\frac{3 + \varphi'(R)}{2}(h-l) + \frac{\varphi(C) + \varphi(R)}{2}(h+l) > \frac{c_1}{(1 - p_H)[\varphi(C) - \varphi(R)]} - \frac{c_1}{(1 - p_L)[1 - \varphi'(R)]}, \quad (4.17)$$

When the condition (4.17) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1 - \varphi(R)](h-l)}{(p_H - p_L)\varphi(R) + p_L} > k > \frac{[1 - \varphi(C)](h-l)}{(p_H - p_L)\varphi(C) + p_L}$, believes that the incumbent uses **S** strategy and uses Byes's rule update his belief about

her type after observing her decision, when repealing the failing policy is preferred to continuing it for the H type incumbent facing nonconformist independent voters, repealing the failing policy must be preferred to continuing it for the L type incumbent facing conformist independent voters.

Therefore, under the conditions (4.14) and (4.17)

$$(0, \Phi) \subseteq (\Phi'_b, \Phi').$$

Similarly, it shows conformity induces S under the conditions (4.14) and (4.17) in case c) of the table 4.1.

- In case d) of Table 4.1,

$$\Phi'_2 > \Phi_2$$

iff

$$\frac{1 + \varphi'(R)}{2}(h - l) + \frac{\varphi(C) + \varphi(R)}{2}(h + l) > \frac{c_1}{1 - p_H} \left[\frac{1}{\varphi(C) - \varphi(R)} - \frac{1}{1 - \varphi'(R)} \right] \quad (4.18)$$

When the condition (4.18) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1 - \varphi(R)](h - l)}{(p_H - p_L)\varphi(R) + p_L} > k > \frac{[1 - \varphi(C)](h - l)}{(p_H - p_L)\varphi(C) + p_L}$, believes that the incumbent uses S strategy and uses Bayes's rule update his belief about her type after observing her decision, when repealing the failing policy is preferred to continuing it for the H type incumbent facing nonconformist independent voters, repealing the failing policy must be preferred to continuing it for the H type incumbent facing conformist independent voters.

Therefore, under the conditions (4.14) and (4.18)

$$(0, \Phi) \subseteq (\Phi'_b, \Phi'),$$

Similarly, it shows conformity induces S under the conditions (4.14) and (4.18) in case d) of the table 4.1.

To sum up, we present the results as Corollary 4.2. The above discussion equals a proof for Corollary , and its proof is omitted.

Corollary 4.2 *When $\frac{[1 - \varphi(R)](h - l)}{(p_H - p_L)\varphi(R) + p_L} > k > \frac{[1 - \varphi(C)](h - l)}{(p_H - p_L)\varphi(C) + p_L}$, and the condition (4.14) is satisfied, iff the condition (4.15) is satisfied in case a) of Table 4.1, or the condition (4.16) is satisfied in case b) of Table 4.1, or the condition (4.17) is satisfied in case c) of Table 4.1, or the condition (4.18) is satisfied in case d) of Table 4.1,*

$$(0, \Phi) \subseteq (\Phi'_b, \Phi'),$$

i.e., conformity induces S .

The intuitions of Corollary 4.2 are simple. We recall that in the second case discussing **S** the incumbent facing conformist voters must be re-elected if and only if she continues her policy in period 1. Simultaneously, we recall that the expected social welfare b_1 is given to be sufficiently large so that the condition (4.14) is satisfied.

First, in case a), the background is that the differences caused by incumbent's decisions in independent voters' *a posteriori* probability that the incumbent is H type is limited. They are inferior to Θ . Under this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.15) is satisfied, the existence of voters' conformity encourages more incumbents to stick to efficient decisions for society.

Second, similar intuitions can be obtained in case b). Its background is that when independent voters are conformist, the difference caused by incumbent's decision in their *a posteriori* probability that the incumbent is H type is adequate, which is equal or superior to Θ . But when independent voters are nonconformist, the difference is limited and inferior to Θ . Under this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.16) is satisfied, the voters' conformity encourages more incumbents to stick to efficient decisions for society.

Third, as before, The background in case c) is that when independent voters are conformist, the difference caused by incumbent's decision in their *a posteriori* probability that the incumbent is H type is limited and inferior to Θ . But when independent voters are nonconformist, the difference is adequate, which is equal or superior to Θ . Under this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.17) is satisfied, the conformity encourages more incumbents to stick to efficient decisions for society.

Fourth, we show the intuitions in case d) as that developed above. Its background is that the differences caused by incumbent's decision in independent voters' *a posteriori* probability that the incumbent is H type are adequate. They are equal or superior to Θ . Under this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.18) is satisfied, the conformity encourages more incumbents to stick to efficient decisions for society.

4.6.1.3 Third case

When $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, $1 \geq \mathbf{G}(\varphi'(C)) > \mathbf{G}(\varphi'(R))$, i.e., if the incumbent's decision is C , the probability that κ_G is smaller than $\varphi'(C)$, is no more than 1; and if the incumbent's decision is R , the probability that κ_G is smaller than $\varphi'(R)$, is smaller than $\mathbf{G}(\varphi'(C))$. It shows that in the third case the incumbent's decision d could not make certainly each independent voter's *a posteriori* belief about that her type is H excels his *prior* belief about that

a challenger's type is H. Comparing Theorem 4.3 with Theorem 4.1, we present Corollary 4.3.

Corollary 4.3 *When $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$,*

if $X_2 \in (0, \Phi')$, we get that $X_2 \in (0, \Phi)$.

It shows the condition about S has become more restricted compared with the case $k = 0$, i.e., conformity reduces S.

The corollary 4.3's intuition is simple. We recall that because of incumbent advantage, when independent voters vote for their incumbent, the incumbent is the winner certainly in our model. While they vote for the challenger, the challenger may be not the winner. It means that conformity makes independent voters prefer the incumbent to the challenger. Moreover, supposing each independent voter believes that the incumbent uses S strategy and uses Bayes' rule update his belief about the incumbent's type, it is worth stressing that her decision C (R) would give her more (less) chance to win. Because independent voters have weak conformity, i.e., $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, they want to win. Being compared with the case where independent voters are nonconformist, because the conformity is weak, the incumbent's decision C (R) gives her another more (less) chance to win. Thus, the effect of the incumbent's decision on her probability of winning in re-election has become more important for her when independent voters have weak desire to win ($\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$) compared with when independent voters are nonconformist. This induces more incumbents to always prefer continuing her policy and ignoring her information. That is, the condition about S from the incumbent's "ego rents X_2 " point has become more restricted, i.e., less incumbents act on her information when giving her decision d in period 1. It shows that conformity as a weak desire to win tends to defer incumbents from efficient decisions and hurt social interests.

4.6.2 P

Inspired by Theorem 4.4, we sequentially discuss P, i.e., the first case where $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, the second case where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, and the third case where $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$.

4.6.2.1 First case

When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, thus, $\mathbf{G}(\varphi') \equiv \mathbf{G}(\varphi'(R)) \equiv 1$. It means that each independent voter will vote for the incumbent no matter what her decision is. The incumbent is the

winner in re-election for certainty. The incumbent's decision is affected by re-election pressure. Because of $b_1 > 0$ and $c_1 > 0$, \mathbf{P} does not exist no matter what the incumbent's "ego rent X_2 " is. This is totally different from the condition about \mathbf{P} when $k = 0$ in Theorem 4.2. We sum the results up in Corollary 4.4. The proof of Corollary 4.4 is omitted for its simplicity.

Corollary 4.4 *When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, \mathbf{P} does not exist. When $k = 0$, \mathbf{P} exists iff the condition (4.7) is satisfied. It shows that conformity reduces \mathbf{P} .*

In other words, Corollary 4.4 shows that when $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, incumbent's pandering is eliminated by the independent voters' desire to win.

4.6.2.2 Second case

When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, $\mathbf{G}(\varphi') = 1 > \mathbf{G}(\varphi'(\alpha, R))$, i.e., if the incumbent's decision is C , the probability that κ_C is smaller than φ' , is 1, and if the incumbent's decision is R , the probability that κ_C is smaller than $\varphi'(R)$, is smaller than 1. It shows that the incumbent's decision C makes certainly each independent voter's *a posteriori* belief about that her type is H excels his *prior* belief that a challenger's type is H, but decision R does not. We see the condition about \mathbf{P} from the condition (4.7) is $X_2 \in (\Psi, +\infty)$, and from the condition (4.12) is $X_2 \in (\Psi', +\infty)$. We present the relationship between Ψ and Ψ' in Table 4.2.

	case a): $\Theta > 1 - \varphi'(R) \geq \varphi - \varphi(R)$ or $\Theta > \varphi - \varphi(R) \geq 1 - \varphi'(R)$	case b): $1 - \varphi'(R) \geq \Theta > \varphi - \varphi(R)$	case c): $\varphi - \varphi(R) \geq \Theta > 1 - \varphi'(R)$	case d): $1 - \varphi'(R) \geq \varphi - \varphi(R) \geq \Theta$ or $\varphi - \varphi(R) \geq 1 - \varphi'(R) \geq \Theta$
Ψ_1	$\Psi = \Psi_1$	$\Psi = \Psi_1$		
Ψ_2			$\Psi = \Psi_2$	$\Psi = \Psi_2$
Ψ'_1	$\Psi' = \Psi'_1$		$\Psi' = \Psi'_1$	
Ψ'_2		$\Psi' = \Psi'_2$		$\Psi' = \Psi'_2$

Table 4.2: The relationship between Ψ and Ψ' when $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$.

Following Table 4.2, we discuss the conditions of \mathbf{P} in four cases sequentially.

- In case a) of Table 4.2,

$$\Psi'_1 > \Psi_1$$

iff

$$\frac{1 + \varphi'(R)}{2}(h-l) + \frac{\varphi + \varphi(R)}{2}(h+l) > \frac{c_1}{1-p_H} \left[\frac{1}{\varphi - \varphi(R)} - \frac{1}{1 - \varphi'(R)} \right]. \quad (4.19)$$

When the condition (4.19) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, believes that the incumbent uses **P** strategy, uses Byes's rule update his belief about her type only after observing her decision R , and remains his belief after observing her decision C , when repealing the failing policy is preferred to continuing it for the H type incumbent facing conformist independent voters, repealing the failing policy must be preferred to continuing it for the H type incumbent facing nonconformist independent voters.

Thus,

$$\Psi' > \Psi.$$

which means $(\Psi', +\infty) \subseteq (\Psi, +\infty)$, i.e., the condition about the emergence of **P** with conformity has become more restricted compared with $k = 0$. In other word, pandering decreases with the independent voters' desire to win.

- In case b) of Table 4.2,

$$\Psi'_2 > \Psi_1$$

iff

$$\frac{3 + \varphi'(R)}{2}(h-l) + \frac{\varphi + \varphi(R)}{2}(h+l) > \frac{c_1}{(1-p_H)[\varphi - \varphi(R)]} - \frac{c_1}{(1-p_L)[1 - \varphi'(R)]}. \quad (4.20)$$

When the condition (4.20) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, believes that the incumbent uses **P** strategy, uses Byes's rule update his belief about her type only after observing her decision R , and remains his belief after observing her decision C , when repealing the failing policy is preferred to continuing it for the L type incumbent facing conformist independent voters, repealing the failing policy must be preferred to continuing it for the H type incumbent facing nonconformist independent voters.

Thus,

$$\Psi' > \Psi.$$

Similarly, it implies that pandering decreases with the independent voters' desire to win.

- In case c) of Table 4.2,

$$\Psi'_1 > \Psi_2$$

iff

$$\frac{-1 + \varphi'(R)}{2}(h - l) + \frac{\varphi + \varphi(R)}{2}(h + l) > \frac{c_1}{(1 - p_L)[\varphi - \varphi(R)]} - \frac{c_1}{(1 - p_H)[1 - \varphi'(R)]}. \quad (4.21)$$

When the condition (4.21) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1 - \varphi(R)](h - l)}{(p_H - p_L)\varphi(R) + p_L} > k > \frac{(1 - \varphi)(h - l)}{(p_H - p_L)\varphi + p_L}$, believes that the incumbent uses **P** strategy, uses Byes's rule update his belief about her type only after observing her decision R , and remains his belief after observing her decision C , when repealing the failing policy is preferred to continuing it for the H type incumbent facing conformist independent voters, repealing the failing policy must be preferred to continuing it for the L type incumbent facing nonconformist independent voters. Thus,

$$\Psi' > \Psi.$$

Similarly, it implies that pandering decreases with the independent voters' desire to win.

- In case d) of Table 4.2,

$$\Psi'_2 > \Psi_2$$

iff

$$\frac{1 + \varphi'(R)}{2}(h - l) + \frac{\varphi + \varphi(R)}{2}(h + l) > \frac{c_1}{1 - p_L} \left[\frac{1}{\varphi - \varphi(R)} - \frac{1}{1 - \varphi'(R)} \right]. \quad (4.22)$$

When the condition (4.22) is satisfied, the intuition is that supposing each conformist independent voter has the conformity degree k where $\frac{[1 - \varphi(R)](h - l)}{(p_H - p_L)\varphi(R) + p_L} > k > \frac{(1 - \varphi)(h - l)}{(p_H - p_L)\varphi + p_L}$, believes that the incumbent uses **P** strategy, uses Byes's rule update his belief about her type only after observing her decision R , and remains his belief after observing her decision C , when repealing the failing policy is preferred to continuing it for the L type incumbent facing conformist independent voters, repealing the failing policy must be preferred to continuing it for the L type incumbent facing nonconformist independent voters. Thus

$$\Psi' > \Psi,$$

Similarly, it implies that pandering decreases with the independent voters' desire to win.

To sum up, we present the results as Corollary 4.5. The proof about Corollary 4.5 is omitted for concision, because it has been well discussed above.

Corollary 4.5 *When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, iff the condition (4.19) is satisfied in case a) of Table 4.2, or the condition (4.20) is satisfied in case b) of Table 4.2, or the condition (4.21) is satisfied in case c) of Table 4.2, or the condition (4.22) is satisfied in case d) of Table 4.2, we have conformity reduce P , i.e.,*

$$(\Psi', +\infty) \subseteq (\Psi, +\infty).$$

The intuitions of Corollary 4.5 are simple. We recall that in the second case discussing P the incumbent facing conformist voters must be re-elected if and only if she continues her policy in period 1.

Then, in case a), the background is that the differences caused by incumbent's decisions in independent voters' *a posteriori* probability that the incumbent is H type is limited. They are inferior to Θ . Under this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.19) is satisfied, the existence of voters' conformity deters many incumbents from pandering.

Similarly, the background in case b) is that when independent voters are conformist, the difference caused by incumbent's decision in their *a posteriori* probability that the incumbent is H type is adequate, which is equal or superior to Θ . But when independent voters are nonconformist, the difference is limited and inferior to Θ . Given this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.20) is satisfied, the conformity deters many incumbents from pandering.

As before, the background in case c) is that when independent voters are conformist, the difference caused by incumbent's decision in their *a posteriori* probability that the incumbent is H type is limited and inferior to Θ . But when independent voters are nonconformist, the difference is adequate, which is equal or superior to Θ . Given this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.21) is satisfied, the conformity deters many incumbents from pandering.

As the intuitions developed above, the background in case d) is that the differences caused by incumbent's decisions in independent voters' *a posteriori* probability that the incumbent is H type are adequate. They are equal or superior to Θ . Under this background, when the expected social welfare loss c_1 is sufficiently minor so that the condition (4.22) is satisfied, the existence of voters' conformity deters many incumbents from pandering.

In short, Corollary 4.5 shows the conditions under which incumbent's pandering decreases with the independent voters' desire to win.

4.6.2.3 Third case

When $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, we have that $1 \geq \mathbf{G}(\varphi') > \mathbf{G}(\varphi'(R))$, i.e., if the incumbent's decision is C , the probability that κ_G is smaller than φ' , is no more than 1, and if the incumbent's decision is R , the probability that κ_G is smaller than $\varphi'(R)$, is smaller than $\mathbf{G}(\varphi')$. It shows that the incumbent's decision (C or R) could not make certainly each independent voter's *a posteriori* belief about that her type is H excels his *prior* belief that a challenger's type is H. Comparing Theorem 4.4 with Theorem 4.2, we present Corollary 4.6.

Corollary 4.6 When $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$,

$$(\Psi, +\infty) \subseteq (\Psi', +\infty).$$

It implies that the condition about \mathbf{P} with conformity has become less restricted compared with $k = 0$, i.e. conformity induces \mathbf{P} .

In other words, Corollary 4.6 shows that incumbent's pandering increases with the independent voters' desire to win. The Corollary 4.6's intuition is simple. We recall again that conformity makes independent voters prefer the incumbent to the challenger in our model. Supposing each independent voter believes that the incumbent uses \mathbf{P} strategy and uses Bayes' rule update his belief about the incumbent's type only after observing her decision is R , it is worth stressing that when her decision is R , the decision R gives the challenger more chance to win. Because independent voters have weak conformity, i.e., $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, they want to win. Being compared with the case where independent voters are nonconformist, because the conformity is weak, the incumbent's decision R gives the challenger another more chance to win. Thus, the unfavourable effect of the incumbent's decision R on her probability of winning in re-election has become more unacceptable for her. It results in many incumbents to always prefer continuing her policy and ignoring her information. That is, the condition about \mathbf{P} from the incumbent's "ego rents X_2 " point has become less restricted. In other words, more incumbents stick to decision C in period 1. It shows that conformity as a weak desire to win tends to hurt social interests.

4.7 Conclusion

We present a re-election model that incorporates partisans and independent voters, where the independent voters are conformists and have a desire to win. We find the conditions of \mathbf{S} (\mathbf{P}) under which the incumbent makes her decision using \mathbf{S} (\mathbf{P}) strategy, when independent voters do not have perfect information about her policy competence and vote for her on the

basis of her decision in period 1. As what we have known, we for the first time present the effects of independent voters' conformity effects as the desire to win on the conditions of **S** and **P**.

Two assumptions play important roles in our analysis. First, we assume that challenger partisans' percentage of all voters are less than half in the light of the facts about "incumbent advantage". This assumption implies that our independent voters are sure to be the winner's side when they vote for our incumbent. Second, we assume that the incumbent and the independent voters have the common knowledge that the probability that more than half of all voters are partisans is decided by the incumbent's policy competence. It means that the probability that more than half of all voters are incumbent's partisans is p_H when the incumbent is H type, and p_L when she is L type. This assumption implies that the existences of two possibly conflicting criteria for independent voters. Firstly, independent voters have an intrinsic preference for one of the two candidates. The intrinsic preference is decided by the comparative analysis between the *a posteriori* probability about the incumbent to be H type following her first period decision and the *prior* probability about that a challenger is H type. Secondly, the independent voters prefer the winner who may be decided by the incumbent's partisans. When the winner is decided by the incumbent's partisans, the winner may be not the one that independent voters want to vote following the first criteria.

