Which Matters Most: Party Strategic Exit or Voter Strategic Voting? A Laboratory Experiment*

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*T*here is abundant empirical evidence that the plurality rule constrains party competition and favors two-party systems. This reduction of party system fragmentation may be due to parties deciding not to enter elections for which they are not viable and/or voters voting strategically. Yet, no prior research has attempted to estimate the respective role of parties and voters in this process. To fill this gap, we conducted a unique laboratory experiment where some subjects played the role of parties and others played the role of voters, and where the two were able to respond to each other just as in real-life elections. We find that the reduction due to party strategic exit is higher than that due to strategic voting. We conclude that parties play a key role in the effect of the plurality rule on party system fragmentation.

Several studies show that the electoral system has a decisive effect on the nature of the party system. They demonstrate that proportional representation rules produce a high number of parties, whereas this number is much lower under the plurality rule (Taagepera and Shugart 1989; Blais and Carty 1991; Lijphart 1994; Powell 2000). This effect is so established in the literature that we sometimes give it status of a law: Duverger's law (1951). One way of characterizing this effect is to consider that proportional representation maintains the "natural" state of party competition. The number of parties under this electoral system depends on the number of issue dimensions and their strength. In contrast, plurality constrains the natural state of party competition and reduces party system fragmentation (Amorim-Neto and Cox 1997; Clark and Golder 2006).

However, the puzzle remains about the exact mechanism that drives this reduction. Cox (1997) argues that this effect is due to the joint effort of parties and voters. On the one hand, voters vote strategically to maximize their impact on the electoral outcome and opt for their most preferred party between those that have some chance of winning the election. On the other hand, the parties strategically decide not to participate in elections when they have no chance of winning.

To date, we still do not know the relative contribution of parties and voters in the reduction of party system fragmentation produced by the plurality rule. Observational studies can hardly address this question, as we do not know how many parties decide not to participate in an election because of strategic considerations. We thus conducted a laboratory experiment replicating real-life elections under the plurality rule, where some subjects played the role of parties and others played the role of voters. This type of experiment has proven to be

remarkably good at bringing out causal relationships (Coppock and Green 2015). In contrast with most, if not all, voting experiments (see Blais, Laslier and Van der Straeten 2016), ours is based on a design where parties and voters interact. On the top of increasing realism, this design allows us to sort out the contribution of both on party system fragmentation. In the coming sections, we first review the theoretical puzzle; second, we describe our experimental protocol; third, we evaluate how this protocol resembles real-life elections; fourth, we state our three hypotheses; finally, we analyze the results and estimate the degree of reduction in party system fragmentation that is attributable to parties and voters.

THE EFFECT OF PLURALITY ON PARTY SYSTEM FRAGMENTATION

A plurality election is an election where, in each district, the candidate who receives the highest number of votes is elected. This electoral system is widely used to elect national parliaments throughout the world, especially in commonwealth democracies (Reynolds, Reilly and Ellis 2005). As mentioned above, an abundant literature shows that this electoral system tends to reduce party system fragmentation (Taagepera and Shugart 1989; Blais and Carty 1991; Lijphart 1994; Powell 2000).

As Duverger (1951) points out, the reduction effect of the plurality rules is due to both a mechanical effect, that is the translation of votes into seats that gives an advantage to large parties, and a psychological effect, that is the anticipation of the mechanical effect by parties and voters. Developing this idea further, Cox (1997) points out that this psychological effect is actually composed of two inter-related elements: strategic voting and strategic party exit. First, voters have an incentive to desert their most preferred party if this party is not viable. The rationale is that voters care about what party is elected and anticipate that some have no chance of winning. Therefore, they cast their vote in favor of a party that has some chance, or more precisely their preferred party among those. In doing so, they maximize their chance of affecting the electoral outcome.

Under the plurality rule, there are at most two viable parties per district. The intuition is that voting for a party that comes third or lower in terms of (perceived) chances is a waste of a voter's vote. This party never stands a chance of being elected. Yet, the voter's vote could potentially make a difference between the top two contenders. She should thus vote for her most preferred party between these two to maximize her chance of affecting the electoral outcome. Of course, the second party may have poor winning prospects as well. But even in this situation the voter should vote for this party if this is the one she prefers between the top two contenders because, at this stage, it makes little sense to vote for the other contender that she does not like. This practice is usually referred to as strategic voting.

