When do conflicting parties share political power? - Online Appendix

1 Theory: The Benchmark game

There are $N = 2n$ players. Nature assigns a color - yellow or blue - to each player. There are two possibilities. In the first, players extract (without replacement) their type from an urn in which there are $n+1$ yellows and $n-1$ blues; in the second they extract (with replacement) their type from an urn in which there are $n+1$ blues and $n-1$ yellows. The players observe their type but they do not know from which urn it has been extracted. However, they know that the yellows are expected to be the majority since the first urn is $x \geq 1$ times more likely than the second.

After observing their type, the players play a game with two stages:

- In the constitutional stage the yellows, and only the yellows, privately choose between two voting rules, rule 1 and rule 2. One yellow's choice is randomly drawn and implemented; and all yellows are equally likely to be drawn. Then, all players are informed about which rule the yellows have implemented.
- In the voting stage all players participate in an election under the voting rule that was previously chosen. They privately vote for either alternative Y or alternative B. Alternative Y assigns a high payoff $\alpha + \delta$, with $\delta > 0$, to each yellow and a low payoff α to each blue player; and alternative B does the reverse.

Under rule 1, one of the N players is randomly drawn and his decision implemented. All N players are equally likely to be drawn. Under rule 2, the alternative with the highest number of votes is implemented. If both alternatives attracted the same number of votes, a fair coin is flipped to decide which alternative to implement. Thus, rule 1 is the random dictator rule and rule 2 the simple-majority rule. In the end, all players learn the outcome of the election and earn their resulting payoff.

The Perfect Bayesian Equilibrium (PBE) of this game can be easily characterized by backward induction.[1] In the voting stage, yellows vote for Y and blues vote for B in all equilibria. Anticipating this, in the constitutional stage, the yellows choose the rule that makes a final outcome of Y most likely. With probability $\frac{x}{x+1} \geq \frac{1}{2}$, the yellows are the larger group (of size $n+1$). Thus, a yellow assigns posterior probability

$$p_y = \frac{x\,(n+1)}{x\,(n+1) + n - 1} > \frac{1}{2}$$

to the event that the yellows are the majority and probability $p_b = 1 - p_y$ to the opposite event. His expected payoff from selecting the random-dictator rule amounts to

$$\pi_y^1 = \alpha + \left(p_y \frac{n+1}{2n} + (1 - p_y) \frac{n-1}{2n} \right) \delta, \tag{1}$$

while his expected payoff from the simple-majority rule is

$$\pi_y^2 = \alpha + p_y \delta.$$

Since $\pi_y^2 > \pi_y^1$, the yellows choose the simple-majority rule. We conclude that in the unique PBE the simple-majority rule is chosen with probability one and the outcome of the election is Y with probability $\frac{x}{1+x}$ and B with probability $\frac{1}{1+x}$ (depending on which group is majoritarian in the second stage).

To interpret the game we can now make two comments. First, at the end of the game the allocation implies that one group receives δ more than the other no matter what the voting rule is. In the unique equilibrium, however, the voting rule has an important impact on the *expected* allocation. In a majoritarian allocation the yellows always impose their preferred choice with probability one. In the random dictator allocation, on the contrary, the probability that the minority chooses the policy is proportional to the number of blues in the population. The second rule, therefore, is closer to a proportional rule. Although we model the decision rules in stylized form, they capture the essence of the problem we are interested in.

Second, the fact that we are assuming that the distribution of the population is random and that the players do not know their own group's size is not playing an important role in the game since we assume x is large and the equilibrium coincides with the equilibrium we would have if the yellows were always the majority (i.e., x is infinity). We have adopted this design only to introduce enough uncertainty to keep the choice interesting.[2]

[1] Since players do not know which color group is in the majority but get some information about it by learning their own type, the equilibrium concept that applies here is Perfect Bayesian equilibrium. As standard in voting games, we focus on equilibria with weakly undominated strategies.

[2] If the yellows were the majority with certainty, the blues might play weakly dominated strategies under the majority rule in equilibrium. We exclude this by introducing a small probability that the blues are the majority.

