Essays on Collective Action

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Introduction

Since Adam Smith's (1776) insight, that an individual who pursues his own interest often also acts in favor of the public interest, a large part of economic research has centered around situations for which this is not the case. Whenever the interests of individuals are not aligned, economic activity is likely inefficient. Prominent examples are situations of market power, asymmetric information, and public goods. The latter two are examined in this dissertation. It seeks both to enhance the understanding of human motivations as well as to shed light on the effects of institutions on human behavior and welfare.

Chapter 1 explores the behavior of individuals who face the provision of a public good that requires a minimal amount of aggregate contributions. Chapter 2 studies how purchase decisions are affected by bundling a public and a private good. Chapter 3 analyzes how the political system affects campaign behavior of political candidates and the voters' capacity to select the best candidate for office. While all chapters are concerned with problems of collective action, their approach is different. Chapters 1 and 2 use experiments to enhance the understanding of human motivations. In contrast, Chapter 3 takes the motivation of agents as given and analyzes the effects of institutions on human behavior and welfare using game theory.

The stylized representation of collective action problems is the provision of public goods, i.e., goods that are individually costly to provide but that generate benefits not only to those who provide them but to a larger group of people. Group welfare is maximized if everyone contributes to the public good, but purely self-regarding individuals do not have an incentive to contribute. Several insights from experimental economics have shown, however, that individuals are willing to forgo private gain and to generate benefits for others (e.g., Isaac et al. 1985, Ledyard 1995). This typically depends on the characteristics of the decision situation and the degree to which it

triggers different motivations, such as the desire for a positive image towards others and towards oneself (Bénabou & Tirole 2006), on the inclination to reciprocate actions of others (Bolton & Ockenfels 2000, Falk & Fischbacher 2006) and on the desire to reduce inequality (Fehr & Schmidt 1999, Bolton & Ockenfels 2000). Singling out such basic motivations is pivotal for an understanding of behavior in collective action problems and also serves as a basis for the analysis of institutions that help alleviate these problems.

Chapter 1 analyzes whether the option to choose the timing of contributions to a threshold public good triggers specific motivations.[1] Threshold public goods require a minimal amount of aggregate contributions to be successfully provided and depict the lumpy nature of many public goods, such as roads, bridges, parks or schools. Also in team production problems a specific amount of effort is often needed to produce a common outcome. The timing of contributions to a threshold public good is crucial. Players who choose to contribute early can induce other players to contribute their fair share to the public good, but they can also try to shift the burden of public good provision to the other players. Players who choose to contribute late, in contrast, can ensure a payoff of the size of their endowment but could also jump in when contributions are missing. Previous research focused on the analysis of behavior with an exogenously given order of contributions. This restriction of the players' action space may have impeded the identification of relevant motivations in this setup.

We explicitly model the endogeneity of the contribution order in an experiment. A comparison of cooperation patterns to the case of an exogenously given order of contributions yields new insights into motivations in collective action problems. We find that an endogenous order of contributions, unlike in the provision of linear public goods, does not improve cooperation rates and payoffs. This is due to an externality that so far remained hidden: When observing unfair contributions, players wait for the contributions of others and thereby leave their group members uninformed about their willingness to contribute. This result suggests that institutions addressing this externality may have a stronger impact on cooperation than acknowledged so far.

A different public good problem arises in individual consumption. Many consumption decisions are intricately linked to public good issues such as preserving

[1] Chapter 1 is based on joint work with Georg von Heusinger.

biodiversity, public health, or mitigating climate change. An increasing number of companies explicitly address these issues by offering bundles of public and private goods. Prominent examples are sustainably fished seafood, certified wood products, hybrid cars, or green electricity. Sometimes, direct cooperations between charitable organizations and firms arise. In 2008, for example, the Danone group promised to provide 10 litres of drinking water in rural Africa for every litre of Volvic mineral water sold.

Chapter 2 analyzes the demand for such bundles of public and private goods, which we call hybrid bundles.[2] According to standard economic theory, a consumer's willingness to pay (WTP) for a combination of two goods should stay unaffected by bundling. Since bundling does not change the inherent characteristics of goods, this assumption is commonly used (e.g., Adams & Yellen 1976, Jehiel et al. 2007). In a laboratory experiment, we challenge this assumption. We analyze subjects' willingness to pay for a private good, a cup, and a public good, a 2€ donation to a charity, that are either bundled or offered separately. Subjects receive an endowment and make a series of purchase decisions facing different prices, from which we obtain their WTPs. In two control treatments, we replace the public good with a comparable private good, a 2€ voucher for an online store. These treatments assess whether the effect of bundling depends on the nature of the bundled goods.

Our data show superadditivity for hybrid bundles, i.e., the WTP for the hybrid bundle exceeds the WTP for the separately offered public and private good. In contrast, we find no increase in the WTP if two private goods are bundled. A review of several behavioral concepts suggests behavior consistent with the data. In particular, the effect in our experiment seems to be driven by spillovers from the public to the private good as well as an extended warm glow from self-signalling. The superadditivity in the evaluation of hybrid bundles suggest that markets can play a strong role in the provision of public goods. Charitable organizations may have much to gain from cooperations with the private sector. The data also provides an explanation for the increasing use of Corporate Social Responsibility (CSR). In particular, CSR may create benefits for firms by inducing a different perception and use of their products.

In principle, some problems of collective action can be overcome by regulation

[2]Chapter 2 is joint work with Gerrit Frackenpohl.

or government intervention. The political process, however, has its own frictions. In particular, if the preferences of politicians are not aligned with the preferences of the electorate, two problems arise. First, before an election, low-ability candidates try not to reveal their true competence to increase their chances of winning the election. Second, once in office, politicians could engage in rent seeking. The political economy literature has extensively studied how political institutions help address this second problem. It found that power-dispersing political institutions discipline egoistic incumbents and thereby increase welfare (e.g., Lizzeri & Persico 2001, Persson & Tabellini 2003). The effects of political institutions on the capacity to select competent politicians, and thereby to address the first problem, is much less understood (Besley 2005). Chapter 3 investigates this issue.[3] It shows how political institutions affect the campaigns of political candidates and the voters' capacity to empower competent candidates.

We develop and solve a game theoretic model of the political process. Candidates are privately informed about their abilities and are motivated by political power as well as welfare considerations. Voters infer the abilities of political candidates from their campaigns. We show that variations in power concentration involve a trade-off. On the one hand, higher concentration of power allocates more power to competent candidates, as long as political campaigns provide at least some information to voters. On the other hand, a higher power concentration increases the incentives of office-motivated candidates to win the election. They are then more likely to mimic the policy choice of competent candidates, thereby reducing the informativeness of political campaigns. Voters are then less able to elect competent candidates. In total, we identify a negative relation between the optimal level of power concentration and the extent of office motivation. We confront our model results with data for established democracies and find evidence that supports this prediction. The chapter highlights the intricate effects of political systems on the ability to select competent politicians for office and has implications for constitutional design questions.

[3]Chapter 3 was developed jointly with Andreas Grunewald and Emanuel Hansen.

Chapter 1

Endogenous Move Order in the Provision of Threshold Public Goods

1.1 Introduction

In a public good problem, there is typically a time lag between contributions, such that previous contributions are observable by undecided parties. The timing of contributions has potentially large effects on cooperation patterns. If provision of the public good requires a minimal amount of total contributions, early contributions can signal a preference for a fair distribution of efforts, but they also provide the opportunity to shift the burden of public good provision to other players. Examples for such threshold or step-level public goods are plentiful both on the individual as well as the national level. They range from the organization of an event at the local sports club over the provision of parks and day-care centers to mitigating climate change.

Research on cooperation problems with such first mover advantages has long focused on contributions that have to be made by players in an exogenously given order. Since in many applications the players themselves decide when to contribute, we analyze a threshold public good to which agents are free to make an irrevocable

contribution at any point in time. By explicitly modeling the endogeneity of the contribution sequence we create new insights into cooperation patterns in this setup. To guide our analysis, we contrast our results to a setup with an exogenously fixed contribution order.

We find that success rates are largely unaffected by the different allocations of contribution positions. On the level of individual contributions, we show that fair contributions cannot be triggered more easily with an endogenous order of contributions. In particular, the fairness norm is frequently violated by players in later positions. We also find a prominent inefficiency that goes along with an endogenous order of contributions. When unfair contributions are observed, players wait for others to contribute, thereby leaving them uninformed about their willingness to contribute. The reason for the reluctance is intuitively clear. Giving up on public good provision ensures a payoff in the height of the endowment. However, waiting for contributions of others before taking an action provides an additional option value of a successfully provided public good. In essence, waiting goes along with a negative externality on other players as it reduces the transmission of information on the players' willingness to contribute. Institutions that address this externality may be particularly conductive to cooperation.

The chapter proceeds as follows: After discussing related literature in the next Section, we formulate hypotheses on likely behavior in Section 1.3. Section 1.4 describes the experimental design in detail. Results of the experiment are discussed in Section 1.5. Section 1.6 draws conclusions.

1.2 Related Literature

A key question in social dilemmas with sequential actions is whether leading parties can induce others to restrain from selfish actions and to contribute to a common goal. For linear linear public goods, this pattern is well documented (e.g., Moxnes & van der Heijden 2003, Potters et al. 2005, Güth et al. 2007, Rivas & Sutter 2011). Rivas & Sutter (2011) additionally show that players who choose to lead contribute more than players assigned to lead. Hence, overall contributions to the linear public good are higher when the order of contributions is endogenous. Clearly, the only

benefit of an early contribution to a linear public good is to foster high follower contributions by setting a good example. However, players in later positions mimic contributions only in part, so that early contributions typically go along with lower earnings. Consequently, early positions are avoided (Arbak & Villeval 2013, Güth et al. 2007, Rivas & Sutter 2011).

For threshold public goods, cooperation patterns with an endogenous move order remain largely unexplored. If the public good does not require full participation, higher contributions of one player allow for lower contributions of another player. If contributions are made sequentially, free riding is only possible in early positions. The efficiency of an endogenous order of contributions will thus depend on (i) whether players move early to encourage other players to contribute fairly or whether they try to shift the burden of public good provision to other players and (ii) how later players respond to contributions of early movers.

An early study examining behavior with an endogenous order of contributions to a threshold public good is provided by Dorsey (1992). He allows for multiple contributions and shows that players implicitly condition their contributions on other players' contributions by raising contributions incrementally when others do so as well. This setup does not induce a theoretical first mover advantage. As players can always adjust their contributions upwards, a commitment to low contributions is not possible.

Goren et al. (2003) and McEvoy (2010) focus on single, all-or-nothing contributions. Goren et al. (2003) study heterogeneously endowed players and point out that subjects with a low endowment contribute their full endowment early. This reflects their higher proportional gain from cooperation. McEvoy (2010) analyzes all-or-nothing contributions of homogeneous players and shows that players in early positions only free ride if the relative payoff of free riders is high. Both papers use a variant of a real-time setup that we employ. In contrast to these studies we allow for partial free riding by permitting continuous contributions. We also focus on a better understanding of behavior in the endogenous move setup by contrasting our results to the benchmark of an exogenous move order. Similar to a threshold public good, the quasi-linear two-person setting of Varian (1994) also displays a theoretical first-mover advantage. In this setup, Andreoni et al. (2002) and Gächter et al. (2010) show that

the theoretical first-mover advantage does not materialize because the players moving second frequently punish free riders. As a consequence, players that can choose the timing of their contribution often choose not to commit early and rather choose simultaneous play in the last period, as shown by Nosenzo & Sefton (2011). Our setup, in contrast, uses continuous time and thereby excludes the possibility of early or late simultaneous play. Finally, we incorporate a larger number of players and can observe timing decisions also when some play has already taken place.

A particular motivation for studying social dilemmas is the design of institutions that foster cooperation. Such institutions have experimentally been tested for an exogenously given order of contributions. For example, Coats et al. (2009) show that a refund of unsuccessful contributions does not increase the provision of threshold public goods. Marks & Croson (1998) show that contributions to a threshold public good increase if contributions surpassing the threshold are invested in a linear public good. However, this rebate does not affect the chances of reaching the threshold. By examining whether an endogenous move order triggers different behavioral motives than an exogenous move order, we also provide a robustness check to this literature. In particular, some institutions may have impacts on behavior that so far remained hidden behind the assumed exogenous move order.

There is yet no theoretical prediction of behavior in a threshold public good for players that decide on both their share of contributions and the order of contributions. For a threshold public good that can be provided by one player alone, Bliss & Nalebuff (1984) and Bilodeau & Slivinski (1996) show that if the payoff from the public good is dependent on the time it is produced, waiting is used as an allocation device. Delaying one's contributions signals the individual cost of public good provision. The public good is eventually provided by the player with the lowest cost. However, no similar studies exist for public goods that require contributions by multiple players. This chapter thus provides first insights into behavior in the described setup. To guide our analysis, we use a simple model with selfish and homogenous players provided in the Appendix. It serves as a starting point for the predictions formulated in the next Section.

1.3 Theoretical Predictions and Hypotheses

In sequential contributions to threshold public goods the leading positions do not only provide the opportunity to persuade others to contribute to the common good. They also offer the chance to announce low contributions as to leave the provision of the public good to the other group members. As shown in the Appendix, strategies that prescribe low contributions in early positions form the only subgame perfect Nash equilibrium. In particular, early contributions are below the average contribution necessary to provide the public good. In other words, early movers contribute less than their equal share. For an exogenous move order, early movers actually exploit their positions to some degree (Coats et al. 2009). We expect a similar behavior with an endogenous move order.

Hypothesis 1. *Early movers contribute less than the equal share to the public good.*

Since strategies in the subgame perfect Nash equilibrium prescribe low contributions in early positions, they also stipulate early moves for the players. Our second hypothesis is thus a direct consequence of our first hypothesis.

Hypothesis 2. *Players prefer to contribute early.*

The overall efficiency of the mechanism will depend mostly on how players select into positions. Take players concerned not only about their own material payoff but also about social welfare and reciprocity as specified in Charness & Rabin (2002). Then, if the move order is endogenous, players can increase the probability of public good provision not only by their contributions but also by their move order. If the distribution of reciprocity is publicly known, less reciprocal players can choose high contributions directly after observing free riding. They thereby increase the costs of punishment by other players and the probability of public good provision. Similarly, players with different degrees of risk aversion can choose their move order to maximize public good provision. A player who knows that her risk aversion is below average may contribute early to reduce the risk of contributing for the other players. A player with a high risk aversion, in contrast, may choose to contribute late, when she can better assess the chances for public good provision. If the move order is exogenously

fixed, this possibility of self-organization is not present. The third hypothesis for the experiment thus is:

Hypothesis 3. *The endogenous mechanism is more efficient than the exogenous mechanism.*

1.4 Experimental Design

Our experiment analyzes contributions to a threshold public good with different allocations of the order of contributions. Subjects receive an endowment of 50 tokens. They are divided into groups of 4 and decide how much of their endowment they want to contribute to a public project. The payoff from the public project resembles that of a threshold public good. If the group contributions to the public project reach or exceed the threshold of 120 tokens the project pays 60 tokens to each subject in the group, irrespective of the individual contributions. If the threshold is not reached, contributions are not refunded.[1] A subject's payoff is thus given by

$$\pi_i = (50 - c_i) + \begin{cases} 60 & \text{if } \sum_{j=1}^{4} c_j \geq 120 \\ \\ 0 & \text{otherwise,} \end{cases}$$

where π_i denotes individual earnings in a given period and c_i denotes individual contributions to the public good. Contributions can not be revised. This form of commitment is analogue to irreversible investments or announcements that are very costly to change.

Two treatments were performed in a total of six sessions: an endogenous order of contributions to the threshold public good using the real-time protocol (which we will refer to as End) and an exogenous order of contributions to the threshold public good (which we will refer to as Ex). Each treatment consisted of 10 rounds with stranger matching within matching groups of 12 subjects. Both treatments are described below.

[1] Payoffs are chosen to be similar to Coats et al. (2009) and Coats & Neilson (2005) but are scaled up to allow for mild degrees of free riding.

1.4.1 Endogenous Treatment

The endogenous treatment (End) allows subjects to choose the timing of their contribution. The order of contributions hence arises endogenously. Subjects have 60 seconds to make their contribution to the public good. Contributions immediately appear on the screen of every group member. We ensure that the order of contributions is strictly sequential by imposing a waiting time of two seconds after a contribution has been made. During this time, no contribution can be announced. To avoid time pressure, subjects are given a time extension of 20 seconds if contributions are made within the last 20 seconds of a round. If all group members contribute before the 60 seconds have passed, the remaining time in the period is not reduced. At the beginning of each period, subjects are given ten seconds to get ready. When a player fails to make an announcement within the given time this is regarded as a contribution of zero tokens.

1.4.2 Exogenous Treatment

In the exogenous treatment (Ex), subjects are randomly assigned a position. Every subject is allocated 15 seconds to make a contribution at her position. When no decision is made within the 15 seconds, this is regarded as a contribution of zero tokens. A subjects' assigned position is kept fixed over all periods to keep the fairness perception of the mechanism unaffected from a reallocation of positions.

1.4.3 Experimental Procedures

The experiment was conducted in the laboratory of the University of Bonn in April 2010 using z-Tree (Fischbacher 2007). A total of 144 undergraduate students were recruited using ORSEE (Greiner 2004) and each subject was only allowed to participate in a single treatment.[2] Upon arrival, the subjects were randomly assigned to private cubicles. The instructions were kept in neutral language and were read aloud to the subjects.[3] All questions were answered in private. We made sure that

[2]The subject pool contained more than 6300 subjects, most of them students from various disciplines. The recruited subjects had an average age of 22.8 years. 43% of the subjects were males.

[3]The instructions are provided in the Appendix.

subjects understood the game by asking control questions and implementing two test periods. In the test periods, subjects interacted with three computer players that announced contributions in the form of a prespecified text at randomly set points in time. Randomization was performed only once and determined the timing of the computer contributions in all sessions. Subjects themselves could announce a hypothetical choice. Earnings of the experiment were accumulated over all 10 rounds and converted at a rate of 0.01 Euro per experimental token. No show-up fee was paid. Average earnings including post-tests were 6.30 Euro. This part of the experiment lasted approximately 40 minutes. The experiment continued with treatments that are not analyzed in this chapter.

1.5 Results

We next describe the observed behavior when players themselves choose the order of their contributions. Throughout the analysis, we use the setup with an exogenously given order as a benchmark. We begin with the general behavioral patterns. All data represents averages over all matching groups.

1.5.1 General Behavior

In End, the public good is successfully provided in 56% of all periods. Average contributions equal 22.2 tokens and show no trend over the different positions (see Table 1.1). Early contributions are below 30 (Wilcoxon signed-rank test, $p = 0.028$ in both treatments)[4], which lends first support to Hypothesis 1.

Table 1.1: Average contributions by position

Position	1	2	3	4
End	22.47	24.28	21.05	20.80
Ex	23.07	19.92	20.59	21.18

Average contributions in later positions are below 30, due to contributions that purposefully make public good provision impossible. In line with the literature, we refer to such contributions as folding. If we only consider contributions that still allow

[4]All reported p-values are two-sided. The tests are based on average values within the matching groups.

the provision of the public good, we see the clearly increasing trend in contributions depicted in Table 1.2 (Wilcoxon signed-rank test for all pairwise comparisons, $p < 0.03$).

Table 1.2: Average contributions by position without folding

Position	1	2	3	4
End	22.47	26.27	28.38	36.19
Ex	23.07	22.69	30.23	35.40

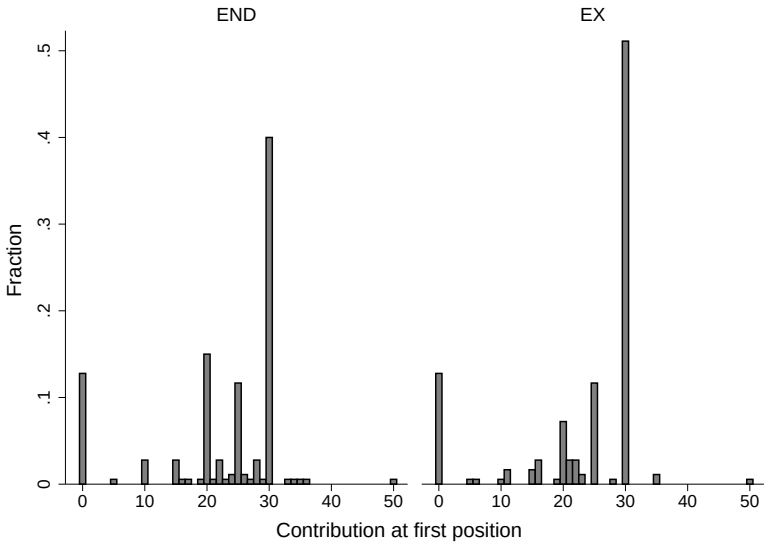
Taking a closer look at the contributions in the first position, Figure 1.1 shows that we can broadly categorize first mover contributions into four categories: 42.8% of all contributions in the first position aim at providing an equal share of the public good, i.e., 30 tokens or more.[5] 21.6% of all contributions lie strictly between 20 and 30 tokens. We label them as mild free riders. A higher degree of free riding is attempted with 22.8% of the contributions, the majority of which is represented by contributions of 20 tokens. Finally, the strongest degree of free riding, with zero contributions, is performed in 12.8% of all contributions. We can conclude that, in line with our theoretical predictions, we see free riding in early positions. Additional evidence for Hypothesis 1 is provided by the amount of contributions a player at the last position has to make if she wants the public good to be provided. With an average of 36.2 tokens these contributions significantly exceed the fair share of 30 (Wilcoxon signed-rank test, $p < 0.026$).

Result 1. *Early movers try to contribute less than others.*

Since early positions allow for free riding we also hypothesized that they should be favored by the players. This is also what the data show. The first contribution is made in the first two seconds in 81 percent of all periods and in the first ten seconds in 96.7 percent of all periods. Overall, the average time that passed before a position was taken increases over the positions (later positions take an average of 10.6 seconds before they are taken). As Table 1.3 reports, this is also the case if only histories with fair contributions are considered. In principle, these histories still allow for free riding in later positions and should thus still be favored. All differences in the time passed up to the third position are pairwise statistically significant (Wilcoxon signed-rank

[5]We will henceforth define contributions of at least 30 tokens as fair.

Figure 1.1: Distribution of contributions in the first position



test, $p < 0.03$ for comparisons with the first position, $p = 0.075$ for a comparison of the second and third position).

Table 1.3: Average time passed after the previous contribution when all contributions have been fair

Position	1	2	3	4
time passed (in sec)	2.5	6.7	9.6	9.3

If we classify players according to their preferences for a specific position[6] we find that about 54% of all subjects display a preference for the first position, preferences over the remaining three positions are divided at 7%, 5.5% and 9.8% for positions 2, 3 and 4 respectively. 23% of all subjects do not display a clear preference for a specific position. The results thus are in favor of Hypothesis 2.

Result 2. *The majority of subjects prefer the first position.*

In line with the theory, this suggests that the underlying features of the cooperation problem we study exhibits a high value of moving early. In particular, subjects in general do not wait for others to contribute early as to base their contribution

[6]We elicit preferences for positions by counting the first attempt to contribute. If there was a unique position that the subject favored and the subject wanted to contribute at this position at least four times the subject was categorized as preferring that position. We also asked subjects for their preferred position in the post-experimental questionnaire. Their answers correspond well with this measure.

decision on the behavior of the other group members. The following results relate to a comparison between the two mechanisms.

1.5.2 Efficiency

Contrary to the findings for linear public goods, we find that the free allocation of contribution positions in the provision of threshold public goods does not foster cooperation. As shown in Table 1.4, groups in End provide the public good successfully in 56.1% of the cases, whereas groups in Ex succeed to provide the public good in 59.4% of the cases (robust rank order test, $\hat{U} = -0.197$, $p > 0.2$). Earnings are also similar in both treatments (robust rank order test, $\hat{U} = 0.737$, $p > 0.2$). Hence, we find no support for Hypothesis 3.

Table 1.4: Efficiency in the treatments

	Success rates	Earnings (in tokens)
End	56.1%	61.5
Ex	59.4%	64.5

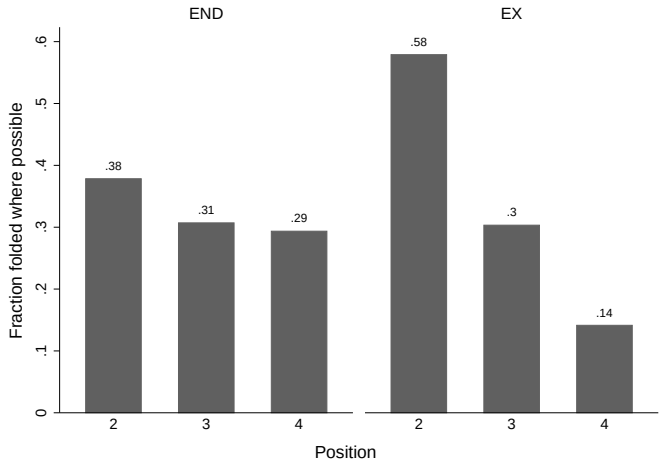
The performance of a sequential contribution mechanisms depends on two aspects. First, on the contributions made in the first position and thus also on who takes the first position. And second, on the reactions of other players to contributions of the first position. We consider both in turn.

1.5.3 Individual Behavior

1.5.3.1 Contributions at the First Position

It can be seen from Figure 1.1 that the contributions in the leading position are similar in both treatments. The average contribution in the first position of 22.5 tokens in End is not statistically different from the average contribution in the first position of 23.07 in Ex (robust rank order test, $\hat{U} = 0.141$, $p > 0.2$). Thus, a free allocation of positions does not lead to higher contributions in the first position, which is in contrast to linear public goods. The first position in the endogenous move setup attracts free riding, but not to a larger extent than if the first position is exogenously allocated.

