

Institutional Choice and Cooperation in Representative Democracies: An Experimental Approach

Fanny Schories *

University of Hamburg, Germany

Abstract

This study presents an economic experiment about the influence of endogenous institutions on cooperation in indirect democracies. It is examined whether a policy has a larger effect if it is introduced by a representative of the affected parties rather than imposed from the outside. I extend a study of Dal Bó, Foster and Putterman (2010) who investigate the same question for direct democracies. My results show that the policy in question is in general beneficial for cooperation, but directly after the reform is introduced, subjects do not cooperate more if it was endogenous compared to when it was not. However, the differences become more pronounced over time and a decomposition shows evidence of an endogeneity premium for cooperation. The implicit information provided by an institution seems to be a relevant factor influencing behaviour.

1. Introduction

Institutions have long been in the focus of manifold economic analyses. In recent years, interest in endogenous institutions which do not "fall from heaven" but are introduced by the affected parties themselves is growing. My experiment sheds light on the question whether cooperation levels in a representative democracy are influenced by the way institutions are formed. A reform that potentially fosters cooperation is democratically introduced into a social dilemma and it is examined whether the policy has the same

*I would like to thank Felix Hadwiger, Julia F. Körner, Jana Mintenig, Julia S. Wolfson, and seminar participants at Hamburg University for suggestions and support. Many thanks to my thesis supervisor Professor Lydia Mechtenberg. I am further grateful for the financial support of my experiment from the Economics Department at Hamburg University.

effect if it is imposed exogenously. Dal Bó, Foster, and Putterman (2010) show that the way of implementing a given institution plays an important role. The authors develop a novel experimental approach to estimating the impact that democratic procedures have on cooperation levels in a direct democracy. I extend this study to include the election of a representative. This modification can be seen as a robustness test for the authors' findings under circumstances that are very common in communities: nations, firms, and private clubs typically delegate decision-making processes to representatives.

The experiment has two stages. The first consists of a repeated prisoners' dilemma as a representation of the tension between the social optimum and individual incentives. Subsequently, subjects form preferences about a payoff modification turning the game of their group into a coordination game, thereby making cooperation incentive-compatible. A vote for a group representative is included, whose preference about modification becomes binding for the members, but is only considered with some probability. If it is not considered, one of the games is randomly chosen. Subjects play the respective game and their cooperation rates are analysed with respect to modification preferences and the outcome of the random intervention.

Dal Bó et al. (2010)'s claim is that a democratically introduced institution has an intrinsic effect that goes beyond the pure policy impact. The question of my study is whether the influence of an institution in a representative democracy is different if it is endogenously implemented. This influence is measured in terms of differences in cooperation rates between subjects with comparable preferences. The central hypothesis, derived from previous experimental studies, is that the endogenous introduction of a policy leads to an increased cooperativeness. The topic of the behavioural effects of endogenous institutions in general and in representative democracies in particular is of relevance for the evaluation of all experimental treatment effects in which subjects are assigned to different institutions. If the way an institution is implemented has behavioural consequences, this has to be accounted for in the experimental analysis. It is also of interest for policy-makers. Consider for example the progressing European integration. Is a reform introduced in Greece as effective when it is de facto prescribed from an external authority such as the "Troika" as if it was introduced directly by the national government? These questions extend economic theory, which

is typically outcome-oriented and does usually not consider that individuals may care about the process that leads to a given outcome, and act according to these preferences.

With regard to the results of my experiment, cooperation is found to be non-zero even in the prisoners' dilemma. Many subjects – especially more pro-social ones – are willing to introduce the payoff modification. The coordination game fosters cooperation even further, but directly after the vote subjects do not cooperate more if the modification was endogenous compared to when it was exogenous. The main shared results with Dal Bó et al. (2010) are that the behavioural differences between the four vote stage outcomes (endogenous and exogenous modification or non-modification), become more pronounced over time. A decomposition of cooperation rates gives evidence of an endogeneity premium beyond the pure policy effect of the modified payoffs. Self-selection of cooperative players into the policy seems to be a smaller factor than expected, but information effects as the driver of higher cooperation under the endogenous institutional choice cannot be excluded.

The remainder of the study is structured as follows. Section 2 reviews the most closely related literature with a focus on the effects of endogenous institutions in experiments. Section 3 presents the design of the experiment. In section 4, I briefly discuss the relevant theory and derive testable hypotheses. Section 5 reports the analysis and results, including the findings on the relation between indirect democracy and cooperation. Section 6 discusses these results and concludes.

2. Literature Review

Institutions¹ are henceforth defined according to North (1990, p.3) as "the rules of the game in a society, [...] the humanly devised constraints that shape human interactions". Hodgson (2006, p.2) adds that institutions create stable expectations by both constraining and enabling this behaviour. The focus of this paper lies on formal institutions, e.g. laws, that are publicly

¹Literature investigating the importance of democratic institutions dates back to authors of the 19th century such as Schmoller, Menger, Veblen, and de Tocqueville (Scott, 2013, pp.2-7). Acemoglu et al. (2001) emphasize the importance of institutions for the development of an economy: differences in institutions are able to explain a great share of differences in development and economic growth across countries. But which specific institutional design and implementation can be recommended is disputed (Aghion, 2006).

designed and enforced, as opposed to informal sanctions which are privately implemented and often self-enforcing (Groenewegen et al., 2010, p.25).

A central result from previous experiments is that direct democratic participation rights increase subjects' contributions to a public good, *ceteris paribus*. These insights cannot be explained with standard economic theory, where analysis is based on the outcome of a procedure. In such a setting, an endogeneity premium of democratic institutions is not reasonable if the institution that is implemented remains the same. However, Frey et al. (2004) introduce *procedural utility* allowing for the possibility that people have preferences about the process that leads to instrumental outcomes and is therefore in contrast with the traditional outcome-oriented understanding of utility (*ibid.*, p.379).

2.1. Endogenous Policy Selection in Public Goods Games

Dal Bó et al. (2010) build on the rapidly growing empirical literature including field and lab experiments exploring the key factors that influence cooperative behaviour in democratic societies. This body of research suggests that the process of the implementation of an institution matters in addition to the institutional design itself. The current evidence about the influence of participation rights on cooperation levels is mainly based on public goods experiments, where democratic structures are implemented into the policy selection process by allowing participants to directly vote on different proposals.

Tyran and Feld (2006) produce evidence that an endogenously chosen non-deterrent law reduces free-riding behaviour in public good provision. The authors vary the severity and enactment of a monetary punishment on free-riding. The treatments involve no, mild (i.e. non-deterrent), and deterrent law, which is implemented endogenously or exogenously. In the endogeneity treatment subjects vote on whether to enact a given law and then play a public goods game with the chosen institution. In the exogenous treatment the game is played with a given ordering of the institutions (Tyran and Feld, 2006, p.142). Any contribution under the mild law is in contradiction to game theoretic predictions. The authors give two explanations why compliance is achieved through the endogenous implementation of non-deterrent law: First, once subjects voted for a law they feel committed to it. Second, the referendum in favour of a law works as a signal to

the affected parties, alters their expectations about others' behaviour, and activates the social norm of conditional cooperation². In addition, any law, be it exogenous or endogenous, can serve as a reminder to citizens about the desired behaviour (Tyran and Feld, 2006). It is found that under exogenous law the mild version does not significantly increase compliance compared to the game without law, while the severe punishment deters free-riding as predicted. In the endogenous treatment, individuals mostly accept mild law and the contribution rate is significantly higher than without law which contradicts the game-theoretic prediction of full free-riding (Tyran and Feld, 2006). It can be seen that yes-voters comply highly under accepted mild law, but have low contribution rates if the mild law is rejected. This is evidence against a *pure* selection effect, because in this case unconditionally cooperative players contribute similarly under both circumstances (Tyran and Feld, 2006, p.150). However, the mechanism does not allow to isolate a *democratic dividend*. We cannot be sure that the result is not mainly driven by conditional cooperation where players adjust their behaviour in response to the other players' signal.

A study by Sutter et al. (2010) of a public goods game presents additional evidence that participation rights enhance cooperation in groups. The authors employ an experiment in which participants can vote for a decentral punishment or reward mechanism. It is found that for any given institution, endogenous choice is associated with higher contributions compared to an identical mechanism implemented through an external authority (Sutter et al., 2010). Given the experimental design, it is not directly possible to separate the effects of self-selection and endogenous choice. In the exogenous treatment subjects are simply told about the predetermined institution (Sutter et al., 2010). This means that players cannot form substantiated expectations about their fellow players' intentions *ex ante*. On the other hand, the vote stage in the endogenous treatment reveals information about the group composition and their members' preferences. Conditionally cooperative players are likely to respond to this and adjust their behaviour accordingly. Sutter et al. (2010, p.1563) note that the voting procedure in small

²Axelrod (1986) defines social norms as implicit rules in a society to which its members feel compelled to adhere to. The specific norm of conditional cooperation requires someone to cooperate if others also cooperate and is frequently observed in experiments (Tyran and Feld, 2006).

groups entails a non-negligible signalling component and can be interpreted as "implicit communication". Further research is needed to disentangle the different channels through which endogenous institutional choice influences behaviour.