Parties, being aware of voters' strategic considerations and anticipating them, have no incentive to participate in an election if they are not viable. If we assume that the goal of a party is to be elected, the existence of even a small cost associated with participation (e.g., the cost of campaigning) should deter it from participating. In turn, there should be at most two competing parties under plurality, the two that are most viable. The other parties should form alliances with the top two parties or simply not participate.

Observational and experimental studies show that under the plurality rule many voters who do not prefer one of the top two contenders engage in strategic voting (Alvarez and Nagler 2000; Abramson et al. 2009; Van der Straeten et al. 2010; Blais et al. 2011). However, we know that many still decide to vote for a party that has no chance of winning, because they do not have the information about the parties' chances, because they want to express their true preference, or because they are not short-term utility maximizers. Although the theory predicts that voters should concentrate on viable parties, the evidence suggests that this is not entirely the case.

The decision of parties to participate in elections is difficult to study empirically. The problem is that researchers can hardly determine how many parties envisioned participating in an election before the campaign. Typically, the only information available is the number parties that ultimately participate. Observational studies are thus not really helpful in this respect. Some laboratory studies address this issue (Cadigan 2005; Bol et al. 2016). In these experiments, subjects play the role of parties that have to decide to participate or not in a series of elections. These studies show that party strategic exit reduces party system fragmentation under the plurality rule. However, these studies cannot help disentangling the relative contribution of party strategic exit and voter strategic voting in the overall reduction of party system fragmentation, as they only study the behavior of parties. No subject plays the role of ordinary voters.

To tackle this problem, we conducted a unique laboratory experiment where a series of elections were held under the plurality rule. In each session, some of the subjects played the role of parties and others played the role of voters, and were able to respond to each other elections after elections. In line with most theories of party competition (Downs 1957; Adams, Merrill and Grofman 2005), parties derive utility from winning while voters derive utility from being as close as possible to the position of the winning party. When they played the role of a party, subjects had to decide whether to participate in the election or form an alliance with another party; when they played the role of a voter, they had to decide for which party to vote. We are thus able to calculate the effective number of parties for each election and determine how much lower it is from the theoretical maximum and how much higher from the theoretical minimum.[1] This allows us to calculate the degree of reduction that is due to voters and parties.

EXPERIMENTAL PROTOCOL[2]

Our laboratory experiment was conducted in October 2014 in the behavioral economics laboratory of CIRANO in Montreal, Canada. We organized four sessions that lasted around an hour and a half. For each session, 17 subjects were randomly recruited in the pool of pre-registered subjects of the laboratory. This sample is typically composed of a mix of students and relatively educated persons.

Before each session, subjects were told that they were about to participate in an experiment about elections where they will play, alternatively, the role of parties and voters in four series of five elections held under the plurality rule. We told them that they would have to make decisions during these elections and that they would gain points depending on their decisions and other subjects' decisions. We informed them that their points would be converted into money at the end of the experiment (1 point = 0.25$) and that they would receive an extra amount of 15$ for participating in the experiment. They also had to answer a short questionnaire at the end of the session.

At the beginning of each series, we randomly assign the 17 subjects to a role: six are designated as parties and 11 are designated as voters. We control the randomization of role

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[1] In our experimental protocol, there is only one party elected in each election. Thus, we use the effective number of electoral parties (ENEP) to measure party system fragmentation. This measure is a count of the number of parties, weighted by their vote shares (Laakso and Taagepera 1979). The formula is $\frac{1}{\sum_{i=1}^{n} v_i}$, where v is the vote share of party i.

[2] We use the software platform Z-tree to conduct our laboratory experiment. The replication files, including the z-tree programs and the slides we used to explain the protocol to the subjects, are available on the corresponding author's website www.damienbol.eu.