Figure 1.2: Folding in different positions when history contained unfair contributions



1.5.3.2 Reactions in Later Positions

Figure 1.2 displays the fraction of folds in situations where the history contained unfair contributions.[7] In End, where players themselves decide when to contribute, 38% of players in the second position fold when they see an unfair contribution in the first position. In Ex, where a player is forced to make a decision facing a comparable history, this number corresponds to 58% (robust rank order test, $\hat{U} = -0.527$, $p > 0.2$). In contrast, players who choose to be in the fourth position give up public good provision in 29% of all cases with unfair histories, whereas players allocated to the fourth position fold in only 14% of these cases (robust rank order test, $\hat{U} = 5.098$, $p < 0.011$). This indicates that contributions to projects are canceled later with an endogenous move order. Obviously, delayed folding is detrimental to the efficiency of the contribution mechanism, since more contributions are forfeit. As a result, the average amount of contributions lost when the public good is not provided is 48.3 tokens in End, but only 33.1 tokens in Ex (robust rank order test, $\hat{U} = 2.502$, $p < 0.102$).

The delayed folding with an endogenous move order can be explained by the

[7]We term a history as unfair if the remaining players can still provide the public good but on average have to contribute more than 30 tokens to do so. The amount of previous contributions in unfair histories are similar over the treatments (robust rank order test, $|\hat{U}| < 1.335$, $p > 0.2$). The second position on average sees contributions of 16.5 tokens and 15.0 tokens, the third position faces total contributions of 45.8 tokens and 45.3 tokens, and the fourth position faces total contributions of 79.4 tokens and 81.8 tokens in End and Ex, respectively. In other words, the extent of observed unfairness is similar.

action space of a player who disapproves of the contribution history. In contrast to a player who is forced to contribute at a specific position, she has the option to wait for additional contributions by other players. This option, like folding, guarantees the safe payoff given by the endowment, but additionally comprises an option value for higher payoffs if other group members contribute favorably. Waiting is thus preferable to folding from an individual perspective.[8] Nevertheless, it generates a negative externality as the remaining players are, due to the players' inaction, not informed about her willingness to contribute.

Table 1.5: Average time passed after the previous contribution when the history contains unfair contributions

	position		
action in position	2	3	4
contribution	15.4	10.3	11.6
fold	24.5	18.7	8.6

Additional evidence that waiting is preferred to folding is presented in Table 1.5. In unfair situations, more time passes when the eventual decision at this position is to fold (Wilcoxon signed-rank test, one-sided $p < 0.072$)[9]. I.e., folding is only performed when longer periods of waiting do not bring forth a player that is willing to contribute.[10] Naturally, this effect is not present at the fourth position.

We can conclude that the delayed folding as well as the similar contributions in early positions reduce the attractiveness of the endogenous move order. As a consequence, a free allocation of positions is not more efficient than exogenously imposed positions. We hence find not support for Hypothesis 3.

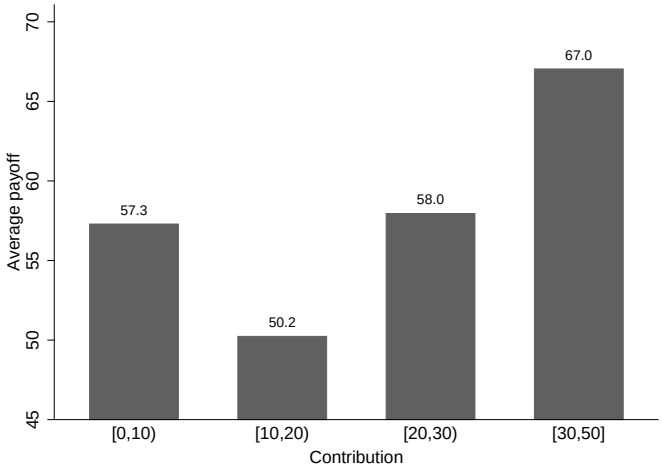
Result 3. *The public good is not provided more efficiently in* End *as compared to* Ex.

[8] Note, that players with strong social preferences, especially those with a high aheadness aversion or a high guilt aversion, might not derive a higher utility from waiting. For them late folding goes along with a loss of utility.

[9] Folding in the second position was performed only in 4 out of 6 subgroups, limiting the number of independent observations.

[10] Support for this reasoning also comes from the timing of contributions in Ex. In Ex, only 2.8 seconds pass until a player enters her contribution, independently of whether the decision is to fold or not (Wilcoxon signed-rank test, one-sided $p > 0.5$). The timing hence does not merely reflect a longer deliberation of subjects on unsatisfactory histories that are eventually folded.

Figure 1.3: Payoff of the first mover depending on contributions



1.5.3.3 Profits when Free Riding

In cooperation problems with sequential actions it is important to know whether a high concession of a first mover can induce other parties to follow the lead and thus is beneficial for the first mover's payoff. We cluster first mover contributions with respect to their fairness and depict the achieved average payoff in Figure 1.3. The subgame perfect Nash equilibrium with selfish players predicts that early high contributions do not pay off. We find the opposite in our experiment. If players can choose when to contribute, a fair contribution in the first position achieves larger expected payoffs than any degree of attempted free riding (Wilcoxon signed-rank test, $p < 0.08$ for all pairwise comparisons)[11]. By virtue of high correlations between early and later movers' contributions, maximizing expected payoffs thus requires a fair contribution in End when moving first. This is in contrast to linear public goods, where high early contributions typically do not pay off. We thus obtain the following result.

Result 4. *Contributing less than the fair amount in the first position in* End *reduces expected payoffs.*

Note that, for free riding not to pay off, the odds for provision of the public good have to be sufficiently decreased to outweight the savings on contributions. This

[11]Not every matching group generated observations in each contribution category. We alternatively test payoffs with contributions of 30 tokens and above against payoffs with contributions below 30 tokens. This yields the same result (Wilcoxon signed-rank test, $p = 0.046$.

Table 1.6: Average payoff depending on contribution, given fair history

	position		
contribution	1	2	3
$[0, 10)$	57.3	50.0	50.0
$[10, 20)$	50.2	40.0	61.0
$[20, 30)$	58.0	64.1	84.6
$[30, 50]$	67.0	73.7	80.0

decline in successful public good provision is prevalent in the first position, but less prominent in the later positions. Table 1.6 reports profits for different degrees of free riding in later positions. To ensure comparability, it only includes histories with exclusively fair contributions. Wilcoxon signed-rank tests reveal that free riding in later positions does no longer significantly change expected profits ($p > 0.24$ and $p > 0.10$ for pairwise comparisons at the second and third position, respecitvely)[12]. This suggests that when later players decide about folding, they take the fair contributions of the previous players into account. If only one of several previous players attempted to free ride, they are more likely to provide the remaining contribution.

1.5.3.4 Fairness Norms

Besides free riding, early movers can also try to induce fair allocations by contributing their fair share to the public good. It could be conjectured that inducing a fairness norm should be easier with an endogenous order of contributions because players may attribute a higher degree of intentionality to early actions. We find, however, that a fair first mover contribution is not significantly more likely to achieve a fair allocation of contributions over all players if the order of contributions is endogenous (the fair allocation results in 36.4% of the cases) than if the order of contributions is fixed (the fair allocation results in 24.2% of the cases, $\hat{U} = 0.289$, $p > 0.10$).

Table 1.7 disaggregates this result. It categorizes contributions in later positions into free riding and fair contributions and thereby reveals reactions to histories of

[12] Again, comparing payoffs with contributions of 30 and above against payoffs with contributions below 30, we get data for all categories. The second position achieves average payoffs of 73.7 with a fair contribution and 62.6 with free riding (Wilcoxon signed-rank test, p=0.17), the third position faces average payoffs of 80.0 with a fair contribution and 80.4 tokens with an unfair contribution (Wilcoxon signed-rank test, p=0.27).

[13] The table contains the share of free riding in positions 2 and 3 in End. The corresponding shares for Ex are reported in parentheses. The analysis only includes contributions that still permit public good provision.

Table 1.7: Free riding in later positions depending on history[13]

	position	
history	2	3
unfair	53.9% (54.0%)	24.4% (22.4%)
fair	33.8% (63.2%)	53.8% (38.9%)

different fairness. Initially, fair contributions seem to be triggered more easily in End. If first movers contribute less than 30 tokens in End, 53.9% of second movers decide to free ride as well, whereas, if first movers contribute their fair share, only 33.8% of second movers free-ride (Wilcoxon signed-rank test, $p = 0.12$).[14] This is remarkable because previous free riding actually permits less room for free riding in later positions. In Ex, a fair contribution in the first position leads to free riding in the second position in 63.2% of the cases, whereas this number is 54.0% when the first position attempted to free ride as well (Wilcoxon signed-rank test, $p = 0.81$).

In position 3, this pattern is reversed, however. While contributions in position 3 are comparable across histories in Ex (Wilcoxon signed-rank test, $p = 0.39$), fair histories are followed by more free riding than unfair histories in End (Wilcoxon signed-rank test, $p = 0.028$). Since players in the third position take advantage of fair contributions that have already been made in End, fair allocations are not induced more easily with an endogenous order of contributions. Our experiment does not permit to distinguish whether this pattern is driven by players that deliberately seek the third position to free ride on previous contributions.

Result 5. *Inducing a fair allocation of contributions is not easier in* End *as compared to* Ex.

1.6 Conclusions

Our experiment depicts social dilemmas in which a cooperative outcome requires a fixed amount of resources. We have shown that moving early is favored and free riding occurs in early positions. However, free riding does not seem to be an equilibrium phenomenon from a payoff maximizing perspective. Instead, it induces later movers

[14] An alternative definition of folding that includes contributions of 0 tokens after an unfair first mover contribution does not change the results qualitatively.

to deviate from their best response and to give up public good provision.

Our results also show that the endogenous move structure does not increase chances for provision of the threshold public good. The data reveals that the endogenous move structure particularly suffers from the lacking necessity to decide on folding right after dissatisfactory contributions have been made. Waiting, though individually rational, generates negative external effects on other players. Undecided players remain uninformed about the willingness to contribute of waiting players. As a consequence, more contributions to the public good have been made when a player eventually decides to give up the provision of the public good. This is in stark contrast to the case of linear public goods where an endogenous move order has been shown to increase efficiency. The payoff structure of the threshold public good suppresses this effect.

We also find that if positions are freely allocated, the party contributing first should choose a fair contribution since this increases prospects for successful public good provision considerably in our data and thus maximizes own expected payoffs. Also in later positions, fair contributions affect folding of later players to a degree that make them weakly preferable to lower contributions.

In this chapter, we have made a first step into analyzing behavior in cooperation problems with first-mover advantages when the order of contributions is endogenous. Several areas warrant further research. This chapter has shown that the way in which the move order is allocated changes behavior in late positions. To the extent that otherwise waiting players could be incentivized to announce the contributions they are willing to make, institutions might increase cooperation rates in frameworks with an endogenous order of contributions. For example, we assumed that contributions are binding and cannot be made conditional on whether total contributions exceed the threshold. Allowing for such a conditioning by the use of a refund has been shown not to have an effect with an exogenously given order of contributions (Coats et al. 2009). However, it could be especially valuable when the order of contributions is chosen by the players themselves.

For this chapter we have assumed homogeneity of the players in the game.[15]

[15]Heterogeneity among the players was only present implicity by differing risk aversion and social preferences and was thus not commonly observable.

Usually, players differ with regard to their endowment or their payoff from the public good. A framework with observable heterogeneity would allow to assess how the chances of public good provision are affected by an early move of a specific player and how the tendency to compensate missing contributions differs among types.

A Appendix

A.1 Equilibrium with Endogenously Ordered Contributions and Selfish Players

$N \in \mathbb{N}$ players are each endowed with e tokens. The public good requires $M > e$ tokens to be successfully provided and, if provided, pays g tokens. The provision of the public good is socially efficient, i.e., $Ng > M$. Without loss of generality, assume $g > e$. The utility of each player is

$$U_i = e - c_i + \begin{cases} g & \text{if } \sum_{j=1}^{N} c_j \geq M \\ \\ 0 & \text{otherwise.} \end{cases}$$

Irrevocable contributions can be made anywhere on the support T of the time dimension where $T \subset \mathbb{N}$. Define p^{t-1} as a row vector containing $t-1$ dummy variables indicating the time at which contributions took place. Likewise, c^{t-1} is a column vector of length $t-1$ containing the history of contributions.

At every time t, the following stage game takes place: All players that have not yet made a contribution decide simultaneously on $d_{it}(c^{t-1}, p^{t-1}) \in \{0, 1\}$ and $c_{it}(c^{t-1}, p^{t-1}) \in [0, e]$. d_{it} takes the value of 1 iff the player wants to contribute at this point in time. c_{it} is the desired contribution. If $\sum_i d_{it} \geq 1$ one player i with $d_{it} = 1$ is chosen at random and her contribution is implemented, i.e., $c_t = c_{it}$.

A beginning of a stage game and its consecutive stage games define a subgame. Note that $m_t(c^{t-1}, p^{t-1}) \equiv M - p^{t-1}c^{t-1} - (N - p^{t-1}\iota - 1)e$ is the minimal amount of contributions required by a player contributing at time t to make provision of the public good feasible. By backward induction we obtain[16]

[16] A player is indifferent between $d_{it} = 1$ and $d_{it} = 0$ when public good provision is infeasible and the optimal contributions would thus be zero. We assume that the player then prefers $d_{it} = 0$.

$$c_{it}(c^{t-1}, p^{t-1}) = \begin{cases} m_t(c^{t-1}, p^{t-1}) & \text{if } m_t(c^{t-1}, p^{t-1}) \leq e \\ 0 & \text{otherwise} \end{cases}$$

$$d_{it}(c^{t-1}, p^{t-1}) = \begin{cases} 1 & \text{if } m_t(c^{t-1}, p^{t-1}) \leq e \\ 0 & \text{otherwise} \end{cases}$$

as the subgame perfect Nash equilibrium strategy. The first rule defines the contribution that should be chosen if d_{it} was equal to 1. It requires to choose contributions of m_t. For contributions above m_t, the subsequent player would reduce her contribution as m_{t+1} would then be lower. Contributions below m_t would inhibit public good provision and are strictly dominated by contributions of zero. Considering whether to actually contribute, players observe that a contribution of $c_{it}(c^{t-1}, p^{t-1})$ increases their payoff compared to no contribution. Players also know that $m_t(c^{t-1}, p^{t-1})$ is increasing in $p^{t-1}\iota$ and early positions go along with weakly higher payoffs. Thus, players try to contribute early as long as the public good can still be provided. Waiting for other players to contribute when indifferent cannot be part of an equilibrium strategy.

A.2 Instructions

In the following we provide the instructions for End. The instructions for Ex were adapted appropriately and are available upon request.

General Explanations for the Participants

You are now taking part in an economic science experiment. If you read the following explanations carefully, you can earn a significant amount of money, depending on the decisions you make. It is therefore very important that you pay attention to the following explanations.

During the experiment, you will not be allowed to communicate with anyone.

Should you have any questions, please direct them directly to us. Not abiding by this rule will lead to exclusion from the experiment and from any payments.

In this experiment, we work with tokens rather than Euros. Your entire income will therefore initially be calculated in tokens. You total income in tokens will consist of the sum of your earnings in all parts of the experiment. The total sum of your earnings will be calculated in Euro and paid to you anonymously at the end of the experiment according to the exchange rate:

1 Token= 1 Eurocent.

The experiment will consist of several parts. All parts of the experiment are completely independent from each other. You will be matched with new participants in each part of the experiment. Similarly your earnings are not dependent on your decisions in a previous part. Your decisions are strictly anonymous, and you will never learn to which participants you were matched. In the same vein, we will analyze your decisions anonymously and won't connect them with your identity.

On the following pages we will describe the exact procedure of the first part. Following that there will be additional parts, which we will explain as we go along.

Informations Regarding Part 1 of the Experiment

This part of the experiment will consist of 10 periods. You will be matched with new participants in each period. Your earnings in this part of the experiment are determined by the sum of your earnings in all periods.

The Decision Situation

Before we will explain the exact procedure of the experiment, we will first explain to you the basic decision situation you and the other participants will face.

The participants will be matched in groups of 4 persons each. Thus, there will be three other members in your group. Each participant will be assigned a certain

color for identification purposes which will have no further meaning and may change in the course of the experiment.

Each participant will have a private account which will have a starting balance of 50 tokens (the so-called endowment). Your group will thus have a total amount of 200 tokens on private accounts. In addition to the private accounts, there will also be a group project.

Each participant will have to decide how many of the 50 tokens she wants to contribute to the group project. This has to be a natural number between zero and 50. These tokens will be deducted from her private account.

The contribution decisions will be made sequentially. As soon as a member of your group will make a decision about her own contribution to the group project, all other members of the group will be informed about this contribution. As soon as a participant has made a contribution decision, this decision cannot be changed.

Calculation of Your Earnings

After the period is over your income consists of two parts:

(1) The earnings from the group project.

(2) The earnings from tokens you left in your private account.

Earnings from the project are calculated as follows: If the sum of all contributions from your group to the project reaches or exceeds 120 tokens then each participant will receive a payoff of 60 tokens. This is independent from the actual amount of the individual contributions. The order of the contributions also has no influence on the earnings from the project. If the sum of contributions is smaller than 120 tokens then no participant will receive a payoff from the project. In that case earnings will consist only of the remaining tokens in the private account.

Informations Regarding the Exact Procedure of the Experiment – Part 1

To make a decision about your contribution to the project type in a natural number between zero and 50 into the input screen. To confirm your contribution click on the OK-Button. As soon as you have pressed the OK-button you will not be able to revise your decision. Your contribution will be subtracted from your private account.

You will make your contribution decision on the following screen:

Each participant of your group has one minute (60 seconds) to make his decision. As soon as you confirm your decision by clicking the OK-Button, your contribution will be announced to the other participants in the upper right corner of the screen. In the same way, you will be informed about all previous contribution decisions. It is up to you to choose the point in time at which you make your contribution decision and therefore also the point in time when it is announced to the other members of your group. If all participants announce their decisions before the 60 seconds run out you will have to wait until the end of the 60 seconds for the experiment to continue.

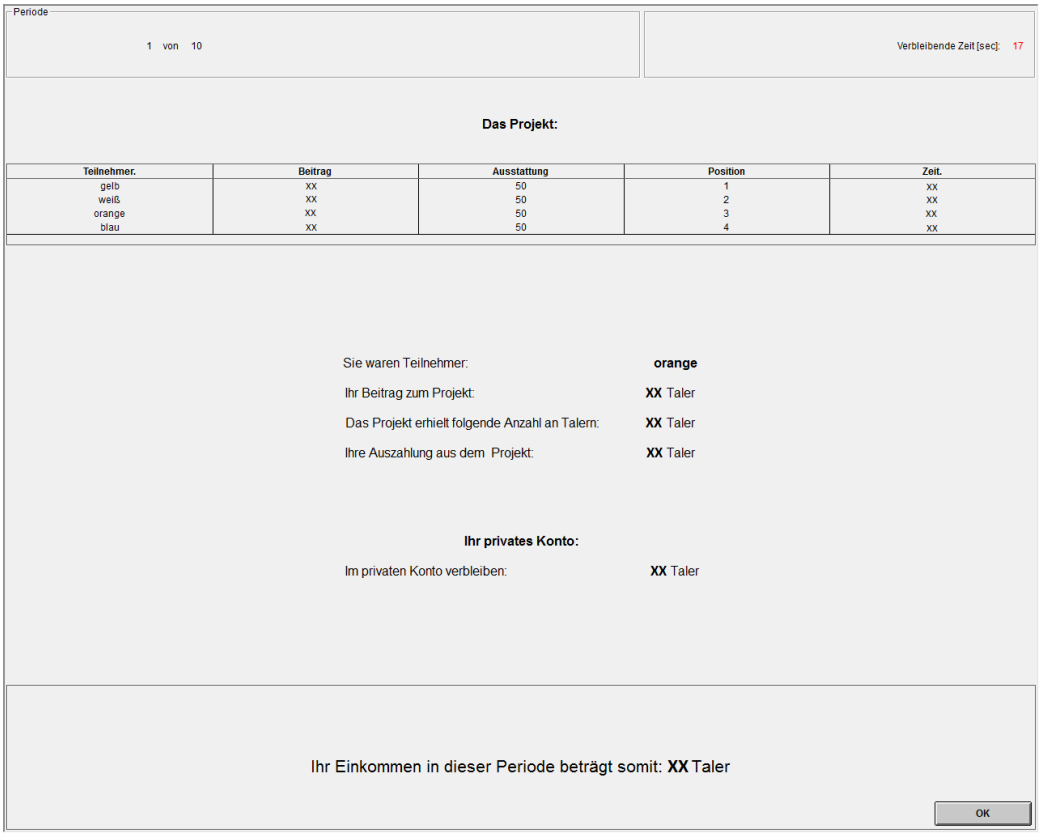
In addition to the 60 seconds all participants will have 10 seconds to familiarize

themselves with the screen. The timer will therefore start at 70 seconds. During the first ten seconds none of the participant can make a decision.

If a participant announces a decision during the last 20 seconds before time is over (that is, after the 50th second) then the time left for this period will be expanded by 20 seconds. This is to ensure that participants which have not yet made their decision are able to react to the decision. Each additional decision will increase the available time by an extra 20 seconds.

Once the time is over no more decisions can be made. All participants who have not made a decision by the end of the time will contribute zero tokens to the project. The following income screen will inform you about the total amount of contributions of all participants of the group to the project (including your own contribution). Additionally you can see how many tokens you earned in this period.

The Income Screen:



At the end of each period the contributions to the project are reset to zero. Afterwards the new period starts with a new endowment of 50 tokens.

Example 1: Participant "Orange" contributes **22 tokens** after 12 seconds. "Blue" contributes **35 tokens** at 34 seconds. "White" contributes **28 tokens** after 53 seconds. This increases the remaining time by 20 seconds until the 90th second. "Yellow" decides on a contribution of **38 tokens** at the 83th second. Therefore the sum of contributions to the project is **123 tokens**. Each participant of the group receives a payoff of 60 tokens from the group project. Assume you are participant "Yellow". Twelve tokens (=50-38) stay in your private account after the contribution to the project. In addition to the payoff from the project your income for this period is 60+12=72 tokens.

Example 2: Participant "White" contributes **0 tokens** as the first one. "Yellow" contributes **38 tokens** as the second one, "Blue" announces a contribution of **47 tokens** as the third one and "Orange" decides as the fourth one on a contribution of **35 tokens**. Therefore the sum of contributions to the project is **120 tokens**. Each participant in your group earns his payoff of 60 tokens from the project. Assume you are participant "White". 50 tokens (=50-0) are left in your private account after your contribution. Together with the payoff from the project, your income for this period is therefore 60 +50=110 tokens.

Example 3: Participant "Yellow" decides on a contribution of **35 tokens** as first. "Blue" announces his decision to contribute **12 tokens** as second. "White" contributes **24 tokens** as third and "Orange" decides as fourth on a contribution of **0 tokens**. Therefore the sum of contributions to the project is **71 tokens**. No participant in your group receives a payoff from the project. Assume you are participant "White". 26 tokens (=50-24) are left in your private account. In addition to the payoff from the project your earnings in this period are therefore 0+26=26 tokens.

If you have any questions, please raise your hand.

Control Questions

Please fill in the gaps!

Question 1: Assume you are "Yellow". So far, in your group,

"Blue" has contributed 33 tokens as the first,

"Orange" has contributed 41 tokens as the second.

You contribute 10 tokens as the fourth. After you,

"White" contributes 36 tokens as the fourth.

Sum of contributions to the project:

Your payoff from the project:

Amount left on your private account:

Your period earnings:

Question 2: Assume you are "White". So far,

"Orange" has contributed 42 tokens as the first.

You contribute 38 tokens as the second. Following you,

"Blue" contributes 13 tokens as the third (after 53 seconds) and

"Yellow" contributes 21 tokens as the fourth (after 86 seconds).

Sum of contributions to the project:

Your payoff from the project:

Amount left on your private account:

Your period earnings:

Question 3: Assume you are "Orange". The other participants have already contributed:

"White" as the first 24 Tokens,

"Yellow" as the second 10 Tokens,

"Blue" as the third 36 Tokens.

(a) What are your earnings if you contribute 50 tokens to the project?

(b) What are your earnings if you contribute 0 tokens to the project?

Before the 10 Periods will start there will be two test periods so that you can familiarize yourself with the procedure of the experiment. Just as in the payoff-relevant periods you can contribute at any point in time. The decisions of the other participants will be simulated by the computer. The contributions of the computer will be represented here by the word "Number" instead of an actual amount.

Chapter 2

Bundling Public with Private Goods

2.1 Introduction

Public goods, such as clean air, education, and culture, constitute an important ingredient of social welfare. Their provision by regional authorities is, however, often hindered by asymmetric information with respect to the valuation of the public goods. Charities evolved to fill this breach but typically have problems raising funds. Therefore, increasing the voluntary provision of public goods remains a crucial task.

This chapter introduces a new mechanism that may increase private contributions to public goods. More precisely, we show in this chapter that bundling a public good with a private good induces superadditivity. That means, offering a private good and a public good as a bundle, i.e., as a single product, may increase consumers' willingness to pay (WTP) for the combination of both goods relative to the case in which they are offered separately. An illustrative example for such a bundle is a carbon neutral flight, as it combines a flight, a private good, with a carbon offset, which constitutes a contribution to the public good of climate change mitigation.[1] Other examples in which a private good is bundled with a public good or, equivalently,

[1]Since contributions to public goods fulfill the defining characteristics of a public good (i.e., non-excludability and non-rivalry), we use the terms "contribution to a public good" and "public good" interchangeably.

features public good characteristics, include ecotourism, sustainably fished seafood, or green electricity.

Standard consumer theory assumes that bundling two goods does not affect consumers' valuations for the bundle's parts (e.g., Adams & Yellen 1976, Jehiel et al. 2007, Armstrong & Vickers 2010). However, several behavioral concepts suggest that a decision maker may exhibit a different valuation for two goods if they are bundled. For example, the presentation of two goods as a bundle can decrease the salience of the bundled goods and lead to lower valuations for the combination of both goods (e.g., Rottenstreich & Tversky 1997, Bernasconi et al. 2009). Bundling may also affect the way in which consumers aggregate information about the bundled goods' attributes and therefore influence their valuations (Tversky & Kahneman 1974, Anderson 1981).

The literature on the evaluation of bundles has so far focused exclusively on bundles of either only private or only public goods. The key contribution of this chapter is to show, based on different behavioral concepts and experimental data, that bundles of public and private goods are special in the way they are evaluated. More precisely, we argue that a consumer's evaluation of such a bundle, which we call *hybrid bundle*,[2] is subject to specific behavioral channels that are absent for bundles of only private or only public goods.