Markussen et al. (2014) contrast informal and formal sanctions in a public goods game. Informal sanctions turn out to be more popular than formal ones because they are more cost-effective in the experimental setting (Markussen et al., 2014). The authors compare endogenous and exogenous regimes to estimate a *democratic dividend*. It is found, just as in Tyran and Feld (2006), that the efficiency of non-deterrent formal sanctions is higher if they are chosen (Markussen et al., 2014, p.303). But again the increased contributions can also be attributed to an information or signalling effect.

Kamei et al. (2015) further develop Markussen et al. (2014)'s experiment by allowing subjects to decide on the parameters of the formal sanctioning regime themselves. They find that endogenous sanctions are slightly more effective in inducing contributions to the public good than exogenous sanctions, but again self-selection cannot be excluded.

Various authors have taken the search for effects of endogenous institutions in public goods games to the field. Cavalcanti et al. (2010) find that public deliberation increases the willingness of participants to contribute to projects for the management of common resources among Brazilian fishermen. The findings emphasize the importance of communication and public participation in institution formation to establish trust and coordinate on cooperation. Deliberation fosters perceived fairness and legitimacy independent of outcome, a phenomenon that can serve as one explanation for the existence of a *democratic dividend*. Other studies such as Bonin et al. (1993), Bardhan (2000), Black and Lynch (2001), and Fearon et al. (2011) find similar results in vastly different settings ranging from irrigation rules in rural India to workplace decisions of manufacturing businesses in the USA: participation rights increase compliance, productivity, and satisfaction. Grossman and Baldassarri (2012) find that subjects electing leaders contribute more to public goods than subjects who were assigned leaders through a lottery.

2.2. Representative Democracies

Hamman et al. (2011) find that repeated electoral delegation is a useful tool to overcome the free-rider problem in a social dilemma situation

via selection. As groups largely choose pro-social representatives, delegation leads to a higher provision of a public good compared to decentralized decision-making. Other experiments find that leadership by example can reduce free-riding and thus improve overall welfare, but is seldom chosen endogenously (Rivas and Sutter, 2011).

Field experiments comparing cooperation under direct and indirect democratic decision-making processes are especially interesting for an assessment of the potential robustness of Dal Bó et al. (2010)'s results when the setting is transferred to a representative democracy. The main finding of a study by Olken (2010) is that when compared to a representative system, direct participation in political decision making increases the satisfaction of participants even when the outcome is not changed. He conducted a randomized field experiment in Indonesian villages, where decisions about the implementation of a project with the character of a public good are either reached through a direct plebiscite or a representative-based meeting. The problem with the latter institution is that it is prone to capture by local elites, thereby losing its legitimacy (Olken, 2010, p.243). The results confirm that a plebiscite leads to higher satisfaction of the citizens, increased willingness to contribute to the public good, better knowledge about the projects, and a higher perceived legitimacy of the decision. The study shows that satisfaction increases even when the outcome of the political process is unaffected, thereby lending support to the findings of Dal Bó et al. (2010)'s experiment in a substantially different setting.

A vast number of experiments investigate tax compliance as a representation of contribution to public goods. Pommerehne and Weck-Hannemann (1996), Frey and Feld (2002), Frey and Torgler (2007), and Feld and Frey (2007) show that institutional quality and tax morale are positively correlated. Moreover, the first two studies find that compliance is higher in direct democratic cantons of Switzerland as compared to purely parliamentary cantons.

2.3. Novel Experiments on Institutions and Cooperation

Dal Bó et al. (2010) further develop the work of Tyran and Feld (2006). In the first part of the experiment, subjects play a prisoners' dilemma in small groups. They are then allowed to vote on whether to change the payoff into a coordination game. This turns cooperation into an additional

Nash equilibrium besides mutual defection and can thus increase efficiency. The decision is reached through a simple majority vote. However, with some probability not the referendum but the computer randomly decides on the modification of payoffs. The subjects are informed both about the choice of game for the last stage and how this decision was reached: democratically or by the computer. They then play their respective game. Dal Bó et al. (2010, p.2217) find that when comparing behaviour under endogenous versus exogenous modification, an effect of democratic institutional formation beyond the instrumental effect through the policy choice itself is present.

The innovative experimental mechanism avoids a self-selection bias in investigating the effect of democracy. Even when controlling for selection, endogenous and exogenous payoff modification have a differing impact on cooperation in Dal Bó et al. (2010)'s study. The authors find evidence of a *democratic dividend*. The results support the hypothesis that the endogeneity of institutions itself affects individuals' behaviour and has to be considered when making policy recommendations. There seems to be an effect of democratic institutions that goes beyond the instrumental effect of the policy choice. Dal Bó et al. (2010) have two hypotheses as to why this could be the case. First, the endogenous modification choice reveals to a subject that their group members are likely to have preferred modification. Second, the endogeneity of the institution as such can influence cooperation. The knowledge that the policy was introduced by the subjects can reinforce cooperation norms or work as an equilibrium selection device. After controlling for information effects in a slightly modified experiment, Dal Bó et al. (2010) conclude that the second claim is more likely to hold true.

Sutter et al. (2010) run an experiment in addition to the presented study, with a mechanism that is very similar to Dal Bó et al. (2010)'s experiment: a group's preferred institution is only implemented in 50 percent of the cases. When regressing individual contributions on several control variables it is found that if the vote was implemented has no significant influence. From this Sutter et al. (2010) conclude that the institutional design itself influences behaviour and not the endogeneity of an institution, which is in contrast to the findings of Dal Bó et al. (2010). At the same time, it is evidence against self-selection as the driver of results (Sutter et al., 2010). The authors conclude that "letting subjects vote is not sufficient for achieving higher contribution levels. [...] Keeping it open whether the vote will really count

is detrimental to cooperation” (Sutter et al., 2010, p.1563). This would mean that the uncertainty involved in Dal Bó et al. (2010)’s design lowers cooperation. This leads to an underestimation, meaning that the true effect of democracy might be even larger than in Dal Bó et al. (2010).

2.4. Research Question

Dal Bó et al. (2010) point out that further research remains to be done to test their results for larger group sizes. I indirectly contribute to this by extending the experiment to a representative decision-making mechanism. It is studied if a given policy that is introduced to a community through an indirect democratic process has a more beneficial effect on cooperation than an exogenous policy. This *democratic dividend* is isolated by controlling for the instrumental effect of the reform itself, potential selection biases, and information effects from the implementation. There are two central questions: Are subjects willing to introduce a policy that incentivises cooperative behaviour in a social dilemma? Is cooperation influenced by the way the policy is implemented?

The addition of a representative democracy introduces important features of political processes typically present in larger communities. I believe this to be relevant for two main reasons. First, it gives important insights into the external validity of Dal Bó et al. (2010)’s findings and the space in which the results can be applied. Further light is shed on the channels through which institutions influence cooperation. Conditional cooperation by observation of compliance is easier in small groups compared to larger communities (Tyran and Feld, 2006, p.139). For the latter expectations play an important role which in turn are influenced by the perceived legitimacy of an institution. Second, the results are of relevance for policy recommendations. For politicians insights into the interdependence between institutions and behaviour, not only for small Polis-style groups, but also for democracies that operate on a larger scale are crucial. These democracies typically use a representative system. Hence, following Alvin Roth’s categorisation, I consider this work to be both *speaking to theorists* as well as *whispering in the ears of princes* (Kagel and Roth, 1995, p.22).

3. The Experiment

The chosen method to shed light on the research question established in the previous chapter is a lab experiment in which subjects participate anonymously through computers. Computerized economic experiments make it possible to measure the effect of policies under conditions that control the incentives and information structure. Neutral language is used throughout as is common practice in experimental economics to minimize the psychological effect of the institution. The experiment was programmed with the z-Tree software by Fischbacher (2007). The procedure consists of two stages, the details of which are explained in the following.³

Both the experiment conducted by Dal Bó et al. (2010) as well as the extension presented here are based on the prisoners' dilemma game. Payoffs are calculated according to Table 1. This game has a strictly dominant strategy and hence a unique and symmetric Nash equilibrium in which both players defect.⁴ The group size is $n = 4$. Groups are randomly formed at the beginning of the experiment and remain together over the entire session.

		Player 2	
		C	D
Player 1	C	50, 50	30, 60
	D	60, 30	40, 40

Table 1: Initial Payoffs – Prisoners' Dilemma

In the first stage, ten rounds of the prisoners' dilemma are played with random rematching of pairs within each group. When players make the decision to cooperate or defect in each round, they do not know against which group member they are playing. However, to make the voting decision in the second stage of my experiment meaningful, the opponent's player ID – a number which is randomly assigned and kept over the entire session so that group members can identify each other over the course of the different stages – is shown on the screen of each subject together with the earned points at the end of every round. Additionally, I show the actions of the other pair in the group. By doing this, it is ensured that all group members have identical

³The experiment was first developed in collaboration with Julia S. Wolffson for a course taught by Prof. Dr. Dr. Lydia Mechtenberg at Hamburg University in 2014.

⁴For neutrality, in the instructions and throughout the experimental sessions the actions cooperate and defect are denoted A and B.

information about the behaviour of the other players in the group. Direct reciprocity among group members is excluded, but it is possible to establish a reputation as a cooperator or "trustworthy partner" (Tyran and Feld, 2006, p.143). However, maintained anonymity of subjects' true identities should rule out the fear of informal sanctions.