2 Experimental Procedure

We conducted three experimental treatments, one for each game. The baseline treatment T1 implemented the benchmark game, treatment T2 implemented the ex-post punishment game, and the interim punishment game was implemented by treatment T3. The free software z-tree (Fischbacher (2007)) was used to computerize all three games. Each treatment had six sessions, all conducted in 2010. The sessions of T1 were conducted on April 2, August 4 and October 19; the sessions of T2 were conducted on April 20, April 27, August 9 and October 19; and the sessions of T3 were conducted on August 10 and 11. Each session lasted approximately 90 minutes. Two sessions of T1 and T2 were conducted at the Experimental Lab of Princeton University (and had been reviewed and approved by the IRB); and the remaining sessions were conducted at the Experimental Lab of the Technical University of Berlin. In each session, 18 subjects participated anonymously in one of the three games. No subject participated in more than one treatment. All participants were undergraduate students from a variety of different subject fields, with a natural focus on technical fields in the sessions run in Germany. They were recruited by university web pages and signs posted in the university buildings. Subjects signed up for a session without knowing the content of the experiment. Apart from the requirememt that subjects had to be students of the respective university, there were no ex ante exclusion criteria. The game at hand was repeated over 30 rounds, with no practice rounds; and at the very end of the session one round was randomly drawn and dollar amounts equivalent to the payoffs were paid out to participants. At the beginning of each round, the computer randomly assigned the participants to three interaction groups of six: thus $n = 3$. Group membership changed randomly over different rounds. Moreover, the computer randomly determined whether the group consisted of $n + 1 = 4$ yellow and $n - 1 = 2$ blue players or instead of two yellows and four blues. Roles were assigned randomly, with random re-matching in every round. The matching group comprised all 18 participants in the session. In each round, it was nine times more likely that the yellows were in the majority; and subjects knew this. Thus, $x = 9$ and $p_y = \frac{18}{19}$. We chose a relatively high x because we wanted the yellows to be clearly perceived as the privileged group by all players. (The higher x is, the more the constitutional power of the yellows is of material consequence.) On the other hand, the small remaining uncertainty about the representation of one's role in the group guaranteed that even under the simple-majority rule and fully self-interested rational voting behavior, a blue player would see a small chance to get her favorite alternative and thus take the election seriously. The difference δ between the high and the low payoff was set to 5 in all sessions. In each session, we varied α randomly across rounds. It took the values 10, 15 and 20.

At the beginning of the sessions and after reading the instructions, subjects had to solve a quiz in order to prove that they understood the game. They were allowed to ask the experimenters questions about the instructions in private. Once each subject knew the correct answers to all quiz tasks and had no more questions the experiment started. No subject was excluded from the experiment; and no deception was used. The subjects earned an average of approximately 18 US-Dollars, including a show-up fee of 5 Dollars. At the end of each session, the participants answered a few demographic questions. Then, the computer randomly drew one round that was paid out to the participants privately and in cash. The experiment has been funded by the Collaborative Research Center 649 in Berlin.[3]

[3] There was no conflict of interest and no restriction as to what results could be published.

3 Results: Additional Tables and Figures

Table A1: Differences in Distributions

	H_0 : Equal distributions of Rulechoice in					
	(1)		(2)		(3)	
	TBase and TPunish		TBase and TExit		TPunish and TExit	
SMALLER GROUP	D	p-value	D	p-value	D	p-value
TBase	0.3519	0	0.3796	0		
TPunish	0	1			0.0833	0.472
TExit			0	1	-0.0370	0.862
Combined K-S	0.3519	0	0.3796	0	0.0833	0.746