One of those channels are spillovers from one good to another. It is well established that cues like the brand name can affect the perception of a good's quality (see the review of Lee et al. 2006). However, also items bundled to a good may either directly hint at the value of the good (Popkowski Leszczyc et al. 2008) or reveal information about the selling firm's trustworthiness in providing good quality and caring about customer needs (Siegel & Vitaliano 2007). Since public goods are positively connoted, they are likely to induce positive inferences about the associated private good in a hybrid bundle. For example, many people conjecture that fair trade food is organic, although the label "fair trade" only guarantees compliance with requirements on working conditions and employee remuneration. Consumers have also been shown to like the taste of a milk shake better if it is labelled as organic (Linder 2011).

[2]Other research suggested the term "impure public good" for a combination of public and private goods. However, this term is also used for goods that exhibit either excludability or rivalry in consumption. To avoid confusion, we instead use the term "hybrid bundle" to capture that a pure public good, whose consumption is non-excludable and non-rival, is combined with a private good, whose consumption is excludable and rival.

Also consumers' desire for a positive self-image (e.g., Brekke et al. 2003, Bénabou & Tirole 2006) can affect their valuations. If a public good is bundled with a durable private good, the use of the latter can remind the consumer of the good deed she performed. The warm glow stemming from the good deed (Andreoni 1989, 1990) can in this way be extended to the duration of use of the private good. A sophisticated consumer anticipates the additional future utility that the hybrid bundle generates and thus exhibits a higher WTP for the bundle. More concretely, a driver of a hybrid car may experience warm glow whenever using the car. The purchase of a carbon offset, in contrast, does not feature the advantage of continuously reminding the consumer of her character.

These and other channels that we discuss in this chapter predict that bundling public and private goods increases the valuation for the combination of the two goods. Nonetheless, it remains an empirical question whether hybrid bundling affects consumer valuations strongly enough to be of economic relevance. Since clean data that allow for a test of superadditivity in hybrid bundles can hardly be obtained in the field, we investigate this question in the controlled environment of a laboratory experiment.

In a between-subjects design, we analyze the effect of hybrid bundling on individuals' valuations. In the spirit of the method introduced by Becker, DeGroot & Marschak (1964), subjects receive an endowment and make a series of purchase decisions in which they face different prices for the two goods. At the end of the experiment one of the choice situations is randomly drawn to be payoff relevant. From subjects' choices we obtain their willingness to pay (WTP) for the offered goods. In the SEPARATE treatment, both a private good (a cup) and a public good (a €2 donation to charity) can be purchased *separately*, while in the BUNDLE treatment the public good is only available in the form of a *bundle* with the private good. Two control treatments, in which the public good is replaced by a private good (a €2 voucher for an online store), further examine whether the effect of bundling on subjects' WTP depends on the nature (public vs. private) of the bundled goods.

We find that subjects exhibit a significantly higher valuation for the hybrid bundle than for the combination of both goods when sold separately. Individuals' WTP for the hybrid bundle, on average, exceeds that for the separately offered goods by more

than 60%, revealing a strong superadditivity evoked by hybrid bundling. Moreover, we do not observe superadditivity when bundling two private goods. Thus, the nature of the bundled goods seems to play a decisive role for the effect of bundling on valuations.

The strong increase in the WTP documented in our experiment suggests sizeable economic effects of hybrid bundling. In particular, our data indicate that bundling can help to increase the provision of public goods. Some charities already use private goods to encourage donations. For example, the World Wide Fund for Nature (WWF) promotes animal adoptions with an "adoption kit" that contains a stuffed animal. Similarly, the Lance Armstrong Foundation uses the profits from the sale of Livestrong apparel in the fight against cancer.

Our results also provide a potential explanation for the recent increase in Corporate Social Responsibility (CSR)[3] measures, since companies linking social activities to the sales of their products effectively offer hybrid bundles. For example, the Danone group promised to provide 10 liters of drinking water in African countries for each liter of Volvic mineral water sold. Similarly, IKEA ties a $1 donation to purchases of child related products in its annual Christmas campaigns. Our data suggest that firms may benefit from CSR because it induces a different perception and use of their products, allowing firms to pass on the costs of the public good and to still increase sales.[4]

The superadditivity in the evaluation of hybrid bundles, conceptualized and empirically documented in this chapter, is a useful building block for the explanation of these phenomena. It is worth noting that, in principle, all market participants may gain from hybrid bundling and the resulting superadditivity. How consumers' augmented valuation is split up between consumers on the one hand and firms and the social cause on the other hand is ultimately determined by the market structure.

The rest of this chapter is organized as follows: In Section 2.2, we describe the design of our experiment. The main behavioral predictions are derived in Section 2.3.

[3]The European Commission defines CSR as a "concept whereby companies integrate social and environmental concerns in their business operations [...] on a voluntary basis" (Commission of the European Communities 2001).

[4]Other explanations of firms' engagement in public good provision rely on complementarity between private and non-marketed public goods (Heal 2003) as well as on firms' altruism and their desire to avoid pressure from interest groups (Baron 2001).

Section 2.4 reports the results of our experiment. Further channels that may affect consumers' valuation for a hybrid bundle in the field are discussed in Section 2.5. The chapter concludes with a discussion of our findings and suggestions for future research in Section 2.6.

2.2 Design

Central to our experiment is the comparison of subjects' willingness to pay for a public and a private good when both goods are sold either as a bundle or separately. We elicit subjects' WTPs by offering the goods at varying prices and observing subjects' purchase decisions. To control for effects of bundling that are independent of the type of the bundled goods, we perform the same analysis also with two private goods.

In this section, we first present the goods used in the experiment and sketch the basic structure of the conducted treatments. Subsequently we discuss the treatments and the elicitation of subjects' WTPs in more detail. We conclude this section with a description of the experimental procedures.

2.2.1 Goods

In the main condition (PUBLIC), subjects are offered a private and a public good. We use a cup as the private good because the benefits of possessing the cup mainly accrue to the cup holder. As the public good, we use a donation of €2 to a nationally renowned charity providing help for children in need. The services provided by the charity, such as improved health care and education, generate non-excludable and non-rival benefits to the society and thus fulfill the characteristics of a public good.[5] Upon purchase of the donation, the experimenters donate €2 to the charity, while subjects pay the respective purchase price. Thus, the objective value of the public good is fixed, while its price can be altered.

In the control condition (PRIVATE), we consider bundling of two private goods. As the first private good we use the same cup as in the PUBLIC condition. The second private good is a voucher for an online store denominated at €2. This choice

[5]The notion that services provided by charities constitute public goods is also applied in, e.g., Andreoni (1990), Glazer & Konrad (1996), and Elfenbein et al. (2012).

of goods keeps the level and the salience of the goods' objective values constant across conditions.

2.2.2 Treatments

The experiment consists of two conditions, PUBLIC and PRIVATE, that differ in the available goods. In each condition, two treatments capture the effect of bundling in a between-subjects design. While the two goods are available separately in the SEPARATE treatments, the donation or voucher is bundled with the cup in the BUNDLE treatments. For an increased comparability between treatments, the cup is available as a distinct product in the BUNDLE treatment as well. The resulting 2x2 design is depicted in Table 2.1.

Table 2.1: Treatments

Treatment	1st good on offer	2nd good on offer	Observations[6]
PUBLIC-SEPARATE	cup	donation	44
PUBLIC-BUNDLE	cup	cup with donation	32
PRIVATE-SEPARATE	cup	voucher	37
PRIVATE-BUNDLE	cup	cup with voucher	42

2.2.3 Elicitation of WTPs

For each condition, our aim is to compare participants' willingness to pay for the combination of two goods between the SEPARATE and the BUNDLE treatment. The standard approach for an incentive compatible elicitation of a WTP goes back to Becker, DeGroot & Marschak (1964). We adapt this method so that it can determine individual valuations for two goods at a time.[7] Participants receive an endowment of €10 and make purchase decisions in various choice situations, all featuring different prices for the two goods on offer. At the end of the experiment, one of these situations is randomly drawn to determine a subject's payment. The respective purchase decision is then implemented, i.e., the subject receives the purchased goods if she intended

[6]The sample is unbalanced because of no-shows and subjects that failed to answer the post-experimental control questions correctly (see Section 2.2.4 and Appendix B.2).

[7]For a detailed explanation of the restrictions of the standard BDM method in our setting see the end of this section.

to buy any, and the corresponding prices are deducted from her endowment.

In the following we describe the purchase options in the SEPARATE and the BUNDLE treatment in more detail. For simplicity, we focus on the PUBLIC condition, but all explanations hold analogously for the PRIVATE condition. As the choice situation in Table 2.2 illustrates, the SEPARATE treatment replicates the standard environment that consumers generally face: a private and a public good are available separately, and the consumer can decide for each good whether she wants to buy it or not. Hence, in every choice situation a subject has four options: a) buying nothing, b) buying the private and the public good, c) buying only the private good, or d) buying only the public good.

Table 2.2: PUBLIC-SEPARATE treatment

situation	cup	donation
nr. 19	price: €0.50 O buy O don't buy	price: €1 O buy O don't buy

In the BUNDLE treatment the public good is offered in a bundle with the private good. In addition, to increase the comparability with the SEPARATE treatment, the private good can also be purchased on its own. Thus, as the choice situation in Table 2.3 illustrates, subjects in the BUNDLE treatment choose between a) buying nothing, b) buying the bundle of the private and the public good, and c) buying only the private good. Also this setting is familiar to subjects since they often choose between similar products, of which one has the additional feature of ensuring contributions to a public good.

Table 2.3: PUBLIC-BUNDLE treatment

situation	cup	cup with donation	nothing
nr. 19	price: €0.50 O buy	price: €1.50 O buy	O buy nothing

Our design allows to elicit valuations for the combination of both goods, for the

cup, and for the donation. To elicit these valuations, all choice situations differ with respect to the prices of the offered goods. More precisely, the price of the cup varies in steps of €0.50 between €0 and €3.50, whereas the price of the donation varies in steps of €0.20 between €0 and €2.40. Every possible combination of cup and donation price constitutes one choice situation, yielding a total of 104 situations. The price intervals cover a broad range of possible valuations, but keep the number of required decisions manageable. The choice situations are ordered lexicographically, first with respect to the cup price and second with respect to the donation price. In the BUNDLE treatment, the price of the bundle equals the sum of the cup and the donation price.[8]

From subjects' decisions we derive measures for their valuation for the different goods. In both treatments we use the highest total price at which a subject acquired both goods (i.e., chose option b) as a measure of her WTP for both goods. Likewise, we obtain a measure of the WTP for the cup from the highest cup price at which a subject bought the cup *exclusively* (i.e., chose option c).[9] As a consistent measure of the valuation for the donation, we use the highest premium subjects tolerate to obtain the donation in addition to the cup. Table 2.4 again summarizes these different measures and their elicitation.

Table 2.4: Elicitation of valuations in the PUBLIC condition[10]

Measure	SEPARATE	BUNDLE
WTP for the cup *and* the donation	highest total price at which both goods are bought (option b)	highest price at which the bundle is bought (option b)
WTP for the cup	highest price of the cup at which it is bought exclusively (option c)	
premium for the donation at a given cup price	highest price of the donation at which it is bought along with the cup (option b)	highest surcharge accepted to obtain the bundle instead of the cup alone (option b)

To test for superadditivity induced by hybrid bundling, we compare subjects'

[8]Instructions and screenshots can be found in Appendix B.2 and B.3.

[9]In some cases, subjects in the BUNDLE treatment always preferred a purchase of the bundle to a purchase of the cup alone. Then, we cannot determine the WTP for the cup and set it to zero. The measure of the WTP for the cup is thus likely to be biased downward in the BUNDLE treatment. However, this does not change our findings qualitatively.

[10]All measures are obtained analogously in the PRIVATE condition.

WTP for the *combination of both goods* between the SEPARATE and the BUNDLE treatment. This way, our results are not influenced by complementarity or substitutability between the goods. The valuation for the single goods may provide additional insights into the driving forces behind potential valuation differences.

Having outlined the design of our experiment, we would like to point out some noteworthy aspects of our novel approach of eliciting the WTP for two goods at a time. First of all, it incorporates the most important features of the Becker-DeGroot-Marschak (BDM) method (1964) for the elicitation of WTPs, as for example the random draw of the final price. For our purposes, however, the standard BDM method cannot be applied separately to measure the WTP for two goods. This would require the random draw of two prices, which leaves two options for the timing of their revelation. On the one hand, revealing the drawn prices only *after* choices for both goods have been made leaves the subject uninformed about whether she obtained the first good when deciding about the purchase of the second good. In this case, not only the uncertainty about the remaining endowment but also substitutability or complementarity between the goods could bias the obtained WTPs. On the other hand, revealing the price draw for the first good *before* eliciting the WTP for the second good may render the WTP for the second good uncomparable between subjects. The reason is that, after the price draw for the first good, subjects' remaining endowments for the acquisition of the second good are likely not identical. To overcome this problem, we adapt the standard BDM procedure by using *price combinations* for both goods from which one combination is drawn at the end of the experiment to become payoff relevant.

2.2.4 Procedure of the Experiment

The experiments were conducted in 2011 in the BonnEconLab, using the experiment software BoXS (Seithe 2012). We recruited a total of 182 subjects for the experiment using ORSEE (Greiner 2004). The subject pool consisted of about 6300 subjects, most of them undergraduate students of all majors from the University of Bonn.[11] Upon arrival, subjects were randomly assigned to private cubicles. The instructions

[11]Participants in the experiment were on average 24.0 years old, 41.2% of them were females. Subjects' sociodemographic variables are summarized in Table 2.6 in Appendix B.1.

were read aloud, whereas questions were answered in private.

Before subjects received a detailed explanation of the goods they could purchase in the experiment, they had to correctly answer control questions relating to the modified BDM procedure. We also checked whether subjects understood the payoff consequences of choosing the donation or the voucher. However, performing this test before the experiment would have risked that subjects anchored their WTP at the objective value of these goods. This test was thus performed only at the end of the experiment with a second set of six control questions (see Appendix B.2). Since we are only interested in analyzing the behavior of subjects who understood the fundamentals of the experiment, participants that made more than three mistakes in answering these questions or were unable to provide the correct anwers in a maximum of three trials are excluded from the analysis.[12] Nevertheless, including them yields qualitatively similar results at the 10% significance level.

The number of observations in each treatment is reported in Table 2.1. Each session of the experiment lasted no more than one hour. Subjects received average earnings of €10.77[13], which include their remaining endowment after the implementation of the randomly drawn choice situation as well as the retail price of the acquired goods.

2.3 Behavioral Predictions

According to standard economic theory, a consumer's willingness to pay for a combination of two goods should stay unaffected by whether she can buy the goods separately or as a bundle. After all, bundling does not alter the goods' inherent characteristics. This holds irrespectively of whether the goods are complements or substitutes.[14] Although complementarity or substitutability between goods can alter the valuation for the combination of the goods, this valuation should not be influenced by bundling.

However, there is reason to expect that hybrid bundling induces valuations that

[12]Based on this criterion, a total of 27 subjects had to be excluded from the analysis, corresponding to 14.8% of all participants.

[13]At the time of the experiment, 1 Euro was worth approximately 1.36 US Dollar.

[14]For an account of affect-based complementarity between public and private goods, see Strahilevitz & Myers (1998).

are not additive but *super*additive. The channels we propose in this chapter suggest that hybrid bundling results in a higher WTP for the combination of the private and the public good than if both goods were offered separately. Our design focuses on two channels, which we discuss below. Additional behavioral channels that may be present in the field are discussed in Section 2.5.

First, consumers with image concerns may use hybrid bundles to *signal social preferences*. Depending on the observability of the purchase and the consumption of the hybrid bundle, this signaling can be directed both to others (e.g., Bénabou & Tirole 2006, Ariely et al. 2009) and to oneself (e.g., Brekke et al. 2003, Bénabou & Tirole 2006). Evidently, driving a hybrid car allows for more signaling than driving a conventional car and purchasing the corresponding carbon offset. The same is true for yoghurt bundled with a donation. Its purchase in the supermarket signals social preferences both to oneself and to other customers, while arranging the same donation in private only allows for self-signaling.

The signaling of favorable personality traits ought to have a particularly strong influence on the evaluation of a hybrid bundle if the private good component is durable. In this case, the use of the hybrid bundle can *extend the warm glow* that is generated by the public good component (see Andreoni 1989, 1990 for the concept of warm glow). We expect a prolongation of warm glow based on consumers' limited attention and imperfect recall. Whenever the consumer uses the private good, an association with the good deed is triggered. This yields a lasting improvement of both the consumers' public image and her self-image. To illustrate this point, think of a consumer donating to a charity. If this donation is bundled with a wristband, wearing the wristband allows to easily recall and signal favorable personality traits. In the same vein, we expect subjects to experience an extended warm glow from self-signaling when they use the hybrid bundle from our experiment. A decision maker who anticipates this additional utility will therefore display a higher WTP for the bundle.

Second, bundling a public good with a private good may induce *spillovers on the perception of the private good*. For bundles of private goods, Popkowski Leszczyc et al. (2008) have already documented such spillovers between goods. They show that a consumer who is uncertain about the value of a bundle tends to infer its value from

a component she is certain about. However, such spillovers need not be restricted to value inferences, but may extend to other attributes of different salience. Early work on the assessment of subordinates has shown, for example, that the rating of salient physical qualities affects the rating of intellectual qualities (Thorndike 1920). Recent work on the rating of goods has identified similar interdependencies. For example, an organic label can affect the liking of the taste of a milk shake (Linder 2011). Hybrid bundling may induce similar effects. In particular, public goods could trigger positive connotations in the consumer that affect the rating of the attached private good.

It has also been suggested that consumers draw inferences about firms when their trustworthiness in providing quality is unobservable. For example, Siegel & Vitaliano (2007) hypothesize that consumers use CSR activity to infer attributes of a firm's products as well as its honesty and reliability. In support of this hypothesis, they find for U.S. data that companies are more likely to engage in CSR the harder it is for consumers to evaluate their products before purchase. Likewise, Elfenbein et al. (2012) show that directing a certain percentage of auction proceeds to charity serves as a substitute for reputation in online auctions. With respect to our experiment, we conjecture that the public good conveys positive connotations to the cup if both are sold as a hybrid bundle.

Since both the signaling and the spillover channel can only be active in the PUBLIC condition but not in the PRIVATE condition, we obtain the following hypothesis.

Hypothesis. *The willingness to pay for the combination of both goods is higher in the* PUBLIC-BUNDLE *treatment than in the* PUBLIC-SEPARATE *treatment. There is no increase in the valuation for both goods from the* PRIVATE-SEPARATE *to the* PRIVATE-BUNDLE *treatment.*

While both outlined channels should increase the WTP for the combination of the goods in the PUBLIC condition, each channel affects the valuations of the individual goods differently. More precisely, in the presence of spillovers, the perception of the cup is altered and its WTP should increase. In contrast, the channel of signaling should leave the WTP for the cup unchanged but increase the premium for the public good.

2.4 Results

We start this section by analyzing subjects' purchase decisions for a private and a public good which are either offered in the form of a bundle or separately. To ascertain that the described behavior is specific to the type of the bundled goods, we subsequently contrast the results for hybrid bundles to those for bundles of two private goods. The main focus of our analysis lies on the willingness to pay for *both* goods, which is the highest sum of prices at which both goods are bought, i.e., option b) is chosen.

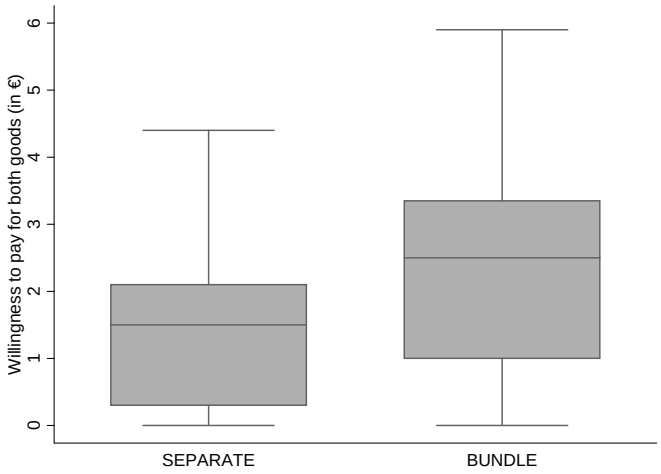
In line with our initial hypothesis, offering the public and the private good as a hybrid bundle indeed increases subjects' WTP for the combination of both goods. Not only the effect itself but also its size is striking: the average WTP for both goods increases from €1.54 in the SEPARATE treatment to €2.48 in the BUNDLE treatment (Wilcoxon rank-sum test, $p = 0.008$)[15]. This corresponds to an increase of more than 60%. The boxplot in Figure 2.1 depicts the distribution of the willingness to pay for both goods. It reveals that the observed superadditivity is not only driven by a minority of subjects but rather constitutes a general behavioral pattern. In particular, the median WTP in the BUNDLE treatment exceeds the upper quartile of the WTP in the SEPARATE treatment.[16] Merely being offered a private and a public good in a bundle instead of separately hence considerably alters individuals' valuations. The size of the effect suggests that bundling public and private goods entails significant consequences for market demand.

Having established that hybrid bundling induces superadditivity, it is further instructive to analyze the WTP for the private good when it is bought exclusively. The average WTP increases from €0.67 in the SEPARATE treatment to €1.39 in the BUNDLE treatment (Wilcoxon rank-sum test, $p = 0.010$), which corresponds to an important share of the increase in the WTP for the combination of both goods. Thus, the presence of the hybrid bundle not only changes the price that subjects are willing to pay for both goods, but also seems to alter the perception of the cup itself. This suggests that spillovers constitute a relevant channel for the observed superadditivity.

[15] Unless specified otherwise, all tests reported in this chapter are two-sided.

[16] The median of a distribution is depicted by the vertical line in the box, whereas the limits of the box indicate the upper and the lower quartile.

Figure 2.1: Willingness to pay for both goods, PUBLIC condition

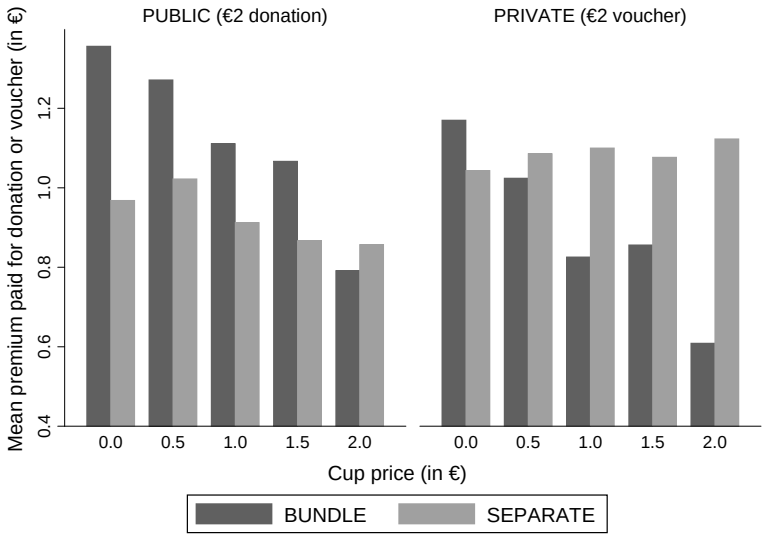


When inspecting subjects' valuation for the public good, we have to keep in mind that, in the BUNDLE treatment, the donation can only be ensured if the cup is bought, i.e., by choosing option b). For a comparable assessment of subjects' valuations across treatments, we may hence only focus on situations in which subjects buy the cup. For these situations, we compare the *premia* that participants are willing to pay for the donation at a specific cup price. A premium corresponds to the maximum additional price that is paid on top of the cup price to ensure the donation. At this donation price a subject still buys both goods (option b), whereas she no longer does so at higher donation prices (option a, c, or d). We restrict the analysis to cup prices of up to €2. Only two subjects in the PUBLIC-SEPARATE treatment exhibit a higher valuation for the cup, rendering choices for cup prices above €2 uncomparable across treatments. Note that this focus imposes no major restrictions since the retail price of the cup of €1.65 is contained in the analyzed price range. We are left with a total of 65 choice situations and a minimum of six observations for every cup price in each treatment.

The left-hand part of Figure 2.2 depicts the premia that subjects pay for the donation in the SEPARATE and the BUNDLE treatment.[17] For a cup price of €0, subjects on average pay more to obtain the donation in addition to the cup if both goods are offered in a bundle (Wilcoxon rank-sum test, $p = 0.078$). Furthermore, the mean premium for the public good gradually decreases with higher cup prices in the

[17]Note that higher cup prices make purchases of the cup less likely, resulting in a decreasing number of observations along the categorical axis.

Figure 2.2: Mean premia paid for the donation or the voucher, given cup purchase



Bundle treatment (Spearman's rank correlation test, $p = 0.032$), while it is more invariant in the Separate treatment (Spearman's rank correlation test, $p = 0.66$). This suggests that subjects evaluate the cup and the donation independently if and only if both goods are offered separately. Given this pattern, the mean premium for the donation is no longer significantly different between treatments for strictly positive cup prices (Wilcoxon rank-sum test for each cup price, $p > 0.37$). The described pattern also stands out in a random-effects interval regression (reported in Appendix B.1), a random-effects tobit regression, and a simple OLS regression.

An alternative measure of a subject's valuation for the public good is the *relative frequency* of public good purchases, i.e., the percentage of choice situations in which the subject buys the donation. In contrast to the premium, this measure has the advantage of including all observations. In particular, it also contains subjects' choices in which they do not buy the cup. A caveat of this measure, however, is that it is biased towards higher purchases of the donation in the Separate treatment. The reason is that acquiring the donation in the Bundle treatment requires to also buy the cup and is therefore weakly more expensive than in the Separate treatment. The left column of Table 2.5 provides data on the fraction of situations in which the donation is bought.[18] Subjects in the Separate treatment buy the donation in 41.8%

[18]In accordance with the analysis above, we again include choice situations with cup prices up to €2.

of the choice situations, whereas subjects in the BUNDLE treatment buy the donation in 42.6% of the situations. Hence, bundling the donation with the cup does not lead to less purchases of the donation (Wilcoxon rank-sum test, $p = 0.47$, one-sided). This is particularly striking since donation purchases in the BUNDLE treatment require the joint purchase of the cup. In total, the data suggest that offering the donation in the bundle also increases subjects' valuation for the donation. This hints at self-signaling as a further relevant channel for the emergence of superadditivity in hybrid bundles.