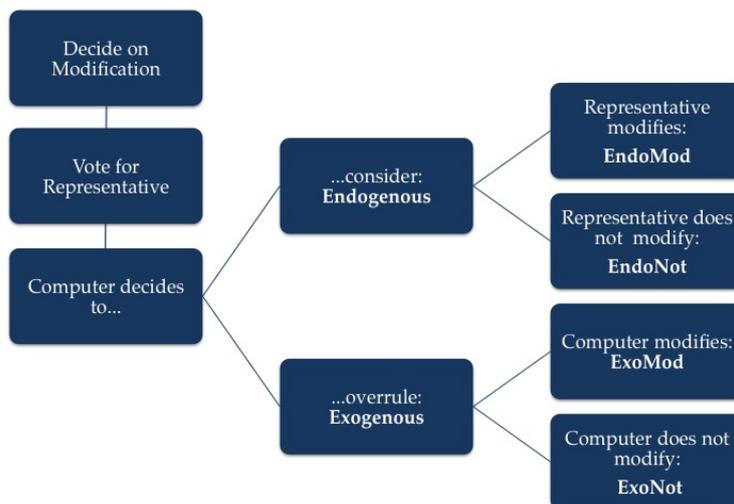
The second stage begins with a vote. Instructions for this stage are handed out after the end of the first in order not to influence behaviour previous to the vote. Subjects are asked whether they want to change the payoff matrix of their small group into a coordination game that has an additional – and more efficient – Nash equilibrium than mutual defection, namely cooperation by both players. The possible modification to the payoff structure is shown in Table 2 and can be understood as introducing a penalty on unilateral defection (Dal Bó et al., 2010, p.2207).

		Player 2	
		C	D
Player 1	C	50, 50	30, 48
	D	48, 30	40, 40

Table 2: Modified Payoffs – Cooperation Game

Every individual privately announces her preference whether to implement the modification or not. This decision will only matter if she is elected as group representative. This speaker is elected in a voting directly after the modification preference is registered. In order to do so, players are asked to privately announce another group member's ID without knowing her preference for modification explicitly. The idea behind this is that players gained some experience in the first stage and can infer the other group members' preferences for cooperation from their behaviour in the prisoners' dilemma game. I expect that a cooperative player has a preference for modification and therefore votes for another member that behaved in a cooperative way. The player who is named most often in a group is then elected as speaker – the computer randomly breaks a tie when it arises – and the speaker's choice of payoff matrix from now on constitutes the whole groups' decision about modification. Analogous to Dal Bó et al. (2010), the speaker's choice is considered with probability $\frac{1}{2}$. In the other cases the computer arbitrarily decides whether the group plays the prisoners' dilemma or coordination game in the second stage (see figure 1).

Figure 1: Overview over Vote Stage



Subjects are informed about the outcome of the second vote (the player ID of the elected representative), the preference of the speaker (modify pay-offs or not), whether this preference was considered, and consequently the game their group is facing in the second stage (prisoners’ dilemma or cooperation game). This game is played for another ten rounds, analogous to the first stage, i.e. with random matching within groups and getting to know the opponent’s identity at the end of each round. To summarize, there are four potential outcomes: payoff modification through the group (EndoMod) or the computer (ExoMod), and an unmodified game either chosen endogenously (EndoNot) or exogenously (ExoNot).

The main confounding factor of experiments investigating endogenous institutions is self-selection, because when a policy is introduced “from within” participants predominantly self-select into the treatment. It is only natural that players select into the treatment that best fits their preferences if they are given the choice between different policies. This makes it difficult to compare the impact of institutional designs, since the assignment is not random. Dal Bó et al. (2010) claim that selection leads to an overestimation of the effect of endogenous policy selection since the voting decision and behaviour are positively correlated. In order to eliminate the effect randomization and control for underlying characteristics are introduced into

the experiment. This design holds the advantage that the results of groups that voted in the same way and ended up with the same game, but through a different mechanism, can be compared. Dal Bó et al. (2010)'s idea is that groups with an identical distribution of votes for and against modification also have identical preferences about modification and thus cooperation, and if their behaviour differs this is attributed to the way the modification was implemented.

The second confounding factor which I control for in the presented design is information. Sutter et al. (2010)'s as well as Dal Bó et al. (2010)'s main experiment involve instructing subjects about their group's choice only in the endogenous case, thereby straining the *ceteris paribus* assumption: not only the implementation of the institution differs between endogenous and exogenous outcomes but also the information provided. One can argue that this information is an essential part of an endogenous institution and the asymmetry between the outcomes should not be erased. However, in my experiment subjects are told about the representative's choice in the endogenous as well as in the exogenous case. This choice is not perfectly informative about the group's composition but hints at the preferences of the majority. Furthermore, the choice of game of the representative is a credible signal. This holds the available information constant across outcomes and means that observed differences can be attributed to the intrinsic difference between democratically and authoritatively introduced policies. I consider this an estimate of the lower bound of a *democratic dividend* because many factors that are inherent to democratic processes are controlled for.

4. Theoretical Considerations and Hypotheses

This section establishes theoretic reflections concerning the experimental design. I consider game-theoretic predictions and results from earlier studies in the light of the research questions to develop testable hypotheses for the analysis in the next chapter.

4.1. The Prisoners' Dilemma in Theory and Practice

Osborne (2004, p.12) defines the classic prisoners' dilemma as:

- **The set of players** $N = \{P_1, P_2\}$, i.e. the two suspects.

- **The set of actions** for each player $i \in NA_i = \{C, D\}$, where C stands for "cooperate" and D for "defect".
- **Players' preferences** P_1 's ordering of the action profiles, from best to worst – where the first action represents P_1 's and the second represents P_2 's – is: (D, C) , (C, C) , (D, D) , and (C, D) . This holds vice versa for P_2 . The payoff function of P_1 should thus satisfy

$$u_1(D, C) > u_1(C, C) > u_1(D, D) > u_1(C, D)$$

and

$$u_2(C, D) > u_2(C, C) > u_2(D, D) > u_2(D, C).$$

It is easily verified that this is the case for the payoff matrix illustrated in table 1. A Pareto-improvement for all players is possible compared to the Nash equilibrium of mutual defection but individual incentives are stacked against it. For the repeated prisoners' dilemma backwards induction tells that defecting is still the unique best response since the game is played for a finite amount of rounds. Thus, the prediction is mutual defection in each round (Gibbons, 1992). However, it can be shown that if there exists uncertainty about the other player's type or preferences – she could e.g. be generally altruistic or play a tit-for-tat strategy which prescribes cooperation if the opponent cooperated in the previous round and vice versa – then cooperation can be part of a payoff-maximizing strategy (Kreps et al., 1982). The sequential equilibrium strategy of every player would be to build a reputation for being altruistic and then defect towards the end of the game (Andreoni and Miller, 1993). This reputation hypothesis has been confirmed to some extent by experiments with the finitely repeated prisoners' dilemma (Andreoni and Miller, 1993). Due to the anonymous re-matching in every round of my experiment, there exists no incentive for a player to build a reputation. However, as the re-matching is done among only four players, the group as a whole could build a reputation, i.e. a social norm (Kandori, 1992). This is made even more feasible since all group members' decisions are shown on the screen after each round. Even if the prediction for a one-shot game of prisoners' dilemma, i.e. mutual defection, is said to be valid in this case due to the finite repetition and random re-matching, I expect some cooperative behaviour in the beginning of the first stage as this is almost always found in experiments. After an initially quite high rate of

cooperation, typically a steady increase in defection is observed over time, be it as part of an equilibrium strategy or simply due to experience (Selten and Stoecker (1986); Andreoni and Miller (1993); Dal Bó et al. (2010)). The "endgame effect" of a sudden spike in defection is typically observed before a pause in the experiment (here the vote) and occurs again more markedly at the very end of the experiment (Rapoport and Dale, 1966).

Hypothesis 1. *Cooperation rates are positive but declining between rounds 1 and 10.*

Regarding individual characteristics, Ortmann and Tichy (1999) show gender differences in behaviour in the prisoners' dilemma: women cooperate significantly more in the first rounds than men. This topic is not inherently related to my research question but relevant for the interpretation of my other findings, as subject pool effects potentially bias all other experimental results (Ortmann and Tichy, 1999, p.328). To investigate gender and other influential characteristics the analysis will predominantly focus on cooperation in round one, before any other learning or group effect influences behaviour.

Hypothesis 2. *In round 1, women cooperate more than men.*

4.2. The Vote

The payoff modification introduces another Nash equilibrium in pure strategies. Now both (C,C) and (D,D) are equilibrium outcomes, with the former being the social optimum. Dal Bó et al. (2010) note for the optimal choice of payoffs that it depends on the players' expectations about what the others will do in the coordination game. If subjects expect to achieve mutual cooperation under the modification, they should vote in its favour; whereas they are indifferent between the two games if they expect mutual defection in the coordination game. Dal Bó et al. (2010) discuss off-equilibrium reasoning as well: A player whose strategy is to always defect could oppose modification as it decreases the deviation profit she obtains every time she faces a cooperating partner. But she could hope to increase others' willingness to cooperate through the modification thereby making it more likely to harvest the (albeit lower) deviation profit. Of course in this case it would be even better for her to cooperate herself.