Our findings show that when independent voters have strong desire to win, **P** does not exist but **S** always exist. Under the condition where independent voters have weak desire to win, compared with the condition where independent voters are nonconformist, the condition about **S** becomes more restricted (i.e. reduce incumbent's true leadership) and the condition about **P** becomes less restricted (i.e., induce incumbent's pandering). These findings show that the conformity has double-faced effect (positive or negative), which depends on its extent. When more than half of all voters are partisans and the challenger can not be elected only depending on her partisans, independent voters' strong desire to win prevents the incumbent's pandering. Otherwise, if the desire to win becomes weaker, it promotes the incumbent's pandering.

Because of the model's simplicity, many other aspects have been left out of the analysis. Our model does not deal with incumbent's mixed strategy equilibria. Besides, our model does not deal with the context where our independent voters would receive a noisy signal about the effect of the incumbent's implemented policy. We hope that future work might be able to extend our analysis in these directions.

4.8 Appendix

Proof of Theorem 4.1

Proof. When $k = 0$, given that independent voters believes that the incumbent uses **S** strategy, when they observe her decision d , they update their belief about her type using Bayes' rule.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for H type incumbent iff:

$$X_1 + b_1 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi(C))(X_2 + h) + [1 - \mathbf{G}(\varphi(C))][\overline{\kappa_C}h + (1 - \overline{\kappa_C})l]\}$$

>

$$X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi(R))(X_2 + h) + [1 - \mathbf{G}(\varphi(R))][\overline{\kappa_R}h + (1 - \overline{\kappa_R})l]\}$$

\Leftrightarrow

$$b_1 + (1 - p_H)[\varphi(C) - \varphi(R)][X_2 + \frac{\varphi(C) + \varphi(R)}{2}(h + l) + (h - l)] > 0. \quad (4.23)$$

The first term in (4.23) represents the effect of continuing the successful policy on welfare, which is obviously positive. The second term in (4.23) represents the effect of the H type incumbent's decision on her probability of re-election, and thus on her expected utility after the re-election. We recall that $\varphi(C) > \varphi(R)$. Thus, provided that the incumbent is H type, the second term in (4.23) is obviously positive. Hence the function (4.23) is obviously positive. Its intuition is simple. Suppose each independent voter believes that the incumbent uses **S** strategy and uses Bayes' rule update his belief about her type after observing her decision, the H type incumbent will continue her successful policy.

2. When the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for L type incumbent iff:

$$X_1 + b_1 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi(C))(X_2 + l) + [1 - \mathbf{G}(\varphi(C))][\overline{\kappa_C}h + (1 - \overline{\kappa_C})l]\}$$

>

$$X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi(R))(X_2 + l) + [1 - \mathbf{G}(\varphi(R))][\overline{\kappa_R}h + (1 - \overline{\kappa_R})l]\}$$

\Leftrightarrow

$$b_1 + (1 - p_L)[\varphi(C) - \varphi(\alpha, R)][X_2 + \frac{\varphi(C) + \varphi(R)}{2}(h + l)] > 0. \quad (4.24)$$

Doing a similar analysis in (4.24) as in (4.23), it is clear that the condition (4.24) is satisfied. Its intuition is that suppose each independent voter believes that the incumbent uses **S** strategy and uses Bayes's rule update his belief about her type after observing her decision, the *L* type incumbent prefers to continue her successful policy.

3. When the incumbent has observed that her policy is a failure, repealing the policy is optimal for the *H* type iff:

$$\begin{aligned} X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi(R))(X_2 + h) + [1 - \mathbf{G}(\varphi(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\ > \\ X_1 + (-c_1) + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi(C))(X_2 + h) + [1 - \mathbf{G}(\varphi(C))][\bar{\kappa}_C h + (1 - \bar{\kappa}_C)l]\} \end{aligned}$$

\Leftrightarrow

$$c_1 + (1 - p_H)[\varphi(R) - \varphi(C)][X_2 + \frac{\varphi(R) + \varphi(C)}{2}(h + l) + (h - l)] > 0. \quad (4.25)$$

The first term in (4.25) represents the benefit of repealing the failing policy, which is positive. The second term in (4.25) is the effect of the *H* type incumbent's decision on her re-election chances, and thus on her welfare after re-election. Repealing the policy hurts the reputation of the *H* type incumbent, i.e., $\varphi(R) - \varphi(C) < 0$. Thus, the second term in (4.25) is negative. Furthermore, if the benefits of repealing the failing policy c_1 is sufficiently small, the condition (4.25) is violated. Therefore, the condition (4.25) is satisfied iff

$$X_2 < \frac{c_1}{(1 - p_H)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l) - (h - l).$$

4. When the incumbent has observed that her policy is a failure, repealing the failing policy is preferred to continuing the policy for *L* type incumbent iff:

$$X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi(R))(X_2 + l) + [1 - \mathbf{G}(\varphi(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\}$$

$>$

$$X_1 + (-c_1) + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi(C))(X_2 + l) + [1 - \mathbf{G}(\varphi(C))][\bar{\kappa}_C h + (1 - \bar{\kappa}_C)l]\}$$

\Leftrightarrow

$$c_1 + (1 - p_L)\{[\varphi(R) - \varphi(C)][X_2 + \frac{\varphi(R) + \varphi(C)}{2}(h + l)]\} > 0. \quad (4.26)$$

Doing a similar analysis as the above case, the condition (4.26) is satisfied iff

$$X_2 < \frac{c_1}{(1 - p_L)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l).$$

In summary, when independent voters believe that incumbent follows **S** strategy and the incumbent has observed her private informative signal about her implemented policy, both types of incumbents' optimal decision is to continue the successful policy, but both types of incumbents' optimal decision is to repeal the failing policy iff the two conditions (4.25) and (4.26) are satisfied:

$$X_2 < \Phi,$$

$$\Phi = \min\left\{ \frac{c_1}{(1 - p_H)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l) - (h - l), \frac{c_1}{(1 - p_L)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l) \right\}.$$

More concretely,

$$\Phi = \begin{cases} \frac{c_1}{(1 - p_L)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l), & \Theta > \varphi(C) - \varphi(R), \\ \frac{c_1}{(1 - p_H)[\varphi(C) - \varphi(\alpha, R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l) - (h - l), & \Theta \leq \varphi(C) - \varphi(R). \end{cases}$$

Therefore, we have proved Theorem 4.1. □

Proof of Theorem 4.2

Proof. When $k = 0$, we assume that independent voters believes that the incumbent uses **P** strategy. Thus, when they observe that her decision d is R , they update their belief about her type using Bayes' rule. Otherwise, they do not adjust their belief about her type.

1. Continuing a policy after observing that the policy is a success is optimal for the H type incumbent iff:

$$\begin{aligned}
& X_1 + b_1 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi)(X_2 + h) + [1 - \mathbf{G}(\varphi)][\bar{\kappa}h + (1 - \bar{\kappa})l]\} \\
& \qquad \qquad \qquad > \\
& X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi(R))(X_2 + h) + [1 - \mathbf{G}(\varphi(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\
& \qquad \qquad \qquad b_1 + (1 - p_H)[\varphi - \varphi(R)][X_2 + \frac{\varphi + \varphi(R)}{2}(h + l) + (h - l)] > 0. \tag{4.27}
\end{aligned}$$

The condition (4.27) is clearly satisfied. Its explanation is similar to (4.23). Its intuition is that if each independent voter believes that the incumbent uses \mathbf{P} strategy, and uses Bayes' rule update his belief about incumbent's type only after observing her decision is R , the H type incumbent will always continue her successful policy.

2. Similarly, continuing the successful policy is preferred to repealing it for the L type incumbent iff:

$$b_1 + (1 - p_L)[\varphi - \varphi(R)][X_2 + \frac{\varphi + \varphi(R)}{2}(h + l)] > 0. \tag{4.28}$$

The condition (4.28) is obviously satisfied.

3. When the incumbent has observed that her policy is a failure, continuing the policy is optimal for the H type incumbent iff:

$$-c_1 + (1 - p_H)[\varphi - \varphi(R)][X_2 + \frac{\varphi(R) + \varphi}{2}(h + l) + (h - l)] > 0. \tag{4.29}$$

It shows although the H type incumbent incurs the cost of continuing the failing policy, she avoids to face a lower probability of re-election which stems from the decision of repealing the policy. The condition (4.29) is held iff the H type incumbent has a sufficiently high "ego rents X_2 " and the policy outcome benefits from repealing the faithful policy c_1 is enough small, i.e.,

$$X_2 > \frac{c_1}{(1 - p_H)[\varphi - \varphi(R)]} - \frac{\varphi + \varphi(R)}{2}(h + l) - (h - l).$$

Its intuition is that suppose each independent voter believes that the incumbent uses \mathbf{P} strategy and uses Bayes' rule update his belief about the incumbent's type only after observing her decision is R , the H type incumbent who have a higher ego rents X_2 would never repeal her failing policy, when the policy outcome benefits from repealing the faithful policy is enough small.

4. Similarly, continuing the failing policy is preferred to repealing it for the L type incumbent iff:

$$-c_1 + (1 - p_L)\left\{[\varphi - \varphi(R)][X_2 + \frac{\varphi + \varphi(R)}{2}(h + l)]\right\} > 0, \quad (4.30)$$

i.e.,

$$X_2 > \frac{c_1}{(1 - p_L)[\varphi - \varphi(R)]} - \frac{\varphi + \varphi(R)}{2}(h + l).$$

In conclusion, there is **P** iff conditions (4.29) and (4.30) are satisfied:

$$X_2 > \Psi,$$

$$\Psi = \max\left\{\frac{c_1}{(1 - p_H)[\varphi - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l) - (h - l), \frac{c_1}{(1 - p_L)[\varphi - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l)\right\}.$$

More concretely,

$$\Psi = \begin{cases} \frac{c_1}{(1 - p_H)[\varphi - \varphi(R)]} - \frac{\varphi + \varphi(R)}{2}(h + l) - (h - l), & \Theta > \varphi - \varphi(R), \\ \frac{c_1}{(1 - p_L)[\varphi - \varphi(R)]} - \frac{\varphi + \varphi(R)}{2}(h + l), & \Theta \leq \varphi - \varphi(R). \end{cases}$$

Therefore, we have proved Theorem 4.2. \square

Proof of Theorem 4.3

Proof.

(a) When $k \geq \frac{[1 - \varphi(R)](h - l)}{(p_H - p_L)\varphi(R) + p_L}$, $\varphi'(C) > \varphi'(R) \geq 1$ and $\mathbf{G}(\varphi'(C)) = \mathbf{G}(\varphi'(R)) = 1$. It means that the incumbent wins certainly in the re-election even she repeals her policy. We continue to analyze **S** as in Theorem 4.1.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for H type incumbent iff:

$$X_1 + b_1 + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi'(C))(X_2 + h)$$

>

$$X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi'(R))(X_2 + h)$$

$$\Leftrightarrow$$

$$b_1 > 0.$$

b_1 represents the effect of continuing the successful policy on welfare in period 1, which is obviously positive. Then, the H type incumbent prefers to continue the successful policy when she wins certainly in the re-election.

2. Similarly, continuing the successful policy is preferred to repealing it for L type incumbent iff:

$$\begin{aligned} X_1 + b_1 + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi'(C))(X_2 + l) \\ > \\ X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi'(R))(X_2 + l) \end{aligned}$$

$$\Leftrightarrow$$

$$b_1 > 0.$$

The above condition is obviously satisfied. Then, the L type incumbent prefers also to continue the successful policy when she wins certainly in the re-election.

3. When the incumbent has observed that her policy is a failure, repealing the policy is optimal for the H type iff:

$$\begin{aligned} X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi'(R))(X_2 + h) \\ > \\ X_1 + (-c_1) + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi'(C))(X_2 + h) \end{aligned}$$

$$\Leftrightarrow$$

$$c_1 > 0.$$

c_1 represents the benefit of repealing the failing policy, which is positive. Therefore, the H type incumbent prefers to repeal her failing policy when she wins certainly in the re-election.

4. Similarly, repealing the failing policy is preferred to continuing it for L type incumbent iff:

$$\begin{aligned}
 & X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi'(R))(X_2 + l) \\
 & \quad > \\
 & X_1 + (-c_1) + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi'(C))(X_2 + l) \\
 & \quad \Leftrightarrow \\
 & \quad c_1 > 0.
 \end{aligned}$$

The above condition is obviously held. Therefore, the L type incumbent also prefers to repeal her failing policy when she wins certainly in the re-election.

In summary, when $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, \mathbf{S} exists.

(b) When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L}$, $\varphi'(C) > 1 > \varphi'(R)$, $\mathbf{G}(\varphi'(C)) = 1 > \mathbf{G}(\varphi'(R))$. It means that the incumbent wins in the re-election certainly only if she continues the policy. We continue to consider the conditions about \mathbf{S} .

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for H type incumbent iff:

$$\begin{aligned}
 & X_1 + b_1 + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi'(C))(X_2 + h) \\
 & \quad > \\
 & X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}h + (1 - \bar{\kappa})l]\} \\
 & \quad \Leftrightarrow
 \end{aligned}$$

$$b_1 + (1 - p_H)(1 - \varphi'(R))[X_2 + \frac{1 - \varphi'(R)}{2}(h - l)] > 0. \quad (4.31)$$

The first term in (4.31) represents the effect of continuing the successful policy on welfare in period 1, which is obviously positive. The second term in (4.31) represents the effect of the H type incumbent's decision on her probability of re-election, and thus on her expected utility after the re-election. We recall that $1 > \varphi(R)$. Thus, the second term in (4.31) is obviously positive. Hence the condition (4.31) is obviously positive.

2. Similarly, continuing the successful policy is preferred to repealing it for L type incumbent iff:

$$\begin{aligned}
& X_1 + b_1 + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi'(C))(X_2 + l) \\
& \quad > \\
& X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(R))(X_2 + l) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\
& \quad \Leftrightarrow \\
& b_1 + (1 - p_L)(1 - \varphi'(R))\left\{X_2 - \frac{1 + \varphi'(R)}{2}(h - l)\right\} > 0. \tag{4.32}
\end{aligned}$$

The first term in (4.32) is obviously positive. We recall the fact that $1 > \varphi'(R) > 0$. Provided that L type incumbent does not care about “ego rents X_2 ”, the second term in (4.32) is negative. If the welfare from continuing the successful policy b_1 is sufficiently small, (4.32) is violated. Then, the condition (4.32) is held iff:

$$X_2 > \frac{-b_1}{(1 - p_L)(1 - \varphi'(R))} + \frac{1 + \varphi'(R)}{2}(h - l).$$

3. When the incumbent has observed that her policy is a failure, repealing the policy is optimal for the H type iff:

$$\begin{aligned}
& X_1 + 0 + p_H(X_2 + hb_2) + (1 - p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\
& \quad > \\
& X_1 + (-c_1) + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi'(C))(X_2 + h) \\
& \quad \Leftrightarrow \\
& c_1 + (1 - p_H)(\varphi'(R) - 1)\left[X_2 + \frac{1 - \varphi'(R)}{2}(h - l)\right] > 0. \tag{4.33}
\end{aligned}$$

The first term in (4.33) represents the benefit of repealing the failing policy, which is positive. The second term in (4.33) is the effect of the H type incumbent’s decision on her re-election chances, and thus on her welfare after re-election. We recall that $1 > \varphi'(C)$. The second term in (4.33) is negative. If the benefits of repealing a failing policy c_1 is sufficiently small and the incumbent’s ego rents X_2 is sufficiently high, the

condition (4.33) is violated. Therefore, the H type incumbent prefers to repeal the failing policy iff the function (4.33) is positive, i.e.,

$$X_2 < \frac{c_1}{(1-p_H)[1-\varphi'(R)]} - \frac{1-\varphi'(R)}{2}(h-l).$$

4. Similarly, repealing the failing policy is preferred to continuing it for the L type incumbent iff:

$$X_1 + 0 + p_L(X_2 + l) + (1-p_L)\{G(\varphi'(R))(X_2 + l) + [1-G(\varphi'(R))][\bar{\kappa}_R h + (1-\bar{\kappa}_R)l]\}$$

>

$$X_1 + (-c_1) + p_L(X_2 + l) + (1-p_L)G(\varphi'(C))(X_2 + l)$$

\Leftrightarrow

$$c_1 + (1-p_L)[\varphi'(R) - 1][X_2 - \frac{1+\varphi'(R)}{2}(h-l)] > 0. \quad (4.34)$$

The first term in (4.34) is positive. We recall that $1 > \varphi(R)$. Supposing that the L type incumbent has a enough high “ego rents X_2 ”, the second term in (4.34) is negative. If the benefits of repealing a failing policy c_1 is sufficiently small, the condition (4.34) is violated. Therefore, the incumbent prefers to repeal her failing policy iff the condition (4.34) is held, i.e.,

$$X_2 < \frac{c_1}{(1-p_L)[1-\varphi'(R)]} + \frac{1+\varphi'(R)}{2}(h-l).$$

In summary, S exists iff the conditions (4.32), (4.33) and (4.34) are held at the same time, i.e.,

$$\frac{-b_1}{(1-p_L)[1-\varphi'(R)]} + \frac{h-l}{2}[1+\varphi'(R)] < X_2 < \Phi', \quad (4.35)$$

$$\Phi' = \min\left\{ \frac{c_1}{(1-p_H)[1-\varphi'(R)]} - \frac{h-l}{2}[1-\varphi'(R)], \frac{c_1}{(1-p_L)[1-\varphi'(R)]} + \frac{h-l}{2}[1+\varphi'(R)] \right\}.$$

More concretely,

$$\Phi' = \begin{cases} \frac{c_1}{(1-p_L)[1-\varphi'(R)]} + \frac{1+\varphi'(R)}{2}(h-l), & \Theta > 1 - \varphi'(R), \\ \frac{c_1}{(1-p_H)[1-\varphi'(R)]} - \frac{1-\varphi'(R)}{2}(h-l), & \Theta \leq 1 - \varphi'(R). \end{cases}$$

(c) When $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, $1 > \varphi'(C) > \varphi'(R)$, $1 > \mathbf{G}(\varphi'(C)) > \mathbf{G}(\varphi'(R))$. It means that the incumbent can not win in the re-election certainly through her decision. In this case, we consider \mathbf{S} as in Theorem 4.1.

1. If the incumbent has observed that her policy is a success, continuing the policy is preferred to repealing the policy for the H type incumbent iff:

$$\begin{aligned} X_1 + b_1 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(C))(X_2 + h) + [1 - \mathbf{G}(\varphi'(C))][\bar{\kappa}_C h + (1 - \bar{\kappa}_C)l]\} \\ > \\ X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\ \Leftrightarrow \end{aligned}$$

$$b_1 + (1 - p_H)[\varphi'(C) - \varphi'(R)][X_2 + \frac{\varphi'(C) + \varphi'(R)}{2}(h + l) + (h - l)] > 0.$$

We recall that $\varphi'(C) > \varphi'(R)$. Being similar to the condition (4.23), this condition is obviously positive.

2. Similarly, continuing the successful policy is preferred to repealing it for the L type incumbent iff:

$$\begin{aligned} X_1 + b_1 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(C))(X_2 + l) + [1 - \mathbf{G}(\varphi'(C))][\bar{\kappa}_C h + (1 - \bar{\kappa}_C)l]\} \\ > \\ X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(R))(X_2 + l) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\ \Leftrightarrow \end{aligned}$$

$$b_1 + (1 - p_L)[\varphi'(C) - \varphi'(R)][X_2 + \frac{\varphi'(C) + \varphi'(R)}{2}(h + l)] > 0.$$

This condition is always satisfied.