Table 2.5: Relative purchase frequencies of the donation or the voucher

Treatment	PUBLIC	PRIVATE
SEPARATE	41.8%	44.1%
BUNDLE	42.6%	30.4%

We now turn to the PRIVATE control condition in which the donation is replaced by a voucher. Conducting the same analysis as above reveals considerable differences to the PUBLIC condition. In the PUBLIC condition, we found a substantial increase in the willingness to pay for the combination of a private and a public good if both are bundled. In the PRIVATE condition, however, this effect is not present. Subjects' WTP for the combination of the cup and the voucher does not significantly differ between the SEPARATE and the BUNDLE treatment. On average, participants pay up to €2.15 when facing the two private goods separately and up to €2.20 for the bundle of both goods (Wilcoxon rank-sum test, $p = 0.95$).

We also find that the WTP for the basic private good, i.e., the cup, is not affected when it is bundled with another private good. Subjects' average WTP for the cup amounts to €1.20 in the SEPARATE treatment, whereas it is €1.26 in the BUNDLE treatment (Wilcoxon rank-sum test, $p = 0.97$). At the same time, the right-hand part of Figure 2.2 reveals that, contrary to the case of an attached public good, subjects' valuation for the voucher is not augmented if it is offered in a bundle with the cup. The premia are comparable between the BUNDLE and the SEPARATE treatment for low cup prices (Wilcoxon rank-sum test, $p > 0.41$ for cup prices $\leq$ €0.5). However, for cup prices exceeding €0.50 subjects are less willing to spend money on the voucher when it is bundled (Wilcoxon rank-sum test, $p = 0.100$, $p = 0.284$, $p = 0.030$ for cup

prices of €1, €1.50 and €2, respectively). The reason is that, as in the PUBLIC condition, the tolerated premium in the BUNDLE treatment again decreases with the cup price, but this time it is not subject to a general upward shift. Again, this observation is supported by a random-effects interval regression (reported in Appendix B.1), a random-effects tobit regression, and a simple OLS regression.

Further evidence on the evaluation of the voucher comes from an examination of its purchase frequencies. As reported in the right column of Table 2.5, the voucher is bought in 44.1% of the choice situations in the SEPARATE treatment, while it is bought in only 30.4% of the situations in the BUNDLE treatment. Hence, bundling the voucher with the cup leads to less purchases of the voucher (Wilcoxon rank-sum test, $p = 0.007$, one-sided). This is not surprising per se, since subjects in the BUNDLE treatment have to buy the cup along with the voucher. However, this result is in stark contrast to the PUBLIC condition, in which purchases of the public good stay unaffected by bundling.

It should generally be noted, however, that we cannot compare the willingness to pay for the cup and the bundle across the PUBLIC and the PRIVATE condition. Not only are the offered goods different, but also the level of awareness of the public good, even though constant *within* each condition, is distinct *across* conditions. Subjects in the PUBLIC condition are explicitly made aware of public good issues by being provided with the opportunity to spend money on a public good within the experiment. This in turn leads to different perceived opportunity costs of purchasing the cup between the PUBLIC and the PRIVATE condition. In the post-experimental questionnaire, nine out of 44 participants in the PUBLIC-SEPARATE treatment stated that they considered the donation as more meaningful than the cup. This suggests that the opportunity costs of acquiring the cup were relatively high in the PUBLIC condition, which induced a lower demand for it in this condition.[19] We did not observe similar statements in the PRIVATE condition.

Despite random assignment of subjects to treatments, a concern could be that our results are due to sampling. In the post-experimental questionnaire, we therefore elicited variables that might affect the general spending patterns of subjects (see

[19]That the awareness of opportunity costs alters purchase decisions has been demonstrated by Frederick et al. (2009).

Table 2.6). All non-parametric results of this chapter are supported in regressions controlling for these sociodemographic and personality variables.

Summarizing and interpreting our results, we can state the following: Bundling a public and a private good significantly increases the willingness to pay for the combination of both goods. No such effect is observed if two private goods are bundled. We conclude that it is the combination of a *public* and a *private* good that plays a decisive role for the documented superadditivity.

2.5 Further Channels

The results of our experiment are in line with the two behavioral channels of signaling and spillovers. However, these channels are not necessary for creating superadditivity, since the field offers a wider range of channels than our experiment. The following discussion of additional channels indicates that many hybrid bundles may induce superadditivity, though the relevance of each channel will depend on the specific bundle and context in question. We first describe channels that are predominantly active for hybrid bundles. Subsequently, we turn to channels which affect the valuation of all types of bundles and discuss why all channels proposed in this section are inactive in our experiment.

2.5.1 Hybrid Bundles

First, by attaching a public good to a private good, the willingness to pay for the public good might increase because the presence of the hybrid bundle in the market can raise consumers' *awareness of the public good*. Awareness of the externalities of one's actions and a strong feeling of personal responsibility, in turn, have been shown to prompt decision makers to partly internalize these externalities and act less selfishly (e.g., Mazar et al. 2008, Hamman et al. 2010).

Second, offering a bundle entails a *suggestion* to the consumer and thereby shapes consumers' purchase decisions, similar to a default. Seeing the bundle, the consumer may conjecture that the retailer expects consumers to be interested in buying it. This implicit suggestion by the retailer creates an additional purchase incentive. The suggestive power entailed by the presentation of options has been shown for investment

and savings behavior as well as for organ donations (e.g., Benartzi & Thaler 2001, Madrian & Shea 2001, McKenzie et al. 2006). A sufficient condition for such effects is a decision maker's uncertainty over her preferences (Kamenica 2008). Companies' product lines may also alter consumers' beliefs about the consumption of others. If a hybrid bundle is offered, these altered beliefs may create a social norm to contribute to the public good and thereby trigger conditionally cooperative behavior (e.g., Cialdini et al. 1990, Traxler & Winter 2012). Such an effect on demand is generally not induced by bundles of private goods.[20] Therefore, the suggestive power of hybrid bundles should be stronger than that of bundles of private goods. The induced demand is in turn reflected in a higher WTP for the hybrid bundle than for the separate goods before the bundle's introduction.

2.5.2 Bundles in General

It has been shown that consumers make mistakes in *information aggregation* when evaluating bundles of private goods. According to experiments by Gaeth et al. (1991) and Yadav (1994), information aggregation is performed by averaging over the separate categorial evaluations of a bundle's components. In this process, the individual evaluations obtain *weights that do not reflect the components' values*. This can both be a consequence of simple averaging (Anderson 1981) or an anchoring and adjustment heuristic (Tversky & Kahneman 1974). Due to this biased information aggregation, attaching a high-quality but low-value good (such as a rather small donation to charity) to another good may disproportionally increase the quality rating of the two goods and hence the overall WTP.

Furthermore, based on prospect theory (Kahneman & Tversky 1979), Thaler (1985) argues that consumers have a *preference to integrate losses*. Thus, the presentation of a single price for multiple items, i.e., bundling, can increase the demand for these items. This argument is supported in experiments on bundles of private goods (e.g., Drumwright 1992, Johnson et al. 1999).

Moreover, the purchase of two goods in the form of a bundle also reduces the *pain of paying* and the *transaction costs* that go along with every purchase. The

[20] An exception may be bundles of private goods with network effects, since they may induce similar interdependencies in decision makers' utility.

former implies that consumers prefer to reduce the number of monetary transactions (Prelec & Loewenstein 1998, Rick et al. 2008). The latter, transaction costs, are well accepted to be part of every purchase. Bundling does not only change the number of transactions for the purchase of multiple products but can also reduce the search costs related to their acquisition. For example, consumers often have to find suitable complementary products for goods they wish to purchase (e.g., a zoom lens for a camera). Similar search costs are present for public goods. For example, donations can be directed to multiple organizations which differ in their scope and efficacy. By suggesting particular organizations or projects, a firm selling a bundle reduces these costs.

All channels explained above drive an increase in the valuation for bundles. Nonetheless, there also exists a behavioral channel which supports subadditivity. More precisely, unpacking a good into its parts can increase the parts' salience and thereby raise the valuation for the sum of its components. This has been termed the "unpacking effect". For instance, Rottenstreich & Tversky (1997) find that subjective probabilities of uncertain events increase when the events are decomposed into disjoint components. Subadditivity in valuations has also been documented for events described in different detail (Johnson et al. 1993, Van Boven & Epley 2003) and for the demand of either unpacked private goods (Bateman et al. 1997) or unpacked public goods (Bernasconi et al. 2009). Thus, if bundling decreases the *salience of product characteristics*, bundles may also be valued less than the sum of their parts.

2.5.3 Discussion

None of the channels presented in this section drives the results of our experiment. We explain in the following how these channels are precluded by the experimental design.

Both the SEPARATE and the BUNDLE treatment provide the opportunity to make a contribution to the public good, effectively inducing the same level of awareness of the public good. Moreover, in contrast to firms' product lines, the goods offered in the experiment are evidently not a response to market demand. Hence, subjects in both treatments learn the same about the desirability of the public good and the

purchase behavior of others. The hybrid bundle thus neither entails suggestive power nor does it increase the awareness of the public good in the experiment.

Also channels affecting bundles in general are either inactive or controlled for by the PRIVATE treatments. Since the offered goods have comparable objective values (€1.65 for the cup vs. €2 for the donation and the voucher), subjects are unlikely to make substantial mistakes if they assign equal weights to the goods in their information aggregation. Furthermore, the experiment keeps both the degree of detail in the description of the goods and the individual goods' salience constant across treatments to exclude valuation differences due to unpacking. Finally, also the channels of loss integration, pain of paying, and transaction costs would affect the WTP for bundles in the PUBLIC and the PRIVATE condition similarly and are thus controlled for.

2.6 Conclusion

In this chapter, we analyze the effect of hybrid bundling on individuals' willingness to pay. Using a controlled laboratory experiment, we elicit subjects' WTP for a private and a public good, varying across subjects whether the public good is sold separately or in a bundle with the private good. We find that the WTP for both goods is about 60% higher when they are sold as a bundle. In contrast, we observe no such effect when two private goods are bundled.

We lay out two behavioral channels that support our results. The first one, self-signaling, stems from an extension of warm glow to the whole usage period of the underlying private good. The second one, spillovers, originates from positive connotations of public goods (e.g., Bjørner et al. 2004, Elfenbein et al. 2012) that carry over to the attached private good. The field offers additional channels that we discuss in Section 2.5. Hence, the superadditivity documented by our experiment should be present for a wide range of hybrid bundles in natural environments.

The higher valuation that subjects attribute to both the public and the private good when bundled indicates that markets may play a stronger role in the provision of public goods than is commonly acknowledged. Both charitable organizations and the private sector may gain from offering hybrid bundles. Such cooperations increasingly evolve and raise significant contributions to public goods. The UNICEF-Volvic

program for providing drinking water in rural Africa elicited $2.5 million in the U.S. and Canada from 2008 to 2009. This corresponds to more than 1.6% of all private-sector donations to UNICEF in these countries. Fostering these cooperations can circumvent political concerns related to tax-based funding as well as the problem of assessing peoples' valuation for specific public goods.

Our results also suggest that hybrid bundling bears the potential to improve a company's sales. The findings thus serve as an explanation for the widening application of Corporate Social Responsibility (CSR) measures by firms, as companies that link social activities to the sales of their products effectively bundle private with public goods. However, since firms' CSR campaigns often go along with altered levels of advertisement and a reshaped image of the company (Baron 2001), the net effect of hybrid bundling on consumers' WTP so far remained unexplored. Our lab experiment abstracts from this image channel and provides clean evidence on how hybrid bundling affects consumers' valuations for the bundled products. The degree to which the WTP increase serves the firm, the good cause, and the consumer is ultimately determined by the market structure.

This chapter constitutes a first step towards understanding the valuation for public goods in markets and documents that the evaluations of public and private goods are interdependent. We therefore see this chapter also as a starting point for future research. For example, it seems important to further evaluate the relevance of the discussed channels in mediating superadditivity. Particular interest should lie on the extent to which self-signaling is responsible for the increase in valuations. If a favorable identity or a desired level of warm glow is maintained more easily through the use of hybrid bundles, prosocial activity in other environments might be crowded out. Thus, if this effect turns out to be dominating in the field, total voluntary contributions can decrease when hybrid bundles are available. A similar point is made by Engelmann et al. (2012) who show experimentally that a hybrid bundle with only token contributions to a public good may crowd out total charitable giving by creating moral wiggle room.

Furthermore, to determine the share of the WTP increase that is due to spillovers, it will be important to distinguish a truly increased appreciation of the private good when observing a hybrid bundle from a preference for consistency (Falk & Zimmer-

mann 2011). Such a preference may induce a discrepancy between stated and true valuations. In our case, this could result in high stated valuations for the private good if the hybrid bundle is valued highly.

This chapter also opens the discussion of public good evaluation in a broader context. According to our results, hybrid bundling increases the private gains from the provision of the bundled public good. Thus, hybrid bundling could divert voluntary contributions away from public goods with higher social return. An extension of this chapter in which a second, more efficient public good is introduced could deliver insights into this problem. Subsequent studies may also wish to adopt a dynamic perspective and focus on repeated decisions. Given the current state of knowledge about the interdependencies of public and private good evaluations, this field promises to be interesting for future research.

B Appendix

B.1 Data

Table 2.6: Summary statistics: Sociodemographic variables

	Public-Separate	Public-Bundle	Private-Separate	Private-Bundle
Demographics				
Female	0.64	0.53	0.68	0.50
	(0.49)	(0.51)	(0.47)	(0.51)
Age	23.32	24.00	23.73	24.19
	(3.25)	(3.07)	(3.60)	(6.61)
Liquidity	0.89	0.81	0.84	0.79
	(0.32)	(0.40)	(0.37)	(0.42)
Big Five				
Openness	0.52	0.60	0.55	0.42
	(1.03)	(1.03)	(0.94)	(1.08)
Conscientiousness	−0.82	−0.68	−0.76	−0.82
	(1.17)	(1.03)	(0.98)	(1.25)
Extraversion	−0.27	0.25	0.09	0.07
	(1.02)	(1.07)	(1.17)	(1.30)
Agreeableness	−0.77	−0.56	−0.48	−0.34
	(1.02)	(0.87)	(1.11)	(0.96)
Neuroticism	−0.10	−0.15	−0.06	−0.01
	(1.14)	(1.06)	(1.11)	(1.03)
Observations	44	32	37	42

Values are means over all observations in the respective treatments. Standard deviations are provided in parentheses.

Table 2.7: Random-effects interval regressions

premium for the donation or the voucher	(1) PUBLIC	(2) PRIVATE
cup price	−0.166***	−0.088**
	(0.064)	(0.038)
BUNDLE	0.365*	0.129
	(0.198)	(0.135)
BUNDLE · cup price	−0.186**	−0.236***
	(0.091)	(0.072)
Individual controls	Yes	Yes
Observations	240	265
Groups	76	77
Chi-squared	49.21	39.57

Marginal effects. Bootstrapped standard errors in parentheses. ***, **, * indicate significance at the 1-, 5-, and 10-percent level, respectively. BUNDLE is a dummy variable indicating the treatment. Individual controls include gender, age, financial situation, and Big Five personality traits.

B.2 Instructions

In the following, we provide the instructions for the PUBLIC-BUNDLE treatment. The instructions for the other treatments were adapted appropriately and are available from the authors upon request.

Information on the experiment

You are now participating in an economic experiment, during which you will receive money and have the opportunity to buy goods. The payoff that you receive from this experiment depends on your personal decisions.

The decisions that you take during the experiment will be analyzed in an exclusively anonymous way. This means that your decisions will never be related to your identity. During the experiment any kind of communication is absolutely forbidden. If you have any questions, put a hand out of your booth. The experimenters will then come to your booth and answer your question there so that the other participants will not be disturbed.

In the following, different situations will be presented to you. In each of these situations you have to decide which one of two available goods (good A and good B) you want to buy at the given prices (or whether you want to buy none of the goods at the given prices). For the purchase of the goods you are provided with an amount of €10 (your initial endowment) in each situation.

Each of the overall 104 choice situations is labeled with a number. One of these situations will be paid out to you afterwards. After the experiment, this situation will be determined by drawing a random number between 1 and 104. Each of the numbers is equally probable. Since, when taking your decision, you of course do not yet know which number will be drawn, you have to think about each of your decisions carefully because each can potentially become relevant for you.
You will receive your payoff directly after this experiment. At this occasion, every

participant will also draw his individual random number.

Your payoff is:

if you bought *good A*	endowment (€10) - price of good A (+ good A)
if you bought *good B*	endowment (€10) - price of good B (+ good B)
if you bought *neither good A nor good B*	endowment (€10)

An example:

Consider the case in which the following situation with the number 37 is presented to you:

situation	good A	good B	nothing
...	...	...	...
nr. 37	price: €3.20 O buy	price: €3.60 O buy	O buy nothing
...	...	...	...

This means that you have the choice to either buy only good A at €3.20, only good B at €3.60 or none of both goods. If you do not want to buy any of the goods, you do not incur any costs, i.e., you keep your endowment of €10.

If you want to buy good A at €3.20 in this situation, you have to tick the corresponding box so that the screen looks like this:

situation	good A	good B	nothing
...	...	...	...
nr. 37	price: €3.20 X buy	price: €3.60 O buy	O buy nothing
...	...	...	...

If you draw the random number 37 afterwards, which corresponds to the situation above, you will accordingly receive good A as well as €6.80 (€10 - €3.20).

If you want to buy good B at €3.60 in this situation, you accordingly have to select 'buy' in the column for good B. If you draw the random number 37 afterwards, you will receive good B as well as €6.40 (€10 - €3.60).

If you do not want to buy any of both goods in this situation, you accordingly have to select 'buy nothing' in the right column. If you draw the random number 37 afterwards, you will receive none of the goods but €10 (€10 - €0) instead.

If you draw a different random number, the decision that you have taken for this other situation becomes payoff relevant.

Before the real experiment starts, we ask you to answer the control questions that will appear on your screen in a few seconds. In case, doing this, you still have additional questions, please indicate this by raising your hand.

Control Questions I

Case I:

1) Which boxes do you have to tick if - facing prices of €4.90 for good A and of €6.70 for good B in situation a) - you prefer the **purchase of good A** over the purchase of good B as well as over the non-purchase of both goods?

situation	good A	good B	nothing
nr. a)	price: €4.90 O buy	price: €6.70 O buy	O buy nothing

2) Which payoff would you receive in this case at the end of the experiment (including the initial endowment of €10) if situation a) were randomly drawn?

Good A: O Yes O No

Good B: O Yes O No

Money: _____ Euro

Case II:

1) Which boxes do you have to tick if - facing prices of €1.50 for good A and of €4.10 for good B in situation b) - you prefer to buy **none of the goods**?

situation	good A	good B	nothing
nr. b)	price: €1.50 O buy	price: €4.10 O buy	O buy nothing

2) Which payoff would you receive in this case at the end of the experiment (including the initial endowment of €10) if situation b) were randomly drawn?

Good A:	O Yes	O No
Good B:	O Yes	O No
Money:	_____	Euro

Case III:

1) Which boxes do you have to tick if you face prices of €3.30 for good A and of €4.00 for good B in situation c), but are willing to pay **at most €3.10 for good A** and **at most €4.30 for good B** in this situation?

situation	good A	good B	nothing
nr. c)	price: €3.30 O buy	price: €4.00 O buy	O buy nothing

2) Which payoff would you receive in this case at the end of the experiment (including the initial endowment of €10) if situation c) were randomly drawn?

Good A:	O Yes	O No
Good B:	O Yes	O No
Money:	_____	Euro

Case IV:

1) Which boxes do you have to tick if you face prices of €1.70 for good A and of €5.20 for good B in situation d), but are willing to pay **at most €3.10 for good A** and **at most €4.30 for good B** in this situation?

situation	good A	good B	nothing
nr. d)	price: €1.70 O buy	price: €5.20 O buy	O buy nothing

2) Which payoff would you receive in this case at the end of the experiment (including the initial endowment of €10) if situation d) were randomly drawn?

Good A:	O Yes	O No
Good B:	O Yes	O No
Money:	_____ Euro	

Further information on the experiment

In this experiment you can buy goods whose values are likely to be subjectively different. In this respect, there do not exist any wrong or correct purchase decisions for you as a participant. You can acquire the following goods:

Good A:

The first available good is a 'blackboard cup' (see the picture below). With the included chalk it can always be daubed or labeled anew.

Good B:

The second available good is an identical 'blackboard cup' which, however, goes along

with a donation of €2 to the 'Kindernothilfe'. The experimenters donate this amount for you if you buy this second good. The donation amount of €2 is independent of the purchase price, i.e., you only have to pay the respective purchase price, while the donation of €2 is performed by the experimenters.
(The 'Kindernothilfe' supports destitute children in 28 countries of the world. The corresponding donation receipt can be inspected immediately after you have received your payoff.)

In the following, we ask you - as described above - to decide in each of the presented situations whether you want to buy

- either the 'blackboard cup'
- or the 'blackboard cup' that goes along with the €2 donation
- or none of the goods

at the given prices.

Control Questions II

Please answer the following additional questions by filling in the blanks.

Case 1:

Suppose the **cup** is offered at a **price of €1** and the **cup with donation** at a **price of €1.70**.
Furthermore suppose that you **buy the cup with donation** in this situation and that you indeed draw this situation.

How many Euros do the experimenters donate to the 'Kindernothilfe'?
Answer: _____ Euro

How many Euros do you have to pay *additionally* so that - instead of only receiving the cup - you also effect the donation?

Answer: _____ Euro

How many Euros do you have to pay altogether (i.e., for the cup with donation)?

Answer: _____ Euro

Case 2:

Suppose that the **cup** is offered at a **price of €1.50** and the **cup with donation** at a **price of €3.70**.
Furthermore suppose that you **buy the cup with donation** in this situation and that you indeed draw this situation.

How many Euros do the experimenters donate to the 'Kindernothilfe'?

Answer: _____ Euro

How many Euros do you have to pay *additionally* so that - instead of only receiving the cup - you also effect the donation?

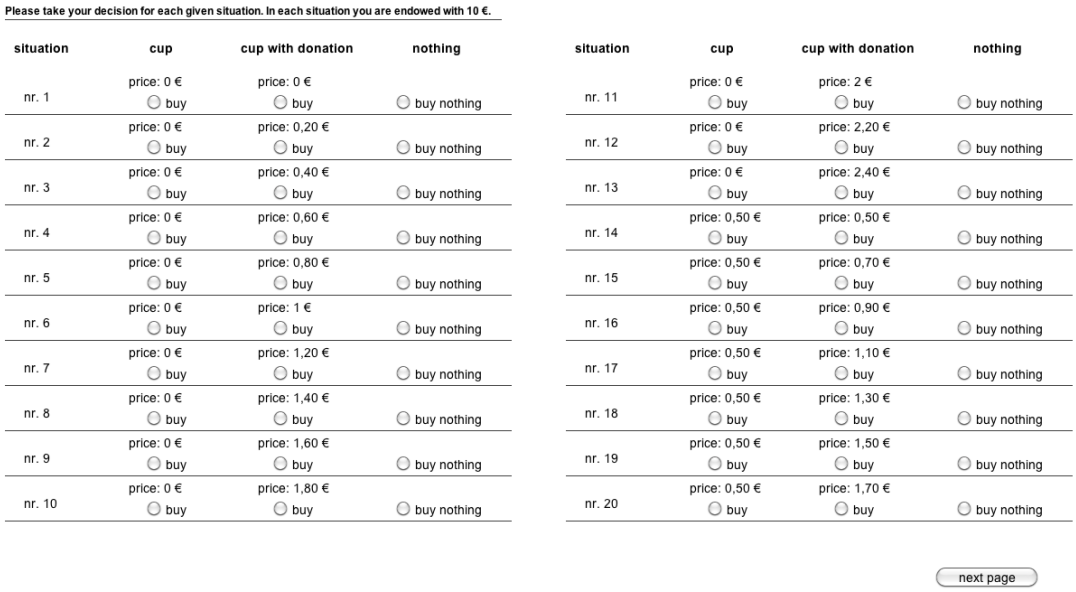
Answer: _____ Euro

How many Euros do you have to pay altogether (i.e., for the cup with donation)?