As the modification of payoffs makes cooperation more attainable I expect both (un-)conditionally cooperative players to favour modification. Dal Bó et al. (2010) find that only slightly more than half the sample wants to modify. This is a phenomenon worth investigating. One explanation is that it takes some amount of logical reasoning to grasp the influence of the modification on the (equilibrium) behaviour of one's group members such that players with a higher cognitive ability are more likely to vote for modification. Dal Bó et al. (2010) test a variant of this hypothesis by comparing whether more intelligent subjects are more responsive to an endogenous modification, as they are more likely to update their beliefs about group members' willingness to cooperate. However, they find no evidence of this information hypothesis (Dal Bó et al., 2010, p.2222).

Hypothesis 3.a. *A subject who is more cooperative in part one is more likely to have a preference for payoff modification.*

Hypothesis 3.b. *Higher cognitive ability is associated with an increased preference for payoff modification.*

I do not consider electoral competition. I expect subjects with a preference for cooperation to vote for a group member that cooperated as well. Conditionally cooperative individuals are likely to be in the majority in the sample (Fischbacher et al., 2001). These would anticipate another player with a preference for cooperation to want to modify as well and consequently vote for this player. Hamman et al. (2011) find that groups typically elect the most cooperative subject as representative.

Hypothesis 4. *Cooperative players are more likely to be elected.*

4.3. *The Coordination Game*

I expect more players to choose option C under the modified payoffs compared to the prisoners' dilemma as this action is not strictly dominated there. Since there is no unique best response anymore, coordination between players is crucial to realise one of the symmetric equilibria, as the name of the game is already suggesting. The ongoings of the vote stage, i.e. who was elected, the speaker's decision, if it was considered, can serve as cues towards one of the equilibria. Markussen et al. (2014) claim that a *democratic dividend* of cooperation is rationalisable with the model of inequality aversion by Fehr and Schmidt (1999). It incorporates fairness concerns into a

self-interested individual utility function, such that inequalities in a subject's own payoff relative to others' payoffs are penalized (Fehr and Schmidt, 1999, p.819).⁵ According to Markussen et al. (2014, p.307) voting can then serve as an equilibrium selection device in the coordination game because it is a credible signal of an intention to cooperate that prompts inequality-averse subjects to cooperate as well.

However, in my setting, two things are known to subjects: The actions of all players in the group in the prisoners' dilemma in part one, and the policy choice of the representative. This becomes known in the exogenous as well as in the endogenous case, thereby erasing potential information differences between the conditions. This possible signalling through the representative is considered in the analysis. With regard to the differing implementation of the modification, I nevertheless expect to replicate the findings of Dal Bó et al. (2010): Endogenous policy selection leads to more cooperation than exogenously imposed institutions. This is evaluated with a between-subjects comparison of cooperation.

Hypothesis 5. *More subjects cooperate in the coordination game compared to the prisoners' dilemma.*

Hypothesis 6. *Average cooperation rates in the coordination game are higher under endogenous modification compared to exogenous modification.*

Hypothesis 7. *Cooperation rates in the coordination game are higher under endogenous modification compared to exogenous modification when controlling for voting behaviour.*

The studies presented in section 2.3, which evaluate direct and representative democratic institutions, find less cooperative behaviour in the latter and thereby point to the possibility of lower cooperation rates in my experiment compared to Dal Bó et al. (2010). It is likely that the effects are somewhat smaller in my study than in Dal Bó et al. (2010) since the indirect voting mechanism leads to a less personal decision making process and therefore potentially less influence of the vote on the perceived legitimacy of an institution.

⁵Formally, in the two-player case with payoffs $x = x_i, x_j$, the utility function of player i is given by $U_i(x) = x_i - \alpha_i \max\{x_j - x_i, 0\} - \beta_i \max\{x_i - x_j, 0\}$, $i \neq j$; where the second term represents a utility loss from disadvantageous inequality and the third term a utility loss from advantageous inequality (Fehr and Schmidt, 1999, p.822).

Hypothesis 4 states that more cooperative players are more likely to be elected. In the literature it is additionally found that being elected increases a feeling of responsibility (Corazzini et al., 2014). This would mean that elected players cooperate even more if they become speaker. However, Corazzini et al. (2014) find that representatives increase their benevolence on a significant level only when they are given the possibility of making pre-vote promises to their electorate. As my design abstracts from any campaign prior to the election, replicating Corazzini et al. (2014) would mean that representatives do not experience an extra behavioural effect through gaining office. I nevertheless expect them to have an increased perception of the difference between the endogenous and exogenous modification. Corazzini et al. (2014, p.588) find that higher approval rates lead to higher cooperation from the representative, but I do not test this phenomenon because in the light of hypothesis 4 I expect it to be highly endogenous.

Hypothesis 8. *Players who are elected as representatives cooperate more in part two compared to part one under exogenous non-modification.*

Furthermore, the function of the representative as leader of the group is considered. The effect of the representative's decision and that of the institution's implementation have to be separated. Analogous to Markussen et al. (2014) I investigate whether the choice of the representative works as a recommending signal also in the exogenous case, e.g. for groups whose speaker wants to modify but is not considered. This is done by a within-subjects analysis. If the information and coordination aspect of the vote stage is dominant over the effect of democracy, cooperation rates are expected to be higher. Please note, however, that the specific design at hand does not allow to control for order effects in the within-analysis by randomizing which stage is played first.

Hypothesis 9. *Cooperation rates of subjects in exogenous non-modification are higher in stage two compared to stage one if the representative chose the coordination game but was overruled.*

Another potential confounding factor for the analysis is a mismatch between an individual's expectations about the representative's preferences and her actual behaviour. For instance, a conditionally cooperative player might expect another group member to be cooperative as well and to vote

for modification. If this player is elected and votes against modification, but the vote is not considered and payoffs are modified nevertheless, the first player's willingness to cooperate might be decreased due to other reasons than the exogeneity of the policy. However, this phenomenon is typical for indirect democracies with free mandates and limited accountability, such that it is not feasible to aim for a complete elimination. Another possibility is that an individual prefers modification but votes for a group member that is then not elected. If the one elected instead endogenously modifies payoffs, the first individual might still perceive this as somehow exogenous.

5. Analysis and Results

This section tries to replicate the main findings of Dal Bó et al. (2010) for a representative democracy and presents additional analyses to test the previously established hypotheses. As the number of observations is often not large enough to obtain consistent regression results, non-parametric statistics are used whenever feasible. I find that the payoff modification has a large and positive influence on cooperation, but with ambiguous results regarding the existence of a *democratic dividend* beyond information and selection effects.

5.1. Protocol and Summary Statistics

Three sessions were run in January 2016 with 28 subjects each, so the sample size amounts to 84 in total. All sessions took place in the experimental computer lab at Hamburg University, and participants were recruited using the software hroot by Bock et al. (2014). At the start of each session, subjects were randomly assigned to a computer, instructed not to communicate, and reminded that their decisions would not be linked to their identity. The instructions for part one were handed out in written form (instructions are available on request). Instructions for the vote and the subsequent game stage were given after the first ten rounds. Before each part began, correct answers to a set of control questions had to be given. At the end of the session three unpaid questions were asked to elicit subjects' strategic sophistication.⁶ Together with these a socio-economic questionnaire asking about

⁶The questions were the following (translated from German): 1) A water lily on a lake doubles in size every day. If the lake is completely covered by the plant after 48 days, how

personal characteristics was filled out by each participant. Payment was made according to the outcome of two randomly chosen rounds, one from the first and one from the second stage. The exchange rate was 10 points = €1. Average individual earnings were around €9 which is in line with the mean hourly wage of €10 that the lab at Hamburg University promises to participants, since all three sessions lasted less than an hour. Payment was made in cash and privately before subjects left the room. It was ensured that only the experimenter and lab assistants knew the individual payouts.

Table 3 presents the most important characteristics of the 84 participants. Of these 33 identified themselves as male, 47 as female, and 4 chose the option "other or prefer not to say". The age of the participants ranged from 17 to 48 with a mean of 25 years. I use the binary variable *econ* that takes the value one if one's subject is related to economics. The mean reported net monthly income was €593. However, the fact that a quarter of participants indicated that their income equals €370 or less suggests that the question⁷ was interpreted by some as money to spend after paying for rent, insurance or other fixed costs. About one third of the subjects answered all three of the aforementioned logic questions correctly.⁸ A voluntary question asked subjects which party they had voted for in the latest election for the German parliament. Most frequently chosen were the Social Democratic Party (SPD), the Christian Democratic Union (CDU) and The Left with 12 subjects each. Half of the subjects did not answer, which makes it problematic to include party preferences into the analysis, as answering the question may not be random.

many days does it take for the pads to cover half the lake? 2) If five machines produce five units in five minutes, how many minutes does it take for one hundred machines to produce one hundred units? 3) A baseball and a bat together cost €1,10. If the bat's price is one euro higher than the ball's, how expensive is the ball? (Kahneman, 2011).