3. When the incumbent has observed that her policy is a failure, repealing the failing policy is optimal for the H type iff:

$$\begin{aligned}
 & X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - \mathbf{G}(\varphi'(R))][\overline{\kappa}_R h + (1 - \overline{\kappa}_R)l]\} \\
 & \qquad \qquad \qquad > \\
 & X_1 + (-c_1) + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(C))(X_2 + h) + [1 - \mathbf{G}(\varphi'(C))][\overline{\kappa}_C h + (1 - \overline{\kappa}_C)l]\} \\
 & \qquad \qquad \qquad \Leftrightarrow
 \end{aligned}$$

$$c_1 + (1 - p_H)[\varphi'(R) - \varphi'(C)][X_2 + \frac{\varphi'(R) + \varphi'(C)}{2}(h + l) + (h - l)] > 0. \quad (4.36)$$

The condition (4.36) is not always satisfied. The first term in (4.36) represents the benefit of repealing the failing policy. It is positive. The second term in (4.36) is the effect of the H type incumbent's decision on her re-election chances, and thus on her welfare after re-election. Repealing the policy hurts the reputation of the H type incumbent, i.e., $\varphi(R) - \varphi(C) < 0$. the second term in (4.36) is negative. Furthermore, if the benefits of repealing a failing policy c_1 is sufficiently small, the condition (4.36) is violated. Therefore, the condition (4.36) is held iff

$$X_2 < \frac{c_1}{(1 - p_H)[\varphi(C) - \varphi(R)]} - \frac{\varphi(C) + \varphi(R)}{2}(h + l) - (h - l).$$

4. Similarly, repealing the failing policy is preferred to continuing it for the L type incumbent iff:

$$\begin{aligned}
 & X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(R))(X_2 + l) + [1 - \mathbf{G}(\varphi'(R))][\overline{\kappa}_R h + (1 - \overline{\kappa}_R)l]\} \\
 & \qquad \qquad \qquad > \\
 & X_1 + (-c_1) + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(C))(X_2 + l) + [1 - \mathbf{G}(\varphi'(C))][\overline{\kappa}_C h + (1 - \overline{\kappa}_C)l]\} \\
 & \qquad \qquad \qquad \Leftrightarrow
 \end{aligned}$$

$$c_1 + (1 - p_L)[\varphi'(R) - \varphi'(C)][X_2 + \frac{\varphi'(C) + \varphi'(R)}{2}(h + l)] > 0. \quad (4.37)$$

Therefore, the condition (4.37) is satisfied iff

$$X_2 < \frac{c_1}{(1 - p_L)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h + l).$$

In summary, when independent voters believe that incumbent follows **S** strategy and the incumbent has observed her private informative signal about her implemented policy in the first period, both types of incumbents' optimal decision is to continue the successful policy, but both types of incumbents' optimal decision is to repeal the failing policy iff the two conditions (4.36) and (4.37) are held:

i.e.,

$$X_2 < \Phi', \quad (4.38)$$

$$\Phi' = \min\left\{ \frac{c_1}{(1-p_H)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h+l) - (h-l), \frac{c_1}{(1-p_L)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h+l) \right\}.$$

More concretely,

$$\Phi' = \begin{cases} \frac{c_1}{(1-p_L)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h+l), & \Theta > \varphi'(C) - \varphi'(R), \\ \frac{c_1}{(1-p_H)[\varphi'(C) - \varphi'(R)]} - \frac{\varphi'(C) + \varphi'(R)}{2}(h+l) - (h-l), & \Theta \leq \varphi'(C) - \varphi'(R). \end{cases}$$

Therefore, we have proved Theorem 4.3. \square

Proof of Theorem 4.4

Proof.

(a) When $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, $\varphi' > \varphi'(R) \geq 1$, and $\mathbf{G}(\varphi') = \mathbf{G}(\varphi'(R)) = 1$. It means that the incumbent wins certainly in the re-election even she repeals her policy.

Therefore, supposing that the incumbent has observed that her policy is a failure, continuing the policy is optimal for the H type incumbent iff:

$$\begin{aligned} & X_1 + (-c_1) + p_H(X_2 + h) + (1-p_H)\mathbf{G}(\varphi')(X_2 + h) \\ & > \\ & X_1 + 0 + p_H(X_2 + h) + (1-p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - G(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \end{aligned}$$

\Leftrightarrow

$$-c_1 > 0.$$

This condition is impossible to hold. Its intuition is that suppose each independent voter believes that the incumbent uses the strategy \mathbf{P} and uses Bayes' rule update his belief about the incumbent's type only after observing her decision is R , the H type incumbent would never repeal her failing policy. Therefore, \mathbf{P} does not exist.

(b) When $\frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L} > k > \frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L}$, $\varphi' \geq 1 > \varphi'(R)$, $\mathbf{G}(\varphi') = 1 > \mathbf{G}(\varphi'(R))$. It means that the incumbent wins certainly in the re-election only if she continues her policy. We continue to consider the conditions about \mathbf{P} .

1. Continuing a policy after observing that the policy is a success is optimal for the H type incumbent iff:

$$\begin{aligned} & X_1 + b_1 + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi')(X_2 + h) \\ & > \\ & X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\ & \Leftrightarrow \\ & b_1 + (1 - p_H)[1 - \varphi'(R)][X_2 + \frac{1 - \varphi'(R)}{2}(h - l)] > 0. \end{aligned}$$

This condition is obviously held. Its intuition is that supposing each independent voter believes that the incumbent uses \mathbf{P} strategy and uses Bayes' rule update his belief about the incumbent's type only after observing her decision is R , the H type incumbent will always continue her successful policy.

2. Similarly, continuing the successful policy is preferred to repealing it for the L type incumbent iff:

$$\begin{aligned} & X_1 + b_1 + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi')(X_2 + l) \\ & > \\ & X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(R))(X_2 + l) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\ & b_1 + (1 - p_L)[1 - \varphi'(R)][X_2 - \frac{1 + \varphi'(R)}{2}(h - l)] > 0. \end{aligned} \tag{4.39}$$

The first term in (4.39) is obviously positive. The second term in (4.39) represents the effect of the L type incumbent's decision on her probability of re-election, and thus on her expected utility after the re-election. We recall the fact that $1 > \varphi(R) > 0$. Provided that the L type incumbent does not care about "ego rents X_2 ", the second term in (4.39) is negative. Furthermore, if the welfare from continuing the successful policy b_1 is sufficiently small, the condition (4.39) is violated. Overall, the condition (4.39) is held iff

$$X_2 > \frac{-b_1}{(1-p_L)[1-\varphi'(R)]} + \frac{1+\varphi'(R)}{2}(h-l).$$

3. When the incumbent has observed that her policy is a failure, continuing the failing policy is optimal for the H type incumbent iff:

$$\begin{aligned} & X_1 + (-c_1) + p_H(X_2 + h) + (1 - p_H)\mathbf{G}(\varphi')(X_2 + h) \\ & > \\ & X_1 + 0 + p_H(X_2 + h) + (1 - p_H)\{\mathbf{G}(\varphi'(R))(X_2 + h) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \\ & - c_1 + (1 - p_H)[1 - \varphi'(R)][X_2 + \frac{1 - \varphi'(R)}{2}(h - l)] > 0. \end{aligned} \quad (4.40)$$

Hence the function (4.40) is held if the H type incumbent has a sufficiently high "ego rents X_2 " and the policy outcome benefits from repealing the failing policy c_1 is enough small, i.e.,

$$X_2 > \frac{c_1}{(1-p_H)[1-\varphi'(R)]} - \frac{1-\varphi'(R)}{2}(h-l).$$

It shows although the H type incumbent incurs the cost of continuing the failing policy, she avoids to face a lower probability of re-election which stems from the decision of repealing the policy. Its intuition is that suppose each independent voter believes that the incumbent uses strategy \mathbf{P} and uses Bayes' rule update his belief about the incumbent's type only after observing her decision is R , the H type incumbent who have a higher "ego rents X_2 " would never repeal her failing policy.

4. Similarly, continuing the failing policy is preferred to repealing the policy for the L type incumbent iff:

$$\begin{aligned} & X_1 + (-c_1) + p_L(X_2 + l) + (1 - p_L)\mathbf{G}(\varphi')(X_2 + l) \\ & > \\ & X_1 + 0 + p_L(X_2 + l) + (1 - p_L)\{\mathbf{G}(\varphi'(R))(X_2 + l) + [1 - \mathbf{G}(\varphi'(R))][\bar{\kappa}_R h + (1 - \bar{\kappa}_R)l]\} \end{aligned}$$

$$-c_1 + (1 - p_L)[1 - \varphi'(R)][X_2 - \frac{1 + \varphi'(R)}{2}(h - l)] > 0. \quad (4.41)$$

The condition (4.41) is held iff

$$X_2 > \frac{c_1}{(1 - p_L)[1 - \varphi'(R)]} + \frac{1 + \varphi'(R)}{2}(h - l).$$

In conclusion, \mathbf{P} exists, iff conditions (4.39), (4.40) and (4.41) are satisfied at the same time. Because $b_1 > 0 > -c_1$, if the condition (4.41) is satisfied, the condition (4.39) is satisfied. To sum up,

$$X_2 > \Psi', \quad (4.42)$$

$$\Psi = \max\left\{ \frac{c_1}{(1 - p_H)[1 - \varphi'(R)]} - \frac{1 - \varphi'(R)}{2}(h - l), \frac{c_1}{(1 - p_L)[1 - \varphi'(R)]} + \frac{1 + \varphi'(R)}{2}(h - l), \right\}.$$

More concretely,

$$\Psi' = \begin{cases} \frac{c_1}{(1 - p_H)[1 - \varphi'(R)]} - \frac{1 - \varphi'(R)}{2}(h - l), & \Theta > 1 - \varphi'(R), \\ \frac{c_1}{(1 - p_L)[1 - \varphi'(R)]} + \frac{1 + \varphi'(R)}{2}(h - l), & \Theta \leq 1 - \varphi'(R). \end{cases}$$

(c) When $\frac{[1 - \varphi](h - l)}{(p_H - p_L)\varphi + p_L} \geq k > 0$, $1 > \varphi' > \varphi'(R)$, $1 > \mathbf{G}(\varphi') > \mathbf{G}(\varphi'(R))$. It means that the incumbent can not win certainly in the re-election through her decisions. The following proof is similar to the proof of Theorem 4.2.

1. Continuing a policy after observing that the policy is a success is optimal for the H type incumbent iff:

$$b_1 + (1 - p_H)\left\{[\varphi' - \varphi'(R)][X_2 + \frac{\varphi' + \varphi'(R)}{2}(h + l) + (h - l)]\right\} > 0.$$

This condition is obviously held, whose explanation is similar to (4.27).

2. Similarly, continuing the successful policy is preferred to repealing it for L type incumbent iff:

$$b_1 + (1 - p_L)[\varphi' - \varphi'(R)][X_2 + \frac{\varphi' + \varphi'(R)}{2}(h + l)] > 0.$$

This condition is always satisfied.

3. When the incumbent has observed that her policy is a failure, continuing the failing policy is optimal for the H type incumbent iff:

$$-c_1 + (1 - p_H)[\varphi' - \varphi'(R)][X_2 + \frac{\varphi' + \varphi'(R)}{2}(h + l) + (h - l)] > 0. \quad (4.43)$$

It shows although the H type incumbent incurs the cost of continuing the failing policy, she avoids to face a lower probability of re-election which stems from the decision of repealing the policy. Hence the condition (4.43) is held if the H type incumbent has a sufficiently high “ego rents X_2 ” and the policy outcome benefits from repealing the faithful policy c_1 is enough small, i.e.,

$$X_2 > \frac{c_1}{(1 - p_H)[\varphi' - \varphi'(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h + l) - (h - l).$$

4. Similarly, continuing the failing policy is preferred to repealing it for the L type incumbent iff:

$$-c_1 + (1 - p_L)[\varphi' - \varphi'(R)][X_2 + \frac{\varphi' + \varphi'(R)}{2}(h + l)] > 0. \quad (4.44)$$

The condition (4.44) is held iff

$$X_2 > \frac{c_1}{(1 - p_L)[\varphi' - \varphi'(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h + l).$$

To sum up, \mathbf{P} exists iff functions (4.43) and (4.44) are satisfied at the same time, i.e.,

$$X_2 > \Psi', \quad (4.45)$$

$$\Psi' = \max\left\{ \frac{c_1}{(1 - p_H)[\varphi' - \varphi'(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h + l) - (h - l), \frac{c_1}{(1 - p_L)[\varphi' - \varphi'(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h + l) \right\}.$$

More concretely,

$$\Psi' = \begin{cases} \frac{c_1}{(1-p_H)[\varphi' - \varphi(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h+l) - (h-l), & \Theta > \varphi' - \varphi'(R), \\ \frac{c_1}{(1-p_L)[\varphi' - \varphi(R)]} - \frac{\varphi' + \varphi'(R)}{2}(h+l), & \Theta \leq \varphi' - \varphi'(R). \end{cases}$$

□

Proof of Corollary 4.3

Proof. Because of $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$,

$$1 \geq \varphi'(C) > \varphi'(R).$$

Because $p_H > p_L$ and $h > l$,

$$1 \geq \varphi'(C) - \varphi'(R) = [\varphi(C) - \varphi(R)] \left[1 + \frac{(p_H - p_L)k}{(h-l)} \right] > \varphi(C) - \varphi(R) > 0. \quad (4.46)$$

Because of the fact (4.46), we prove Corollary 4.3 from three cases separately: (1) $\Theta \geq \varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R)$, (2) $\varphi'(C) - \varphi'(R) > \Theta > \varphi(C) - \varphi(R)$, and (3) $\varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R) \geq \Theta$.

- (1) when $\Theta \geq \varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R)$, under the assumption that independent voters believe that the incumbent follows **S** strategy, the effect of the incumbent's decision (C or R) on her probability of winning in re-election is smaller than Θ , no matter whether independent voters are conformist or nonconformist.

From the condition(4.6) where $\Phi = \Phi_1$ and the condition (4.11) where $\Phi' = \Phi'_3$, the conditions of **S** are written separately as $X_2 \in (0, \Phi_1)$ and $X_2 \in (0, \Phi'_3)$. We recall that $\varphi'(d) > \varphi(d), d \in \{C, R\}$. Thus, together with the fact (4.46), it implies the fact (4.47)

$$\Phi'_3 < \Phi_1. \quad (4.47)$$

Therefore,

$$(0, \Phi') \subset (0, \Phi).$$

That is to say, under the assumption $k \geq \frac{[1-\varphi(R)](h-l)}{(p_H-p_L)\varphi(R)+p_L}$, if $\Theta \geq \varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R)$, the conditions of **S** have become more restricted compared to the case $k = 0$. In other words, the conformity reduce **S**. We present the results as Lemma 4.1.

Lemma 4.1 *Under the assumption $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, if $\Theta \geq \varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R)$, the condition of S has become more restricted compared with the case $k = 0$.*

- When $\varphi'(C) - \varphi'(R) > \Theta > \varphi(C) - \varphi(R)$, under the assumption that independent voters believe that the incumbent follows S strategy, if they are conformist, the effect of the incumbent's decision (C or R) on her probability of winning re-election is larger than Θ , and if they are nonconformist, the effect of the incumbent's decision (C or R) on her probability of winning re-election is smaller than Θ .

From the condition (4.6) where $\Phi = \Phi_1$ and from the condition (4.11) where $\Phi' = \Phi'_4$, the conditions of S are written separately as $X_2 \in (0, \Phi_1)$ and $X_2 \in (0, \Phi'_4)$. We recall the fact that (4.47). Under the condition $\varphi'(C) - \varphi'(R) > \Theta > \varphi(C) - \varphi(R)$, it implies that

$$\Phi'_4 < \Phi'_3 < \Phi_1.$$

Thus,

$$(0, \Phi') \subset (0, \Phi).$$

In sum, we present the results as Lemma 4.2.

Lemma 4.2 *Under the assumption $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, if $\varphi'(C) - \varphi'(R) > \Theta > \varphi(C) - \varphi(R)$, the condition of S has more restricted compared with the case $k = 0$.*

- When $\varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R) \geq \Theta$, under the assumption that independent voters believe that the incumbent follows S strategy, the effect difference between the incumbent's decisions (C or R) about her probability of winning in re-election is larger than Θ , no matter whether independent voters are conformist or nonconformist.

From the condition (4.6), $\Phi = \Phi_2$, and from the condition (4.11), $\Phi' = \Phi'_4$. We recall again that $\varphi'(d) > \varphi(d), d \in \{C, R\}$. Thus, together with the fact (4.46), it is obvious that

$$\Phi'_4 < \Phi_2.$$

Therefore

$$(0, \Phi') \subset (0, \Phi).$$

That is to say, it becomes more restricted to have a S compared with the case $k = 0$. In sum, we present the results in Lemma 4.3.

Lemma 4.3 *Under the assumption $\frac{[1-\varphi(C)](h-l)}{(p_H-p_L)\varphi(C)+p_L} \geq k > 0$, if $\varphi'(C) - \varphi'(R) > \varphi(C) - \varphi(R) \geq \Theta$, the condition of S has become more restricted compared with the case $k = 0$.*

Because of the Lemmas 4.1,4.2 and 4.3, we have proved Corollary 4.3. \square

Proof of Corollary 4.6

Proof. Because of $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$,

$$1 \geq \varphi' > \varphi'(R).$$

Because $p_H > p_L$ and $h > l$,

$$1 > \varphi' - \varphi'(R) = [\varphi - \varphi(R)][1 + \frac{(p_H - p_L)k}{(h-l)}] > \varphi - \varphi(R) > 0. \quad (4.48)$$

Inspired by the fact (4.48), we prove Corollary 4.6 in three cases separately: (1) $\Theta \geq \varphi' - \varphi'(R) > \varphi - \varphi(R)$, (2) $\varphi' - \varphi'(R) > \Theta > \varphi - \varphi(R)$, and (3) $\varphi' - \varphi'(R) > \varphi - \varphi(R) \geq \Theta$.

- When $\Theta \geq \varphi' - \varphi'(R) > \varphi - \varphi(R)$, under the assumption that independent voters believe that the incumbent follows **P** strategy, the effect of the incumbent's decision on her probability of winning re-election is smaller than Θ , no matter whether independent voters are conformist or nonconformist. From the condition (4.7) where $\Psi = \Psi_1$, and the condition (4.13) where $\Psi' = \Psi'_3$, the conditions about **P** are written as $X_2 \in (\Psi_1, \infty)$ and $X_2 \in (\Psi'_3, \infty)$. We recall that $\varphi'(R) > \varphi(R)$ and $\varphi' > \varphi$. Therefore, together with the fact (4.48), we get that

$$\Psi'_3 < \Psi_1.$$

Therefore,

$$\Psi' < \Psi.$$

Thus, under the assumption $\frac{[1-\varphi](h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, if $\Theta \geq \varphi' - \varphi'(R) > \varphi - \varphi(R)$, the conditions about **P** have become less restricted compared with the case $k = 0$. That is to say, the conformity induce **P**. We present the results as Lemma 4.4.