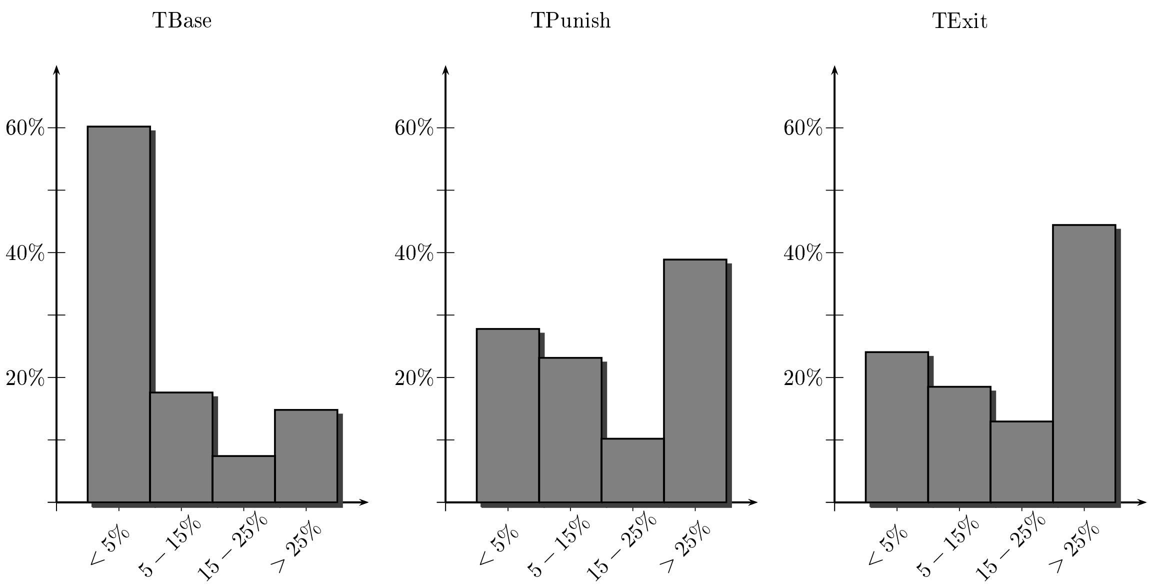
NOTE– Two sample Kolmogorov-Smirnov test for equality of distribution functions is used. In the Combined K-S row, the exact p-value is reported.
The first line under (1) tests the hypothesis that *rulechoice* in *TBase* contains smaller values than in *TPunish*. D denotes the largest difference between the distributions in this direction. So the left hand size gives the group which is assumed to be smaller.

Table A2: Logit Regression of Exit

	(1)		(2)	
	Pooled Estimator		Fixed Effect Estimator	
VARIABLES	exit	tstat	exit	tstat
rule	0.740***	3.440	0.997***	5.105
Constant	-2.384***	-5.340		
Observations	1,188		870	
Number of individuals	108		79	

*** p<0.01, ** p<0.05, * p<0.1
Coefficients estimated using logit regressions. Standard Errors clustered on session level.

Figure A3: Histogram of chosing the simple majority rule when Yellow



Appendix B: Instructions

Thank you for agreeing to participate in this experiment. During the experiment we require your complete, undistracted attention and ask that you follow instructions carefully. Please turn off your cell phones. Do not open other applications on your computer, chat with other students, or engage in other distracting activities, such as reading books, doing homework, etc. You will be paid for your participation in cash, at the end of the experiment. Different participants may earn different amounts. What you earn depends partly on your decisions, partly on the decisions of others, and partly on chance. It is important that you not talk or in any way try to communicate with other participants during the experiments.
Following the instructions, there will be a practice session and a short comprehension quiz. All questions on the quiz must be answered correctly before continuing to the paid session. At the end you will be paid in private and you are under no obligation to tell others how much you earned. Note that we are bound not to use deception, so all information in these instructions is true. If something is unclear to you while reading, or if you have other questions, please let us know by raising your hand. We will then answer your questions individually.
As a matter of course, your anonymity and the anonymity of the other participants will be guaranteed throughout the entire experiment. You will neither learn about the identity of the other participants, nor will they learn about your identity.

1. General

This is an experiment in decision-making. It consists of **thirty rounds**. At the end of the experiment, the computer randomly draws one of the rounds; and the dollars that you have earned in this round will be paid out to you in cash. The exact sequence of the stages of the experiment is explained in detail in the following.

2. Players

There are 18 participants in total. At the beginning of each round, the computer randomly assigns the participants to 3 groups of 6. During each round, you interact exclusively with the participants of the group you are assigned to. No participant knows the identity of the other members of his or her group. Group membership changes randomly over different rounds.