⁷In German: "Wieviel Geld steht Ihnen pro Monat netto zur Verfügung?"

⁸Interestingly, female subjects answered an average of 1.17 questions correctly, while men answered 2.03 correctly. From an OLS estimate we obtain that,

$$\widehat{logic} = 1.369 + 0.043 \text{ age} - 0.001 \text{ income} - 0.849 \text{ female} - 0.002 \text{ econ}$$

(0.769) (0.029) (0.000) (0.263) (0.270)

n = 80, R²=0.176, Standard errors in parentheses;

indicating that gender is the only included variable significantly correlated with my proxy for cognitive ability. Without further investigation I can only guess about the explanation of this phenomenon – after all only three questions were asked and they were not paid – and refer the interested reader to the psychological literature on gender differences in mathematical and logical thinking, e.g. Hyde et al. (1990).

Table 3: Summary Statistics

Variable	Mean	Standard Deviation
Age	25.3	5.6
Monthly Income (€)	592.7	305.5
Semester	5.5	4.7
Logic	1.6	1.2
Payout (€)	9.1	1.3
Share		
Female	56 %	
Economics Student	38 %	
Knowledge of Game Theory	23 %	

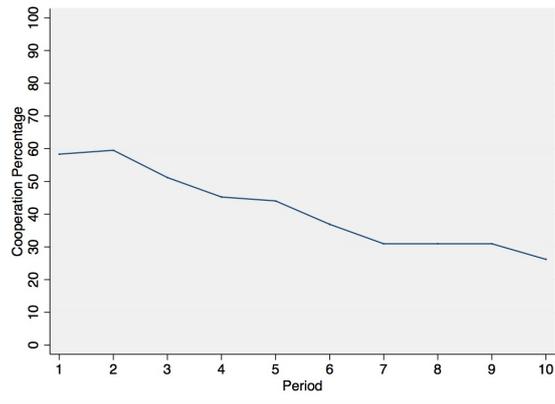
Note: Logic gives number of questions correctly answered (out of three).

5.2. The First Stage

Figure 2 shows the cooperation rates of the first stage which consists of the rounds one to ten. Average cooperation in these rounds amounts to 41.4 percent. Overall cooperation was highest in the second round, where 59.5 percent chose option C. The cooperation rate decreased with experience to 26.2 percent in period ten. The difference between round 2 and 10 is significant at the 1-percent level.

Result 1. *Not all subjects defect in the first stage, but cooperation rates decline between the rounds 1 and 10.*

Figure 2: Cooperation in Stage One



In a linear probability model (LPM) of individual cooperation in the first round on personal characteristics (table A.8), gender seems to be the most

influential factor.⁹ Being female is associated with an increased probability of cooperation and highly significant. Studying economics is negatively correlated with cooperation and significant at the 10 percent-level. An individual voting for the Left party is more likely to cooperate, while voting for the CDU has a negative significant relationship with cooperation. The model with all covariates shows that gender is the only significant personal characteristic included in predicting cooperation.

Result 2. *Women are more likely to cooperate in the first round than men.*

5.3. The Vote

In this stage, subjects' preferences about modification and the election of a speaker are registered. About two-thirds (65.5 percent) of my sample would modify the payoffs in case they became group speaker. Dal Bó et al. (2010, p.2212) find that only 53 percent of their participants vote in favour of the modification and relate this to inefficiency preferences and delayed reforms. To further investigate the phenomenon I asked subjects to give a reason for their preference in the questionnaire. Two types of players emerge here. Almost all of those who want to modify mention fairness motives and the hope for an increase in cooperation as reasons for changing the game. Those who want to continue with the prisoners' dilemma indicate that they expected to earn higher payoffs from this game. The answers contribute to the knowledge gap insofar, as it becomes clear now that the reason behind the inefficiency preference of some actors is mainly egoistic off-equilibrium reasoning, where subjects hope to harvest the highest possible deviation payoff from a cooperating partner.

Table A.9 shows an LPM of voting for modification regressed on variables covering experiences from stage one and personal characteristics. Own and the partners' cooperation in the first stage are not significant when used as the only independent variables. However, when included in an estimate with other regressors, their magnitude and significance increase dramatically. Own cooperation is positively correlated with a modification preference. Having highly cooperative partners in part one decreases the prob-

⁹As no further information about the four subjects' gender who chose the "other" option was collected, I exclude them from the analyses of gender effects. I also exclude subjects who did not state their party preference from the regressions that include these variables.

ability of voting for the coordination game. This is intuitive because already cooperative partners may not be seen in need of additional incentives to cooperate. Cognitive ability is significantly positively correlated with a preference for modification. The effects of income, gender, age, and studying economics are neither statistically nor economically significant. Overall, the data lends support to Hypotheses 3.a and b and the reported insights regarding individual voting behaviour are in line with Dal Bó et al. (2010)'s observations.

Result 3. *Cooperative individuals, especially those who faced less cooperative partners, and those with higher cognitive ability are associated with an increased preference for modification.*

As to the reasons of the vote for the representative, nearly half of the participants declared they had voted for a specific group member because it had been cooperative in the first stage. Contradicting the subjective evaluation of the voters a MannWhitney U test shows that the future speakers did in fact not cooperate more than the rest of the subjects (p-value = 0.58 for a two-sided test). 71 percent of the speakers preferred the coordination game over the prisoners' dilemma, whereas 64 percent of the other players wanted the modification, indicating that the knowledge of or preference for the cooperation-enhancing policy was indeed more pronounced among the representatives. But a p-value of 0.51 indicates that this is not significant.

Result 4. *Players want to elect pro-social players but the representatives are not significantly more cooperative than their group members in part one.*

Unfortunately, a bug in the z-Tree code confronted subjects of the first session with a confusing screen output right after the vote and their payoffs were not modified. I exclude these observations from the analysis of the second stage. This diminishes the sample to 60 subjects but is nevertheless done in order not to corrupt the results. As to the outcome of the vote stage table 4 shows that the speakers' decision was considered for nine groups and overruled for another six. In the endogenous cases seven speakers modified the payoffs of their group (EndoMod) and two decided against modification (EndoNot). In the exogenous cases, two groups' payoffs were modified (ExoMod) compared to four who stayed in the prisoners' dilemma (ExoNot). In stage two, a total of 36 subjects played the coordination game and 24 remained in the prisoners' dilemma.

Table 4: Number of Subjects per Vote Stage Outcome

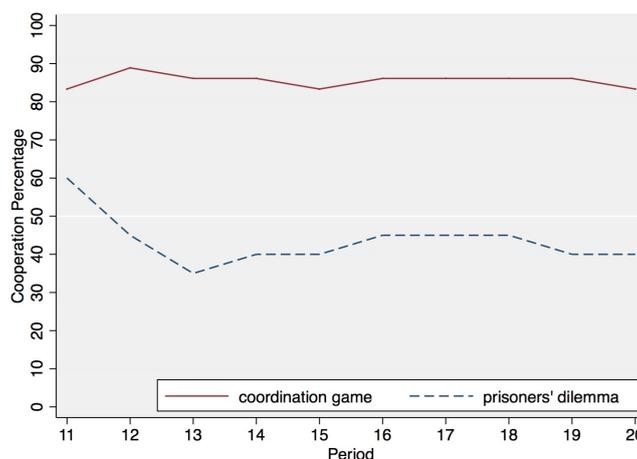
	Prisoners' Dilemma	Coordination Game	Total
<i>Implementation:</i>			
Endogenous	8	28	36
Exogenous	16	8	24
Total	24	36	60

5.4. The Second Stage

After an initially high cooperation in the prisoners' dilemma in round 11 the rates declined to under 50 percent but remained stable at a level above 30 percent (see figure 3). We see from the graph that cooperation rates were very high and stable under the modified payoffs, meaning that almost all players in this game coordinated on the Nash equilibrium with mutual cooperation. This means that in general subjects are willing to cooperate, respond to the incentives of the different games and are able to coordinate quite well. The difference in cooperation rates between the two games is highly significant (p-value < 0.01 for a two-sided t-test) and is in line with hypothesis 5.

Result 5. *Cooperation is higher in the coordination game compared to the prisoners' dilemma.*

Figure 3: Cooperation in Stage Two



The effects of the policy and its implementation are disentangled further. Dal Bó et al. (2010) suspect subjects who play under endogenous modification to have different underlying personal characteristics than those who are under exogenous modification. The most important tool to eliminate the selection bias is to condition the analysis of cooperation on a subject's vote. Doing this endogenous modification is assumed not to be correlated with unobserved personal characteristics anymore. Table 5 gives the number of observations and cooperation rates directly before and after the vote stage disaggregated by voting behaviour and vote stage outcome. The first message to take away from this table is that selection might not be as big a factor as expected. In the EndoMod condition, 68 percent of the subjects voted for the modification. In the ExoMod condition, 63 percent voted for the modification. The difference is not significant (p-value = 0.78).

We gather from the second panel that there are differences in behaviour at the end of the first stage, especially that yes-voters cooperate more than no-voters (p-value = 0.06). This means that self-selection could be a confounding factor if the types of voters were unequally distributed across groups. The share of yes-voters is lower in the two unmodified conditions EndoNot and ExoNot (50 percent preferred modification in both cases), but the difference between voter shares in the modified and unmodified conditions is again not significant (p-value=0.39).