Lemma 4.4 *Under the assumption $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, if $\Theta \geq \varphi' - \varphi'(R) > \varphi - \varphi(R)$, the conditions about **P** have become less restricted compared with $k = 0$.*

- When $\varphi' - \varphi'(R) > \Theta > \varphi - \varphi(R)$, under the assumption that independent voters believe that the incumbent follows **P** strategy, if they are conformist, the effect of the incumbent's decision on her probability of winning in re-election is larger than Θ ; and if they are nonconformist, the effect of the incumbent's decision on her probability of winning in re-election is smaller than Θ . Thus, from the condition (4.7), we get $\Psi = \Psi_1$. From the condition (4.13), we get $\Psi' = \Psi'_2$. Because $\varphi' - \varphi'(R) > \Theta > \varphi - \varphi(R)$,

$$\Psi_2 < \Psi_1.$$

Going back to the fact (4.48), the fact $\varphi'(R) > \varphi(R)$ and the fact $\varphi' > \varphi$, it is obvious that

$$\Psi'_4 < \Psi_2.$$

Therefore,

$$\Psi'_4 < \Psi_2 < \Psi_1$$

thus

$$\Psi' < \Psi$$

In sum, we present the results in Lemma 4.5.

Lemma 4.5 *Under the assumption $\frac{[1-\varphi](h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, if $\varphi' - \varphi'(R) > \Theta > \varphi - \varphi(R)$, the condition of \mathbf{P} equilibria has become less restricted compared with the case $k = 0$.*

- When $\varphi' - \varphi'(R) > \varphi - \varphi(R) \geq \Theta$, under the assumption that independent voters believe that the incumbent follows \mathbf{P} strategy, the effect difference between the incumbent's decisions on her probability of winning in re-election is larger than Θ , no matter whether independent voters are conformist or nonconformist. Thus, from the condition (4.7), we get $\Psi = \Psi_2$. From the condition (4.13), we get $\Psi' = \Psi'_4$. We recall that $\varphi'(R) > \varphi(R)$ and $\varphi' > \varphi$. Thus, together with the fact (4.48),

$$\Psi'_4 < \Psi_2.$$

Therefore,

$$\Psi' < \Psi.$$

That is to say, it becomes less restricted to have \mathbf{P} compared with the case $k = 0$. In sum, we present the results as Lemma 4.6

Lemma 4.6 *Under the assumption $\frac{(1-\varphi)(h-l)}{(p_H-p_L)\varphi+p_L} \geq k > 0$, if $\varphi' - \varphi'(R) > \varphi - \varphi(R) \geq \Theta$, the conditions about \mathbf{P} have become less restricted compared with the case $k = 0$.*

Because of Lemmas 4.4, 4.5 and 4.6, we have proved Corollary 4.6. □

Chapter 5

Conformity preferences and information gathering effort in collective decision making

5.1 Abstract

We study a model of collective decision making about an information collection between two voters. Each voter, who likes to make the same voting choice as the other's because of his conformity preference, collects information about the consequences of a project and then votes on the project to approve or to reject it. We focus on an informative equilibrium where voters vote informatively using pure strategies. It is a symmetric Nash equilibrium. Our interesting result is that nonconformist voters exert less effort from a social point of view because of positive externality that results in the free-rider problem; while conformity preferences can help to improve the sum of voters' expected payoffs from the social point of view. The reason is that 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 the correlation has no link with the signals' precision. Moreover, we present the exact conformity preference level which helps voters exert optimal effort level that maximizes the sum of voters' expected payoffs compared to the nonconformist case. We highlight that the appearance of one prejudiced voter tends to lead the two conformist voters to exert less effort, thus reinforces the free-rider problem. In addition, we graphically illustrate comparative statics about effort levels in informative equilibria.

Keywords: Normative conformity preferences Symmetric pure Nash equilibria
Informative equilibria Effort levels Voting Comparative statics Prejudiced voters

5.2 Introduction

Conformity is a behavior referring to the act of changing one's behavior to match the behavior of others, which is a common observation in our life (Cialdini and Goldstein, 2004). Beginning with the famous conformity experiment of Asch (1951), a large literature in social psychology exhibits conformity (Cialdini and Goldstein, 2004). One popular explanation of 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 surely 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 part of conformist behaviour is based on the desire for gaining group acceptances, which is called "normative conformity" (Deutsch and Gerard, 1955; Cohen, 1978), 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). It has received substantial attentions in economic literature since the initial theoretical inquiry in Jones (1984). In this paper, we focus on the normative conformity preferences in a small voting group about collective decision making, i.e., each conformist voter gains utility when he makes the same choice as the majority.

In general, examples of two voters' voting about collective decision making include a loan contract which needs to be agreed by two authorized loan officers of a bank, an investment which needs agreement between two partner who own a common company, a military order which needs to be agreed by two officers, and so on. They are important practical situations where conformity preferences manifest itself, i.e., voters have the incentive to conform to the decisions of others voters besides an incentive to be right (Hung and Plott, 2001). Zafar (2011) gives empirical evidence about the conformity preference ¹.

The objective of this paper is to understand the consequences of normative conformity effects in two voters' effort levels to collect information for collective decision making before voting. We analyze a variety 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 under uncertainty. The two voters follow a decision procedure which consists 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 effort a voter has put in acquiring information. In the second stage, the voters vote on the project to approve or to reject it.

¹ Zafar (2011) confirm the fact that when asked for a personal opinion, people usually do not straightforwardly state what they truly think. Rather they are tempted to misrepresent their opinion by conforming to their friends because the disagreement entails uncomfortable feelings.

About the binary states of the world in our voting game, voters have equal prior probability² and are of identical ability to pay for informative signals. Truth-telling by voters is the ideal status where most information is possibly transmitted. Thus, we focus on informative equilibria, which are symmetric Nash equilibria in pure truthful strategies, where voters vote sincerely following their signals whose quality is decided by their effort for collecting information. We assume that their effort are identically measured in a way of signals' precisions, and 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. In the benchmark where there are no normative conformity preferences, we prove that there exists an informative equilibrium where voters exert too little effort, which does not maximize the expected total payoff from a social point of view. Our contributions in this paper are two things. First, if each voter has payoff utility from voting the same choice as the other because of normative conformity preferences, the voters' effort levels in informative equilibria increase and the whole expected payoff from a social point of view can be improved. This contribution shows that normative conformity preferences affect the effort that each voter puts into acquiring information. Especially, when information becomes cheap, the degree of normative conformity preferences decreases in an informative equilibrium for helping voters to exert the social optimal effort level which maximizes the expected total payoffs from a social point of view with nonconformist. When information becomes expensive, the degree of normative conformity preferences increases. Why? We suppose that information is almost free to see why. Then voter 1 considers it very likely that voter 2 has received correct information. This reduces voter 1's conformity preferences degree to make voter 1 exert more effort to collect information for society and not act as a free-rider. It is similar for the voter 2. When information is expensive, it is far less likely that voter 2 has received correct information. Because of normative conformity preferences, voter 1 wants to make the same voting decision as voter 2. When the degree of normative conformity preferences increases, voter 1 will exert more effort to collect information, which would improve the whole expected social payoffs. It is also similar to the voter 2. Second, if a new prejudiced voter appears in the group, the effort of the two conformist voters decreases, which may aggravate free-rider problems. It is because gathering more information may make one less likely to take the same decision as the prejudiced voter.

People's voting is influenced by various reasons. We model one of these reasons: group acceptances, which is related to Callander (2008) that presents normative conformity preferences with majority rule, and emphasises bandwagon phenomenon resulting from voters' desire to win. Conformist voters in our paper deviate from Callander (2008) in two ways. First, we do not assume a given distribution of information between voters. Our two voters must be

²Changing this probability does not affect our main results.

motivated to choose effort level for collecting information. Second, through unanimity rule³, we assume a common benefit for each voter when they make the same voting decision. Thus, because of normative conformity preferences, we emphasize the desire to vote for the same decision as others about a project rather than the desire to vote for the winner. The desire to vote for the same decision as the other in a small group has already been modelled by Glazer (2008). In his model, a voter can please voters who prefer one candidate by voting for the same candidate, and anger these voters by voting for other candidates. In other words, voters have utility from being pleased when they have made the same voting choice compared with when they have made different voting choices, which is represented by normative conformity preferences in our paper. Furthermore, Cooper and Rege (2011) employ a series of controlled laboratory experiments to study choices under uncertainty and conclude that an individual's utility from an action is enhanced by others taking 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 as follows. The next section presents the model and the voting rule. Section 3 analyzes how the two voters vote if they are non-conformist. Concretely, we examine the existence of voters' informative equilibria and compared the individual effort level with the social optimal effort level in informative equilibria. Section 4 presents the normative conformity preferences' effects in informative equilibria. Particularly, we find the special normative conformity preference degree which makes conformist voters exert the effort level that equals to the optimal effort level from a social point of view if given that they are non-conformist. Section 5 presents comparative statics graphically about informative equilibria. Section 6 considers the cases with prejudiced voters who prefer a particular viewpoint. First, assuming one of the two voters is prejudiced, we present conditions of sincerely voting for the other voter. Second, assuming the prejudiced voter is a new voter, we analyse informative equilibria as in section 4, then compare them with section 4. Third, assuming there are more than one prejudiced new voter who prefer one choice identically, we still focus on informative equilibria for the two voters. In Section 7, we conclude. Except for some Figures in the text, all the rest Figures and all proofs can be found in the appendix.

³It requires that implementation of a project need all voters vote for implementation.

5.3 Model with unanimity rule

There are two voters, $i \in \{1, 2\}$, who own a common investment company. There is a risky financial project with a negative expected payoff ($p < 0$). Corresponding to the project, there are two states of the world $S \in \{-h, h\}$. If $S = h$ the project is profitable with profits \overline{G} , ($\overline{G} = p + h > 0$). If $S = -h$, it is unprofitable with losses \underline{G} , ($\underline{G} = p - h < 0$). $v_i = Y$ means voter i wants to implement the project, while $v_i = N$ means 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 $D = N$. In other words, the voting rule is unanimity rule and abstention is not allowed. Both voters have identical preferences over D ($D \in \{N, Y\}$) and states, which are represented by $u_i(\cdot)$ in the following function (5.1).

Voters do not know the true state of the world. But both voters have equal prior probability about the states. Moreover, each voter receives a private signal, $s_i \in \{-h, h\}$, about the true state. We suppose that both voters are of identical ability to pay for information in their private signals. A signal is informative, which means a signal reveals the state of the world with probability e_i ($0 \leq e_i \leq 1$). For simplicity, we equate the probability e_i and the effort level that voter i has put in collecting information. Examples of the effort are money, time and so on⁴. Thus, a signal is uninformative with probability $1 - e_i$. An uninformative signal is not correlated to the state of the world. Being consistent with the assumption that 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 $Pr(h) = Pr(-h) = \frac{1}{2}$. 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, $s_1 = s_2$.

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

We go back to e_i which shows the relationship between effort and the quality of a signal, and the effort are measured in such a way of e_i for each i . We assume that effort is costly, i.e., an informative signal is costly. $c(e_i)$ denotes the costs of the informative signal. We assume that $c(0) = 0$, $c'(e_i) > 0$, and $c''(e_i) > 0$. In particular, $c(e_i) = be_i^2$ where $b > 0$ presents voters

⁴A more complicated informative signal production function would involve two types of interdependencies of the two voters' effort. First, efforts levels might be interdependent through the price of information. Second, effort levels might also be interdependent through an interdependence of marginal informative signal productivity. Obviously, any interdependency of the second type can be represented through an interdependence via the price rate of information. Moreover, the voters ultimately care about the value of their signals. Thus, this assumption is not at all restrictive.

are identical in their disutility of effort for collecting information. Then voter i 's payoff U_i is given by:

$$U_i(D, S, e_i) = u_i(\cdot) - be_i^2 + k * \mathbb{1}_{\{v_1=v_2\}}, \quad (5.1)$$

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

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

The final term in function 5.1, which is assumed identical for both voters, represents the conformity element. It is assumed that $k \geq 0$, thereby $k = 0$ is the special case without conformity. $v_1 = v_2$ means that the two voters have made the same decision in voting.

Table 1 presents a formal description of our game with the unanimity rule: $(v_1, v_2) = (Y, Y)$.

Table 1 The description of the model
<p>Players: $i \in \{1, 2\}$</p> <p>Timing</p> <ul style="list-style-type: none"> • 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 $v_i \in \{N, Y\}$. <p>Payoffs:</p> <p>If $(v_1, v_2) = (Y, Y)$, then $D = Y$ and $U_i(S = h, e_i) = \overline{G} - be_i^2 + k$ and $U_i(S = -h, e_i) = \underline{G} - be_i^2 + k$.</p> <p>If $(v_1, v_2) = (N, Y)$ or $(v_1, v_2) = (Y, N)$, then $D = N$ and $U_i = -be_i^2$.</p> <p>If $(v_1, v_2) = (N, N)$, then $D = N$ and $U_i = -be_i^2 + k$.</p> <p>Assumptions:</p> <p>$p < 0, h + p > 0; \overline{G} = p + h, \underline{G} = p - h; b > 0; k \geq 0$.</p>

5.4 A benchmark: non-conformity

In this section, we assume that there are no normative conformity preferences. The model of Section 5.3 then reduces to a conventional two-voter economic model in voting without conformity (Swank and Wrasai, 2003). Each voter makes two decisions. First, each voter chooses how much effort to put in collecting information. Second, each voter chooses how to vote. For ease of exposition, we proceed in a backward way to show the necessary conditions

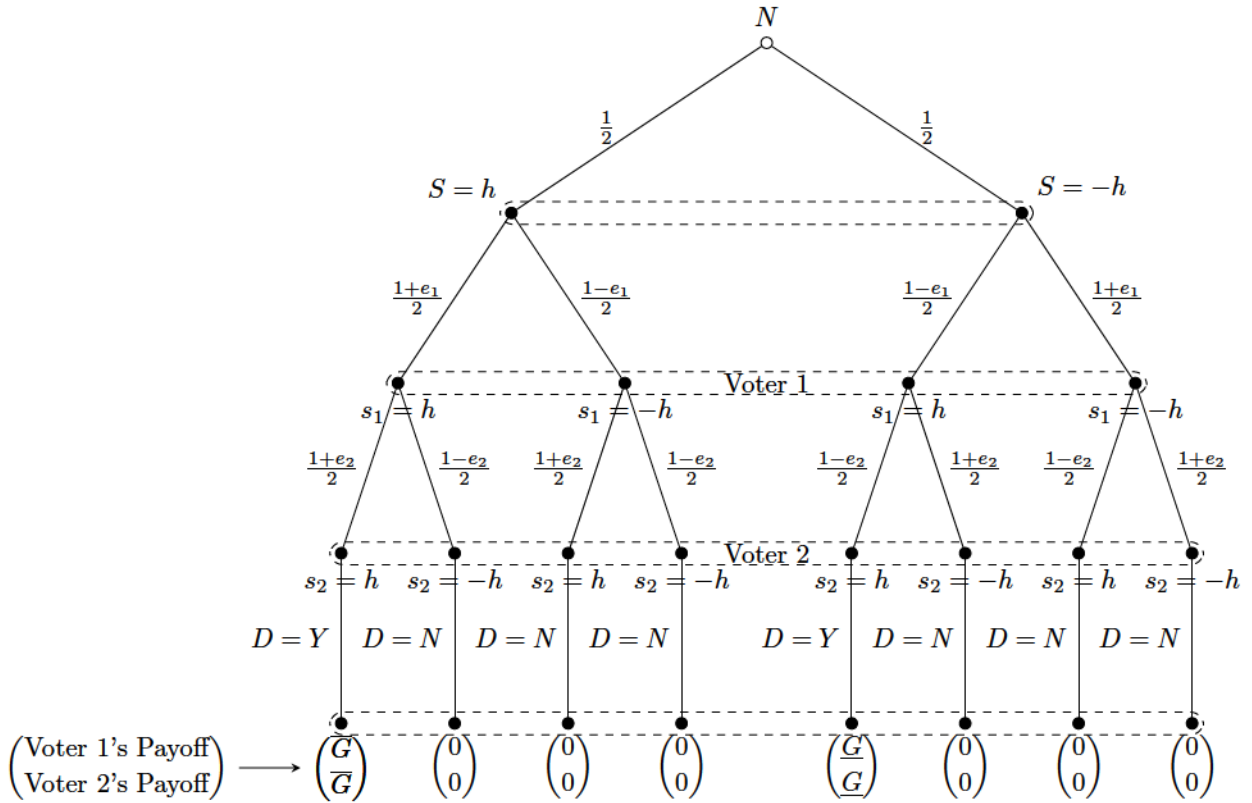


Figure 5.1: The outcomes from voting decisions when given both nonconformist voters vote sincerely with e_1 and e_2 .

for informative equilibrium under the assumption of sincere voting decisions. The sincere voting decisions mean that it is optimal for each voter to vote in line with his signal, given that the other voter also votes in line with his signal. Then, we go back to find the conditions about sincere voting decisions in Lemma 5.1.

5.4.1 The informative equilibrium

Because of unanimity rule, the project will be rejected unless both voters receive a positive signal. In general, under the assumption of sincere voting decisions where voters vote in line with their signals, we present in Figure 5.1 their decisions about effort to put in collecting information.

Following Figure 5.1, when the two voters have the same signals with this voting rule, if the signal is right the corresponding expected utility for voter i is $\frac{1}{2}\overline{G}$, while if the signal is wrong the corresponding expected utility is $\frac{1}{2}\underline{G}$. If their signals are different, the policy cannot be

applied with this voting rule, thus, the expected utility is 0. Consequently, when choosing an effort level e_1 , voter 1's expected payoff is $S_{1N}(e_1)$:

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

Differentiating the above 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:

$$S'_{1N}(e_1) = 0. \tag{5.2}$$

Equation (5.2) 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:

$$S'_{2N}(e_2) = 0. \tag{5.3}$$

Equation (5.3) defines voter 2's effort as a function of \overline{G} , \underline{G} , and e_1 .

The functions (5.2) and (5.3) imply the followings (5.4) and (5.5):

$$e_1 = \frac{\overline{G} + \underline{G}}{16b}e_2 + \frac{\overline{G} - \underline{G}}{16b}, \tag{5.4}$$

$$e_2 = \frac{\overline{G} + \underline{G}}{16b}e_1 + \frac{\overline{G} - \underline{G}}{16b}. \tag{5.5}$$

Assuming $\frac{h}{-p} > \frac{h}{8b}$, Figure 5.5 illustrates these two reaction functions between voter 1 and voter⁵ 2 .

Using the functions (5.4) and (5.5), at the informative equilibrium (e_1^*, e_2^*) in Figure 5.5:

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

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

$$e_N^* = \frac{\bar{G} - \underline{G}}{16b - (\bar{G} + \underline{G})}, \quad \text{if } e_N^* \in [0, 1]. \quad (5.6)$$

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.