Answer: _____ Euro

B.3 Screenshots

Figure 2.3: Screenshot PUBLIC-BUNDLE treatment



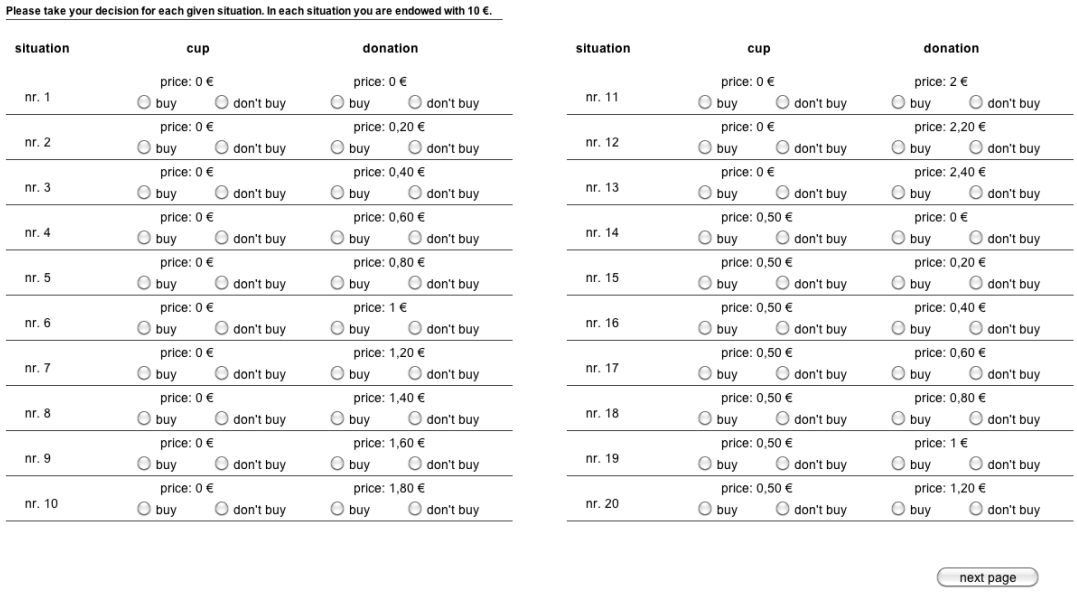
Please take your decision for each given situation. In each situation you are endowed with 10 €.

situation	cup	cup with donation	nothing
nr. 1	price: 0 € ○ buy	price: 0 € ○ buy	○ buy nothing
nr. 2	price: 0 € ○ buy	price: 0,20 € ○ buy	○ buy nothing
nr. 3	price: 0 € ○ buy	price: 0,40 € ○ buy	○ buy nothing
nr. 4	price: 0 € ○ buy	price: 0,60 € ○ buy	○ buy nothing
nr. 5	price: 0 € ○ buy	price: 0,80 € ○ buy	○ buy nothing
nr. 6	price: 0 € ○ buy	price: 1 € ○ buy	○ buy nothing
nr. 7	price: 0 € ○ buy	price: 1,20 € ○ buy	○ buy nothing
nr. 8	price: 0 € ○ buy	price: 1,40 € ○ buy	○ buy nothing
nr. 9	price: 0 € ○ buy	price: 1,60 € ○ buy	○ buy nothing
nr. 10	price: 0 € ○ buy	price: 1,80 € ○ buy	○ buy nothing

situation	cup	cup with donation	nothing
nr. 11	price: 0 € ○ buy	price: 2 € ○ buy	○ buy nothing
nr. 12	price: 0 € ○ buy	price: 2,20 € ○ buy	○ buy nothing
nr. 13	price: 0 € ○ buy	price: 2,40 € ○ buy	○ buy nothing
nr. 14	price: 0,50 € ○ buy	price: 0,50 € ○ buy	○ buy nothing
nr. 15	price: 0,50 € ○ buy	price: 0,70 € ○ buy	○ buy nothing
nr. 16	price: 0,50 € ○ buy	price: 0,90 € ○ buy	○ buy nothing
nr. 17	price: 0,50 € ○ buy	price: 1,10 € ○ buy	○ buy nothing
nr. 18	price: 0,50 € ○ buy	price: 1,30 € ○ buy	○ buy nothing
nr. 19	price: 0,50 € ○ buy	price: 1,50 € ○ buy	○ buy nothing
nr. 20	price: 0,50 € ○ buy	price: 1,70 € ○ buy	○ buy nothing

next page

Figure 2.4: Screenshot PUBLIC-SEPARATE treatment



Please take your decision for each given situation. In each situation you are endowed with 10 €.

situation	cup	donation
nr. 1	price: 0 € ○ buy ○ don't buy	price: 0 € ○ buy ○ don't buy
nr. 2	price: 0 € ○ buy ○ don't buy	price: 0,20 € ○ buy ○ don't buy
nr. 3	price: 0 € ○ buy ○ don't buy	price: 0,40 € ○ buy ○ don't buy
nr. 4	price: 0 € ○ buy ○ don't buy	price: 0,60 € ○ buy ○ don't buy
nr. 5	price: 0 € ○ buy ○ don't buy	price: 0,80 € ○ buy ○ don't buy
nr. 6	price: 0 € ○ buy ○ don't buy	price: 1 € ○ buy ○ don't buy
nr. 7	price: 0 € ○ buy ○ don't buy	price: 1,20 € ○ buy ○ don't buy
nr. 8	price: 0 € ○ buy ○ don't buy	price: 1,40 € ○ buy ○ don't buy
nr. 9	price: 0 € ○ buy ○ don't buy	price: 1,60 € ○ buy ○ don't buy
nr. 10	price: 0 € ○ buy ○ don't buy	price: 1,80 € ○ buy ○ don't buy

situation	cup	donation
nr. 11	price: 0 € ○ buy ○ don't buy	price: 2 € ○ buy ○ don't buy
nr. 12	price: 0 € ○ buy ○ don't buy	price: 2,20 € ○ buy ○ don't buy
nr. 13	price: 0 € ○ buy ○ don't buy	price: 2,40 € ○ buy ○ don't buy
nr. 14	price: 0,50 € ○ buy ○ don't buy	price: 0 € ○ buy ○ don't buy
nr. 15	price: 0,50 € ○ buy ○ don't buy	price: 0,20 € ○ buy ○ don't buy
nr. 16	price: 0,50 € ○ buy ○ don't buy	price: 0,40 € ○ buy ○ don't buy
nr. 17	price: 0,50 € ○ buy ○ don't buy	price: 0,60 € ○ buy ○ don't buy
nr. 18	price: 0,50 € ○ buy ○ don't buy	price: 0,80 € ○ buy ○ don't buy
nr. 19	price: 0,50 € ○ buy ○ don't buy	price: 1 € ○ buy ○ don't buy
nr. 20	price: 0,50 € ○ buy ○ don't buy	price: 1,20 € ○ buy ○ don't buy

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Chapter 3

Political Selection and the Concentration of Political Power

3.1 Introduction

Unfortunately, most politicians are neither benevolent nor omniscient. It is thus the role of political institutions to enforce the voter's interest within the political process. From the founding of modern democracies in the 18th century to recent constitutional drafts in Egypt and Lybia, political thinkers have been engaged in finding the best institutions for centuries. A central question in constitutional design has been whether political power should be concentrated on a group of political agents, typically the one winning the general election, or dispersed between different groups.[1] Strikingly, there are pronounced cross-country differences along this dimension, with classical extreme cases being the United Kingdom with concentrated power on the one hand, and Belgium and Switzerland with dispersed power on the other hand.

The Federalist Papers highlight two channels through which constitutions affect social welfare: the selection of competent politicians and the reduction of moral hazard of politicians in office.[2] The economic literature on the first channel, moral

[1] For a discussion of this crucial issue and its relation to various specific institutions, see Lijphart (2012), Lijphart (1999) and Tsebelis (2002).

[2] "The aim of every political Constitution, is or ought to be, first to obtain for rulers men who possess most wisdom to discern, and most virtue to pursue, the common good of society; and in the next place, to take the most effectual precautions for keeping them virtuous whilst they continue to

hazard, consistently finds that power-dispersing institutions increase welfare as they help to discipline egoistic incumbents. In contrast, economists have yet little to say about the second channel, political selection (see Besley 2005). Selecting competent politicians, however, is non-trivial. Since voters base their ballot on their perceptions of candidates' competence (Stokes et al. 1958, King 2002, Pancer et al. 1999), politicians exert considerable effort in appearing competent and virtuous during electoral campaigns. This affects voters' capacity to identify and empower able candidates. A comprehensive appraisal of political institutions thus has to account for whether institutions hinder or enforce the selection of competent candidates for office.

The aim of this chapter is to study the effects of power-concentrating institutions on campaigns and political selection. We consider a pre-election setup in which candidates are privately informed about their quality and are partly office motivated. Voters infer candidates' qualities from their campaigns. In this setup, we identify a trade-off that arises for changes in the level of power concentration. On the one hand, higher concentration of power implies a better allocation of political influence to competent candidates, as long as political campaigns provide at least some information to voters. We refer to this positive effect on welfare as the *empowerment effect*. On the other hand, more concentration of power increases the desire of office motivated candidates to win the election. Thus, mimicking of good candidates becomes more profitable, resulting in increasingly distorted policy choice. Campaigns convey less information on the competence of individual candidates and voters are less able to select high quality politicians. We call this negative welfare effect the *behavioral effect*.

We formalize our argument by a simple model in which two candidates compete in a public election by making binding policy proposals. In particular, candidates can either commit to a risky reform or to the (riskless) status quo. Candidates differ in their abilities, which are unobservable to the electorate. Only highly able candidates can increase expected welfare by adopting the risky policy, while less able candidates should stick to the status quo. Voters observe policy proposals and draw inferences about the candidates' abilities. In equilibrium, a reform proposal is associated with high ability and reforming candidates win the election more often

hold their public trust" (Madison 1788*b*)

than those proposing the status quo. Politicians do not only care about welfare but are also office motivated. This creates incentives for low-ability candidates to mimic the policy choice of their more able counterparts at the cost of adopting inefficient policies.

Variations in the level of power concentration involve a trade-off between the empowerment effect and the behavioral effect. The size of these effects depends on the relative weights of office motivation and policy motivation in the candidates' utility function. We find that the optimal level of power dispersion is higher, the more politicians are driven by office rents. If and only if politicians care predominantly about implementing efficient policies, it is optimal to concentrate power completely in the hands of the election winner. Conversely, if office rents are a strong component of candidates' motivation, some dispersion of political power enhances voter welfare.

The basic intuition behind this result is the following. Candidates' office motivation induces mimicking and distorts their policy choice. These distortions are fueled by the concentration of power because higher concentration increases electoral incentives. For particularly high office motivation, it is then optimal to reduce the resulting inefficiencies by dispersing political power among candidates. Hence, power dispersing institutions are beneficial if politicians are mainly office motivated.

We generalize the model in different aspects, finding that the qualitative results do not change. First, we introduce a continuous policy space such that candidates may choose the magnitude of reform they propose rather than limiting their choice set to a reform and the status quo. Second, we relax the assumption of binding policy commitments by introducing the possibility to withdraw a proposed reform after the election, under some circumstances. Third, we allow for heterogeneous policy preferences in the electorate. In this setting, we additionally show that increasing power dispersion reduces inequality in the society. If the social planner is inequality averse, the optimal level of power dispersion is consequently higher.

Data from international surveys like the *International Social Survey Panel* indicate considerable cross-country differences in voters' assessments of politicians' office motivation. Assuming that they mirror actual differences in politicians' motivation, our theoretical analysis gives rise to a testable hypothesis: Countries in which politicians are predominantly office motivated benefit from power dispersion. In contrast,

countries with policy motivated politicians reduce welfare if they disperse political power.

In a cross-country design, we investigate the interaction effect of power dispersion and politicians' motivation on social welfare. For this purpose we combine measures of political institutions[3] with data on the perceived motivation of politicians. As a measure for the performance of the political system, we use growth in per capita GDP. Due to the availability of this data our analysis is restricted to eighteen established democracies. For this set of countries, the data provide support for our hypothesis. For countries with highly office motivated politicians, we find a positive relationship between power dispersion and growth, while we observe a negative relationship for countries with mainly policy motivated politicians.

Our analysis intends to identify the economic effects of power-dispersing institutions, which limit the office-holders discretion. Many economists have addressed this question abstracting from the problem of political selection. For a homogeneous set of politicians, power-dispersing institutions increase voter welfare. For example, Lizzeri & Persico (2001) demonstrate that office-motivated politicians campaign for more public good provision and less pork-barrel spending under proportional representation than under the winner-takes-all regime. For the term in office, Persson & Tabellini (2003) show that voters are more able to discipline an incumbent if power is separated between multiple political agents.

These papers abstract from any heterogeneity in candidate quality and thus from the role of political selection.[4] The importance of incorporating the selection aspect into the analysis of political institutions is emphasized by Besley (2005). The process of selecting politicians that are qualified for office has two aspects. First, to choose among competing candidates the one who holds most promise to design and implement efficient policies. This part of political selection is based on electoral campaigns, which are typically studied in pre-election models (see, e.g., Downs 1957, Lindbeck &

[3]We use Lijphart's index of the executive-parties dimension which considers five categories of political institutions to order political systems according to the implied dispersion or concentration of power (Lijphart 1999).

[4]The assumption that candidates differ in a quality dimension, sometimes referred to as "valence issue", is applied in a large number of papers, including Adams (1999), Ansolabehere and Snyder (2000), Groseclose (2001), Aragones and Palfrey (2002), Sahuguet and Persico (2006) and Krasa and Polborn (2011).

Weibull 1987). Second, to keep in office only politicians who adequately performed during the term. This aspect of political selection is based on the behavior of an incumbent, which is analyzed in post-election models in the spirit of Barro (1973) and Ferejohn (1986). While pre-election models are based upon the idea that politicians can commit to policies through campaigns, post election models assume that commitment is not possible. However, models of both types identify a common pattern. If an unobservable trait of politicians, e.g., competence, is important to voters, politicians will do their best to signal this trait. This affects politicians' behavior both before the election (Callander & Wilkie 2007, Callander 2008, Kartik & McAfee 2007) and after it (Majumdar & Mukand 2004) and should have an impact on the voters' capacity to select and retain the politician they want.

The role of institutions for political selection only recently came to attention and has so far only been studies in post-election settings. A first model addressing this question is Maskin & Tirole (2004). It investigates conditions under which the voter prefers political decisions to be taken by accountable politicians instead of non-accountable judges. Maskin & Tirole (2004) argue that holding public officials accountable in reelections is not optimal for all kind of policy decisions. While they do not compare alternative democratic institutions, this approach is taken by Smart & Sturm (2006) in a closely related paper. They study variations in the level of accountability through the introduction of term limits. Depending on the amount of noncongruent politicians, a limit of two terms as applied in many modern democracies is shown to be optimal.

Closest to this chapter is the analysis by Besley & Smart (2007), who study the effects of several fiscal restraints on political selection in a post-election setting. Similarly to Maskin & Tirole (2004) and Smart & Sturm (2006), they show a trade-off between disciplining incumbents and improving political selection. Whenever an institution allows to discipline bad incumbents, i.e., to make them adopt welfare-enhancing policies, this prevents effective political selection because voters are unable to distinguish a disciplined but bad politician from a good one. Our pre-election model produces a different trade-off. If voters have to infer the ability of candidates from their campaigns, dispersing power leads to both better policy choice and better selection, but comes at the cost of giving some political power to low-ability candi-

dates. Besley & Smart (2007) consider four fiscal restraints, such as limits on the government size and transparency, which limit the office-holders' discretion. Our focus, in contrast, is on power-dispersing institutions, such as proportional representation, federalism, or public referenda. Interestingly, Besley & Smart (2007) find that three of the four restraints only increase voter welfare if there are sufficiently many good politicians. This contrasts our result according to which power dispersion is optimal if and only if the candidates are strongly driven by egoistic motives.

Finally, we also relate to a growing empirical literature on democratic systems and their effects on fiscal policy. The analyzes often focus on specific political institutions (see, e.g., Feld & Voigt 2003, Persson & Tabellini 2004, Enikolopov & Zhuravskaya 2007, Blume et al. 2009, Voigt 2011). In contrast, we apply a classification of political systems based on the implied dispersion of political power, thus encompassing a broad range of institutions. Lijphart (1999, 2012) as well as Armingeon (2002) study the influence of the dispersion of power on various political and economic outcomes. While Lijphart (1999) finds no effect of power dispersion on economic variables, Armingeon (2002) finds a negative effect of power dispersion on unemployment and inflation. Complimenting these findings, we show that the effect of power dispersion on growth in GDP positively interacts with the strength of politicians' office concerns.

3.2 The Model

Our model studies the effects of institutions on candidates' campaigns and the empowerment of competent politicians. Candidates differ in quality, more precisely in the ability to implement welfare-enhancing policies. They are privately informed about their abilities and commit to a policy prior to the election. Voters observe candidates' campaigns and vote based on the expected welfare each candidate provides. We depict political institutions in reduced form, by means of how much political power is concentrated in the political system. With higher concentration of power, the candidate receiving a majority of votes is more capable to enforce his agenda.

The game consists of three stages. At the first stage, nature independently draws both candidates' abilities a_1 and a_2, which are privately revealed to the candidates. At the second stage, both candidates simultaneously make binding policy proposals,

x_1 and x_2. At the third stage, voters observe the proposals, update their beliefs about the candidates' abilities and cast their votes. Based on the election result, the power allocation rule divides political power between both candidates. Finally, each candidate's power determines the enacted policy.

While the basic model serves to clarify the main arguments, we discuss a number of modifications in Section 3.7. In particular, we allow for a continuous policy space, a form of limited commitment and heterogeneity in the voters' policy preferences. Importantly, these modifications do not alter the main results of the basic model.

3.2.1 Voters

There is a continuum of fully rational and risk neutral voters of mass one who have preferences both over policy and candidates. Voters have identical preferences regarding the considered policy field. In this policy field, either the status quo can be maintained ($x_i = 0$) or a reform can be implemented ($x_i = 1$). All voters receive a positive payoff from the reform if and only if it is successful. More precisely, we assume that a successful reform yields a return of 1 to each voter while a failing reform leads to a return of zero. Whenever a reform is adopted, all voters bear a cost of c. Maintaining the status quo gives a certain payoff of zero.

Voters might also care about other policy fields and about the candidates' ideologies or personal characteristics. We account for these preferences in the tradition of the probabilistic voting model by assuming that voters have heterogeneous candidate preferences (Lindbeck & Weibull 1987).[5] If candidate 1 is in power, voter k receives an additional utility of μ_k, while we normalize the additional utility if candidate 2 enters office to zero. Let μ_k be distributed according to some symmetric cdf Ω with expected value zero. Furthermore, let Ω have full support on the interval $[-1, 1]$ to guarantee heterogeneity in the resulting voting preferences. Altogether, if candidate i is in power and sets policy x_i, voter k receives a utility of

[5]Note that our results are independent of whether these candidate preferences are subject to an additional aggregate shock as in Lindbeck & Weibull (1987).

$$V_k(x_i, i) = \begin{cases} \mathbb{1}(i)\mu_k + 1 - c & \text{reform succeeds} \\ \mathbb{1}(i)\mu_k - c & \text{if reform fails} \\ \mathbb{1}(i)\mu_k & \text{status quo is maintained,} \end{cases}$$

where $\mathbb{1}(i)$ denotes the indicator function which is one if $i = 1$ and zero otherwise. Voter k prefers candidate 1 if and only if he expects $V_k(x_1, 1)$ to be larger than $V_k(x_2, 2)$. Voters vote sincerely, i.e., each voter casts his vote for his preferred candidate. Hence, candidate i's vote share depends positively on the voters' belief about the payoff he provides, and negatively on the belief about the payoff provided by his opponent.

3.2.2 Candidates

There are two candidates running for office. Each candidate i can either commit to a reform ($x_i = 1$) or to the status quo ($x_i = 0$). More able candidates design better reforms, i.e., reforms that are more likely to succeed. We measure candidate i's ability by the implied probability of a successful reform, $a_i \in [0, 1]$. Hence, policy x_i set by candidate i provides an expected payoff of $x_i(a_i - c)$ to each voter. We refer to it as the candidate's welfare contribution.

Prior to the election, nature independently draws both candidates' abilities from the cumulative distribution Φ. Let the corresponding density function ϕ have full support on $[0, 1]$ and be continuously differentiable. After observing his ability, each candidate i commits to policy $x_i \in \{0, 1\}$. Thus, the strategy X_i of politician i is a mapping from abilities to policy commitments.

Candidates care about gaining political power (office motivation) as well as about the expected welfare contribution of the policy they have designed (policy motivation). The utility function of politician i is given by

$$U_i(a_i, x_i) = f(v_i, \rho) \left[\theta + x_i(a_i - c)\right], \tag{3.1}$$

where $\theta > 0$ denotes the relative weight of office motivation. Candidate i's power $f(v_i, \rho) \in (0, 1)$ equals the probability that he can enforce his policy proposal x_i.

It depends on his vote share v_i and the parameter of power concentration ρ, representing the set of political institutions. To simplify notation, this utility function is formulated at an ex interim stage, i.e., taking the expected payoff after the election but before the reform outcome has been realized. We also omit the dependence of v_i on both candidates' strategies and actions.

Note that candidate i only cares about how expected welfare is affected by his policy choice, not about voter welfare in general. This way to formulate policy preferences of politicians has been introduced by Maskin & Tirole (2004), who phrase it *legacy motive*. It captures the idea that politicians have a desire to leave a positive legacy to the public.

3.2.3 Institutions of Power Allocation

We model political institutions by a power allocation rule f that translates election results into an allocation of political power, i.e., each politician's probability to implement his policy proposal. Technically, candidate i's power $f(v_i, \rho)$ depends on his vote share v_i and on the level of power concentration ρ implied by the set of political institutions.

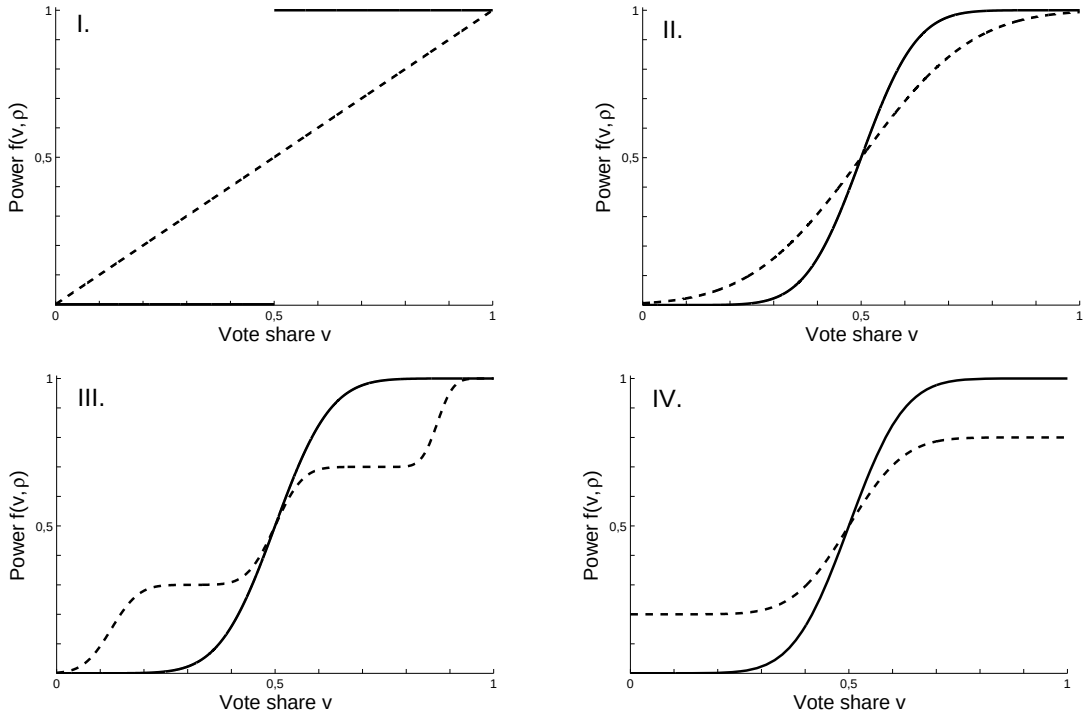
Definition 1. *The continuously differentiable function* $f : [0,1] \times \mathbb{R}_+ \to [0,1]$ *is a power allocation function if it satisfies:*

1. *monotonicity in* v_i*:* $\frac{\partial f(v_i,\rho)}{\partial v_i} > 0 \ \forall \ \rho$
2. *symmetry in* v_i*:* $f(v_i, \rho) = 1 - f(1 - v_i, \rho)$
3. *piece-wise monotonicity in* ρ*:* $\frac{\partial f_i(v_i,\rho)}{\partial \rho} > 0 \ \forall \ v_i \in (1/2, 1)$.

The first property rules out that candidates receive a larger amount of political power if they gain less votes in the election. The second establishes anonymity, i.e., the constitution does not treat candidates differently. The third allows us to interpret any rise in ρ as an unambiguous increase in the concentration of power. The higher is ρ, the larger is the amount of power assigned to the election winner, i.e., the candidate that gains more than half of the votes.

This modeling approach allows to study a large variety of institutional differences. Figure 3.1 illustrates how political institutions can be represented by power allocation

Figure 3.1: Political institutions and the corresponding power allocation rules.



functions. Each of the four panels depicts two examples of allocation functions. Throughout, the solid line represents an institutional setup that concentrates power more strongly than the one corresponding to the dashed line.

Panel I depicts two stylized allocation rules frequently used to compare electoral systems in the theoretical literature (see, amongst others, Lizzeri & Persico 2005). The solid line represents institutions that fully concentrate power in the hands of the election winner. The step function is the standard way to model plurality voting, also known as winner-takes-all system. The dashed line represents proportional representation, which implies a lower concentration of political power and is often modeled by the identity function $f(v, \rho) = v$.

A less simplistic representation of these two systems is shown in Panel II. Here, the amount of power depends on the margin of victory, e.g., because delegates might occasionally vote against the party lines. Plurality voting tends to generate clear-cut majorities, as the winning party typically receives a share of parliamentary seats beyond its vote share. In contrast, the allocation of seats corresponds closely to vote shares under proportional representation. Thus, the dashed curve for the proportional system is flatter than the one for plurality voting.

In Panel III, the dashed line represents a political system with a supermajority requirement for certain policy decisions (as employed in Germany and the US). This requirement generates additional steps in the power allocation function, since some policies can only be enforced after a landslide victory. In contrast, the solid line corresponds to a system as applied in the UK where any decision can be taken by a simple majority.

Finally, the dashed line in Panel IV depicts the use of direct democratic measures as employed for example in Switzerland. Even with a landslide victory in the election, the winning party cannot always implement their agenda. The opposition party can block policies via a referendum or even enforce their own proposals. Thus, only a limited part of political power is at stake in the parliamentary election (similar arguments can be made with respect to federalism, bicameralism or a constitutional court).[6]

3.2.4 Equilibrium Concept and Normative Criterion

To solve this game, we study Perfect Bayesian equilibria. Thus, an equilibrium of this game consists of a strategy profile and a belief system such that (1) both candidates play mutually best responses at the announcement stage, anticipating the winning probabilities for each vector (x_1, x_2) that are implied by the voters' beliefs, and (2) the voters' belief system σ is derived from the candidates' strategies X_1, X_2 according to Bayes' rule everywhere on the equilibrium path.