Table 5: Overview of Individual Data

	<i>Endogenous Condition</i>		<i>Exogenous Condition</i>		
Vote for modify	EndoMod	EndoNot	ExoMod	ExoNot	Total
<i>Number of subjects in each outcome by preference:</i>					
No	9	4	3	8	24
Yes	19	4	5	8	36
Total	28	8	8	16	60
<i>Cooperation rate in round 10 (in percent):</i>					
No	11.1	0	33.3	25.0	
Yes	36.8	0	60.0	37.5	
Average	28.6	0	50.0	31.3	
<i>Cooperation rate in round 11 (in percent):</i>					
No	66.7	50.0	100.0	62.5	
Yes	89.5	25.0	80.0	62.5	
Average	82.1	37.5	87.5	62.5	

The different group composition is however still controlled for in the decomposition of the results in order not to underestimate cooperation rates in the unmodified game. Interestingly, in round 10 subjects cooperate less on average in those groups that later end up in the EndoMod condition compared to the ExoMod agents, but not significantly so (p-value = 0.26). Dal Bó et al. (2010) observe that in the first round after the vote individuals cooperate significantly more if they are under endogenous modification. It can be seen in the lower panel of table 5 that this is not the case for my experiment. EndoMod does on average not bring about higher cooperation in round 11 when compared to ExoMod. Average cooperation in round 11 is in fact slightly lower in EndoMod. Only those players that voted in favour of the policy and received it cooperate more in the endogenous case. Neither of these differences is statistically significant.

Result 6. *Directly after the vote stage, subjects do not cooperate more if the modification is endogenous than when it is exogenous.*

Dal Bó et al. (2010) further decompose the effect of the institution. The authors break down the total effect into a selection effect and the endogenous treatment effect. The latter can be further separated into an exogenous treatment effect and the endogeneity premium. This is done by using weighted averages of the individual cooperation rates and voter shares in round 11 that are provided in table 5 of this thesis (see (Dal Bó et al., 2010, p.2218) for a more formal discussion). The total effect of the policy is given by the difference between EndoMod and EndoNot and amounts to 55 percentage points in Dal Bó et al. (2010)'s case and 45 in mine.¹⁰

The selection effect, meaning that differences in the proportion of types of players in a group lead to changes in behaviour that go beyond the differing treatment, is calculated by Dal Bó et al. (2010) to account for an increase in cooperation of about 4 percentage points. This represents the increase in average cooperation that is supposed to happen in the EndoNot condition if the share of yes-voters was the same as in EndoMod. In my case, this effect is actually a *decrease* in cooperation of roughly the same magnitude as in Dal Bó et al. (2010) because the no-voters in EndoNot cooperate much

¹⁰The total policy effect in round 11 can be calculated following Dal Bó et al. (2010) from table 5: $[66.7(9/28) + 89.5(19/28)] - [50(4/8) + 25(4/8)] = 44.67$.

more than the yes-Voters in the same condition.¹¹

The endogenous treatment effect then gives the increase in cooperation that is *not* due to the different composition of groups but caused by the endogenous policy choice. It is the difference in cooperation rates between EndoNot and EndoMod weighted with the vote structure of EndoMod. Its magnitude is found to be about 50 percentage points by Dal Bó et al. (2010) as well as by me.¹² The change in cooperation caused by an exogenous payoff modification is represented by the exogenous treatment effect which compares ExoNot and ExoMod. By keeping the proportion of yes- and no-voters as in the endogenous estimate but using the cooperation rates from the exogenous conditions, Dal Bó et al. (2010) calculate it to be at 36 percentage points. From my results it is estimated to amount to about 24 percentage points.¹³ Lastly, the difference between the exogenous treatment effect and the endogenous treatment effect gives the endogeneity premium which accounts for 14 percentage points in Dal Bó et al. (2010) and 25 in mine.¹⁴ This *democratic dividend* seems large and is mainly driven by the high cooperation of both yes- and no-voters in ExoNot in round 11 which diminishes the exogenous treatment effect. I broaden the focus of the analysis to include all rounds in stage two to investigate the development of cooperation across the vote stage outcomes.

Result 7. *When controlling for voting behaviour, the endogeneity premium accounts for a large increase in cooperation.*

¹¹Selection effect: $50(9/28 - 4/8) + 25(19/28 - 4/8) = -4.46$.

¹²Endogenous treatment effect: $(9/28)(66.7 - 50) + (19/28)(89.5 - 25) = 49.14$.

¹³Exogenous treatment effect: $(9/28)(100 - 62.5) + (19/28)(80 - 62.5) = 23.93$.

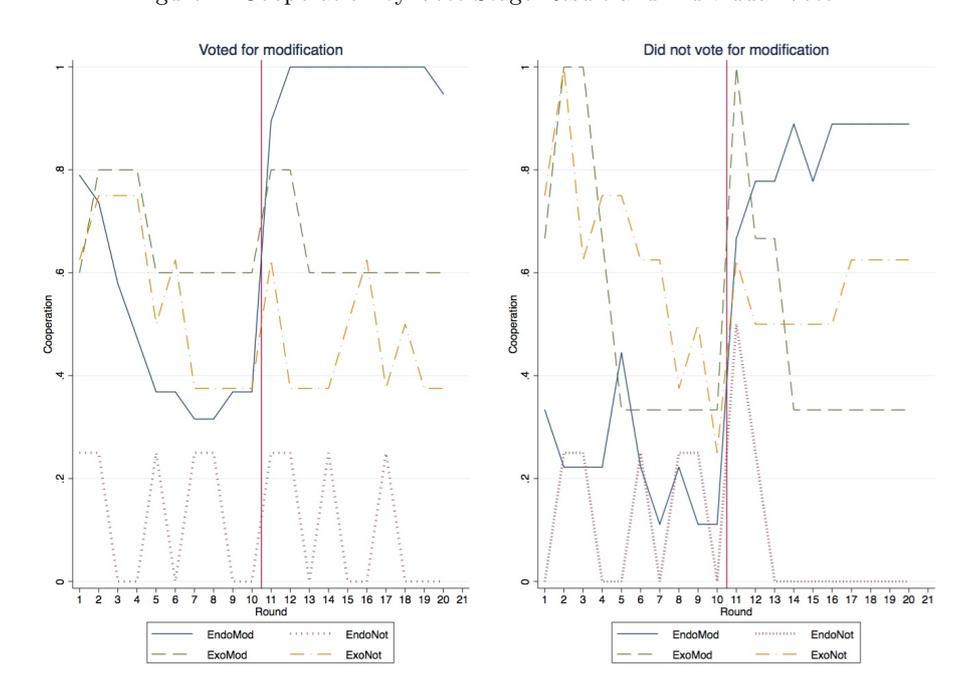
¹⁴Endogeneity premium: $49.14 - 23.93 = 25.21$.

Figure 4 shows that differences in behaviour over the rounds 11 to 20 are evident at first glance and become more pronounced as the second stage proceeds. Analogous to table 5 it gives individual cooperation for all four vote stage results separated by individual voting behaviour. It can be observed from the left-hand side that for those who voted for modification, the endogenous modification has a considerable effect and leads to almost full cooperation in stage two. Exogenous modification results in the second highest average cooperation, but the modification does not increase cooperation beyond the already high rate in part one. Not surprisingly, cooperation is lower without modification. EndoNot yes-voters seem to fail at establishing cooperation. Cooperation is also decreasing among the yes-voters in the ExoNot condition.

The right panel shows the development of cooperation for individuals who voted against payoff modification. Some of them, especially those who ended up under the exogenous conditions in part two, start part one with high cooperation, which then declines until round ten and increases dramatically for the first periods of part two. This behaviour is exemplary for the restart effect that is common in experiments, where after a short break in the experiment a sudden spike in cooperation is observed (Selten and Stoecker, 1986). For those no-voters who received the coordination game exogenously, cooperation declines again after a pronounced restart effect in round 11. The players under exogenous non-modification display the second highest cooperation rate of all no-voters towards the end of part two.

Figure 4 suggests that it is not sufficient to compare behaviour from only the rounds 10 and 11 as table 5 does. Those who were against modification but whose speaker endogenously modified steadily increase their cooperation to over 80 percent in the final rounds. Unsurprisingly, the EndoNot players resort to complete defection in part two. At first glance, the differences between the four outcomes become more pronounced over time, which is why I extend the analysis to all ten rounds of stage two with a special focus on the end round. However, those rounds should be treated with caution, as the experiences a player makes with her opponents as the experiment proceeds influence her behaviour, which is thus not independent across rounds. If a (conditionally) cooperative player meets more cooperative individuals, cooperation can become a self-reinforcing process due to selection. Dal Bó et al. (2010, p.2216) therefore note that "after round 11 differences in coop-

Figure 4: Cooperation by Vote Stage Result and Individual Vote



eration between EndoMod and ExoMod cannot be fully attributed to the effect of democracy”.