5.4.2 Sincere voting decisions

We have known that $e_1 = e_2$ is a necessary condition in informative equilibrium with the assumption of sincere voting decisions. With the equality $e_1 = e_2$, Lemma 5.1 presents the conditions under which there are sincere voting decisions.

Lemma 5.1 *Let us assume the level of effort $e_1 = e_2 = e$, ($e \in [0, 1]$), such that $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$, then, it is optimal for each voter to vote in line with his signal, given that the other one votes in line with his own signal.*

Therefore, we suppose that $e_N^* = \frac{\bar{G} - \underline{G}}{16b - (\bar{G} + \underline{G})}$ where $e_N^* \in [0, 1]$, so that the condition in Lemma 5.1 holds, i.e., when $e = e_{1N}^*$, $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$. Then, the informative equilibrium exists, in which (i) each voter votes informatively and (ii) each voter chooses effort e_N^* .

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

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

⁵It is easy to note that the cases $\frac{h}{-p} < \frac{h}{8b}$ and $\frac{h}{-p} = \frac{h}{8b}$ do not compromise the rest of the results. Especially, $\frac{h}{-p} = \frac{h}{8b}$, equations (5.4) and (5.5) are the same equations, which directly imply that $e_1 = e_2$. For convenience, because the two other cases similar to the case $\frac{h}{-p} > \frac{h}{8b}$, we just present the case $\frac{h}{-p} > \frac{h}{8b}$ in the Figure 5.6, 5.7, 5.8, 5.9 and 5.10.

The corresponding function with respect to e_N^* is:

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

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

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

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

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

From the assumptions, for all the e_i , $S''_N(e_i) < 0$. We see that if e_N^{**} with $e_N^{**} \in [0, 1]$ satisfies the function $S'_N(e_N^{**}) = 0$, e_N^{**} maximizes function $S_N(e_i)$, where

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

The fact that $S''_N(e_i) < 0$ also shows that $S'_N(e_i)$ is decreasing with e_i . When go back to the function $S'_{1N}(e_N^*) = 0$, we see that $\frac{1}{2}(\bar{G} - \underline{G}) + \frac{e_N^*}{2}(\bar{G} + \underline{G}) = 8be_N^*$.

Therefore, we note that

$$\begin{aligned} S'_N(e_N^*) &= \frac{\bar{G} + \underline{G}}{2}e_N^* + \frac{\bar{G} - \underline{G}}{2} - 4be_N^* \\ &= \frac{\bar{G} + \underline{G}}{2}e_N^* + \frac{\bar{G} - \underline{G}}{2} - 8be_N^* + 4be_N^* \\ &= 4be_N^* > 0. \end{aligned} \tag{5.7}$$

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., $e_N^{**} > e_N^*$. Thus, it means that from a social point of view, 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 good component which is realized by unanimity rule in this paper. Through the voting rule, when voter 1 increases his effort to receive an informative signal, voter 2 also benefits. The social benefits of collecting information thus exceed their private benefits.

5.5 A model of normative conformity preferences

In this section, we take a view of normative conformity preferences effect. We present an informative equilibrium with conformist voters who have normative conformity preferences. As the benchmark model in section 5.4, conformist voters vote on the project after they have received their signals. Each conformist voter makes two decisions. First, each conformist voter chooses how much effort to put in collecting information. Second, each conformist voter chooses how to vote. As in the above section, we first show the necessary conditions for informative equilibrium under the assumption of sincerely voting decisions. Then we go back to find the conditions about sincere voting decisions as Lemma 5.2.

5.5.1 The informative equilibrium with conformity

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

Figure 5.2 presents the game tree with conformity, given that voter i chooses effort e_i and votes sincerely.

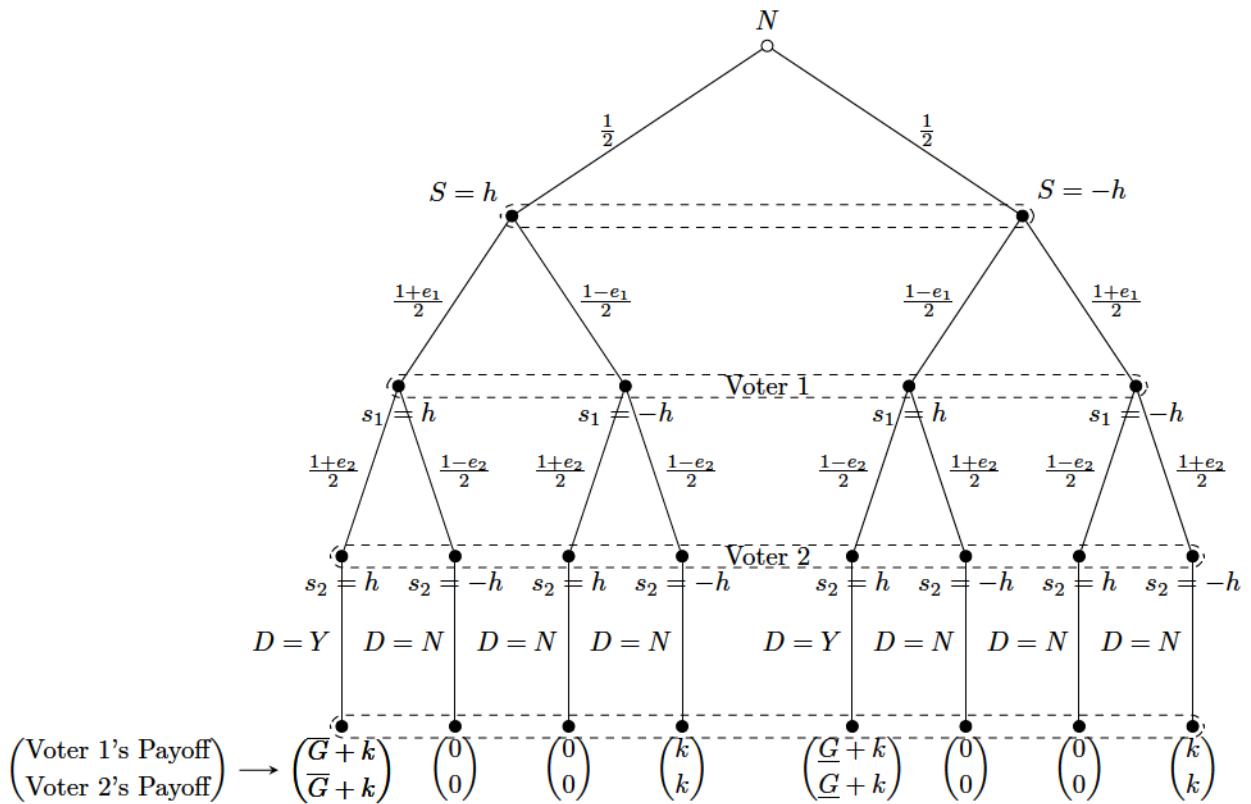


Figure 5.2: The outcomes from voting decisions when given both conformist voters vote sincerely with e_1 and e_2 .

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

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

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

$$S'_{1C}(e_1) = \frac{\bar{G} - G}{8} + \left(\frac{\bar{G} + G}{8} + \frac{1}{2}k\right)e_2 - 2be_1, \quad (5.8)$$

We make the first order condition equal to zero:

$$S'_{1C}(e_1) = 0. \quad (5.9)$$

Equation (5.9) implicitly defines voter 1's effort as a function of \bar{G} , G , e_2 and k . An analogous condition can be derived for e_2 :

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

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

$$S'_{2C}(e_2) = \frac{\bar{G} - G}{8} + \left(\frac{\bar{G} + G}{8} + \frac{1}{2}k\right)e_1 - 2be_2. \quad (5.10)$$

We make the first order condition equal to zero:

$$S'_{2C}(e_2) = 0 \quad (5.11)$$

Equation (5.11) implicitly defines voter 2's effort as a function of \bar{G} , G , e_1 and k .

The functions (5.9) and (5.11) imply the function (5.12)

$$e_1 = \left(\frac{\bar{G} + G}{16b} + \frac{k}{4b}\right)e_2 + \frac{\bar{G} - G}{16b}, \quad (5.12)$$

$$e_2 = \left(\frac{\bar{G} + G}{16b} + \frac{k}{4b}\right)e_1 + \frac{\bar{G} - G}{16b}. \quad (5.13)$$

Figure 5.6 illustrates these two reactions functions: (5.12) and (5.13).

Using the functions (5.12) and (5.13), the informative equilibrium (e_{1C}^*, e_{2C}^*) in Figure 5.6 is:

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

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

5.5.2 Sincere voting decision with conformity

We have known that $e_{1C}^* = e_{2C}^*$ is a necessary condition of informative equilibrium with conformity under the assumption of sincere voting decisions. Supposing $e_1 = e_2 = e$, we consider the conditions about conformist voters' sincere voting decisions. Lemma 5.2 presents the results, i.e., the conditions under which it is optimal for conformist voter 1 (2) to vote in line with his signal, given that the other conformist voter also votes in line with his signal.

Lemma 5.2 *let us assume a level of effort $e_1 = e_2 = e$, ($e \in [0, 1]$), such that $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + e^2k > 0$. Then, it is optimal for each conformist voter to vote in line with his signal, given that the other one also votes in line with his own signal. Moreover, when the condition about the sincere voting with nonconformist voters is met, the condition about sincere voting with conformist voters is met for certain.*

We suppose $e_{1C}^* = e_{2C}^* = e_C^*$, so that the condition $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + e^2k > 0$, where $e = e_C^*$ in Lemma 5.2 holds. Then the informative equilibrium with normative conformity preferences exists, in which (i) each conformist voters votes informatively and (ii) each conformist voter chooses e_C^* . e_C^* is a constant determined by \bar{G} , \underline{G} and k , where

$$e_C^* = \frac{\bar{G} - \underline{G}}{16b - 4k - (\bar{G} + \underline{G})}, \quad \text{if } e_C^* \in [0, 1]. \quad (5.14)$$

Theorem 5.1 *let us assume that $k > 0$, and the level of effort (e_i) is sufficiently high, ($e_i \in [0, 1]$), so that $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + e^2k > 0$. Then, the conformity preference level k cannot help to maximize the welfare from a social point of view i.e., $e_C^* \neq e_C^{**}$, where e_C^{**} means voters' effort level that maximizes the sum of social expected payoffs ($S_C(e_i)$). Concretely,*

<i>if k satisfies</i>	<i>the effort level</i>
$4k > 8b - (\bar{G} + \underline{G})$	$e_C^* > 0 > e_C^{**}$
$4k = 8b - (\bar{G} + \underline{G})$	$e_C^* \neq e_C^{**}$
$4k < 8b - (\bar{G} + \underline{G})$	$0 < e_C^* < e_C^{**}$

Moreover, when $k = 2b$ and $\frac{1+(e_C^*)^2}{4}(\bar{G} + \underline{G}) + \frac{e_C^*}{2}(\bar{G} - \underline{G}) > 0$,

$$e_C^* = e_N^{**}.$$

It means that the conformity preference $k = 2b$ resolves the free-rider problem in the benchmark.

Theorem 5.1 implies that (i) from a social point of view, the voters may exert fewer or more effort, and (ii) when the conformist degree $k = 2b$, the sum of the expected payoff to the two conformist voters is improved in informative equilibrium compared with the case where $k = 0$.

The intuition behind this result is straightforward. (i) Voters compare the costs and the benefits of effort for choosing effort levels in the informative equilibrium. In our model, there are two types of benefits. First, by exerting more effort, the voter reduces the probability that he receives a wrong signal. Second, exerting more effort increases the probability that the two voters have the same signals. Without conformity, information matters to make the right choice. The correlation of the signals affects the effort level of each voter(i.e., the precision of one's signal), because of the free riding problem. With conformity, the correlation between the signals of the two voters matters to their coordination (making the same vote). Even if the correlation has no links with the precision of the two voters' signals, it would be still important to them. Thus, voters' normative conformity preferences affect their effort levels that voters put into acquiring information in the informative equilibrium. But normative conformity preferences does not eliminate the free-rider problem. This makes that the voters may exert too fewer or too many effort from a social point of view. (ii) Suppose conformist voters exert the exact effort level that maximizes the expected total payoff from a social point of view in the informative equilibrium about the nonconformist case and that information becomes almost free. Then voter 1 considers it very likely that himself receives more correct information. Meanwhile, voter 1 considers that voter 2 has also received more correct information, this makes 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 from making the same decision as the other, needs to become smaller for inducing voters to exert the exact effort level. When information becomes expensive, it is far less likely that voters have received correct information. The correlation between their signals is lost. Since the normative conformity preferences make the two voters want to do the same voting decision, which results in making the free-rider problem less severe, its level needs to become larger to make them give the exact effort level. In short, when information becomes cheap, the level of exogenous compliance conformity preferences decreases in informative equilibrium for helping voters to exert the social optimal

effort level which maximizes the expected total payoffs from a social point of view in the case where there are no conformity preferences. When information becomes expensive, this normative conformity preference level increases.

Overall, normative conformity preference makes the correlation between the signals of the two conformist voters matter to them for coordination (making the same vote), and even when the correlation has no links with the precision of the signals. Therefore, in the informative equilibrium the two voters with a special conformity preference level can exert the exact effort level which maximizes the expected total payoffs from a social point of view under the case of non-conformity where voters exert fewer effort because of a positive externality. It is equally true to say that the expected total payoffs in the informative equilibrium have been increased through the special conformity preference.

5.6 Comparative statics

Many properties of our model can be highlighted by comparing two informative equilibria when only one element differs between these equilibria. With respect to differing parameters about the project or preferences of voter's effort, we calculate our results and illustrate the results graphically.

First, if we consider two equilibria, α and β where the profit of the project differs, say $\bar{G}_\alpha - \underline{G}_\alpha > \bar{G}_\beta - \underline{G}_\beta$, then it is clear that more effort is supplied when the higher profit $\bar{G}_\alpha + \underline{G}_\alpha$ prevails (Figure 5.7), both reaction functions shift out in a parallel manner. The expression for conformist voters, where $k > 0$, is similar.

Second, if we consider two equilibria where only voter's disutility of effort parameter differs, say $b^\alpha > b^\beta$, then a graph (Figure 5.8) illustrates how fewer effort are supplied when the disutility of effort is higher (case α): voter 1's reaction function shifts to the left and becomes gentler; voter 2's reaction function shifts to the left and becomes steeper. The expression for conformist voters, where $k > 0$, is similar.

Third, if we consider two equilibria where only the project's negative expected utility payoffs parameter differs, say $\bar{G}_\alpha + \underline{G}_\alpha > \bar{G}_\beta + \underline{G}_\beta$, then a graph (Figure 5.9) illustrates how more effort is supplied when the negative expected utility is higher (case α): voter 1's reaction function shifts to the right and becomes gentler; voter 2's reaction function shifts to the right and becomes steeper. The expression is similar for conformist voters where $k > 0$.

At last, we consider two equilibria where only the conformity parameter, k , differs, say $k_\alpha > k_\beta > k = 0$. A graph (Figure 5.10) illustrates how more effort is supplied when the

normative conformity preferences are higher (case α): voter 1's reaction function shifts to the right and becomes gentler; voter 2's reaction function shifts to the right and becomes steeper.

5.7 Prejudiced voters

In this section, we still focus on informative equilibria where there are prejudiced voters who favor a particular viewpoint. We analyse three cases. First, one of the two voters is prejudiced. Second, the prejudiced voter is a newcomer. Third, there are more than one newcomer who are prejudiced voters and prefer a special viewpoint identically.

5.7.1 One of the two voters is prejudiced.

In this subsection, one of our two voters is prejudiced. For convenience, let voter 2 be the prejudiced voter. His determined viewpoint is transmitted to voter 1 by the media.

(a) If $k = 0$ and voter 2 prefers N , following the unanimity rule, the voting result is N . Under this situation, voter 1 chooses e_i to maximize his payoff U_i , where $U_i = -be_1^2$. Thus, $e_{1P}^* = 0$. Suppose $e_{1P}^* = 0$, and voter 2 votes N . When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoff 0, and $v_1 = N$ yields an expected payoff that equals to 0, thus $v_1 = N$ equals $v_1 = Y$. When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoff 0, and $v_1 = N$ yields an expected payoff that equals to 0, thus $v_1 = Y$ equals to $v_1 = N$. In sum, supposing the prejudiced voter 2 prefers N , it is optimal for voter 1 to exert effort 0 and to vote Y or N .

(b) If $k > 0$ and voter 2 prefers N , following the unanimity rule, the voting result is N . Under this situation, voter 1 chooses e_i to maximize his payoff U_i , where $U_i = -be_1^2 + k * \mathbb{1}_{\{v_1=v_2\}}$. Thus, $e_{1P}^* = 0$. Suppose $e_{1P}^* = 0$, and voter 2 votes N . When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoff 0, and $v_1 = N$ yields an expected payoff that equals to k , because of $k > 0$, thus $v_1 = N$ dominates $v_1 = Y$. When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoff 0, and $v_1 = N$ yields an expected payoff that equals to k , thus $v_1 = N$ dominates $v_1 = Y$, because $k > 0$. In sum, supposing $k > 0$ and the prejudiced voter 2 prefer N , it is optimal for voter 1 to exert effort $e_{1P}^* = 0$ and to vote N .

Now we assume that the prejudiced voter 2 prefers Y . Following the unanimity rule, the voting result is decided by v_1 .

(c) If $k = 0$, voter 1 chooses e_1 to maximize his payoff U_1 , where $U_1 = \frac{\bar{G}}{2} \times \frac{1}{2}(1 + e_1) + \frac{G}{2} \times \frac{1}{2}(1 - e_1) - be_1^2$. Thus, $e_{1P}^* = \frac{\bar{G}-G}{8b}$.

Suppose $e_{1P}^* = \frac{\bar{G}-\underline{G}}{8b}$, and voter 2 votes Y . When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoff $\frac{1+e_{1P}^*}{2} \times \underline{G} + \frac{1-e_{1P}^*}{2} \times \bar{G} - c(e_{1P}^*)$ that equals to $\frac{\bar{G}+\underline{G}}{2} + \frac{-(\bar{G}-\underline{G})}{2}e_{1P}^* - c(e_{1P}^*)$, and $v_1 = N$ yields an expected payoff that equals to $-c(e_{1P}^*)$, because of $\bar{G} + \underline{G} < 0$ and $\bar{G} - \underline{G} > 0$, thus $v_1 = N$ dominates $v_1 = Y$.

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoffs $\frac{1+e_{1P}^*}{2} \times \bar{G} + \frac{1-e_{1P}^*}{2} \times \underline{G} - c(e_{1P}^*)$ that equals to $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})}{2}e_{1P}^* - c(e_{1P}^*)$, and $v_1 = N$ yields an expected payoffs that equals to $-c(e_{1P}^*)$, thus $v_1 = Y$ dominates $v_1 = N$ if $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})}{2}e_{1P}^* > 0$, i.e. $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})^2}{16b} > 0$.