There are two possible states, state 1 and state 2. In each round, the state is implemented as follows: After participants have been matched into groups, the computer randomly draws a number from 1 to 10. All numbers are equally likely. If the number is less than 10, then the state is state 1. If the number is 10, then the state is state 2. You are not informed about the state. The state remains the same during a round but may change over different rounds.

1. In state 1, the computer randomly assigns the role of a "yellow player" to 4 out of the 6 participants in a group and the role of a "blue player" to the remaining 2 participants.

2. In state 2, the computer randomly assigns the role of a "blue player" to 4 out of the 6 participants in a group and the role of a "yellow player" to the remaining 2 participants.

Although nobody observes the state, each participant is informed about his (her) own role, i.e. whether he (she) is a yellow or a blue player. Nobody observes the role of any other participant. Note that since the assignment of roles is random and is repeated each round, roles change across rounds. In each round your role is indicated on the upper left of your screen.

3. Payoffs Structure

Your group will be asked to collectively choose one of two **alternatives: Y, B**. Your payoff will depend on your assigned role and the alternative (Y or B) that is chosen. The following table presents an example of a possible payoffs structure. The columns designate the roles, and the rows designate the alternatives:

Payoffs

	yellow	**blue**
Y	20	15
B	15	20

In this example, if you are a yellow player and alternative Y is chosen, or if you are a blue player and alternative B is chosen, your payoff is 20 \$. However, if you are a yellow player and alternative B is chosen, or if you are a blue player and alternative Y is chosen, your payoff is 15 \$.

The payoffs may change from round to round.

In addition, and independently of roles and decisions during the experiment, you earn a show- up fee of 10 $.

4. The choice of the alternative Y or B

The group's decision between Y and B is made in two stages.

In the first stage, the **yellow players** collectively choose a **decision rule**. There are two possible decision rules:

Rule 1	Both the Yellow and the Blue players individually vote for either Y or B. The **computer randomly draws one of the players in the group and implements this player's choice**. All players in the group are equally likely to be drawn.
Rule 2	Both the Yellow and the Blue players individually vote for either Y or B. **The alternative with the largest number of votes is implemented**. In case of a tie, the computer selects the alternative randomly, with both alternatives being equally likely to be implemented.

The rule choice is made as follows. Each yellow player individually votes for Rule 1 or Rule 2. The computer randomly draws one of the yellow players and implements this player's choice. All yellow players in the group are equally likely to be drawn.

In the second stage, the final alternative, either Y or B, is chosen according to the decision rule that was selected in the first stage.

This procedure is repeated 30 times.

5. Summary

1. The computer randomly matches the 18 participants in 3 groups of 6 players.
2. The computer randomly draws a number from 1 to 10. All numbers are equally likely. If the number is below 10, then the state is state 1. If the number is ten, then the state is state 2. You are not informed about the state.
3. The computer randomly allocates the roles of a yellow player and a blue player. In state 1, 4 out of 6 players in the group are yellow, and the remaining 2 players are blue. In state 2, 4 out of 6 players are blue, and the remaining 2 players are yellow. You are informed about your own role. You are not informed about the roles of the other players.
4. The computer randomly selects a payoff structure. This payoff structure is displayed on the screen.
5. In each group, the yellow players collectively select Rule 1 or Rule 2.
6. All players in the group are informed about the rule.
7. Alternative Y or B is chosen according to the rule.
8. Your payoff in the round is determined by the rule, the votes and the payoff structure.
9. All players in the group are informed about the final outcome.

6. The end of the experiment

At the end of the 30th round, the computer randomly draws a round that determines your earnings from the experiment. All rounds are equally likely of being selected. You will be informed of your final earnings. You will not learn anything about the earnings of the other participants.

Please remain seated and wait quietly until we call you by your identification number (the number of your computer place). Please come when called, and you will be paid out your total earnings in private.

If there was anything you did not understand, please let us know by raising your hand. We will answer your questions on an individual basis.

Thank you for participating!