As the observation numbers in each cell of table 5 are so low I refrain from conducting regressions. Instead I rely on the non-parametric methods reported in table 6, where it is tested whether the differences in cooperation are significantly different across vote stage outcomes and voting preferences. In round 11, only EndoMod and EndoNot are statistically distinguishable for pro-modification voters. Without controlling for voting behaviour the difference between endogenous and exogenous modification is significant in the aggregated rounds 11 to 20 and in round 20. It is also significant for yes-voters in the last round. Since most of the outcomes are not statistically distinguishable at any conventional level of significance the estimate of the endogeneity premium reported previously has to be treated with caution. I conclude that democracy seems to be beneficial for cooperation, but the statistical power of the analysis does not suffice to demonstrate the existence of a dividend of democracy beyond reasonable doubt.

Within- and between-subjects tests show that neither do representatives

Table 6: The Influence of Democracy on Cooperation

	(1)	(2)	(3)	(4)	(5)	(6)
	round 11 ^a		rounds 11 to 20 ^b		round 20 ^a	
EndoNot = ExoNot	0.235		0.038**		0.102	
EndoMod = ExoMod	0.597		0.072*		0.014**	
EndoMod = EndoNot	0.024**		0.000***		0.000***	
ExoMod = ExoNot	0.218		0.548		0.667	
EndoNotn = ExoNotn		0.576		0.138		0.444
EndoModn = ExoModn		0.382		0.323		0.127
EndoModn = EndoNotn		0.510		0.017**		0.200
ExoModn = ExoNotn		0.339		1.000		0.424
EndoNoty = ExoNoty		0.273		0.165		0.339
EndoMody = ExoMody		0.521		0.146		0.099*
EndoMody = EndoNoty		0.021**		0.000***		0.003***
ExoMody = ExoNoty		0.490		0.449		0.413

Note: The "y" or "n" suffix denotes the individual decision for or against modification. Reported are p-values with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

^a Fisher's exact test.

^b Mann-Whitney U test.

cooperate more in stage two compared to stage one if they remain in the prisoners' dilemma, nor do they cooperate more than the rest of their group in stage two in the coordination game.¹⁵

Result 8. *Subjects elected as representatives do not change their behaviour more than other players.*

Another important question in the light of signalling effects is whether recommendation works. Hypothesis 9 states that a speaker who is willing to modify is able to induce her group towards increased cooperation even in the exogenously installed prisoners' dilemma. There are indeed differences in the cooperation rates of the groups in question (speaker wanted to modify but was overruled with exogenous non-modification) between part one and two; but the effect is rather the opposite of what was hypothesised: cooperation is much higher in part one (48 percent versus 29 percent). A Wilcoxon signed-rank test confirms that this difference is highly significant (p-value = 0.02). I can only speculate about the reasons, maybe cooperation is lowered by disappointed players who were not granted their desired policy or maybe the general pattern of decaying cooperation in the absence of institutions is reflected here.

¹⁵A Wilcoxon signed-rank test of the first statement gives a p-value of 0.38 and a Mann-Whitney U test of the second claim a p-value of 0.47.

Result 9. *The signal of a speaker who wants to modify does not suffice to increase cooperation rates under exogenously unmodified payoffs.*

If there is no significant difference between exogenous and endogenous modification in my study, but Dal Bó et al. (2010) and previous authors found such a difference, this could be due to the information effect discussed in chapter 3. To control for information, Dal Bó et al. (2010) ran further sessions with a design that slightly modifies their original experiment. Now subjects in the exogenous condition are informed whether there was a majority for or against modification in their group. In case of a tie the same random message is displayed to all group members (Dal Bó et al., 2010, p.2222). Even though a part of the endogeneity premium is not explained by informational effects, Dal Bó et al. (2010, p.2224) "cannot reject statistically the hypothesis that information plays no role". But as the authors find no difference between yes-voters in the ExoMod groups with a majority for and against modification in round 11; and a significant difference between cooperation in ExoMod and EnoMod, they conclude that there is "no evidence that information differences between endogenous and exogenous modification explain the observed difference in behaviour" (Dal Bó et al., 2010, p.2225).

Analogous to Dal Bó et al. (2010, p.2224), table 7 is a variant of table 5 and shows that the information hypothesis should not be rejected too readily. It contains only subjects who played the coordination game in part two. I disentangle what choice the representative made for the groups who received modification. This is straightforward for endogenous modification; but in the exogenously modified condition both preferences in favour and against can be present. We see that of these ExoMod speakers one chose the prisoners' dilemma (centre column) and one the coordination game (right column). The results therefore hinge on a comparison of just two groups and are obviously not reliable. But we see that the ExoMod group whose speaker did not want to modify starts out with a cooperation rate below the group whose speaker was pro-modification, and is not able to coordinate on the socially optimal equilibrium over the course of the second stage. It is indubitable that more data is needed for a more conclusive analysis of the information effect and the match between own and representative's choice.

Result 10. *The importance of information effects as key factors in explaining differences in cooperation cannot be rejected.*

Table 7: Individual Cooperation – Controlling for Speaker’s Choice under Modified Payoffs

Speaker’s Choice	<i>Endogenous Condition</i>		<i>Exogenous Condition</i>	
	Modify	Not Modify	Modify	Not Modify
<i>Number of subjects in each outcome by preference:</i>				
No	9		2	1
Yes	19		2	3
Total	28		4	4
<i>Cooperation rate in round 11 (in percent):</i>				
No	66.7		100.0	100.0
Yes	89.5		50.0	100.0
Average	82.1		75.0	100.0
<i>Cooperation rate in part two (in percent):</i>				
No	83.3		20.0	100.0
Yes	98.4		10.0	100.0
Average	93.6		15.0	100.0

6. Concluding Remarks

The paper presents an experiment that extends a study by Dal Bó et al. (2010) investigating the behavioural effects of an endogenous institutional choice. Small groups are presented with the possibility of changing their pay-off structure from a prisoners’ dilemma into a coordination game, thereby making cooperation incentive-compatible. It is tested whether this modification has the same influence when it is implemented by a group speaker compared to an external authority. Beforehand, this speaker is elected in a small group to simulate a representative democracy. Her choice of game is considered and implemented for the group with a 50 percent probability. In the other cases, a game is chosen by the computer. This randomization allows for a comparison of subjects with the same preferences and the same institution who only differ in the way the institution was established. The modification preference of each player is used as a proxy for personal characteristics.

Dal Bó et al. (2010) find that endogenous modification increases cooperation more than exogenous modification, especially for players who preferred the modified over the unmodified game. To summarize my results, the first stage confirms the well-known phenomenon that subjects cooperate

in prisoners' dilemma experiments despite defection being the best response. Gender seems to have an influence on willingness to cooperate. When presented with the opportunity of payoff modification, a higher cognitive ability is associated with an increased preference for the cooperation-fostering policy. The coordination game has a positive influence on cooperation, which is in line with theoretical considerations and previous empirical findings. Unsurprisingly, more cooperative players favour the modification, which means that selection is an issue to be concerned with as it can lead to an overestimation of the policy's effect. However, the distribution of voters in the groups with endogenously and exogenously modified payoffs is similar. Subjects try to elect pro-social representatives, but factually these do not behave significantly different than the rest of the sample in both stages. Furthermore, a cooperative speaker is not sufficient as a cue towards more cooperation when payoffs are not modified. Under exogenous modification however, the speaker's choice seems to have an influence on behaviour, but the observation number is too small for a sound analysis of the phenomenon. Information effects cannot be excluded to drive results in the studies by Tyran and Feld (2006) and Sutter et al. (2010). In these, the group's institutional choice was only revealed in the endogenous cases. My design controls for this by presenting the speaker's choice also in the exogenous outcomes.

Directly after the vote stage, subjects do not cooperate more if the modification is endogenous compared to when it is exogenous. Over the course of the experiment, differences between endogenous and exogenous modification become more pronounced for players who preferred the modification. Using an estimation strategy of Dal Bó et al. (2010), which controls for different shares of player types in the outcomes, the *democratic dividend* is calculated to account for a substantial increase in cooperation. However, observation numbers are low and statistically most of the vote stage outcomes are not distinguishable. Thus, the small sample size does not enable me to fully replicate the results of Dal Bó et al. (2010), especially with regard to the differences between endogenous and exogenous modification. Furthermore, a more profound theoretical background needs to be established to allow for a more sophisticated and targeted testing of the channels through which institutional designs really influence behaviour. Therefore, the analysis of especially the information effects and on the group level remains incomplete.

Further limitations of my abstract experimental design are that many

essential features of a representative democracy are excluded. There is no running for elections, no pandering and no accountability, and no rent for the elected politician. While this simplified model is undoubtedly useful when conducting a robustness check on Dal Bó et al. (2010), the external validity of the results should not be overrated. Incorporating the mechanism of Dal Bó et al. (2010) into more complex experiments regarding representative democracies promises to be a way of obtaining unbiased estimates of all kinds of endogenous treatment effects. Possible extensions to my study are giving more power to the representative, e.g. by letting her decide on the strategies of the citizens. Repeated elections, campaigning of candidates, or lobbying for citizens with different interests are further relevant factors in representative democracies that could be included. All in all, more research needs to be done to better understand the influence of indirect democratic institutions on cooperation in societies small or large.