In sum, supposing $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})^2}{16b} > 0$, it is optimal for voter 1 to exert effort e_{1P}^* and to vote in line with his signal: if $s_1 = h$, then $v_1 = Y$, and if $s_1 = -h$, $v_1 = N$, given that the prejudiced voter votes Y .

(b) If $k > 0$, voter 1 chooses e_1 to maximize his payoff U_1 , where $U_1 = \frac{\bar{G}}{2} \times \frac{1}{2}(1 + e_1) + \frac{\underline{G}}{2} \times \frac{1}{2}(1 - e_1) - be_1^2 + \frac{k}{2}$. Thus, $e_{1PC}^* = \frac{\bar{G}-\underline{G}}{8b} = e_{1P}^* > e_{1N}^*$.

Suppose $e_{1PC}^* = \frac{\bar{G}-\underline{G}}{8b}$, and voter 2 votes Y . When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoffs $\frac{1+e_{1P}^*}{2} \times \underline{G} + \frac{1-e_{1P}^*}{2} \times \bar{G} + k - c(e_{1P}^*)$ that equals to $\frac{\bar{G}+\underline{G}}{2} + \frac{-(\bar{G}-\underline{G})}{2}e_{1P}^* + k - c(e_{1P}^*)$, and $v_1 = N$ yields a expected payoffs that equals to $-c(e_{1P}^*)$, because $\bar{G} + \underline{G} < 0$, $\bar{G} - \underline{G} > 0$, thus $v_1 = N$ dominates $v_1 = Y$.

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoffs $\frac{1+e_{1P}^*}{2} \times \bar{G} + \frac{1-e_{1P}^*}{2} \times \underline{G} + k - c(e_{1P}^*)$ that equals to $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})}{2}e_{1P}^* + k - c(e_{1P}^*)$ and $v_1 = N$ yields an expected payoffs that equals to $-c(e_{1P}^*)$, thus $v_1 = Y$ dominates $v_1 = N$ if $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})}{2}e_{1P}^* + k > 0$, i.e. $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})^2}{16b} + k > 0$.

In sum, supposing $\frac{\bar{G}+\underline{G}}{2} + \frac{(\bar{G}-\underline{G})^2}{16b} + k > 0$, it is optimal for voter 1 to exert effort e_{1PC}^* and to vote in line with his signal: if $s_1 = h$, then $v_1 = Y$, and if $s_1 = -h$, $v_1 = N$, given that the prejudiced voter votes Y .

Because $e_{1P}^* = e_{1PC}^* = \frac{\bar{G}-\underline{G}}{8b}$, $e_N^* = \frac{\bar{G}-\underline{G}}{16b-(\bar{G}+\underline{G})}$ and $8b - (\bar{G} + \underline{G}) > 0$, we have that $e_{1P}^* = e_{1PC}^* > e_N^*$. It shows that given one of them is prejudiced and prefers Y , the other one would exert more effort.

5.7.2 One new prejudiced voter

In this subsection, we focus on the above two conformist voters⁶. We assume that there is only one new prejudiced voter, whose preference is either N or Y .

⁶We note that when the two voters are nonconformist because this prejudiced voter's existence has no effect, the situation is the same as the benchmark.

5.7.2.1 The prejudiced voter prefers N

When the prejudiced voter prefers N (i.e., his vote is N determinedly), following the unanimity rule, the voting result is N . The two voters' best choice would be to pay no effort for collecting information and to vote identically. We present it as Proposition 5.1.

Proposition 5.1 *If there is only one prejudiced new voter who prefers N , the two conformist voters would pay no effort for collecting information and vote identically.*

5.7.2.2 The prejudiced voter prefers Y

In this subsection, we assume that the prejudiced voter prefers Y . Following the voting rule, the voting result is uncertain and will be decided by the two conformist voters. As before, the two voters separately choose how much effort to put in collecting information, and then separately choose how to vote. We still focus on informative equilibria. As before for convenience, first given the assumption of the sincere voting decision, we present the informative equilibrium. Then we consider the conditions about sincere voting decisions in the informative equilibrium as Lemma 5.3.

The informative equilibrium

How much effort do the voters put into collecting information when there is another prejudiced voter, given that they are conformist voters and vote in line with their signals (sincere voting)? Given that voter i , $i \in \{1, 2\}$ chooses effort e_i and votes sincerely, Figure 5.3 presents the game tree with conformity when there is another prejudiced voter whose determined vote is Y .

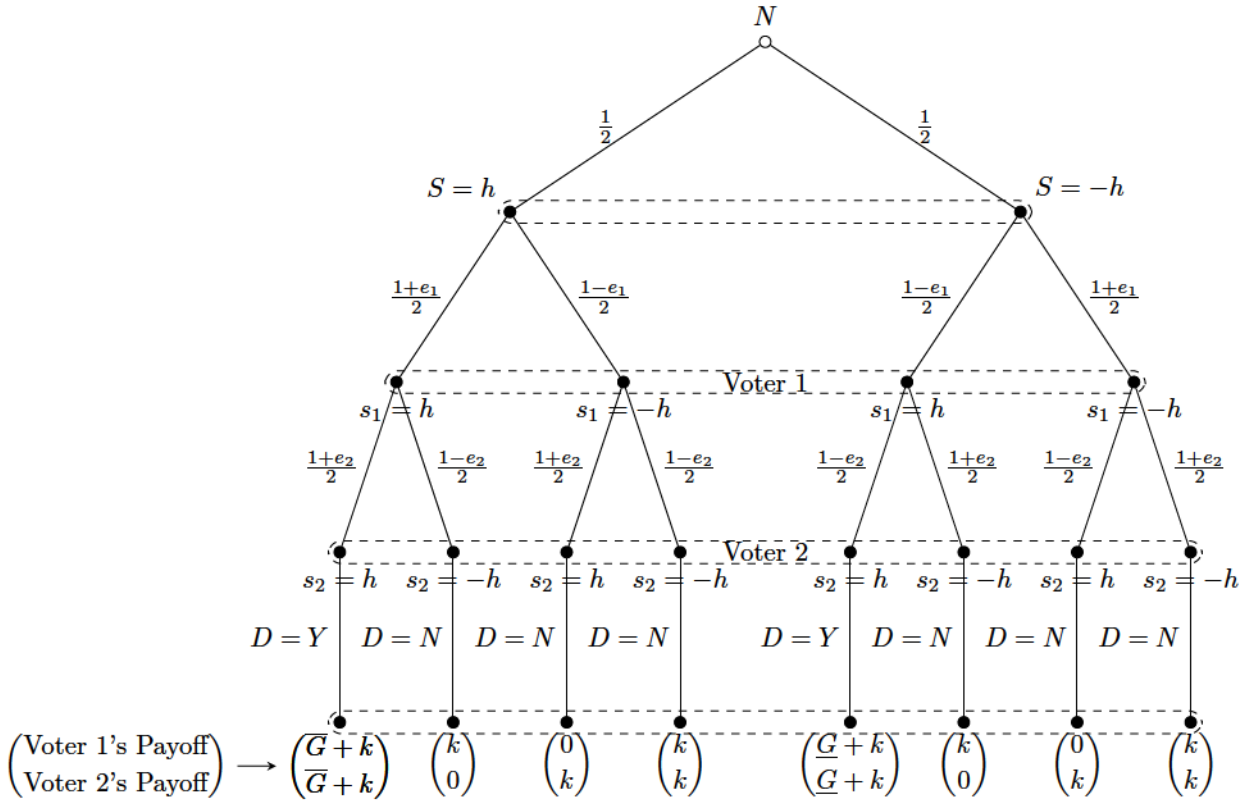


Figure 5.3: The outcomes from voting decisions given that both conformist voters vote sincerely with e_1 and e_2 and another prejudiced voter's determined vote is Y .

When voter 1 chooses effort, his expected payoff S_{1P} , is equal to his expected payoffs from the project itself adding with the utility from normative conformity preferences, i.e., the conformity preferences level k multiplied by the probability that voter 1's vote is the same as the majority's vote:

$$\begin{aligned}
 S_{1P} &= \left(\frac{\bar{G}}{2} + k\right) \times \frac{1}{4}(1 + e_1)(1 + e_2) + \left(\frac{\bar{G}}{2} + k\right) \times \frac{1}{4}(1 - e_1)(1 - e_2) \\
 &\quad + \frac{k}{2} \times \frac{1}{4}[(1 + e_1)(1 - e_2) + (1 - e_1)(1 + e_2)] - be_1^2.
 \end{aligned}$$

Differentiating the function S_{1P} with respect to e_1 yields the first-order condition:

$$S'_{1P}(e_1) = \frac{\bar{G} - G}{8} + \left(\frac{\bar{G} + G}{8} + \frac{1}{4}k\right)e_2 - 2be_1 \tag{5.15}$$

An analogous condition can be derived for e_2 :

$$S_{2P} = \left(\frac{\bar{G}}{2} + k\right) \times \frac{1}{4}(1 + e_1)(1 + e_2) + \left(\frac{\bar{G}}{2} + k\right) \times \frac{1}{4}(1 - e_1)(1 - e_2) \\ + \frac{k}{2} \times \frac{1}{4}[(1 + e_2)(1 - e_1) + (1 - e_2)(1 + e_1)] - be_2^2,$$

and

$$S'_{2P}(e_2) = \frac{\bar{G} - \underline{G}}{8} + \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{4}k\right)e_1 - 2be_2. \quad (5.16)$$

The functions (5.15) and (5.16) imply the following two functions:

$$e_1 = \left(\frac{\bar{G} + \underline{G}}{16b} + \frac{k}{8b}\right)e_2 + \frac{\bar{G} - \underline{G}}{16b}, \quad (5.17)$$

$$e_2 = \left(\frac{\bar{G} + \underline{G}}{16b} + \frac{k}{8b}\right)e_1 + \frac{\bar{G} - \underline{G}}{16b}. \quad (5.18)$$

Using the above two functions, in the informative equilibrium,

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

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

Sincere voting decisions

We have known that $e_{1P}^* = e_{2P}^*$ is a necessary condition of the informative equilibrium. We need to consider voters' sincere voting decisions in the informative equilibrium. The Lemma 5.3 presents the conditions under which it is optimal for voter 1 (2) to vote in line with his signal, given that the other voter also votes in line with his signal and the prejudiced voter prefers Y and $e_1 = e_2$.

Lemma 5.3 *When $\frac{-(\bar{G} + \underline{G})}{2} > k > 0$, facing a prejudiced voter who prefers Y , let us assume that a level of effort $e_1 = e_2 = e$, ($e \in [0, 1]$), such that $\frac{1+e^2}{2}k + \frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$. Then, it is optimal for each voter to vote in line with his signal, given that the other one also votes in line with his signal.*

In summary, we suppose that $\frac{-(\bar{G} + \underline{G})}{2} > k > 0$, $e_{1P}^* = e_{2P}^* = e_P^*$, ($e_P^* \in [0, 1]$), and the condition $\frac{1+e^2}{2}k + \frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$, where $e = e_P^*$ in Lemma 5.3 holds. Then the informative equilibrium with conformity preferences exists, in which (i) each conformist

voters votes informatively and (ii) each conformist voter chooses e_P^* . And e_P^* is a constant determined by \bar{G} , \underline{G} , b and k :

$$e_P^* = \frac{\bar{G} - \underline{G}}{16b - 2k - (\bar{G} + \underline{G})}, \quad \text{and} \quad e_P^* \in [0, 1]. \quad (5.19)$$

Next, through considering the benefits from a social welfare point, we find the optimal k with one prejudiced voter in the following theorem.

Theorem 5.2 *Facing with a prejudiced voter who prefers Y , and under the conditions $k > 0$ and $k < \frac{-(\bar{G} + \underline{G})}{2}$, let us assume that $e_1 = e_2 = e$, ($e \in [0, 1]$), such that $\frac{1+e^2}{2}k + \frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$. Then, the normative conformity preferences level k cannot help to maximize the welfare from a social point of view, i.e., $e_P^* \neq e_P^{**}$, where e_P^{**} means voters' effort level that maximizes the sum of social expected payoffs ($S_P(e_i)$). Concretely,*

<i>if k satisfies</i>	<i>the effort level</i>
$3k > 8b - (\bar{G} + \underline{G})$	$e_P^* > 0 > e_P^{**}$
$3k = 8b - (\bar{G} + \underline{G})$	$e_P^* \neq e_P^{**}$
$3k < 8b - (\bar{G} + \underline{G})$	$0 < e_P^* < e_P^{**}$

Moreover, when $k = 4b$ and $\frac{1+(e_P^*)^2}{4}(\bar{G} + \underline{G}) + \frac{e_P^*}{2}(\bar{G} - \underline{G}) > 0$, the normative conformity preferences $k = 4b$ alleviates the free-rider problem through making the two conformist voters exert the exact effort which maximizes S_N .

The intuition is similar to that of Theorem 5.1. Thus, for conciseness, the intuition of Theorem 5.2 is omitted.

At last, Proposition 5.2 presents the differences of effort levels in informative equilibrium between the case with one prejudiced voter and the case without prejudiced voters.

Proposition 5.2 *When $0 < k < \frac{-(\bar{G} + \underline{G})}{2}$, let us assume that $e_1 = e_2 = e$, ($e \in [0, 1]$), so that $e^2k + \frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$, and $\frac{1+e^2}{2}k + \frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$, if facing with one prejudiced voter who prefers Y , the two conformist voters will exert fewer effort for gathering information compared with the case without prejudiced voters.*

Proposition 5.2 shows that (i) Compared with the case where there are no prejudiced voters, facing one prejudiced voter who prefers Y , the conformist voters would exert fewer effort certainly in the informative equilibrium. That is to say, when conformity preference degree is k with $0 < k < \frac{-(\bar{G} + \underline{G})}{2}$, for the same k , in informative equilibrium, the two conformist voters pay fewer effort in the case with a prejudiced voter than the case without prejudiced voters.

Therefore, for the optimal $k = 2b$ in Theorem 5.1, the role of one prejudiced voter reinforces the free-riding problem, because gathering more information may make one less likely to take the same decision as the prejudiced one.

5.7.3 More than one prejudiced voters who prefer one choice identically

In this subsection, we assume that there are more than one prejudiced voter who prefer identically to or not to implement the project. The voting rule is still that implementation requires that all voters vote for implementation. The prejudiced voters' preference, either N or Y , is transmitted to the two conformist voters by the media⁷.

5.7.3.1 Prejudiced voters prefer N

When prejudiced voters prefer N . Following the voting rule, the voting result is N . Our two conformist voters' best choice would be to pay no effort for collecting information and to vote N . We present it as Proposition 5.3.

Proposition 5.3 *If there are at least two prejudiced voters who prefer N identically, the two conformist voters would pay no effort for collecting information and vote N .*

5.7.3.2 The prejudiced voters prefer Y

When the prejudiced voters prefer Y identically, following the voting rule, the voting result is uncertain and will be decided by the two conformist voters. As before, we focus on informative equilibria. First, given the assumption of the sincere voting decision, we present that each conformist voter chooses how much effort to put in collecting information in informative equilibrium. Second, we show the conditions about sincere voting decisions.

Informative equilibrium

First, given that voter i chooses effort e_i and votes sincerely, Figure 5.4 presents the game tree with conformity when the prejudiced voters prefer Y .

⁷ When the two voters are nonconformist, the prejudiced voters' existence has no effect. The situation is the same as the case of the benchmark.

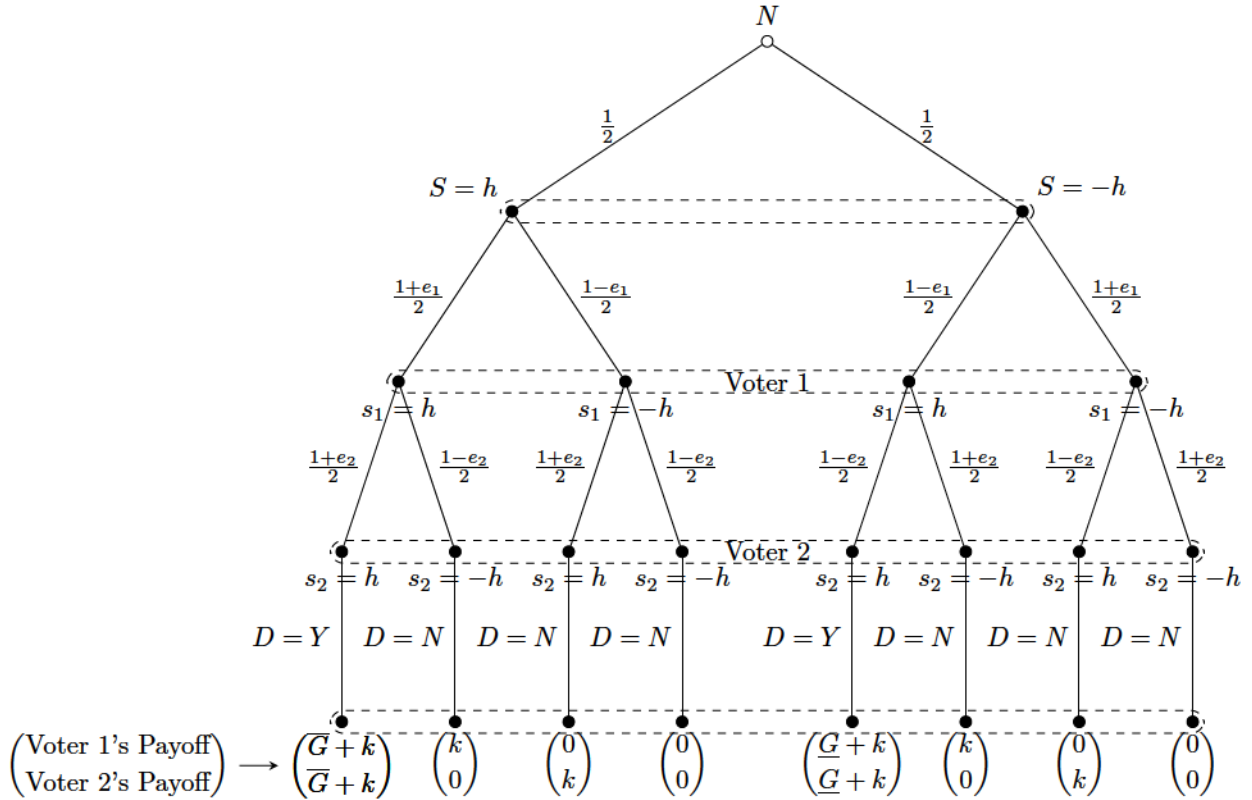


Figure 5.4: The outcomes from voting decisions given that both conformist voters vote sincerely with e_1 and e_2 and the prejudiced voters' determined votes are Y .