In the following, we compare the effects of changes in power concentration, i.e., in parameter ρ. As normative criterion, we use a utilitarian welfare function in ex ante perspective, i.e., expected welfare before candidates' abilities are drawn:

$$W(\rho, \theta) = \int_0^1 \int_0^1 \phi(a_1)\phi(a_2) \sum_{i=1}^{2} f(v_i, \rho) X_i(a_i)(a_i - c)\ da_2 da_1.$$

Welfare is, hence, given by the weighted sum of the politicians' welfare contribution, integrated over all possible combinations of candidates' ability. The weights correspond to the candidates' power, $f(v_i, \rho)$. Note that welfare is calculated using

[6]Note that our definition of the power allocation function does not allow to compare all institutional settings. For example, the dashed lines in Panels III and IV of Figure 3.1 cannot be ordered unambiguously in terms of power concentration, as they intersect more than once.

equilibrium strategies, which are functions of the parameters ρ (power concentration) and θ (candidates' office motivation).[7]

3.3 Benchmark Case: Perfect Information

If individual abilities are observable to the electorate, voters condition their ballot on candidates' abilities and reform proposals. In particular, the fraction of citizens voting for a candidate is increasing in his welfare contribution.

Candidates' choices are driven by two motives. They seek to obtain power and to contribute to voter welfare. Under perfect information, these motives are fully aligned: Each candidate maximizes his electoral prospects by proposing the policy with highest welfare contribution. Hence, a reform is only proposed by high-ability candidates with $a_i \geq c$. In contrast, a candidate with ability $a_i < c$ gains more power by proposing the status quo instead of a reform with a negative welfare contribution. Thus, candidates' policy choices are undistorted: A politician proposes to implement a reform if and only if the reform enhances welfare. As a consequence, candidates with higher ability, i.e., those who propose to reform, receive higher vote shares in the election.

This result has a direct welfare implication. While variations in the power concentration parameter ρ do not distort candidates' behavior, higher concentration of power allocates more power to candidates' with higher welfare contribution. Hence, welfare strictly increases with the level of power concentration ρ. The following Proposition summarizes these results (all proofs are found in Appendix C.1).

Proposition 1. *Under perfect information, candidates propose a reform if and only if $a_i \geq c$. Welfare is maximized if political power is completely concentrated.*

3.4 Imperfect Information

In the following, we derive the equilibrium properties under the assumption that candidates are privately informed about their abilities. Under imperfect information, voters form beliefs about politicians' welfare contribution on the basis of their policy

[7] We neglect the candidates' utilities when calculating welfare.

proposals. The vote share of candidate i thus depends on the proposals only, and not on candidates' abilities. However, the higher a candidate's ability a_i, the higher is his welfare contribution from a reform. A candidate's incentive to propose a reform is thus monotonically increasing in his ability. Hence, the optimal behavior of candidates exhibits the cutoff property, i.e., all candidates with ability greater or equal to some cutoff value α_i propose a reform, while candidates with lower ability propose the status quo.

Lemma 1. *Given any belief system σ and any strategy of the opponent X_j, the optimal strategy of candidate i can be characterized by a unique cutoff $\alpha_i \in [0,1]$ such that*

$$X_i(a_i) = \begin{cases} 1, & \text{if } a_i \geq \alpha_i \\ 0, & \text{if } a_i < \alpha_i. \end{cases}$$

In the following, we denote strategies only by their corresponding cutoffs. Candidates compare the utility of proposing a reform and of proposing the status quo, given the strategy of the opponent and voters' belief system σ. They propose a reform if the following utility difference is positive:

$$R_i(a_i, \alpha_i, \alpha_j, \rho) = E[U_i(a_i, x_i = 1)|\alpha_i, \alpha_j, \sigma] - E[U_i(a_i, x_i = 0)|\alpha_i, \alpha_j, \sigma].$$

We refer to this utility difference as the reform incentive function R_i.

Proposition 2. *Two classes of Perfect Bayesian equilibria exist. In class one, equilibria exhibit symmetric cutoffs $\alpha_i = \alpha_j = \alpha$ smaller than c. In class two, at least one of the cutoffs is equal to 1. Class one is non-empty and consists of divine equilibria only, while all equilibria in class two are not divine.*

To refine the set of equilibria, we apply the divinity criterion proposed by Banks & Sobel (1987), which restricts the feasible set of out-of-equilibrium beliefs. In any divine equilibrium, a deviation from equilibrium actions must be attributed to the type that profits most of it. For all equilibria in class two, at least one of the candidates always proposes the status quo even if he has the highest ability possible. This can only be optimal if voters are convinced that candidates proposing a reform have low ability. In this case a reform proposal is associated with a substantially

lower vote share than the status quo proposal. According to the divinity criterion, however, the reform proposal necessarily needs to be attributed to the most able type of candidate, whose incentive to propose a reform is highest among all candidates. Hence, such an equilibrium cannot be divine.

The first class of equilibria, in contrast, is robust to the divinity criterion. If $\alpha \in [0, c)$, all actions are played in equilibrium and there are no out-of-equilibrium beliefs. If the cutoffs are equal to zero, even the least able candidates propose a reform. If any candidate deviates to the status quo, his associated welfare contribution is zero independently of his ability. Since the welfare contribution of such a deviation is known, out-of-equilibrium beliefs about abilities are irrelevant for the voting decision. Hence, restricting these will not eliminate this equilibrium. In the following, we only consider equilibria of this class.

To see that all equilibria in this class are characterized by $\alpha \leq c$, note that a reform proposal is always associated with a positive welfare contribution. In other words, the expected vote share increases if a reform is proposed. If voters associated a negative welfare contribution with a reform proposal, candidates with ability below c would never choose to propose a reform. Otherwise, they would suffer from a negative welfare contribution as well as from a loss in expected office utility. Clearly, this is a contradiction: If only candidates with ability above c were to choose a reform, the associated welfare contribution could not be negative. Hence, a reform is associated with a higher vote share than the status quo. It follows that candidates with ability above c always choose to reform. They gain not only from their welfare contribution but also from an increase in expected office rewards. Thus, the equilibrium cutoffs must be below c.

Definition 2. *A perfect Bayesian Nash equilibrium with $\alpha > 0$ is an informative equilibrium.*

Next, we derive the equilibrium condition for informative equilibria.[8] In any informative equilibrium, candidates with high ability choose to propose a reform while candidates with low ability choose the status quo. Policy proposals hence convey an informative signal about candidates' abilities. The cutoff type is indifferent between

[8]We discuss non-informative equilibria in the extensions.

proposing a reform or refraining to do so. Thus, the equilibrium cutoff α is implicitly defined by $R_i(\alpha, \alpha, \alpha, \rho) = 0$. The resulting equilibrium condition is

$$R(\alpha, \rho) = \underbrace{\theta \left(f(v^r, \rho) - \frac{1}{2} \right)}_{\text{Change in office utility}} + \underbrace{\left[\frac{1}{2} + \Phi(\alpha) \left(f(v^r, \rho) - \frac{1}{2} \right) \right] (\alpha - c)}_{\text{Change in welfare contribution}} = 0, \tag{3.2}$$

where v^r represents the vote share from proposing a reform, when facing an opponent who proposes the status quo.

Both aspects of the politicians' preferences can easily be distinguished in Equation (3.2). The change in office utility stems from the expected increase in office rewards due to a reform proposal. This term is always positive, since a reform proposal is associated with a higher vote share. However, the politician also cares about the welfare contribution that is induced by his proposal. The first part of the change in welfare contribution stands for the probability that a proposed reform is implemented. The second part is the welfare contribution of a reform implemented by the cutoff type. Note that this term represents a loss, since the ability of the cutoff type α is below the cost c. The cutoff type is hence willing to make a negative welfare contribution to increase his chances to enter office. Next, we establish the uniqueness of divine equilibria.

Assumption 1. *The ability distribution $\phi(a)$ is bounded from above with $\phi(a) < \frac{1+\Phi(a)}{c-a}$ for all $a < c$.*

Assumption 1 is a regularity assumption on the ability distribution, which is fulfilled for example for the uniform distribution. It ensures that the reform incentive is monotonically increasing in the cutoff. Hence, both incentive functions cannot intersect more than once and there is only one symmetric equilibrium. For the remainder of this chapter, we take Assumption 1 as given.[9]

Proposition 3. *There is a unique divine equilibrium. Moreover, it exists $\tilde{\theta}(\rho) \in \mathbb{R}^+ \cup \{\infty\}$, such that this equilibrium is informative if and only if $\theta < \tilde{\theta}(\rho)$.*

For any given level of power concentration, the existence of informative equilibria depends on the level of office motivation. If office motivation is not too large ($\theta <$

[9] If Assumption 1 is not given, multiple equilibria may arise. The following analysis is not changed, if we restrict it to the welfare optimal equilibrium.

$\tilde{\theta}(\rho)$), cutoffs are larger than zero, and the unique divine equilibrium is informative. Otherwise, all candidates propose a reform, and the equilibrium is non-informative. If the average ability is smaller than the costs, the unique equilibrium is informative for all $\theta < \infty$. In this case, a non-informative would imply a negative welfare contribution from a reform so that candidates with low ability would prefer to propose the status quo.

3.5 The Effects of Power-Concentrating Institutions

Empirically, democratic countries differ strongly in their political institutions and the levels of power concentration implied by them. As we have argued in Subsection 3.2.3, our framework allows to represent these differences by means of an appropriate power allocation function f. In this section, we study the effects of these variations, captured by changes in the parameter of power concentration ρ.

3.5.1 Effects on Candidates' Behavior

The power allocation function f determines the electoral incentives of political candidates. Under perfect information, variations in power concentration leave the behavior of politicians unaffected. As low-ability candidates are not able to mimic their more able counterparts, policy choice is always efficient (see Proposition 1).

With asymmetric information and office-motivated candidates, in contrast, policy choice is distorted as some low-ability candidates propose welfare-reducing reforms. It turns out that political institutions affect the magnitude of these policy distortions.

Proposition 4. *In any informative equilibrium, increasing power concentration ρ leads to the proposal of more inefficient reforms: $\frac{d\alpha}{d\rho} < 0$.*

Consider some level of power concentration ρ_0. By construction, the cutoff type with ability $a_i = \alpha_0 < c$ is indifferent between proposing the reform and the status quo. We find that after an increase in power concentration, the cutoff type strictly prefers to propose the reform. In particular, his utility of proposing the status quo decreases while his utility of proposing the reform increases.

If the cutoff type proposes the status quo, his welfare contribution is equal to zero. Thus, his utility is only determined by the office rents he receives according to his expected amount of power. With increasing power concentration, office rents are reduced because he receives less power when running against a reforming opponent.

If the cutoff type proposes a reform, his utility is composed of two parts. He receives office rents but also incurs a utility loss due to a negative welfare contribution. As he is indifferent between proposing a reform and the status quo, the sum of the two is positive. With increasing power concentration, both office rents and negative welfare contribution increase by the same factor. Hence, the sum of both, representing his utility from a reform proposal, also increases by this factor.

Consequently, with higher levels of power concentration, status quo proposals lead to lower utility while reform proposals become more profitable. The equilibrium cutoff is thus decreasing in the level of power concentration.

3.5.2 Welfare Effects

In the following, we study the effects of power-concentrating institutions on the performance of the political system. The objective function is the utilitarian welfare function formulated in ex ante perspective, i.e., before the candidates' abilities are drawn.

With privately informed candidates, the relation between power concentration and welfare is not as clear-cut as under perfect information. On the one hand, there is still a positive *empowerment effect* of power concentration. Whenever both policies are proposed, the majority of votes goes to the reforming candidate, who provides a higher expected welfare than the candidate proposing the status quo (see Section 3.4). Consequently, any increase in power concentration ρ assigns more power to the appropriate candidates.

On the other hand, the previous section demonstrated a negative *behavioral effect* of power concentration. By reinforcing the electoral stakes, a stronger concentration of power leads to the proposal of more inefficient reforms. This reduces the information revealed during the campaigns and limits the voters' capacities to allocate power to high-ability candidates. We show below that the relative size of the two effects, and

thus the overall sign, depend on the average payoff from a proposed reform. This in turn is determined by the level of power concentration itself. Under weak conditions, however, there is a unique welfare optimum.

Assumption 2. *The ability distribution has a non-decreasing reversed hazard rate* $\Phi(a)/\phi(a)$.

In the following, we assume that this regularity condition is satisfied.

Lemma 2. *The welfare function* W *is strictly quasi-concave in* ρ.

Lemma 2 implies that the welfare function has at most one maximum in ρ. In other words, the behavioral effect and the empowerment effect are equalized at most once, and the optimal level of power concentration is well-defined.

To prove Lemma 2, we analyze how the empowerment effect and the behavioral effect are influenced by changes in power concentration. The positive empowerment effect results because, with increasing ρ, a reforming candidate receives more power if he runs against an opponent proposing the status quo. Thus, its size depends positively on the average payoff from a proposed reform and the probability that a candidate advocates the status quo, $\Phi(\alpha)$. The empowerment effect is consequently highest at $\rho = 0$, i.e., completely dispersed power. With increasing ρ, the average reform payoff becomes smaller as more inefficient reforms are conducted. At the same time, the probability $\Phi(\alpha)$ is reduced because less types propose the status quo. Thus, the empowerment effect is strictly decreasing in ρ, as illustrated in Figure 3.2.

The negative behavioral effect results because increasing power concentration leads to a reduction in the cutoff α. The size of this effect depends on, first, how harmful this decline in α is to welfare, and second, how sensitively α reacts to changes in power concentration. The effect of changes in power concentration on the size of both factors is directly opposed. On the one hand, a marginal decrease in α reduces the average reform payoff by $\phi(\alpha)(\alpha - c)$. With completely dispersed power ($\rho = 0$), the cutoff is equal to c, and a marginal change in α does not affect welfare. With increasing power concentration, α departs further from c and the additionally proposed reforms are increasingly harmful for welfare. Hence, the size of the first factor increases in ρ. On the other hand, the sensitivity of α depends on the additional vote

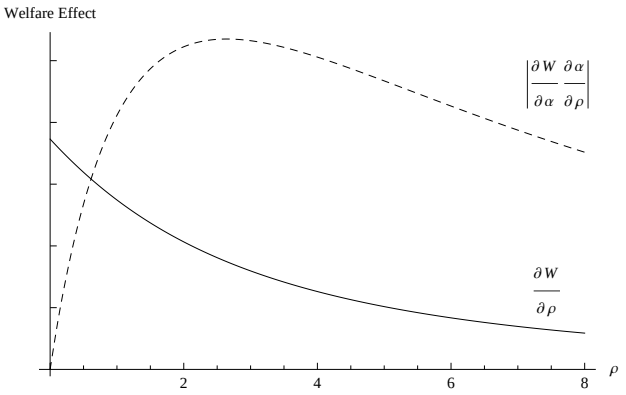


Figure 3.2: *The welfare effects of a change in ρ for a logistic power allocation function with mean $\mu = 0.5$ and scale parameter $\beta = 1/\rho$, μ_k distributed according to $\mathcal{N}(0, 0.5)$, a uniform ability distribution, $\theta = 1$, and $c = 0.6$. The solid line represents the (positive) empowerment effect, the dashed line represents the (negative) behavioral effect. The optimal level of ρ is attained at the intersection of both lines.*

share a candidate gains by proposing a reform. For higher levels of power concentration, the average payoff from a proposed reform is smaller and so is the additional vote share. Thus, the cutoff α reacts less sensitively to further increases in ρ and the size of the second factor decreases in ρ. As a consequence, the behavioral effect is not monotonic in ρ (see Figure 3.2).

In Appendix C.1, we show that the sign of the overall welfare effect depends only on the relative sizes of the probability to face a status quo proposing candidate, $\Phi(\alpha)$, and the marginal welfare contribution, $\phi(\alpha)(c - \alpha)$. The standard assumption of a monotone hazard rate guarantees that, at every local extremum, the empowerment effect is strictly increasing in the cutoff relatively to the behavioral effect. Since α depends negatively on ρ, the relative size of the empowerment effect is strictly decreasing in ρ. Thus, there cannot be a local minimum and at most one local maximum, which corresponds to the definition of quasi-concavity.

Proposition 5. *If and only if office motivation is below some threshold level $\bar{\theta}$, welfare is maximized by full concentration of power. If instead $\theta > \bar{\theta}$, it is optimal to disperse power to some degree $\rho^*(\theta) \in (0, \infty)$, and the optimal concentration of power is strictly decreasing in the candidates' office motivation: $\frac{d\rho^*}{d\theta} < 0$.*

Proposition 5 establishes a relation between candidates' motivation and the optimal level of power concentration. For two reasons, changes in office motivation affect

the relative size of empowerment effect and behavioral effect. First, increasing office motivation θ implies that candidates respond more strongly to electoral incentives. Thus, the negative behavioral effect is reinforced. Second, increasing θ results in larger policy distortions, i.e., a lower cutoff α. As argued above, the reduction in α implies that the negative behavioral effect increases relatively to the positive empowerment effect at the optimal level of concentration. In total, an increase in office motivation makes power concentration less beneficial for voters.

Regarding the optimal level of concentration, we have to distinguish two cases. First, consider the case of mainly policy-oriented candidates, in which mimicking is not prevalent. For $\theta < \bar{\theta}$, the behavioral effect is sufficiently small to be dominated by the positive empowerment effect for all levels of ρ. Consequently, welfare is maximized by full concentration of power. For higher levels of office motivation, $\theta > \bar{\theta}$, both effects outbalance each other at some interior level of power concentration $\rho^* \in (0, \infty)$, representing the optimal political institutions. With any further rise in θ, the relative increase of the behavioral effect implies that both effects are equalized at a strictly lower level of ρ. Hence, the more office-motivated politicians are, the more dispersion of power is optimal.

Intuitively, office motivation represents a source of inefficiency in our model because it induces policy distortions, which are aggravated by high levels of power concentration. The more severe the implied inefficiency is, the more beneficial it is to attenuate these distortions through power-dispersing political institutions.

3.6 Empirical Analysis

In this section, we analyze whether data for established democracies is in line with our model predictions. Our model establishes a relationship between democratic institutions and the efficiency of implemented policies. Crucially, the effect of institutions depends on the motivation of politicians. Proposition 5 states that power concentration is always conductive to the implementation of efficient policies at low levels of office motivation, $\theta < \bar{\theta}$. At higher levels of office motivation, however, the optimal level of power concentration is interior and power should not be maximally concentrated. Moreover, the optimal degree of power concentration declines for fur-

ther increases in office motivation. Since the welfare function is quasi-concave, the implications of our model can be summarized in the following Hypothesis.

Hypothesis. *The effect of power concentration on welfare depends on the level of politicians' office motivation. Power concentration has positive effects on welfare if politicians are mainly policy motivated. In contrast, if politicians are mainly office motivated, the welfare effect of power concentration is significantly smaller or even negative.*

We discuss an operationalization of the relevant variables and an empirical test of this Hypothesis in the following.

3.6.1 Operationalization

The test of our model's predictions requires three basic measures. As the dependent variable, we need a measure of efficient policies. Key independent variables are the degree of power dispersion within the political system and the extent of politicians' office motivation.

Any efficient policy, as described by our model, benefits the public as a whole. As a measure for *efficient policies*, we use growth in real GDP per capita (World Bank). It provides a concise and objective measure of developments that bear the potential of welfare improvements for the general public. Growth has been used as outcome variable by a number of other empirical studies on political institutions as Feld & Voigt (2003) and Enikolopov & Zhuravskaya (2007). Other frequently used outcome measures relate to fiscal policy (see Voigt 2011), which is not addressed in our model.

Several measures of democratic institutions have been discussed in the literature. The *allocation of power* that is implied by political institutions is well described by Lijphart's index of the executive-parties dimension (Lijphart 1999). This well-established measure quantifies how easily a single party can take complete control of the government. High values of the index correspond to high dispersion of power within the political system. It focuses on economically developed countries with a long democratic tradition and hence covers 36 countries. The measure is based on the period 1945-1996. New Zealand underwent major constitutional changes after

1996 and is thus excluded from the analysis. Its inclusion, however, does not change the qualitative results.

While *office motivation* cannot be measured objectively, indication for it may come from surveys of voters.[10] The International Social Survey Panel (ISSP) includes questions on voters' opinion about politicians.[11] The item relevant to our study was included in its 2004 survey, which was performed in most democratic states: 'Most politicians are in politics only for what they can get out of it personally.' Agreement with this statement is coded on a five point scale. We use the mean points of all survey participants in a country as our measure for the importance of office motivation in our model. That means, we assume that differences in this item reflect differences in politicians' motives.

For an easy interpretation of regression results, we normalize the indices for both office motivation and power dispersion to range between zero and one. High values indicate pronounced office motivation of political leaders or a strong dispersion of political power, respectively.

3.6.2 Design

Our analysis focuses on countries with a similar degree of democratization. We require that all countries be established democracies as identified by the 2002 Polity IV Constitutional Democracy index (Marshall & Jaggers 2010). All countries have to feature an index of 95 or higher, which excludes Venezuela from the sample. The remaining 18 countries in the sample are similar with respect to their economic characteristics. In particular, all countries are highly economically developed as classified by the World Bank. They furthermore feature a Human Development Index (HDI) of at least 0.9 in 2004, which places them in the top quintile of all countries.[12]

The time-invariant regressors require a cross-country analysis. To address prob-

[10] Alternatively, one could use measures that are based on experts' assessments like the Corruption Perception Index from Transparency International and the Worldwide Governance Indicators from Kaufmann et al. (2009). However, these indices focus on rent extraction and not on private motivations of politicians in general.

[11] Other surveys, as the World Values Survey, the Global Barometer Survey, the Eurobarometer, or the European Value Survey query trust or confidence in institutions, such as the political parties and the national parliament. Such questions only indirectly relate to politicians' motivation.

[12] The similarity in socioeconomic development was formulated as a major prerequisite for cross-country analyses in Armingeon (2002).

lems of reverse causality, we use 2004 as the base year for the regression. Our explained variable captures growth after 2004, while our explanatory variables are measured at or before this year. We control for variables that may be correlated with both our explanatory variables and our explained variable. Most notably, past economic performance affects growth (see, e.g., Barro 1991, Sala-i-Martin 1994) and may also alter voters' perception of politicians. We hence control for GDP per capita of 2004. Also other variables have been shown to robustly affect growth, such as capital accumulation, school enrollment rates, life expectancy, or openness of the economy (see, e.g., Sala-i-Martin 1997). To capture such influences and to keep the number of explanatory variables low, we add past growth in real GDP per capita (from 1991 to 2004) to the regression. All variables used in our regression are summarized in Appendix C.3.

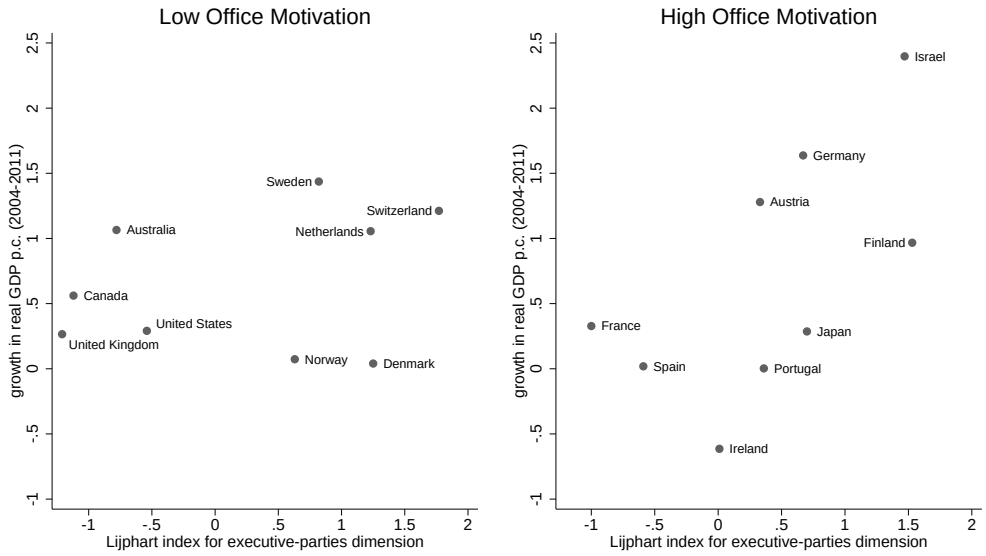
3.6.3 Results

As a first step in our analysis, we split the country set at the median value of politicians' office motivation. Figure 3.3 plots growth against the dispersion of power for the two sets of countries. The left panel depicts the relationship for countries in which politicians' office motivation is below its median value, while the right panel depicts the relationship for countries in which politicians' office motivation is above its median value. The figure suggests that power dispersion has only small effects if politicians are mainly policy motivated, whereas power dispersion is beneficial for growth if politicians are mainly office motivated. For both groups of countries, the unconditional correlations between power dispersion and growth support this observation.[13]

A statistical test of the effect of power dispersion on economic growth is performed in the OLS regressions presented in Table 3.1. Test statistics are based on White heteroscedasticity-consistent standard errors. Column (a) displays the regression results if the interaction term between power dispersion and politicians' office

[13]For countries with high levels of politicians' office motivation, there is a positive and weakly significant relationship between growth and power dispersion (Pearson's correlation coefficient, $\rho = 0.618$, $p = 0.0759$), while there is no significant relationship between the two variables for countries with low levels of politicians' office motivation (Pearson's correlation coefficient, $\rho = 0.291$, $p = 0.447$).

Figure 3.3: Relationship between power dispersion and growth



motivation is omitted. The unconditional effect of power dispersion on economic outcomes is insignificant.

This picture changes if the interplay between power dispersion and politicians' motivation is taken into account. Column (b) reports the corresponding regression results. Note the positive and significant coefficient of the interaction term between power dispersion and office motivation. It implies that power dispersion is more positively related to growth, the more office motivated politicians are. The inclusion of the interaction term in the regression also strongly increases the explanatory power of the econometric model. The adjusted R^2 increases from 0.19 to 0.49. In the analysis of political institutions, neglecting the interplay between power dispersion and politicians' office motivation would thus ignore a relevant aspect.

As it turns out, power dispersion goes along with either increased or decreased growth prospects depending on the level of politicians' office motivation. The conditional effect of power dispersion at the lowest and the highest level of office motivation are reported in Table 3.2. At the lowest level of office motivation, power dispersion is negatively related to growth whereas this relationship turns out to be positive at the highest level of office motivation. Our analysis thus leads to the following result.