Appendix A. Tables

Table A.8: OLS Regression – Initial Cooperation
 Dependent variable: probability of individual cooperation in round 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Logic	0.039 (0.046)							0.053 (0.070)
Female		0.442*** (0.103)						0.415** (0.159)
Income			-0.000* (0.000)					-0.000 (0.000)
Economics				-0.185* (0.110)				0.008 (0.149)
CDU					-0.311* (.158)			-0.190 (0.151)
SPD						-0.083 (0.165)		0.009 (0.200)
Linke							0.371** (0.545)	0.078 (0.201)
Constant	0.522*** (0.091)	0.303*** (0.079)	0.781*** (0.117)	0.654*** (0.068)	0.727*** (0.082)	0.667*** (0.085)	0.021*** (0.080)	0.248* (0.289)
<i>N</i>	84	80	84	84	45	45	45	44
<i>R</i> ²	0.008	0.192	0.042	0.033	0.082	0.006	0.118	0.361
adj. <i>R</i> ²	-0.004	0.182	0.030	0.021	0.061	-0.017	0.097	0.237

Note: Logic is an indicator variable between 0 and 3 for the number of questions correctly answered. CDU, SPD, and Linke are binary variables equal to one if a subject votes for the respective party. Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.9: OLS Regression – Determinants of Modification Preference
 Dependent variable: probability of voting for modification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Own cooperation	0.024 (0.016)							0.055*** (0.016)
Partners' cooperation		-0.007 (0.017)						-0.047** (0.020)
Logic			0.139*** (0.042)					0.150*** (0.038)
Income				-0.000* (0.000)				-0.000 (0.000)
Female					-0.080 (0.116)			-0.066 (0.092)
Age						-0.011 (0.010)		-0.012 (0.009)
Econ							0.053 (0.105)	0.051 (0.092)
Constant	0.557*** (0.083)	0.685*** (0.088)	0.435*** (0.099)	0.862*** (0.120)	0.697*** (0.083)	0.933*** (0.259)	0.635*** (0.070)	0.865*** (0.301)
<i>N</i>	84	84	84	84	80	84	84	80
<i>R</i> ²	0.035	0.003	0.117	0.050	0.007	0.016	0.003	0.279
adj. <i>R</i> ²	0.023	-0.010	0.106	0.038	-0.006	0.004	-0.009	0.209

Note: Own and partners' cooperation range from 0 to 10 depending on the number of times "C" was played. Logic is an indicator variable between 0 and 3 depending on number of questions correctly answered. Standard errors (in parentheses) clustered at group level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B. Bibliography

- Acemoglu, D., Johnson, S., Robinson, J. A., 2001. The colonial origins of comparative development: An empirical investigation. *The American Economic Review* 91 (5), 1369–1401.
- Aghion, P., 2006. On institutions and growth. In: Eicher, T. S., García-Peñalosa, C. (Eds.), *Institutions, Development, and Economic Growth*. Cambridge, Massachusetts: MIT Press.
- Andreoni, J. A., Miller, J. H., 1993. Rational cooperation in the finitely repeated prisoner’s dilemma: Experimental evidence. *The Economic Journal* 103 (418), 570–585.
- Axelrod, R., 1986. An evolutionary approach to norms. *American Political Science Review* 80 (04), 1095–1111.
- Bardhan, P., 2000. Irrigation and cooperation: An empirical analysis of 48 irrigation communities in south india. *Economic Development and Cultural Change* 48 (4), 847–865.
- Black, S. E., Lynch, L. M., 2001. How to compete: The impact of workplace practices and information technology on productivity. *Review of Economics and Statistics* 83 (3), 434–445.
- Bock, O., Baetge, I., Nicklisch, A., 2014. hroot: Hamburg registration and organization online tool. *European Economic Review* 71 (1), 117–120.
- Bonin, J. P., Jones, D. C., Putterman, L., 1993. Theoretical and empirical studies of producer cooperatives: Will ever the twain meet? *Journal of Economic Literature* 31 (3), 1290–1320.
- Cavalcanti, C., Schläpfer, F., Schmid, B., 2010. Public participation and willingness to cooperate in common-pool resource management: A field experiment with fishing communities in brazil. *Ecological Economics* 69 (3), 613–622.
- Corazzini, L., Kube, S., Maréchal, M. A., Nicolo, A., 2014. Elections and deceptions: An experimental study on the behavioral effects of democracy. *American Journal of Political Science* 58 (3), 579–592.

- Dal Bó, P., Foster, A., Putterman, L., 2010. Institutions and behavior: Experimental evidence on the effects of democracy. *American Economic Review* 100 (5), 2205–29.
- Fearon, J. D., Humphreys, M., Weinstein, J. M., 2011. Democratic institutions and collective action capacity: Results from a field experiment in post-conflict liberia. In: APSA 2011 Annual Meeting Paper.
- Fehr, E., Schmidt, K. M., 1999. A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114 (3), 817–868.
- Feld, L. P., Frey, B. S., 2007. Tax evasion in switzerland: The roles of deterrence and tax morale. In: Hayoz, N., Hug, S. (Eds.), *Tax Evasion, Trust, and State Capacities*. Vol. 3. Bern: Peter Lang.
- Fischbacher, U., 2007. z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics* 10 (2), 171–178.
- Fischbacher, U., Gächter, S., Fehr, E., 2001. Are people conditionally cooperative? evidence from a public goods experiment. *Economics Letters* 71 (3), 397–404.
- Frey, B. S., Benz, M., Stutzer, A., 2004. Introducing procedural utility: Not only what, but also how matters. *Journal of Institutional and Theoretical Economics* 160 (3), 377–401.
- Frey, B. S., Feld, L. P., 2002. Deterrence and morale in taxation: An empirical analysis. CESifo Working Paper Series 760.
- Frey, B. S., Torgler, B., 2007. Tax morale and conditional cooperation. *Journal of Comparative Economics* 35 (1), 136–159.
- Gibbons, R., 1992. *A Primer in Game Theory*. New York City, New York: Harvester Wheatsheaf.
- Groenewegen, J., Spithoven, A., Van den Berg, A., 2010. *Institutional Economics: An Introduction*. London: Palgrave Macmillan.
- Grossman, G., Baldassarri, D., 2012. The impact of elections on cooperation: Evidence from a lab-in-the-field experiment in uganda. *American Journal of Political Science* 56 (4), 964–985.

- Hamman, J. R., Weber, R. A., Woon, J., 2011. An experimental investigation of electoral delegation and the provision of public goods. *American Journal of Political Science* 55 (4), 738–752.
- Hodgson, G., 2006. What are institutions? *Journal of Economic Issues* 40 (1), 1–25.
- Hyde, J. S., Fennema, E., Lamon, S. J., 1990. Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin* 107 (2), 139–155.
- Kagel, J. H., Roth, A. E., 1995. *The Handbook of Experimental Economics*. Princeton, New Jersey: Princeton University Press.
- Kahneman, D., 2011. *Thinking, Fast and Slow*. London: Macmillan.
- Kamei, K., Putterman, L., Tyran, J.-R., 2015. State or nature? endogenous formal versus informal sanctions in the voluntary provision of public goods. *Experimental Economics* 18 (1), 38–65.
- Kreps, D. M., Milgrom, P., Roberts, J., Wilson, R., 1982. Rational cooperation in the finitely-repeated prisoners' dilemma. *Journal of Economic Theory* 27 (2), 245–252.
- Markussen, T., Putterman, L., Tyran, J.-R., 2014. Self-organization for collective action: An experimental study of voting on sanction regimes. *Review of Economic Studies* 81 (1), 301–324.
- North, D. C., 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- Olken, B. A., 2010. Direct democracy and local public goods: Evidence from a field experiment in indonesia. *American Political Science Review* 104 (02), 243–267.
- Ortmann, A., Tichy, L. K., 1999. Gender differences in the laboratory: Evidence from prisoners dilemma games. *Journal of Economic Behavior & Organization* 39 (3), 327–339.
- Osborne, M. J., 2004. *An Introduction to Game Theory*. Vol. 3. Oxford: Oxford University Press.

- Pommerehne, W. W., Weck-Hannemann, H., 1996. Tax rates, tax administration and income tax evasion in Switzerland. *Public Choice* 88 (2), 161–170.
- Rapoport, A., Dale, P. S., 1966. The "end" and "start" effects in iterated prisoner's dilemma. *Journal of Conflict Resolution* 11 (1), 363–366.
- Rivas, M. F., Sutter, M., 2011. The benefits of voluntary leadership in experimental public goods games. *Economics Letters* 112 (2), 176–178.
- Scott, W. R., 2013. *Institutions and Organizations: Ideas, Interests, and Identities*. Thousand Oaks, California: Sage Publications.
- Selten, R., Stoecker, R., 1986. End behavior in sequences of finite prisoner's dilemma supergames: A learning theory approach. *Journal of Economic Behavior & Organization* 7 (1), 47–70.
- Sutter, M., Haigner, S., Kocher, M. G., 2010. Choosing the carrot or the stick? endogenous institutional choice in social dilemma situations. *The Review of Economic Studies* 77 (4), 1540–1566.
- Tyran, J.-R., Feld, L. P., 2006. Achieving compliance when legal sanctions are non-deterrent. *The Scandinavian Journal of Economics* 108 (1), 135–156.