Thus, given the assumption of sincere voting decisions and the assumption that there are more than one prejudiced voters, when the conformist voter 1 chooses effort, his expected payoff S_{1T} , is equal to his expected payoff from the project itself adding with the normative conformity preference utility, i.e., the conformity preference level k multiplied by the probability that voter 1's vote is Y :

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

Thus,

$$S_{1T}(x) = S_{1N}(x) + \frac{k}{2} \tag{5.20}$$

The analogous argument applies to voter 2. Thus, the equation (5.20) shows that the case with two conformist voters and prejudiced voters is similar to the case of benchmark in section 5.4.1. For conciseness, given the sincere voting decisions, the discussion about the effort levels

in informative equilibrium with more than one prejudiced voters is omitted. Overall, in the informative equilibrium $e_{1T}^* = e_{2T}^* = e_N^*$, i.e.,

$$e_{1T}^* = e_{2T}^* = \frac{\bar{G} - \underline{G}}{16b - (\bar{G} + \underline{G})}, \quad \text{and} \quad e_{1T}^*, e_{2T}^* \in [0, 1].$$

Sincere voting decisions

Now we need to consider voters' sincere voting decisions. The Proposition 5.4 presents the condition under which it is optimal for voter 1 (2) to vote in line with his signal, given that the other voter also votes in line with his signal and the prejudiced voters prefer Y identically

Proposition 5.4 *Let us assume that $0 < k < \frac{(1-e^2)}{2}[-(\bar{G} + \underline{G})]$, and a level of effort $e_1 = e_2 = e$ so that $k + \frac{(1+e^2)}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0$. Then, it is optimal for each conformist voter to vote in line with his signal, given that the other one also votes in line with his own signal.*

In short, given the assumption sincere voting decisions, when there are more than one prejudiced voters who prefer one choice identically, the two conformist voters' behaviors in informative equilibrium are the same as in the case of the benchmark. But there are differences in the conditions about sincere voting decisions in informative equilibrium between the two cases, which can be found through comparing Lemma 5.1 and Proposition 5.4.

5.8 Conclusion

Voters like the voter who has made the same voting choice as theirs, which is a common observation on real life. This phenomenon reflects normative conformity of social psychology. In addition to making the right voting choice, voters who have the normative conformity preferences would want to do the same voting choice in order to be liked and accepted by others in the same small group. Taking advantage of social psychologists' work, we model the consequences of normative conformity preferences in voting instead of modeling how voters have normative conformity preferences. In this model, we have examined the normative conformity's effects in voters' effort (with or without prejudiced voters) and find special conditions under which normative conformity preferences makes voters exert the effort level that equals to the level that maximizes the sum of voters' social expected payoffs when the voters are nonconformist (with or without prejudiced voters).

Our most surprising result is that the normative conformity preferences can help to internalize the positive externality. Specifically, when information's marginal cost is cheap, a low

exogenous compliance conformity level is needed for making conformist voters exert the exact effort level that maximizes the sum of voters' social benefits from a social point of view in the informative equilibrium when they are nonconformist. When information's marginal cost is expensive, a high normative conformity preferences level is needed for making conformist voters exert the exact effort level that maximizes the sum of voters' social benefits from a social point of view in the informative equilibrium when they are nonconformist.

In short, normative conformity preference has positive effects from a social point of view. It is because conformity preference makes the correlation between the signals of the two voters be important for coordination (making the same vote). Even if the correlation has no link with the precision of the signals, the correlation still matters to the two voters. Thus, normative conformity preference relieves the free-rider problem.

Furthermore, conformist voters may give effort that exceed the optimum effort which maximize total benefits of the society from a social point of view. However, nonconformist voters always exert too little effort and never more effort compared with their optimum effort for the society from a social point of view. Conformist voters' extra effort compared with their optimum effort are a waste. Thus, the normative conformity preference causes an effort waste from the social point of view. It shows normative conformity preferences' negative effects.

In addition, given a new prejudiced voter, gathering more information may make each conformist voter less likely to take the same decision as the prejudiced voter. We recall the optimal conformity preference degree that makes the two conformist voters facing no prejudiced voters exert the exact effort that maximise the sum of social expected payoff in the case of nonconformity. Therefore, when the two conformist voters hold the optimal normative conformity preference degree, the existence of one prejudiced voter reinforces the free-rider problem.

In contrast, although our model focuses on conformity, it could apply to people who value consensus or dislike fights and disagreements. If assuming people dislike uncertainty, even with no taste for conformity, our model could also be useful. It is because conforming gives more confidence in one's estimate for his signals under uncertainty. Of course, we are aware that our results are derived from three restrictive assumptions. First, except for prejudiced voters who are in favor of a particular viewpoint, we consider only two voters who may be conformist. Therefore, when there are no prejudiced voters, one voter's choice is deemed to be the group's choice by the other voter. Supposing there are more than two such voters, some extra conditions are needed for the existence of positive externality which results in the free-rider problem. Under these extra conditions, we think assuming that there are more than two such conformist voters would not compromise the main results of our paper. Second, the two voters are identical. Especially, they are the same, not only at the level of normative

conformity preferences, but also in the ability to pay for informative signals and in disutility of their effort. It is possible to make the two voters different, which make our results more general. In short, although the two assumptions are critical for our conclusions, our modeling is general. Future work could relax the two assumptions, such as, introducing more such conformist voters, making voters have different degrees of normative conformity preference, and so on.

5.9 Appendix

Proof of Lemma 5.1:

Proof. Suppose $e_1 = e_2 = e$, and that voter 2 follows his signal. When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoffs $\frac{1}{2}(1+e) \times \frac{1}{2}(1-e) \times \underline{G} + \frac{1}{2}(1-e) \times \frac{1}{2}(1+e) \times \overline{G} - c(e)$ that equals to $\frac{1-e^2}{4}(\overline{G} + \underline{G}) - c(e)$ and $v_1 = N$ yields a expected payoffs that equals to $-c(e)$, because of $\overline{G} + \underline{G} < 0$, thus $v_1 = N$ dominates $v_1 = Y$.

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoffs $\frac{1}{2}(1+e) \times \frac{1}{2}(1+e) \times \overline{G} + \frac{1}{2}(1-e) \times \frac{1}{2}(1-e) \times \underline{G} - c(e)$ that equals to $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) - c(e)$ and $v_1 = N$ yields an expected payoffs that equals to $-c(e)$, thus $v_1 = Y$ 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.

In sum, supposing a level of effort $e = e_1 = e_2$ 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 signal: if $s_1 = h$, then $v_1 = Y$, and if $s_1 = -h$, $v_1 = N$, while given that the other voter votes in line with his signal. \square

Proof of Lemma 5.2:

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

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoffs $\frac{1}{2}(1+e) \times \frac{1}{2}(1+e) \times (\overline{G} + k) + \frac{1}{2}(1-e) \times \frac{1}{2}(1-e) \times (\underline{G} + k)$ that equals to $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + \frac{1-e^2}{2}k - c(e)$, and $v_1 = N$ yields an expected payoffs $\frac{1}{2}(1+e) \times \frac{1}{2}(1-e) \times k + \frac{1}{2}(1-e) \times \frac{1}{2}(1+e) \times k - c(e)$ that equals to $\frac{1-e^2}{2}k - c(e)$, thus $v_1 = Y$ 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.

In sum, let us assume that a level of effort $e_1 = e_2 = e$ such 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 signal: if $s_1 = h$, then $v_1 = Y$, and if $s_1 = -h$, $v_1 = N$, while given that the other voter votes in line with his signal. Because $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) > 0$, $\frac{1+e^2}{4}(\overline{G} + \underline{G}) + \frac{e}{2}(\overline{G} - \underline{G}) + e^2k > 0$. Thus, from Lemma 5.1, we note that when sincere voting with nonconformist voters exist, sincere voting with conformist voters exist. \square

Proof of Theorem 5.1:

Proof. We suppose that $k > 0$ and the level of effort e_C^* from the function (5.14), where $e_C^* = \frac{\overline{G} - \underline{G}}{16b - 4k - (\overline{G} + \underline{G})}$ and $e_C^* \in [0, 1]$, satisfies the condition about sincere voting in Lemma 5.2 (\square)

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 totally expected social surplus, $(S_C(e_C^*))$:

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

We get $S'_C(e_i)$:

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

Therefore

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

Thus, 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, $S'_C(e_i)$ is increasing with e_i if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b > 0$ and $S'_C(e_i)$ is decreasing with e_i if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b < 0$.

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

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

We get

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

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

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

Thus e_C^{**} , which is derived from the function $S'_C(e_C^{**}) = 0$, cannot be equal to e_C^* because the inequality function, $S'_C(e_C^*) > 0$, is always right. It shows that even when voters have the normative conformity preferences, the optimum whole social benefits of collecting information could never be achieved by maximizing each conformist voter's private benefits. Concretely, e_C^* is bigger than e_C^{**} if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b > 0$ and e_C^* is smaller than e_C^{**} if $\frac{\overline{G}+\underline{G}}{2} + 2k - 4b < 0$. In sum,

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

Thus, from a social point of view, voters exert more effort when $4k > 8b - (\bar{G} + \underline{G})$ and voters exert fewer effort when $4k < 8b - (\bar{G} + \underline{G})$.

Let $M_C(e_i) \equiv S_N(e_i)$, so that

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

Because of $S_C(e_i) = M_C(e_i) + k(1 + e_i^2)$,

$$S_C(e_i) > M_C(e_i)$$

.

Differentiating $M_C(e_i)$ with respect to e_i yields the first order condition:

$$M'_C(e_i) = \frac{\bar{G} + \underline{G}}{2}e_i + \frac{\bar{G} - \underline{G}}{2} - 4be_i.$$

And differentiating $M'_C(e_i)$ with respect to e_i yields:

$$M''_C(e_i) = \frac{\bar{G} + \underline{G}}{2} - 4b.$$

Because of our assumptions, $M''_C(e_i) < 0$ for all e_i which means $M'_C(e_i)$ is decreasing in e_i .

And we note that:

$$\begin{aligned} M'_C(e_C^*) &= \frac{\bar{G} + \underline{G}}{2}e_C^* + \frac{\bar{G} - \underline{G}}{2} - 4be_C^* \\ &= \frac{\bar{G} - \underline{G}}{2} + \left(\frac{\bar{G} + \underline{G}}{2} + 2k\right)e_C^* - 8be_C^* - 2ke_C^* + 4be_C^* \\ &= -2ke_C^* + 4be_C^*. \end{aligned}$$

Because of $M''_C(e_i) < 0$ and $M_C(e_i) \equiv S_N(e_i)$, if

$$k = 2b,$$

$M'_C(e_C^*) = 0$, then $M_C(e_C^*)$ is the maximized value of $S_N(e_i)$ for all e_i , where

$$e_C^* = \frac{\bar{G} - \underline{G}}{8b - (\bar{G} + \underline{G})},$$

and e_C^* is a function of \bar{G}, \underline{G} and b .

Furthermore, we assume that the effort level e_C^* satisfies the condition about sincere voting in Lemma 5.1, i.e., $\frac{1+(e_C^*)^2}{4}(\bar{G} + \underline{G}) + \frac{e_C^*}{2}(\bar{G} - \underline{G}) > 0$. Therefore, it is obvious that

$$e_C^* = e_N^{**} = \frac{\bar{G} - \underline{G}}{8b - (\bar{G} + \underline{G})}.$$

Therefore, we have proved the Theorem 5.1. \square

Proof of Proposition 5.1:

Proof. When there is a prejudiced voter with two conformist voters, because the prejudiced voter prefers N , following the voting rule, the voting result is N . Under this situation, each conformist voter i choose e_i to maximize his payoffs U_i , where $U_i = -c(e_i) + k * \mathbb{K}_{\{v_1=v_2\}}$.

	$v_2 = N$	$v_2 = Y$
$v_1 = N$	$-c(e_i) + k, -c(e_i) + k$	$-c(e_i) + k, -c(e_i) + 0$
$v_1 = Y$	$-c(e_i) + 0, -c(e_i) + k$	$-c(e_i) + k, -c(e_i) + k$

Thus, the case $e_i = 0$ with $v_i = N$ and the another case $e_i = 0$ with $v_i = Y$ are two equilibria where $U_i = k$. \square

Proof of lemma 5.3:

Proof. We suppose that $e_1 = e_2 = e$ and conformist voter 2 follows his signal.

When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoffs $\frac{(1+e)(1-e)}{4}\underline{G} + \frac{(1-e)(1+e)}{4}\overline{G} + k - c(e)$ that equals to $\frac{1-e^2}{4}(\overline{G} + \underline{G}) + k - c(e)$, and $v_1 = N$ yields an expected payoffs $\frac{(1+e)(1+e)}{4}k + \frac{(1-e)(1-e)}{4}k - c(e)$ that equals to $\frac{(1+e^2)}{2}k - c(e)$. If $(k + \frac{\overline{G} + \underline{G}}{2})(1 - e^2) < 0$, i.e., $k + \frac{\overline{G} + \underline{G}}{2} < 0$, $v_1 = N$ dominates $v_1 = Y$.

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

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

Proof of Theorem 5.2:

Proof. When $\frac{-(\overline{G} + \underline{G})}{2} > k > 0$, facing with a prejudiced voter who prefers Y , supposing e_P^* from the function (5.19) satisfies the condition about sincere voting in Lemma 5.3, i.e., $\frac{1+(e_P^*)^2}{4}(\overline{G} + \underline{G}) + \frac{e_P^*}{2}(\overline{G} - \underline{G}) + \frac{1+(e_P^*)^2}{2}k > 0$. Then, using the functions $S_{1P}(e_P^*) = S_{2P}(e_P^*)$, it is easy to calculate the totally expected social surplus ($S_P(e_P^*)$):

$$S_P(e_P^*) = \left(\frac{\overline{G} + \underline{G}}{4} + k\right)[1 + (e_P^*)^2] + \frac{\overline{G} - \underline{G}}{2}e_P^* + \frac{k}{4}[1 - (e_P^*)^2] - 2b(e_P^*)^2.$$

We get $S'_P(e_i)$:

$$S'_P(e_i) = \left(\frac{\overline{G} + \underline{G}}{2} + \frac{3}{2}k\right)e_i + \frac{\overline{G} - \underline{G}}{2} - 4be_i.$$

Therefore

$$S''_P(e_i) = \frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b.$$

Thus, if $\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b > 0$, $S''_P(e_i) > 0$. Otherwise, $\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b < 0$, $S''_P(e_i) < 0$. Therefore, $S'_P(e_i)$ is increasing with e_i if $\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b > 0$ and $S'_P(e_i)$ is decreasing with e_i if $\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b < 0$.

We assume that e_P^{**} makes $S'_P(e_P^{**}) = 0$:

$$\left(\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k\right)e_P^{**} + \frac{\bar{G} - \underline{G}}{2} - 4be_P^{**} = 0.$$

We get

$$e_P^{**} = \frac{\bar{G} - \underline{G}}{8b - 3k - (\bar{G} + \underline{G})}.$$

From the function $S'_{1P}(e_P^*) = 0$, i.e., $\frac{\bar{G} - \underline{G}}{8} + \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{4}k\right)e_P^* - 2be_P^* = 0$, we note that $e_P^* \neq 0$, because $\bar{G} - \underline{G} > 0$. Thus,

$$\begin{aligned} S'_P(e_P^*) &= \frac{\bar{G} - \underline{G}}{2} + \left(\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k\right)e_P^* - 4be_P^* \\ &= \frac{\bar{G} - \underline{G}}{2} + \left(\frac{\bar{G} + \underline{G}}{2} + k\right)e_P^* - 8be_P^* + \frac{1}{2}ke_P^* + 4be_P^* \\ &= 0 + \frac{1}{2}ke_P^* + 4be_P^* = \frac{1}{2}ke_P^* + 4be_P^* > 0 \end{aligned}$$

Thus e_P^{**} , which is derived from the function $S'_P(e_P^{**}) = 0$, cannot be equal to e_P^* because the inequality function, $S'_P(e_P^*) > 0$, is always right.

Concretely, e_P^* is bigger than e_P^{**} if $\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b > 0$ and e_P^* is smaller than e_P^{**} if $\frac{\bar{G} + \underline{G}}{2} + \frac{3}{2}k - 4b < 0$. That shows the normative conformity preferences cannot help to maximize the totally expected payoffs from a social point of view a social point of view by maximizing each conformist voter's private benefits. In sum,

if k satisfies	the effort level
$3k > 8b - (\bar{G} + \underline{G})$	$e_P^* > 0 > e_P^{**}$
$3k = 8b - (\bar{G} + \underline{G})$	$e_P^* \neq e_P^{**}$
$3k < 8b - (\bar{G} + \underline{G})$	$0 < e_P^* < e_P^{**}$

Thus, from a social point of view, voters exert more effort when $3k > 8b - (\bar{G} + \underline{G})$ and voters exert fewer effort when $3k < 8b - (\bar{G} + \underline{G})$.

Let $M_P(e_i) \equiv S_N(e_i)$, so that

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

Because of $S_P(e_i) = M_C(e_i) + k(1 + e_i^2) + \frac{k}{4}(1 - e_i^2)$, $S_P(e_i) > M_C(e_i)$.

Differentiating $M_P(e_i)$ with respect to e_i yields the first order condition:

$$M'_P(e_i) = \frac{\bar{G} + \underline{G}}{2}e_i + \frac{\bar{G} - \underline{G}}{2} - 4be_i.$$

And differentiating $M'_P(e_i)$ with respect to e_i yields:

$$M''_P(e_i) = \frac{\bar{G} + \underline{G}}{2} - 4b.$$

Because of our assumptions, $M''_P(e_i) < 0$ for all e_i which means $M'_P(e_i)$ is decreasing in e_i .

Because $S_{1P}(e_P^*) = 0$, we note that:

$$\begin{aligned} M'_P(e_P^*) &= \frac{\bar{G} + \underline{G}}{2}e_P^* + \frac{\bar{G} - \underline{G}}{2} - 4be_P^* \\ &= \frac{\bar{G} - \underline{G}}{2} + \left(\frac{\bar{G} + \underline{G}}{2} + k\right)e_P^* - 8be_P^* - ke_P^* + 4be_P^* \\ &= S_{1P}(e_P^*) - ke_P^* + 4be_P^* \\ &= -ke_P^* + 4be_P^*. \end{aligned}$$

Because of $M''_P(e_i) < 0$ and $M_P(e_i) \equiv S_N(e_i)$, if

$$k = 4b$$

, $M'_C(e_P^*) = 0$, then $M_P(e_P^*)$ is the maximized value of $S_N(e_i)$ for all e_i , where

$$e_P^* = \frac{\bar{G} - \underline{G}}{8b - (\bar{G} + \underline{G})},$$

and e_P^* is a function of \bar{G} , \underline{G} and b .

Furthermore, we assume that the effort level e_P^* satisfies the condition about sincere voting in Lemma 5.1 ,i.e., $\frac{1+(e_P^*)^2}{4}(\bar{G} + \underline{G}) + \frac{e_P^*}{2}(\bar{G} - \underline{G}) > 0$. Therefore, it is obvious that

$$e_P^* = e_N^{**} = \frac{\bar{G} - \underline{G}}{8b - (\bar{G} + \underline{G})}.$$

Thus, we have proved the Theorem 5.2. □

Proof of Proposition 5.2:

Proof.

When $\frac{-(\bar{G} + \underline{G})}{2} > k > 0$, on one hand, supposing e_C^* from the function (5.14) satisfies the condition about sincere voting in Lemma 5.2, i.e., $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + e^2k > 0$; on

the other hand, supposing e_P^* from the function (5.19) satisfies the condition about sincere voting in Lemma 5.3, i.e., $\frac{1+e^2}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + \frac{1+e^2}{2}k > 0$. Then, we know that e_C^* and e_P^* exist in informative equilibria. In this Proposition 5.2, we compare e_C^* with e_P^* .