Table 3.1: OLS regression results

	Growth in real GDP per capita (2004-2011)	
	(a)	(b)
Power dispersion	0.852	−3.565*
	(0.490)	(1.637)
Office motivation	−0.125	−6.382**
	(1.090)	(2.666)
Power dispersion		**8.948****
· office motivation		(3.520)
Real GDP per capita	−0.0247	−0.0436*
in 2004 (in $ 1000)	(0.0251)	(0.0214)
Growth in GDP per capita	−0.267***	−0.352***
(1991-2004)	(0.0789)	(0.0586)
Constant	1.530	5.410***
	(1.045)	(1.583)
adjusted R^2	0.19	0.49
F	4.38	14.17
N	18	18

Standard errors are provided in brackets. ***, **, * indicate significance at the 1-, 5-, and 10-percent level, respectively.

Result. *The higher is office motivation the more positively is the link between power dispersion and growth. Furthermore, power dispersion is positively related to growth if and only if politicians' office motivation is high. If politicians' are mainly policy motivated, power dispersion comes along with reduced growth.*

This result is in support of the hypothesis derived from our model. We do not only observe that the interaction effect is as predicted, but also that the effects of power dispersion changes its sign as suggested by the theory. In total, we conclude

Table 3.2: Effect of power dispersion

	low office motivation	high office motivation
Coefficient	−3.565*	5.382***
Standard error	1.637	1.955

The table depicts the coefficient of power dispersion for the lowest level of office motivation ($\theta = 0$) and for the highest level of high office motivation ($\theta = 1$). ***, **, * indicate significance at the 1-, 5-, and 10-percent level, respectively.

that the data is in line with the model presented in this chapter.

3.6.4 Discussion of Empirical Results

We conduct several robustness checks for our empirical test. In the following, we discuss the use of different indicators for our main variables, the period of the financial crisis in our data, and an alternative explanation for our result.

We check whether the positive and significant interaction term between power dispersion and politicians' office motivation is robust to the use of different measures for our key variables. Instead of politicians' motivation from the ISSP, we also use confidence in political parties as contained in the third wave of the World Values Survey (WVS), which was concluded in 1998. Using this measure and adjusting the GDP and growth variables to the survey date, the interaction effect remains positive and significant (p=0.009, F=1141.31, N=10). Unfortunately, the set of countries covered both by the third wave of the WVS as well as by Lijphart is small. Other surveys on politicians' office motivation have been conducted only very recently and are thus not applicable within our research design.

The measure for power dispersion by Lijphart (1999) is available in a more current version from Armingeon et al. (2011). The use of this indicator yields a highly significant interaction term (p=0.009, F=9.95, N=17). Armingeon et al. (2011) also provide a modified index which focuses on institutional factors only. It is based on the variables "electoral disproportionality" and "number of parties" and is invariant to behavioral factors such as "absence of minimal winning coalitions" included in the original index. Using this measure instead, the results remain significant (p=0.061, F=15.99, N=17). We also use three different measures which depict important aspects of power dispersion and find similar patterns. For the index for checks and balances (Keefer & Stasavage 2003) and a plurality electoral system dummy (Beck et al. 2001), the interaction effect shows the expected sign ($p \leq 0.087, F \geq 8.91, N = 18$). For the nine-categorial type of electoral system (IDEA 2004), however, the coefficient is insignificant ($p = 0.159, F = 8.53, N = 18$).

One might fear that our result is influenced by the Financial crisis which affected output beginning in 2008. To ensure that the Financial crisis does not drive patterns

in the data, we may restrict explained GDP growth to the years 2004-2007. For this shorter period the interaction term between power dispersion and office motivation remains weakly significant (p=0.092, F=4.20, N=18). Using the World Values Survey for our measure of politicians' office motivation we can expand explained GDP growth to the years 1998-2007. This data provides a similar picture (p=0.062, F=127.54, N=10). An alternative approach to deal with the financial crisis is to exclude countries that were particularly affected. The result is robust to the exclusion of any one country from the analysis ($p \leq 0.081$) and to the exclusion of any subset of the countries Ireland, Spain, and Portugal ($p \leq 0.075$), which were affected disproportionately.

Finally, the empirical observation in this section could have a different explanation. This may be the case if our measure for politicians' office motivation captures politicians' preferences not only for office but also for rent extraction. Our measure is in fact likely to represent a mix of both motives. However, it is not evident that institutions interact with rent seeking as predicted by our model. In particular, models that allow the prevalence of rent seeking to vary among politicians (Smart & Sturm 2006, Besley & Smart 2007) deliver ambiguous results.

3.7 Modifications and Extensions

Our model is flexible enough to incorporate several modifications and extensions. In a first step, we extend the analysis to non-informative equilibria. In a second step, we generalize the setting in three dimensions. First, we introduce a continuous policy space such that candidates may choose the magnitude of reform they propose rather than limiting their choice set to a complete reform and the status quo. Second, we show that limited commitment, i. e., the possibility to withdraw a proposal after the election with a certain probability, does not change the results. Third, we allow for heterogeneous policy preferences of voters in the sense that proposals of candidates may be valued by some voters and disliked by others. None of these modifications alter the qualitative results of the model (all proofs are found in Appendix C.2). We end the section with a discussion of the desirability of democratic selection where we contrast a result of Maskin & Tirole (2004) with our findings.

3.7.1 Non-Informative Equilibria

In the main part of the chapter, we focus on the effects of power dispersion in informative equilibria. However, changes in power concentration may also allow to move from a non-informative to an informative equilibrium, thereby increasing welfare.

Proposition 3 establishes a dependence between the level of office motivation θ and the characteristics of the unique divine equilibrium. This equilibrium is informative if and only if θ is below the threshold $\bar{\theta}(\rho)$. If instead $\theta \geq \bar{\theta}(\rho)$, the unique divine equilibrium is non-informative: the reform incentive function is larger than zero for all types of candidates. Even the least able candidate proposes a reform, although it will fail with certainty ($\alpha = 0$). However, $\bar{\theta}(\rho)$ is strictly decreasing in ρ. Thus, it is possible to move from non-informative equilibria to informative ones by implementing political institutions that induce more power dispersion.

Proposition 6. *For any level of θ, there exists $\bar{\rho}(\theta) > 0$ such that the unique divine equilibrium is informative if and only if power is sufficiently dispersed, $\rho < \bar{\rho}(\theta)$. All informative equilibria strictly welfare-dominate non-informative equilibria.*

For the last statement, note that in any informative equilibrium low ability candidates with $a_i \in [0, \alpha)$ refrain from proposing inefficient reforms. Hence, these candidates receive less power, while more power is allocated to welfare enhancing candidates with $a_i \geq \alpha$, who provide a positive welfare contribution.

3.7.2 Continuous Policy Space

Until now, we have assumed that candidates can either propose a reform or the status quo. However, many policy decisions are inherently continuous and politicians can choose "how much" of a reform they propose to be implemented. Suppose that the action space of the candidates is $x_i \in [0, 1]$, with $x_i = 0$ being the status quo and $x_i = 1$ representing a complete reform. As before, the welfare contribution of candidate i is given by $x_i(a_i - c)$.

Given the continuous policy space, it is possible to interpret the realized outcome as a compromise between the candidates' agendas instead of a lottery between the proposals. Then, candidates with larger amount of power $f(v_i, \rho)$ are able to enforce

larger parts of their agenda, while candidates with less power only slightly influence the political decision.

Proposition 7. *Let the action space of candidates be continuous with $x_i \in [0, 1]$. There is a unique divine equilibrium, which is outcome equivalent to the one resulting for a binary action space. As a consequence, Propositions 1 to 5 hold.*

Since reform incentives are still monotonically increasing in the ability of the candidates, so is the magnitude of reform they propose. The divinity criterion yields that only complete reforms or the status quo are played in equilibrium. To see this, first note that complete reforms are always proposed in a divine equilibrium. If this was not the case, the divinity criterion would require that a deviation to a complete reform would have to be attributed to the most able candidate. Given these beliefs, a complete reform would yield a profitable deviation for the most able candidates. As a consequence, all agents with ability above c choose to propose a complete reform instead of proposing only a share of a reform, since they profit from the higher welfare contribution as well as from the higher office utility generated by this proposal. Thus, voters associate a negative welfare contribution with any intermediate reform proposal. Hence, such a proposal leads to a smaller vote share than the status quo. For candidates below c, an intermediate reform proposal also leads to a smaller welfare contribution than the status quo. Overall, only the two extremes of the action space are played in a divine equilibrium.

Consequently, restricting the action space of candidates to the status quo policy or a complete reform does not impose a loss of generality. The unique divine equilibrium is outcome equivalent in the sense that strategies are equivalent and only out-of-equilibrium beliefs may distinguish the equilibria. All proofs carry over to this setup.

3.7.3 Limited Commitment

The assumption of full commitment is widely used to ensure tractability of models (see, e.g., Persson & Tabellini 2003). However, it may seem too restrictive that politicians can never change or adapt their agenda. In our setting, candidates with ability lower than c have an incentive to withdraw a reform proposal when they gain power. A straightforward way to introduce limited commitment into the model is

to assume that, with probability $\lambda > 0$, the environment changes after the election and politicians may deviate from their proposal. This could be due to an unexpected shock in the policy field, a major event in another policy field, etc. With probability $1 - \lambda$, on the contrary, they have to carry out their proposal.

Proposition 8. *Suppose policy proposals are binding with probability λ. Then Propositions 1 to 5 continue to hold.*

This form of limited commitment does not change the main results of the chapter. In essence, it increases incentives to propose a reform for low ability candidates, since they may be able to withdraw their proposal after the election. However, this only affects the level of equilibrium cutoffs and not the qualitative results.

The welfare effect of reduced commitment is ambiguous. On the one hand, all candidates with ability $a_i < c$ withdraw their reforms with probability λ, thereby increasing welfare. On the other hand, as limited commitment diminishes the negative welfare contribution of a reform proposal for low ability candidates, more inefficient reforms are proposed. Thus, reform proposals become less informative to the voters, and high-ability candidates receive less political power. The worse selection of politicians as well as the more inefficient reform proposals per se represent a negative effect on welfare.

3.7.4 Heterogeneous Preferences

In political philosophy as well as public debate, a major virtue of power dispersion is seen in the political representation of minorities and the prevention of a tyranny of the majority. For example, James Madison argues in the Federalist Papers #51 that "the rights of the minority will be insecure" without proper checks and balances (Madison 1788*a*). So far, our analysis has abstracted from this aspect of political institutions in order to emphasize effects of power dispersion that are independent of minority rights.

To incorporate heterogeneity in voters' policy preferences into our model, we may assume that voters differ in their valuation of a reform rather than in their candidate preferences.[14] In particular, voter k receives a payoff of μ_k if a reform is successfully

[14]Our model also allows for additional (ideological) heterogeneity. Let the reforms advocated

implemented. Let the preference parameter μ_k be symmetrically distributed according to the pdf $\xi(\mu)$ and the cdf $\Xi(\mu)$ with full support on some interval $\left[\underline{\mu}, \bar{\mu}\right]$. We assume that the mean preference is larger than the reform cost c, while $\underline{\mu} \in (0, c)$. This implies that a majority of voters is in favor of the reform as long as it is adopted by a sufficiently able candidate, while a minority strictly prefers the status quo.

Proposition 9. *If the voters have heterogeneous policy preferences according to distribution $\Xi(\mu)$, Propositions 1 to 5 continue to hold.*

Essentially, the proofs for all previous results hold whenever the expected vote share of a reforming candidate i is increasing in the average ability of candidates that propose a reform, i.e., in the equilibrium cutoff α_i. The basic model can be seen as the special case with a degenerate distribution function with $\mu_k = 1$ for all voters.

Given these heterogeneous policy preferences, our model allows to reconsider Madison's conjecture. Increasing power dispersion leads to higher amounts of power for candidates proposing the status quo, which is the minority's preferred option. As a consequence, the status quo is proposed more often yielding an additional increase in the minority's welfare.

Lemma 3. *In any informative equilibrium, the utility of each minority voter k with $\mu_k \leq c$ is strictly decreasing in the concentration of political power.*

The quote above suggests that the Founding Fathers of the United States were interested in the protection of minority rights per se. Formally, this objective can be captured by introducing inequality aversion into the welfare function, using a strictly increasing, strictly concave and twice continuously differentiable weighting function w:

$$W_{IA} = \int_{\underline{\mu}}^{\bar{\mu}} w(V(\mu_k, \rho))\xi(\mu_k)d\mu_k.$$

In this function, $V(\mu_k, \rho)$ represents the expected utility of a voter with preference μ_k. Following Atkinson (1973) and Hellwig (2005), the relative curvature of w can be

by both candidates be targeted towards a different group of voters and let μ_{ki} denote the payoff to voter k from a successful reform by candidate i. If both parameters share the unconditional distribution $\Xi(\mu)$ defined above, Proposition 9 continues to hold for any correlation between μ_{k1} and μ_{k2}. With negative correlation, the candidates' reform proposals differ strongly or are even diametrically opposed (as in a stylized left-right policy space).

referred to as a measure of inequality aversion. Compared to the inequality-neutral welfare function, W_{IA} puts higher weights on voters with low expected utility.

Proposition 10. *Any welfare function W_{IA} with inequality aversion is maximized at a lower level of power concentration than the inequality-neutral function W.*

Intuitively, power-dispersing institutions reduce the discretion of the election winner, who is chosen by the majority. The expected utility of the majority of voters is hence reduced while the minority is better off. The utility of the minority is valued strongly by an inequality averse constitutional designer. Thus, he will choose to disperse power more strongly than if he was inequality-neutral.[15]

3.7.5 Desirability of Democratic Selection

Our model also allows to investigate whether democratic selection leads to higher welfare than a non-democratic system in which one agent is drawn randomly and receives unlimited political power. A similar question is addressed by Maskin & Tirole (2004), who investigate whether decision-making power should be allocated to accountable "politicians" or nonaccountable "judges". While a non-democratic system in our model does not allow for sorting of candidates, it does not provide the decision-maker with incentives to choose inefficient policies, either. Clearly, this is an extremely positive view on non-democratic systems, which reflects the lack of agency problems in our model, once a candidate is in office.

In our framework, a non-democratic system is mathematically equivalent to the limit case of complete dispersion of power. With $\rho = 0$, the allocation of power is independent of the election result and each candidate sets policy with probability one half. Thus, it follows directly from Proposition 5 that political selection is always desirable.

Corollary 1. *For any $\theta < \infty$, democratic elections with optimally chosen power concentration ($\rho = \rho^*$) provide strictly higher welfare than non-democratic systems with random assignment of political power.*

Note that this contrasts to the result of Maskin & Tirole (2004) who find that, un-

[15] Note that W_{IA} is maximized at a strictly lower level than W for any $\theta < \bar{\theta}$. For the opposite case, even constitutional designers with small degrees of inequality aversion will prefer to concentrate power completely.

der certain circumstances, political decisions should rather be delegated to “judges" than to “politicians". In contrast to our setup, accountability in their model refers to whether the public official is subject to reelection after taking a political decision. More importantly, however, Maskin & Tirole only consider the polar case of politicians with fully concentrated political power, while we allow for continuous changes in the degree of power concentration.[16]

3.8 Conclusion

We have investigated effects of variations in the level of power concentration on the behavior of politicians in political campaigns and the implied welfare changes if candidates are office-motivated and privately informed about their ability. Increasing the concentration of power causes two effects. On the one hand, it has a positive *empowerment effect* because more power is given to election winners, who provide higher welfare in expectation. On the other hand, it also has a negative *behavioral effect*. With a stronger concentration of political power, low-ability candidates have a stronger incentive to mimic more able ones by committing to risky reforms. This limits the voters' capacities to select high ability politicians. The optimal level of power concentration balances both effects.

Furthermore, we have identified a negative relation between the extent of office motivation and the optimal level of power concentration. If politicians care mainly about welfare, power concentration yields strictly positive effects. In the case of strong office motivation, on the contrary, welfare is maximized by institutions that divide power between election winner and loser.

In the empirical part, we have confronted these findings with data for eighteen established democracies. Our findings are in line with the theoretical predictions: There is a significant positive interaction effect between office motivation and power dispersion. For the lowest levels of office motivation, power-dispersing institutions come along with significantly lower economic growth, while we find a positive correlation for countries with higher levels of office motivation.

[16] If one restricts attention to the two polar cases of fully concentrated and completely dispersed power, however, one of the main results of Maskin & Tirole (2004) can be replicated in our model. Then, non-democratic systems perform better if candidates are mainly office-motivated.

C Appendix

C.1 Proofs for Main Model

Proof to Proposition 1:

Efficient policy choice: Since voters can directly observe candidates' abilities as well as their policies, voters have that the belief system $\sigma = a$ and are able to fully anticipate the difference in payoffs. The vote share of Candidate 1 is given by:

$$v_1(x_1, x_2, \sigma) = 1 - \Omega(x_2(\hat{a_2}(x_2) - c) - x_1(\hat{a_1}(x_1) - c)) = 1 - \Omega(x_2(a_2 - c) - x_1(a_1 - c)).$$

Candidate 1 chooses x_1, taking into account his opponent's strategy X_2, to maximize

$$U_1(x_1, a_1) \quad = \quad \int_0^1 \phi(a_2) f(v_1(x_1, x_2, \sigma), \rho) \left(\theta + x_1(a_1 - c)\right) da_2$$

As f is strictly increasing in v_1, which in turn is strictly increasing in the difference in welfare contributions, candidate 1 is only interested in maximizing his welfare contribution. Clearly, the dominant strategy is given by

$$X_1(a_1) = \begin{cases} x_i = 0 & \text{for} \quad a_i < c \\ x_i = 1 & \qquad\quad a_i \geq c. \end{cases}$$

Positive welfare effect of increasing power concentration: To simplify notation, denote the welfare contribution of player i by $\pi_i(x_i, \sigma) = x_i(\hat{a_i}(x_i) - c)$. We suppress the dependence on the belief system and the action if possible without creating confusion. Moreover, let $g(\pi_1 - \pi_2, \rho)$ be the expected power share above one half

$$f(v_1(x_1, x_2, \sigma), \rho) - \frac{1}{2} = g(\pi_1 - \pi_2, \rho).$$

For any candidate there are two cases. He can either face an opponent with a reform proposal or one that proposed the status quo. The ex ante welfare is the weighted average of these two alternatives. Given the optimal behavior identified above, welfare in the full

information case is given by

$$
\begin{aligned}
&W(\rho) = \\
&\int_0^1 \int_0^{a_1} \phi(a_1)\phi(a_2) \left\{ \pi(X_1(a_1),\sigma) \left[\frac{1}{2} + g(\pi_1 - \pi_2, \rho) \right] + \pi(X_2(a_2),\sigma) \left[\frac{1}{2} - g(\pi_1 - \pi_2, \rho) \right] \right\} da_2 da_1 \\
&+ \int_0^1 \int_{a_1}^1 \phi(a_1)\phi(a_2) \left\{ \pi(X_1(a_1),\sigma) \left[\frac{1}{2} + g(\pi_1 - \pi_2, \rho) \right] + \pi(X_2(a_2),\sigma) \left[\frac{1}{2} - g(\pi_1 - \pi_2, \rho) \right] \right\} da_2 da_1 \\
&= 2 \int_0^1 \int_0^{a_1} \phi(a_1)\phi(a_2) \left\{ \pi(X_1(a_1),\sigma) \left[\frac{1}{2} + g(\pi_1 - \pi_2, \rho) \right] + \pi(X_2(a_2),\sigma) \left[\frac{1}{2} - g(\pi_1 - \pi_2, \rho) \right] \right\} da_2 da_1.
\end{aligned}
$$

The derivative of the welfare function with respect to power concentration ρ is given by

$$
\frac{dW}{d\rho} = 2 \int_0^1 \int_0^{a_1} \phi(a_1)\phi(a_2) \left[\pi(X_1(a_1),\sigma) - \pi(X_2(a_2),\sigma) \right] \frac{\partial g(\pi_1 - \pi_2, \rho)}{\partial \rho} da_2 da_1 > 0.
$$

As $a_1 > a_2$ under the integral, the payoff difference $\pi_1 - \pi_2$ and $g(\pi_1 - \pi_2, \rho)$ are throughout positive, so that we have $\frac{\partial g(\pi_1 - \pi_2, \rho)}{\partial \rho} > 0$ due to the properties of the function $f(v, \rho)$.

Proof of Lemma 1: We only need to deal with the case of a politician with ability lower than c, since candidates with ability above c always choose to reform. Candidate 1 chooses to reform if and only if:

$$
\begin{aligned}
&prob(x_2 = 1) f(v_1(x_1 = 1, x_2 = 1, \sigma), \rho)(\theta + a_1 - c) \\
&+ (1 - prob(x_2 = 1)) f(v_1(x_1 = 1, x_2 = 2, \sigma), \rho)(\theta + a_1 - c) \\
&- prob(x_2 = 1) f(v_1(x_1 = 0, x_2 = 1, \sigma), \rho)\theta - (1 - prob(x_2 = 1))\theta \frac{1}{2} > 0.
\end{aligned}
$$

It can easily be seen that this reform incentive function is strictly monotonously increasing in the individual ability a. The same argument holds for Candidate 2. Thus, the optimal strategy of each candidate will always be of the cutoff type.

Proof of Proposition 2: Depending on the parameter values there may exist equilibria with cutoff being equal to one. As argued in the text these cannot be divine. In the following we show that there exists a unique equilibrium exhibiting cutoffs different from 1 and that this equilibrium features symmetric cutoffs.

Symmetry of cutoffs: Using the insight from above, we can write the incentive function of player 1 as:

$$\begin{aligned}R_1(a,\alpha_1,\alpha_2,\rho) =&(1-\Phi(\alpha_2))f(\rho,v_1(x_1=1,x_2=1,\sigma))(\theta+a-c)\\&+\Phi(\alpha_2)f(\rho,v_1(x_1=1,x_2=0,\sigma))(\theta+a-c)\\&-(1-\Phi(\alpha_2))f(\rho,v_1(x_1=0,x_2=1,\sigma))\theta-\Phi(\alpha_2)\frac{\theta}{2}.\end{aligned}$$

Using the definition of $g(\pi_1-\pi_2,\rho)$, this simplifies to

$$\begin{aligned}&R(a,\alpha_1,\alpha_2)=(1-\Phi(\alpha_2))\left[\left(g(\pi_1-\pi_2,\rho)+\frac{1}{2}\right)(\theta+a-c)\right]\\&+\Phi(\alpha_2)\left[\left(g(\pi_1,\rho)+\frac{1}{2}\right)(\theta+a-c)\right]-(1-\Phi(\alpha_2))\left(\frac{1}{2}-g(\pi_2,\rho)\right)\theta-\Phi(\alpha_2)\theta\frac{1}{2}.\end{aligned}$$

In equilibrium, the reform incentive is zero for the cutoff-type α_1.

$$\begin{aligned}&R_1(\alpha_1,\alpha_1,\alpha_2)=0\\&\Leftrightarrow\frac{\theta\left[\Phi(\alpha_2)g(\pi_1,\rho)+(1-\Phi(\alpha_2))\left[g(\pi_1-\pi_2,\rho)+g(\pi_2,\rho)\right]\right]}{c-\alpha_1}=\\&\frac{1}{2}+\Phi(\alpha_2)g(\pi_1,\rho)+(1-\Phi(\alpha_2))g(\pi_1-\pi_2).\end{aligned}$$

Subtracting the corresponding equation for R_2, we get

$$\begin{aligned}&\frac{\theta\left[\Phi(\alpha_2)g(\pi_1,\rho)+(1-\Phi(\alpha_2))\left[g(\pi_1-\pi_2,\rho)+g(\pi_2,\rho)\right]\right]}{c-\alpha_1}\\&-\frac{\theta\left[\Phi(\alpha_1)g(\pi_2,\rho)+(1-\Phi(\alpha_1))\left[-g(\pi_1-\pi_2,\rho)+g(\pi_1,\rho)\right]\right]}{c-\alpha_2}=\\&\Phi(\alpha_2)g(\pi_1,\rho)+(1-\Phi(\alpha_2))g(\pi_1-\pi_2,\rho)-\Phi(\alpha_1)g(\pi_2,\rho)+(1-\Phi(\alpha_1))g(\pi_1-\pi_2,\rho)\\&\Leftrightarrow\left[\frac{\theta\Phi(\alpha_2)}{c-\alpha_1}-\frac{\theta(1-\Phi(\alpha_1))}{c-\alpha_2}-\Phi(\alpha_2)\right]g(\pi_1,\rho)\\&-\left[\frac{\theta\Phi(\alpha_1)}{c-\alpha_2}-\frac{\theta(1-\Phi(\alpha_2))}{c-\alpha_1}-\Phi(\alpha_1)\right]g(\pi_2,\rho)\\&+\underbrace{\left[(1-\Phi(\alpha_2))\left(\frac{\theta}{c-\alpha_1}-1\right)+(1-\Phi(\alpha_1))\left(\frac{\theta}{c-\alpha_2}-1\right)\right]}_{>0}g(\pi_1-\pi_2,\rho)=0.\end{aligned}$$

If $\alpha_1 = \alpha_2$, this condition is trivially fulfilled. Assuming wlog $\alpha_1 > \alpha_2$, the equality above can only be satisfied, if

$$\left[\frac{\theta\Phi(\alpha_2)}{c-\alpha_1} - \frac{\theta(1-\Phi(\alpha_1))}{c-\alpha_2} - \Phi(\alpha_2)\right] g(\pi_1,\rho) < \left[\frac{\theta\Phi(\alpha_1)}{c-\alpha_2} - \frac{\theta(1-\Phi(\alpha_2))}{c-\alpha_1} - \Phi(\alpha_1)\right] g(\pi_2,\rho).$$

However, we have $\pi_1 > \pi_2$ by assumption, which implies $g(\pi_1,\rho) > g(\pi_2,\rho)$. Furthermore, we can show that the factor before $g(\pi_1,\rho)$ is larger than the one before $g(\pi_2,\rho)$:

$$\begin{aligned} \frac{\theta}{c-\alpha_1}\Phi(\alpha_2) - \frac{\theta}{c-\alpha_2}(1-\Phi(\alpha_1)) - \Phi(\alpha_2) &> \frac{\theta}{c-\alpha_2}\Phi(\alpha_1) - \frac{\theta}{c-\alpha_1}(1-\Phi(\alpha_2)) - \Phi(\alpha_1) \\ \Leftrightarrow \frac{\theta}{c-\alpha_1} + \Phi(\alpha_1) &> \frac{\theta}{c-\alpha_2} + \Phi(\alpha_2). \end{aligned}$$

The last inequality is clearly fulfilled, generating a contradiction. Thus, the reform incentive functions R_1 and R_2 can never attain zero simultaneously for different cutoffs and there are only symmetric equilibria.