First, go back to the function (5.8):

$$S'_{1C}(e_C^*) = \frac{\bar{G} - \underline{G}}{8} + \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{2}k\right)e_C^* - 2be_C^*,$$

where $e_C^* \neq 0$ from $\bar{G} - \underline{G} \neq 0$. The corresponding function is

$$S'_{1C}(x) = \frac{\bar{G} - \underline{G}}{8} + \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{2}k\right)x - 2bx.$$

Because of the function (5.15):

$$S'_{1P}(e_P^*) = \frac{\bar{G} - \underline{G}}{8} + \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{4}k\right)e_P^* - 2be_P^*$$

The corresponding function is

$$S'_{1P}(x) = \frac{\bar{G} - \underline{G}}{8} + \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{4}k\right)x - 2bx$$

We get that

$$S'_{1C}(x) = S'_{1P}(x) + \frac{1}{4}kx.$$

The above function shows that $S'_{1C}(e_C^*) \neq S'_{1G}(e_C^*)$, because of $k > 0$.

From the above function, we get

$$S'_{1C}(e_C^*) = S'_{1P}(e_C^*) + \frac{1}{4}ke_C^*,$$

Because of $S'_{1C}(e_C^*) = 0$ and $\frac{k}{4}e_C^* > 0$, thus,

$$S'_{1P}(e_C^*) < 0 = S'_{1P}(e_G^*).$$

Going back to the function $S''_{1P}(x) = \left(\frac{\bar{G} + \underline{G}}{8} + \frac{1}{4}k\right) - 2b$, because $\frac{\bar{G} + \underline{G}}{2} + k < 0$ and $b > 0$,

$$S''_{1P}(x) < 0.$$

Thus, $S'_{1P}(x)$ is the decreasing with x . Knowing that $S'_{1P}(e_C^*) < 0 = S'_{1P}(e_G^*)$, we get that

$$e_C^* > e_G^*.$$

□

Proof of Proposition 5.3:

Proof. When there are at least two prejudiced voters with two conformist voters and the

	$v_2 = N$	$v_2 = Y$
$v_1 = N$	$-c(e_i) + k, -c(e_i) + k$	$-c(e_i) + k, -c(e_i) + 0$
$v_1 = Y$	$-c(e_i) + 0, -c(e_i) + k$	$-c(e_i), -c(e_i)$

prejudiced voters prefer N . Following the voting rule, the voting result is N . Under this situation, each conformist voter i choose e_i to maximize his payoffs U_i , where $U_i = -c(e_i) + k * Pr(v_i = J)$.

Thus, the case $e_i = 0$ with $v_i = N$ is the equilibrium where $U_i = k$. \square

Proof of Proposition 5.4:

Proof. We suppose that $e_1 = e_2 = e$ and conformist voter 2 follows his signal.

When voter 1 has received $s_1 = -h$, $v_1 = Y$ yields an expected payoffs $\frac{(1+e)(1-e)}{4}\bar{G} + \frac{(1-e)(1+e)}{4}\underline{G} + k - c(e)$ that equals to $\frac{(1-e^2)}{2}(\bar{G} + \underline{G}) + k - c(e)$, and $v_1 = N$ yields a expected payoffs $-c(e)$ that equals to $-c(e)$. Thus, if $\frac{(1-e^2)}{2}(\bar{G} + \underline{G}) + k < 0$, $v_1 = N$ dominates $v_1 = Y$.

When voter 1 has received $s_1 = h$, $v_1 = Y$ yields an expected payoffs $\frac{(1+e)(1+e)}{4}\bar{G} + \frac{(1-e)(1-e)}{4}\underline{G} + k - c(e)$ that equals to $\frac{(1+e^2)}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + k - c(e)$, and $v_1 = N$ yields an expected payoffs $-c(e)$, thus $v_1 = Y$ dominates $v_1 = N$ if $\frac{(1+e^2)}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) + k > 0$. The analogous argument applies to voter 2.

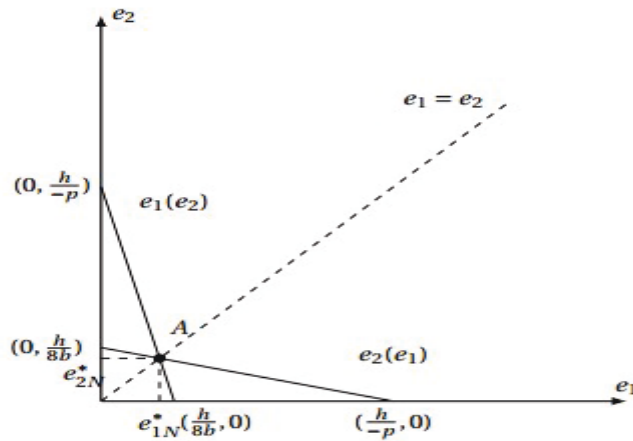
In sum, supposing a level of effort $e_1 = e_2 = e$ so that

$$k < \frac{(1-e^2)}{2}[-(\bar{G} + \underline{G})]$$

and

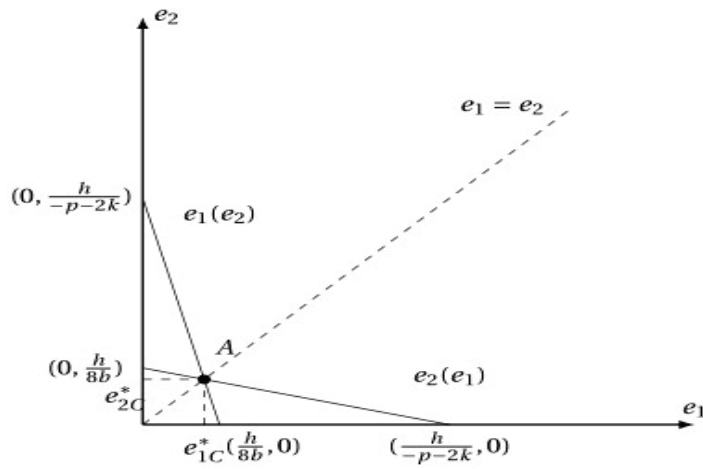
$$k + \frac{(1+e^2)}{4}(\bar{G} + \underline{G}) + \frac{e}{2}(\bar{G} - \underline{G}) > 0,$$

while given that the other one also votes in line with his own signal, it is optimal for each voter to vote in line with his signal, i.e., if $s_i = h$, then $v_i = Y$, and if $s_i = -h$, $v_i = N$, where $(i \in \{1, 2\})$. \square



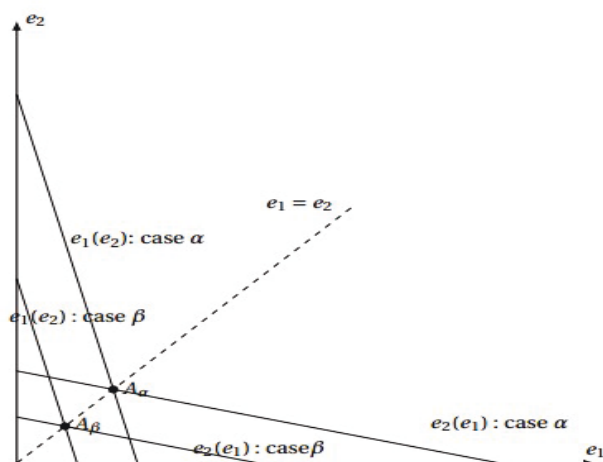
The dot A denotes an equilibrium point. $e_1(e_2)$ is voter 1's reaction function. $e_2(e_1)$ is voter 2's reaction function. $\bar{G} + \underline{G} = 2p$ and $\bar{G} - \underline{G} = 2h$.

Figure 5.5: The informative equilibrium.



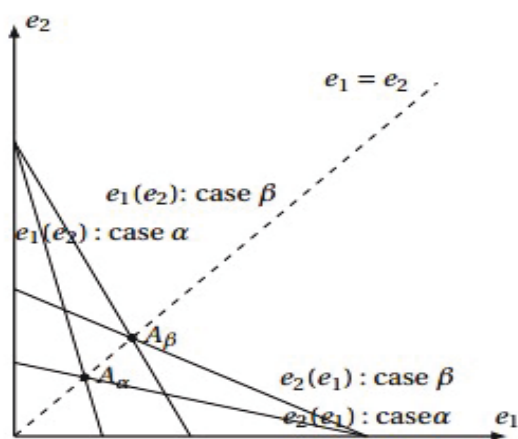
The dot A denotes an equilibrium point. $e_1(e_2)$ is voter 1's reaction function. $e_2(e_1)$ is voter 2's reaction function. $\bar{G} + \underline{G} = 2p$ and $\bar{G} - \underline{G} = 2h$.

Figure 5.6: The informative equilibrium with conformity.



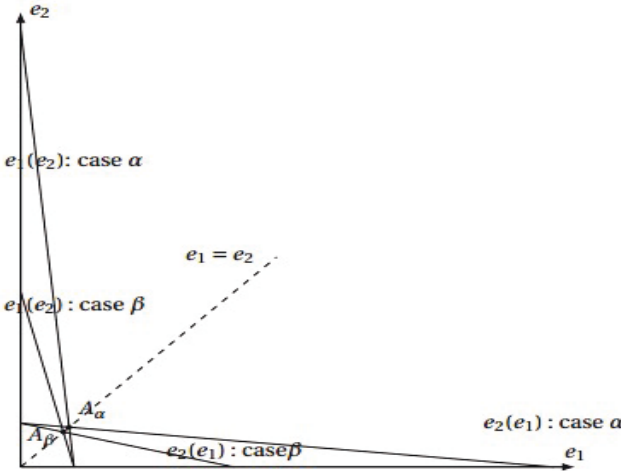
$\bar{G}_\alpha - \underline{G}_\alpha > \bar{G}_\beta - \underline{G}_\beta$. The dots A_α and A_β denote equilibrium points.

Figure 5.7: The effect of a difference in the profit.



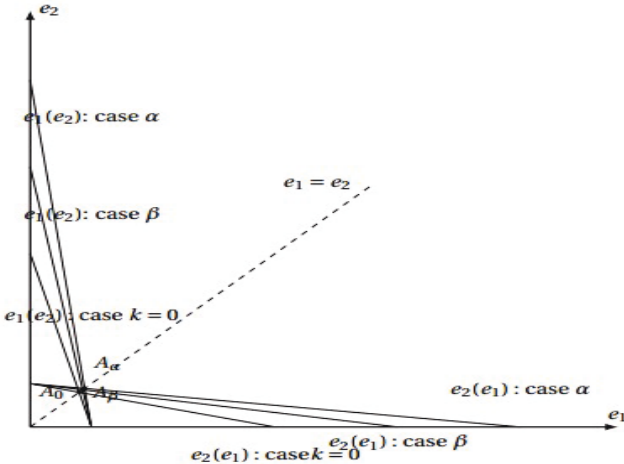
$b^\alpha > b^\beta$. The dots A_α and A_β denote equilibrium points.

Figure 5.8: The effect of a difference in voters' disutility of effort.



$\bar{G}_\alpha + \underline{G}_\alpha > \bar{G}_\beta + \underline{G}_\beta$. The dots A_α and A_β denote equilibrium points.

Figure 5.9: The effect of a difference in the project's negative expected utility payoffs.



$k_\alpha > k_\beta > k_0 = 0$. The dots A_α, A_β and A_0 denote equilibrium points.

Figure 5.10: The effect of a difference in conformity degree k .

Part IV

Summary and future work

Summary and future work

Our thesis has focused on the compliance conformity preference effects in a re-election and in voting separately. We study equilibria's existences and present the outcomes from the social point of view. We aim to solve two interesting problems: the incumbent's pandering problem in re-election and the free-rider problem in voting. In this part, we summarize the main findings and discuss some of the topics for future work.

A summary of main findings

In Chapter 1, we have reviewed the related literature about conformity in social psychology. First, we present the definition of conformity in social psychology. The definition is that “Conformity is a behavior to conform when an individual in a group displays that behavior because it is the most frequent the individual witnessed in others.” Second, we review the important experimental relevance of conformity in social psychology. These great experiments give us clues to do classification of conformity from motivations. Then we detail the classification of conformity in social psychology: informational conformity and normative conformity. For better understanding normative conformity, we present obedience and compared it with normative conformity. Inspired by Kelman (1958), we divide normative conformity into three subdivisions: compliance conformity, internalization conformity and identification conformity. At last, we have cited the table 1 of Claidière and Whiten (2012) to show the theoretical and empirical differences between informational conformity and normative conformity in social psychology. Finally, we give a conclusion of this chapter.

In Chapter 2, we presented experimental evidence in economics about informational conformity and normative conformity separately. First, we focus on information cascades that is an obvious expression of informational conformity in economic experiments (Anderson and Holt, 1997; Cipriani and Guarino, 2005). Second, we review the economic experimental literature about compliance conformity that is normative conformity from social pressure. Finally, we give much experimental evidence about internalization conformity that is normative conformity from a preference for conformity. In addition, the fact that informational conformity

and normative conformity are always interrelated has been mentioned in social psychology, which has been noted by economists too. Economists always make empirical not experimental research to discuss the two kinds of conformity simultaneously.

In Chapter 3, the main objective of the chapter is to examine theoretical models literature on conformity in behavioural economics. In the first section, we review models of informational conformity. All these models are divided by whether the decision process is in sequence or not. Concretely, we present the models of exogenous sequential decision first, the models of endogenous sequential decision second, and the models of non-sequential decision finally. In the second section, we review models of compliance conformity. Compliance conformity is normative conformity from social pressure. We present that economists model compliance conformity endogenously or exogenously. Further, we review the exogenous compliance conformity preference papers about voters when abstention is forbidden. Here voters' exogenous compliance conformity preference means that voters want to be the winner's side or to vote unanimously. In the third section of this chapter, we review the economic model literature about internalization conformity, where individuals' preference is not taken as given.

In Chapter 4, we develop a re-election (two-periods voting) model with complete information about the quality of the candidates. Our paper allows for three different types of voters: incumbent partisans, challenger partisans and independent voters. The independent voters might be conformists in the sense that they want to vote for the winner. This might induce a trade-off between voting for the better candidate and the candidate that is most likely to win.

As what we have known, the paper for the first time presents, from the incumbent's "ego rents X_2 " points, the effects of independent voters' conformity preferences on the conditions of Socially Efficient Strategy Equilibrium (**S**)'s existence, where the incumbent in the first period continues a successful policy and repeals a failed one, and Office-Seeking Strategy Equilibrium (**P**)'s existence, where the incumbent in the first period continues the first-period policy regardless of its outcome. Our findings show that when independent voters have enough strong conformity, for any incumbent, **P** dose not exist and **S** exists. It implies that strong conformity tends to promote **S** but restrain **P**. For this reason, strong conformity tends to improve social interests. Under the condition where independent voters have enough weak conformity, compared with the condition where independent voters are nonconformist, the condition about incumbent's "ego rents X_2 " becomes difficult under which **S** exists and the condition about incumbent's "ego rents X_2 " becomes less strict under which **P** exists. Thus, weak conformity tends to restrain **S** and promote **P**. It means weak conformity tends to hurt social interests. More precisely, given independent voters' conformity that is neither too strong nor too weak, we find the conditions under which conformity improves social interests

as promoting **S** and restraining **P**. In brief, independent voters' conformity preference can help to deter incumbents from inefficient decisions (i.e., incumbents' pandering). After the discussion in this chapter, an advantage of conformity is introduced, which is not intuitively obvious.

In Chapter 5, we study a model of collective decision making about an information collection between two conformist voters who like to make the same voting choice between them. Before voting on a project, each voter collects information about the consequences of the project. We focus on the informative equilibrium which is a symmetric Nash equilibrium. In the equilibrium, voters vote informatively using pure strategies. We examine the effects of voters' conformity preferences from a social point of view. Our interesting result is that when voters are nonconformist, they exert too little efforts in the informative equilibrium from a social point of view because of positive externality that results in the free-rider problem; while the existence of conformity preferences between voters can help to improve the sum of the two voters' expected payoffs from a social point of view in the informative equilibrium. The reason for this result is that normative conformity preferences may alleviate the free-rider problem associated with coordination (make the same vote). Specifically, normative conformity preferences give special importance to the correlation between the two voters' signals, even if this correlation has no link with the precision of the signals. We present the exact conformity preference degree which could make each conformist voter exert the optimal effort level that maximizes the sum of voters' expected payoffs compared to when voters are nonconformist. Moreover, we show that the free-rider problem is reinforced by the appearance of a new prejudiced voters, who has determined viewpoints of supporting the project. The reason is that the appearance of the new prejudiced voter leads the two conformist voters to exert less effort.

Topics for future work

In this thesis, we have built links between economics and social psychology by studying conformity behaviour in voting. We only model normative conformity among voters, which means to conform to the majority, such as wanting to vote for the winner, or to vote unanimously because of the social norm of consensus. We see four main directions for future research.

First, one topic for further research is related to exit polls in elections. Spangenberg (2003) states a survey of 66 countries worldwide finds that of the 59 that permit exit polls during an election, 41 prohibit publication of the results until after all voting has concluded. Recently, Sinclair and Plott (2012) undertake a series laboratory experiments with uninformed voters and find evidence to support that, after participating pre-election polls, uninformed voters use rational bayesian rules to help them make correct decisions. Morton, Muller, Page and Torgler (2015) empirically find that exit poll information significantly increases bandwagon voting, i.e, voters who choose to turn out are more likely to vote for the expected winner. We want a theoretical model to present their findings and to explain how the behavior of later voters is affected by exit poll information about earlier voter choices. These voters would be assumed to have exogenous compliance conformity. We wonder where there are equilibria which can explain the findings of Sinclair and Plott (2012) and Morton et al. (2015).

Second, another topic for further research is related to experimental analysis about the model of our Chapter 5. An example about experimental issues is to identify which social groups (based on measurable variables such as income, gender, ethnicity, etc.) are more likely to have the compliance conformity preference i.e., wanting to vote unanimously in voting about collective decision making. Another example about experimental issues is to design a task where voters' effort levels could be observed. We will ask whether this experiment's results are consistent with the model's predictions in our Chapter 5. We believe that the models' findings can be proved by experimental analysis. Similarly, we also hope to find empirical evidence for our Chapter 4's main result that is conformity among voters deters incumbent from inefficient decisions.

Third, our thesis focuses on situations under which a voter with compliance conformity faces just two choices. The two choices in Chapter 4 are two candidates in a re-election. In Chapter

5, they are whether to approve or note a projection in a voting. However, in many situations voters have several choices. In these situations, what are compliance conformity's effects? We are looking to develop the work on exogenous compliance conformity in three candidates in re-election.

Finally, in the two models of our thesis, we have focussed only on conformist voters' pure voting strategies. In future research, we shall also consider conformist voters' mixed voting strategies.

We leave these ideas and possible extensions to future research.

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