Existence: Let π denote the difference in welfare contributions between a reform and a status quo proposal. Making use of the symmetric cutoffs, the incentive function simplifies to:

$$R(\alpha,\rho) = \left[\frac{1}{2} + \Phi(\alpha)g(\pi,\rho)\right](\alpha - c) + \theta g(\pi,\rho) = 0.$$

Note that $R(1,\rho)$ is always positive if $\alpha = 1$. If $R(0,\rho) < 0$, the reform incentive is equal to zero at least once, due to the continuity and there exists an interior equilibrium. If $R(0,\rho) \geq 0$, it is an equilibrium that all candidates choose to reform. Hence, there is at least one equilibrium.

Proof of Proposition 3: Next, we establish uniqueness. The derivative of the incentive function with respect to α is:

$$\frac{\partial R}{\partial \alpha} = \underbrace{(\theta + (\alpha - c)\Phi(\alpha))g_\pi(\pi,\rho)\frac{\partial \pi}{\partial \alpha}}_{A} + \underbrace{\left(\frac{1}{2} + (\Phi(\alpha) + (\alpha - c)\phi(\alpha))g(\pi,\rho)\right)}_{B}.$$

The reform incentive function yields that A is always larger than zero in equilibrium for the cutoff type. B is also larger than zero, due to Assumption 1. The reform incentive is thus increasing at any cutoff. Consequently, there can only be one cutoff value.

Since the incentive function is equal to zero in any informative equilibrium, we use implicit differentiation to prove that there is a unique $\tilde{\theta}(\rho)$. The cutoff α is given by the maximum of zero and the value implying a reform incentive equal to zero. If there is an informative equilibrium the derivative is given by

$$\frac{d\alpha}{d\theta} = -\frac{g(\pi,\rho)}{(\theta+(\alpha-c)\Phi(\alpha))g_\pi(\pi,\rho)\frac{\partial\pi}{\partial\alpha} + \left(\frac{1}{2}+(\Phi(\alpha)+(\alpha-c)\phi(\alpha))g(\pi,\rho)\right)} < 0.$$

The denominator is positive (see above), as is numerator. Thus, the derivative is strictly negative in any interior equilibrium. Moreover, the reform incentive implies that $\alpha \to c$ if $\theta \to 0$. Hence, there is a unique $\tilde{\theta} > 0$, such that the unique equilibrium is informative if $\theta < \tilde{\theta}$.

Proof of Proposition 4: Again we use implicit differentiation to evaluate the derivative.

$$\frac{d\alpha}{d\rho} = -\frac{\frac{\partial R}{\partial\rho}}{\frac{\partial R}{\partial\alpha}} = -\frac{(\theta+(\alpha-c)\Phi(\alpha))g_\rho(\pi,\rho)}{(\theta+(\alpha-c)\Phi(\alpha))g_\pi(\pi,\rho)\frac{\partial\pi}{\partial\alpha} + \left(\frac{1}{2}+(\Phi(\alpha)+(\alpha-c)\phi(\alpha))g(\pi,\rho)\right)} < 0.$$

While the numerator is unambiguously positive, the positive sign of the denominator follows from Assumption 2. Hence, the overall effect is negative.

Proof of Lemma 2: Using the symmetry in equilibrium, the welfare can be simplified considerably.

$$\frac{W(\rho)}{2} = \underbrace{\int_\alpha^1 \phi(a)(a-c)da}_{z(\alpha)}\left(\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)\right).$$

Note that there is a direct effect on welfare, since the function $g(\pi,\rho)$ depends on ρ and an indirect effect since ρ changes the strategies of the politicians. Hence, we evaluate the total derivative of $W(\rho)$:

$$\frac{dW}{d\rho} = \frac{\partial W}{\partial\rho} + \frac{\partial W}{\partial\alpha}\frac{d\alpha}{d\rho}.$$

In the following we denote by $D > 0$ the denominator of the derivative of α with respect to ρ.

$$\begin{aligned}
\frac{dW}{d\rho} =& \Phi(\alpha)z(\alpha)g_\rho(\pi,\rho)+ \\
&+\left\{(c-\alpha)\phi(\alpha)\left(\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)\right)+z(\alpha)\left(\phi(\alpha)g(\pi,\rho)+\Phi(\alpha)g_\pi(\pi,\rho)\frac{\partial\pi}{\partial\alpha}\right)\right\}\frac{d\alpha}{d\rho} \\
=&\left\{\Phi(\alpha)z(\alpha)\left[\theta+(\alpha-c)\Phi(\alpha)\right]g_\pi\frac{d\pi}{d\alpha}+\Phi(\alpha)z(\alpha)\left[\frac{1}{2}+(\Phi(\alpha)+(\alpha-c)\phi(\alpha))g(\pi,\rho)\right]\right. \\
&-\left[(c-\alpha)\phi(\alpha)\left(\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)\right)+z(\alpha)\left(\phi(\alpha)g(\pi,\rho)+\Phi(\alpha)g_\pi(\pi,\rho)\frac{\partial\pi}{\partial\alpha}\right)\right] \\
&\left.\left[\theta+\Phi(\alpha)(\alpha-c)\right]\right\}\frac{g_\rho(\pi,\rho)}{D} \\
=&\frac{g_\rho(\pi,\rho)}{D}\left\{\Phi(\alpha)z(\alpha)\left[\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)+(\alpha-c)\phi(\alpha)g(\pi,\rho)\right]\right. \\
&\left.-\left[\phi(\alpha)\theta g(\pi,\rho)+z(\alpha)\phi(\alpha)g(\pi,\rho)\right]\frac{c-\alpha}{2g(\pi,\rho)}\right\} \\
=&\frac{g_\rho(\pi,\rho)}{D}\left\{\Phi(\alpha)z(\alpha)\left(\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)\right)-\phi(\alpha)(c-\alpha)\left[\frac{\theta}{2}+z(\alpha)\left(\frac{1}{2}+\Phi(\alpha)\right)\right]\right\} \\
=&\frac{g_\rho(\pi,\rho)}{D}\left\{\Phi(\alpha)\frac{W(\rho)}{2}-\phi(\alpha)(c-\alpha)\left[\frac{\theta}{2}+\frac{W(\rho)}{2}\right]\right\} \\
=&\frac{g_\rho(\pi,\rho)}{2D}\left\{\Phi(\alpha)W(\rho)-\phi(\alpha)(c-\alpha)\left(\theta+W(\rho)\right)\right\}
\end{aligned}$$

In any equilibrium, the term in brackets has to equal zero, since its factor is always positive. Rearranging, we get the following necessary and sufficient condition for extreme values of the welfare function:

$$h(\rho) \equiv \frac{\Phi(\alpha)}{\phi(\alpha)(c-\alpha)} - \left(1+\frac{\theta}{W(\rho)}\right) = 0.$$

Next, we prove that function h has at most one root in ρ, i. e., the welfare function attains at most one maximum. Assumption 2 is a sufficient condition for the first term to be decreasing in ρ and, thus, increasing in α. In any extreme value of the welfare function, the second term is constant in ρ. Thus, h is decreasing in each root and so is the term in brackets. As $h(\rho)$ is continuous in ρ, this implies that the welfare function has at most one interior maximum and no interior minimum, i. e., it is strictly quasi-concave.

Proof of Proposition 5: In the next step, we show how the derived maximum shifts with changes in θ. For $\theta \to 0$ we get from the equilibrium condition $\alpha = c$. The derivative

of the welfare function at $\theta = 0$ is given by:

$$\left.\frac{dW(\rho)}{d\rho}\right|_{\theta=0} = \frac{g_\rho(\pi,\rho)}{D}\Phi(\alpha)W(\rho).$$

This is positive. Hence, for $\theta \to 0$ the optimal institution embodies full concentration of power. Due to continuity, this is also true for an interval around 0. Finally, we show that the optimal ρ decreases monotonically in θ.

$$\frac{d\rho^*}{d\theta} = -\frac{\frac{dh(\rho)}{d\theta}}{\left.\frac{dh(\rho)}{d\rho}\right|_{\rho=\rho^*}}.$$

As argued before the term in the denominator is negative. With respect to the numerator, note that the equilibrium cutoff α is decreasing in θ, $\frac{d\alpha}{d\theta} = -\frac{g(\pi,\rho)}{D} < 0$. Consequently, the same is true for welfare, $\frac{dW}{d\theta} = \frac{\partial W}{\partial \alpha}\ \frac{d\alpha}{d\theta} < 0$. Hence, h is monotonically decreasing in θ. In total, we conclude that $\frac{d\rho^*}{d\theta} < 0$.

C.2 Proofs for Modifications and Extensions

Proof of Proposition 6: The cutoff $\bar{\theta}(\rho)$ is defined by $\bar{\theta} = \frac{c}{2g(\pi,\rho)}$. At this point a candidate with ability equal to zero is indifferent between proposing a reform or the status quo. $\bar{\theta}$ is decreasing in ρ. For $\rho \to 0$, we get that $g(\pi,\rho) \to 0$ implying $\bar{\theta} \to \infty$. Hence, for any given θ there is a ρ such that only informative equilibria can exist. Due to the monotonicity of $\theta(\bar{\rho})$, there is exactly one cutoff $\bar{\rho}(\theta)$, such that for all $\rho < \bar{\rho}(\theta)$ the unique divine equilibrium must be informative.

Proof of Proposition 8: For the case of limited commitment, the proofs of Proposition 1-5 need to be considered one by one. We shorten the argumentation, whenever it is equivalent or very similar to the case with full commitment. The proof of Proposition 1 does not rely on full commitment and thus conveys to the new setting.

Proof of Lemma 1 with limited commitment: We only need to deal with the case of a politician with ability lower than c, since candidates with ability above c always choose to reform. Limited commitment changes the payoff from entering office from $\theta + a - c$ to $\theta + \lambda(a - c)$. The rest of the proof is equivalent to the case with full commitment.

Proof of Proposition 2 with limited commitment: We just need to prove symmetry of cutoffs. The proof with regard to the classification of equilibria is identical to the

case with full commitment. In equilibrium, the reform incentive with limited commitment simplifies to:

$$
\begin{aligned}
&R_1(\alpha_1, \alpha_1, \alpha_2) = \\
&\theta \left[\Phi(\alpha_2) g(\pi_1, \rho) + (1 - \Phi_2) \left[g(\pi_1 - \pi_2, \rho) + g(\pi_2, \rho)\right]\right] + \\
&\lambda(\alpha_1 - c) \left[\frac{1}{2} + \Phi(\alpha_2) g(\pi_1, \rho) + (1 - \Phi(\alpha_2)) g(\pi_1 - \pi_2)\right] = 0 \\
&\Leftrightarrow \frac{\theta \left[\Phi(\alpha_2) g(\pi_1, \rho) + (1 - \Phi(\alpha_2)) \left[g(\pi_1 - \pi_2, \rho) + g(\pi_2, \rho)\right]\right]}{\lambda(c - \alpha_1)} = \\
&\frac{1}{2} + \Phi(\alpha_2) g(\pi_1, \rho) + (1 - \Phi(\alpha_2)) g(\pi_1 - \pi_2).
\end{aligned}
$$

Subtracting the corresponding equation for the second player and proceeding as in the proof with full commitment, we obtain

$$
\begin{aligned}
&\Leftrightarrow \left[\frac{\theta \Phi(\alpha_2)}{\lambda(c - \alpha_1)} - \frac{\theta(1 - \Phi(\alpha_1))}{\lambda(c - \alpha_2)} - \Phi(\alpha_2)\right] g(\pi_1, \rho) + \\
&\underbrace{\left[(1 - \Phi(\alpha_2)) \left(\frac{\theta}{\lambda(c - \alpha_1)} - 1\right) + (1 - \Phi(\alpha_1)) \left(\frac{\theta}{\lambda(c - \alpha_2)} - 1\right)\right] g(\pi_1 - \pi_2, \rho)}_{>0} = \\
&\left[\frac{\theta \Phi(\alpha_1)}{\lambda(c - \alpha_2)} - \frac{\theta(1 - \Phi(\alpha_2))}{\lambda(c - \alpha_1)} - \Phi(\alpha_1)\right] g(\pi_2, \rho).
\end{aligned}
$$

If $\alpha_1 = \alpha_2$, this condition is trivially fulfilled. Assuming wlog $\alpha_1 > \alpha_2$, the equality above implies that

$$
\left[\frac{\theta \Phi(\alpha_2)}{\lambda(c - \alpha_1)} - \frac{\theta(1 - \Phi(\alpha_1))}{\lambda(c - \alpha_2)} - \Phi(\alpha_2)\right] g(\pi_1, \rho) < \left[\frac{\theta \Phi(\alpha_1)}{\lambda(c - \alpha_2)} - \frac{\theta(1 - \Phi(\alpha_2))}{\lambda(c - \alpha_1)} - \Phi(\alpha_1)\right] g(\pi_2, \rho).
$$

However, we have $\pi_1 > \pi_2$. Moreover, we can show that

$$
\begin{aligned}
\frac{\theta}{\lambda(c - \alpha_1)} \Phi(\alpha_2) - \frac{\theta}{\lambda(c - \alpha_2)} (1 - \Phi(\alpha_1)) - \Phi(\alpha_2) &> \frac{\theta}{\lambda(c - \alpha_2)} \Phi(\alpha_1) - \frac{\theta}{\lambda(c - \alpha_1)} (1 - \Phi(\alpha_2)) - \Phi(\alpha_1) \\
\Leftrightarrow \frac{\theta}{\lambda(c - \alpha_1)} + \Phi(\alpha_1) &> \frac{\theta}{\lambda(c - \alpha_2)} + \Phi(\alpha_2).
\end{aligned}
$$

Thus, the reform incentive functions R_1 and R_2 can never simultaneously attain zero for $\alpha_1 > \alpha_2$, implying that there can only be symmetric equilibria.

Existence: The reform incentive function simplifies to

$$R(\alpha,\rho)=\left[\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)\right]\lambda(\alpha-c)+\theta g(\pi,\rho)=0.$$

Note that it is always positive if $\alpha=1$. If $R(0,\rho)<0$, the reform incentive is equal to zero at least once, due to the continuity and there exists an interior equilibrium. If $R(0,\rho)\geq 0$, it is an equilibrium that all candidates choose to reform. Hence, there is at least one equilibrium.

Proof of Proposition 3 with limited commitment: Next, we establish uniqueness. The derivative with respect to α is:

$$\frac{\partial R}{\partial \alpha}=\underbrace{(\theta+(\alpha-c)\lambda\Phi(\alpha))g_\pi(\pi,\rho)\frac{\partial \pi}{\partial \alpha}}_{A}+\underbrace{\lambda\left(\frac{1}{2}+(\Phi(\alpha)+(\alpha-c)\phi(\alpha))g(\pi,\rho)\right)}_{B}.$$

The remainder of the proof is equivalent to the case with perfect commitment.

Proof of Proposition 4 with limited commitment: We use implicit differentiation to prove the proposition:

$$\frac{d\alpha}{d\rho}=-\frac{\frac{\partial R}{\partial \rho}}{\frac{\partial R}{\partial \alpha}}=-\frac{(\theta+\lambda(\alpha-c)\Phi(\alpha))g_\rho(\pi,\rho)}{(\theta+(\alpha-c)\lambda\Phi(\alpha))g_\pi(\pi,\rho)\frac{\partial \pi}{\partial \alpha}+\lambda\left(\frac{1}{2}+(\Phi(\alpha)+(\alpha-c)\phi(\alpha))g(\pi,\rho)\right)}<0.$$

While the numerator is unambiguously positive, the positive sign of the denominator follows from Assumption 1.

Proof of Proposition 5 with limited commitment: The welfare can be simplified to:

$$\frac{W(\rho)}{2}=\underbrace{\left(\lambda\int_\alpha^1\phi(a)(a-c)da+(1-\lambda)\int_c^1\phi(a)(a-c)da\right)}_{z(\alpha)}\left(\frac{1}{2}+\Phi(\alpha)g(\pi,\rho)\right).$$

The total derivative of the welfare function can be simplified along the same lines as with full commitment and yields the same equilibrium condition

$$h(\rho)=\frac{\Phi(\alpha)}{\phi(\alpha)(c-\alpha)}-\left(1+\frac{\theta}{W(\rho)}\right)=0.$$

Thus, the rest of the proof is equivalent.

For the second step, we have to show how the unique maximum changes with θ. For $\theta \to 0$ we get from the reform incentive $\alpha = c$ and

$$\left.\frac{dW(\rho)}{d\rho}\right|_{\theta=0} = \frac{g_\rho(\pi,\rho)}{D}\Phi(\alpha)\lambda W(\rho).$$

This is positive. Hence, for $\theta \to 0$ the optimal institution is full power concentration. Due to continuity we get that this is also true for an interval around 0. Since $h(\rho,\alpha)$ does not change with limited commitment we again refer the reader to the proofs for full commitment to see that the optimal ρ is monotonically decreasing in θ.

Proof of Proposition 9: In all proofs of Appendix C.1 we use only one important feature of the vote share $v_i(x_1, x_2, \sigma)$. This is, the vote share is weakly increasing in the expected abilities of the candidates and thus in the difference of welfare contributions. In the following we show that this still holds for the case of heterogeneous policy preferences. All other proofs do not change. In the new setting, voter i votes for candidate 1 if:

$$x_1(\mu_{1i}\hat{a_1} - c) \geq x_2(\mu_{2_i}\hat{a_2} - c)$$

If both propose a reform, the vote share for candidate one is:

$$v_1(x_1 = 1, x_2 = 1, \sigma) = \int_k^l \int_k^{\frac{\mu_1 \hat{a_1}}{\hat{a_2}}} \xi(\mu_2)\xi(\mu_1).$$

The derivative with respect to $\hat{a}_1$ is positive, since we assume the mean of the preferences to be larger than zero. If candidate 1 faces a status quo proposing opponent, his expected vote shares is

$$v_1(x_1 = 1, x_2 = 0, \sigma) = \int_{\frac{c}{\hat{a_1}}}^l \xi(\mu_1).$$

The derivative with respect to the expected ability of Candidate 1 is again positive. In the third case, where Candidate 1 proposes the status quo, the vote share does not depend on the expected ability, since the payoff does neither. Hence, the expected overall vote share of candidate i is weakly increasing in his expected competence and, thus, his welfare contribution.

Proof of Lemma 3: In an informative equilibrium, the expected utility of voter k with reform preference μ_k is given by

$$V(\mu_k, \rho) = 2\int_\alpha^1 \phi(a)(\mu_k a - c)da \left(\frac{1}{2} + \Phi(\alpha)g(\pi, \rho)\right).$$

It is strictly increasing in μ_k, and negative for any $\mu_k \leq c$. Its derivative with respect to power concentration follows as

$$\begin{aligned}
\frac{dV(\mu_k,\rho)}{d\rho} &= 2\Phi(\alpha)\frac{dg}{d\rho}\int_\alpha^1 \phi(a)(\mu_k a - c)da \\
&\quad +2\left[\left(\phi(\alpha)g + \Phi(\alpha)\frac{dg}{d\rho}\right)\int_\alpha^1 \phi(a)(\mu_k a - c)da\right. \\
&\quad \left. -\phi(\alpha)(c - \mu\alpha)\left(\frac{1}{2} + \Phi(\alpha)g(\pi,\rho)\right)\right]\frac{d\alpha}{d\rho} \\
&= 2\left(\frac{1}{2} + \Phi(\alpha)g(\pi,\rho)\right)\left(\Phi(\alpha) + \phi(\alpha - c)\right)\frac{dg}{d\rho}\int_\alpha^1 \phi(a)(\mu_k a - c)da \\
&\quad +2\left(\frac{1}{2} + \Phi(\alpha)g(\pi,\rho)\right)\phi(\alpha)(c - \mu\alpha)\frac{d\alpha}{d\rho} \\
&= \frac{g_\rho}{D}\left\{\left[\Phi(\alpha) - \phi(\alpha)(c - \alpha)\right]\left(\frac{1}{2} + \Phi(\alpha)g(\pi,\rho)\right)\int_\alpha^1 \phi(a)(\mu_k a - c)da\right. \\
&\quad \left. -\phi(\alpha)(c - \mu\alpha)\frac{\theta}{2}\right\}
\end{aligned}$$

For any $\rho \leq \rho^*(\theta)$, the term $\Phi(\alpha) - \phi(c - \alpha)$ is positive by Proposition 5 and Assumption 2. Thus, the expected utility of every voter with $\mu_k < c$ is strictly decreasing in ρ on this interval. By a similar argument as used in Lemma 2, it can be shown that $V(\mu_k, \rho)$ has at most one minimizer. For the limit case $\rho \to \infty$, however, we find that $\frac{dV}{d\rho} \leq 0$. In this limit, we have $g(\pi, \rho) = 1$, which implies $\theta \geq [1 + \Phi(\alpha)](c - \alpha)$ and a negative sign of the bracket in the last line above. Thus, $V(\mu_k, \rho)$ is monotonically decreasing in ρ.

Proof of Proposition 10: The proof consists of two steps. First we show that there exists at least one maximum for some $\rho < \rho^*$, second we ensure that there can never be a maximum for any $\rho \geq \rho^*$. Note that the expected utility $V(\mu_k, \rho)$ is increasing in the reform preference μ_k. Due to the strict concavity of w, this directly implies that $w'(V(\mu_k, \rho)) > w'(V(\mu_k', \rho))$ for any $\mu_k < \mu_k'$. Moreover, the marginal effect of ρ on the expected utilities is

$$\frac{d^2V(\mu_k,\rho)}{d\rho\, d\mu_k} = \frac{2g_\rho(\pi,\rho)}{D}\left[\left(\frac{1}{2} + \Phi(\alpha)g(\pi,\rho)\right)\left(\Phi(\alpha) + \phi(\alpha)(\alpha - c)\right)\int_\alpha^1 a\phi(a)da + \frac{\theta}{2}\alpha\phi(\alpha)\right].$$

Take any welfare function of an inequality averse society:

$$W_{IA}(\rho) = \int_{\underline{\mu}}^{\bar{\mu}} w(V(\mu_k, \rho))\xi(\mu_k)d\mu_k$$

Its derivative with respect to ρ is

$$\frac{dW_{IA}(\rho)}{d\rho} = \int_{\underline{\mu}}^{\bar{\mu}} w'(V(\mu_k, \rho))\frac{dV(\mu_k, \rho)}{d\rho}\xi(\mu_k)d\mu_k.$$

For the case of $\rho' < \rho^*$, the cross derivative $\frac{d^2V(\mu_k,\rho)}{d\rho\ d\mu_k}$ is larger than zero. All terms of it are always positive except for $\big(\Phi(\alpha) + \phi(\alpha - c)\big)$. This however is positive for all $\rho' \leq \rho^*$ (see Proposition 5 and Assumption 2). The positive cross derivative yields

$$\frac{dW_{IA}(\rho)}{d\rho} = \int_{\underline{\mu}}^{\bar{\mu}} w'(V(\mu_k, \rho))\frac{dV(\mu_k, \rho)}{d\rho}\xi(\mu_k)d\mu_k < \frac{dW(\rho)}{d\rho} = \int_{\underline{\mu}}^{\bar{\mu}} \frac{dV(\mu_k, \rho)}{d\rho}\xi(\mu_k)d\mu_k.$$

The derivatives of the expected utility are smaller for voters with smaller μ. Exactly these utilities are weighted more strongly in the case of inequality aversion, since $w'(V(\mu_k, \rho)) > w'(V(\mu'_k, \rho))$. Hence, the derivative of the welfare function at ρ^* is negative and there exists at least one local maximum for a $\rho' < \rho^*$.

Now consider the case of $\rho' > \rho^*$, where $\frac{dW}{d\rho} < 0$. If the cross derivative is still positive for any $\rho' > \rho^*$, we have that $\frac{dW_{IA}}{d\rho}\Big|_{\rho'} < \frac{dW}{d\rho}\Big|_{\rho'} < 0$ and there can not be a maximum at ρ'. Suppose that the cross derivative is negative at ρ'. From Lemma 3 we know that the marginal effect of ρ is negative for voters with $\mu < c$. As a consequence of the negative cross derivative, the marginal effect is negative for all agents. Thus, the derivative of the welfare function is certainly negative. Overall there cannot be any maximum in the range $[\rho^*, \infty)$.

C.3 Data

Description and Sources of Variables

Growth in real GDP per capita	Average growth rate. Self calculated based on GDP in 2000 US$. World Bank.
GDP per capita	Denominated in thousand year 2000 US$. World Bank.
Office motivation	International Social Survey Panel, module "Citizenship 1", 2004.
Power dispersion	Lijphart's index for executive-parties dimension. Lijphart (1999).
Checks and balances	Number of veto players. Keefer & Stasavage (2003).
Plurality electoral system	Dummy variable. Beck et al. (2001).
Electoral system	Type of electoral system, 9 minor categories. IDEA (2004).

Country List

Australia	Austria	Canada	Denmark
Finland	France	Germany	Ireland
Israel	Japan	Netherlands	Norway
Portugal	Spain	Sweden	Switzerland
United Kingdom	United States		

Summary of Variables

	Mean	Std. dev.	Min	Max	Poss. values
Power dispersion	0.31	0.98	−1.21	1.77	[-2,2]
Office motivation	3.37	0.37	2.61	4.20	[1,5]
GDP p.c.	26.98	7.69	11.55	39.83	
GDP p.c. growth (2004-2011)	0.68	0.74	−0.61	2.40	
GDP p.c. growth (1991-2004)	2.08	1.07	0.56	5.59	

Correlation between Variables

	Power dispersion	Office motivation	GDP p.c.	GDP p.c. growth (2004-2011)
Office motivation	−0.20	1		
	(0.43)			
GDP p.c.	0.20	−0.58	1	
	(0.43)	(0.01)		
GDP p.c. growth	0.44	0.072	−0.15	1
(2004-2011)	(0.07)	(0.78)	(0.56)	
GDP p.c. growth	−0.27	−0.10	−0.021	−0.48
(1991-2004)	(0.28)	(0.69)	(0.93)	(0.05)

Pearson's correlation coefficient, p-values in parentheses

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Chapter 1

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