TABLE 1   *Positions of Voters and Parties on the 11-Point Scale*

Scale	0	1	2	3	4	5	6	7	8	9	10
Parties (uniform)	A		B		C		D		E		F
Parties (centralized)			A	B	C		D	E	F		
Voters	I	II	III	IV	V	VI	VII	VIII	IX	X	XI

assignment to make sure that each subject plays at least one time the two roles.[3] To encourage learning, we only re-assign these roles after five elections (one series). All the elections are held under the plurality rule and the voters are asked to cast a vote for one of the competing parties. The winner is the party with the highest number of votes. After each election, the subjects are presented with the full results. During the sessions, they interact through repetitive elections, but they are not allowed to communicate by other means.

On top of assigning a role to the subjects, we also give them a position on a scale ranging from 0 to 10. The positions of subjects are reshuffled after each series of five elections. Each voter is given a different position on this 11-point scale; such as there is only one voter by position. Table 1 illustrates this positioning (the voters are represented in Roman numbers). We assign subjects to a variety of positions to represent the real-life diversity of policy opinions. In the same way, each party is assigned a different position among six pre-defined positions, such as there is only one party by position (in Table 1, the parties are represented by letters).

These pre-defined party positions vary from series to series. This constitutes the first experimental condition. In two out of the four series (ten elections in total), the six parties are *uniformly* distributed across the 11-point scale (at positions 0, 2, 4, 6, 8, and 10). In the other half they are assigned more *central* positions (at positions 2, 3, 4, 6, 7, and 8). The order of the first experimental condition varies from session to session to control for potential learning effects (see the sequence in the appendix, Table A1).

At the beginning of each election, the parties are paired two by two (the pairs are kept constant for the entire experiment). Party A is paired with party B, C with D, and E with F (see Table 1). One party in each pair is randomly selected to initiate a potential alliance between the two. She can propose to be the only one to participate in next election, or she can offer to withdraw and allow the other party to participate. Then, the other party sees on her screen the proposal from her potential ally and has to accept or reject it. If there is no agreement or the initiating party does not make a proposal, the two parties participate in the election. Different alliances can be formed at the beginning of each election.

Each election has two stages. First, the paired parties decide to form an alliance or not. Each pair has to take this decision simultaneously so that they do not know what other pairs are deciding. Then, the voters see on their screen which parties are participating and they have to decide for which party to vote among them. Here as well, they have to take this decision simultaneously; they do not know the decisions of the other voters at the time of making their decision.[4]

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[3] We decided to make subjects alternating in the role of voters and parties to ensure that our results, and in particular the one regarding the reduction in party system fragmentation due to voters and parties, are not driven by some specific subjects that were, by chance, attributed to one of these two roles.

[4] We decided to frame our experimental game as a series of elections organized between subjects as to facilitate their comprehension. In doing so, we followed the decision made by many scholars that have studied strategic voting (see Blais, Laslier and Van der Straeten 2016). This may create noise in the data as left-wing subjects, for example, may be more likely to vote for a party located on the left of the 11-point scale (though, we never mentioned the word 'left' or 'right' to describe this scale during the experiment). However, we believe that

After the election, the party that received the most votes is declared the winner.[5] If this winning party is not in an alliance with her paired party, she gets 40 points. If there is an alliance the 40 points are divided between the two partners. The distribution of gains between them constitutes the second experimental condition. In two out of four series, the distribution is *equal*: each party receives 20 points. In the other half, the distribution is *unequal*: the party that participates in the election receives 30 points, while the other receives only 10 points. The order of the second experimental condition also varies from session to session (see Table A1 in the Online Appendix). We vary the distribution of gains in alliances in order to cover real-life situations where parties have more or less bargaining power.

After the parties have formed (or not) an alliance, the voters are invited to vote for one of the participating parties (depending on the number of alliances, there can be between three and six parties). The party that receives the most votes wins the election. The voters then receive a number of points inversely proportional to their distance from the winning party on the 11-point scale: 10 points minus the distance between their position and the winning party's position. At the end, all subjects (parties and voters) are presented with the results.[6]

REALISM OF THE PROTOCOL

Our laboratory experiment was conceived as an abstract game in which subjects interact, and where the structure of monetary incentives created situations that resembled real-life elections. As in every laboratory experiment, we had to make some simplifications. However, we believe that our protocol is overall realistic. In this section, we outline what are the most and least realistic parts of the protocol. Also, we discuss the differences between our protocol and the classic theoretical models in the literature on party competition.

First, the structure of payoffs of both voters and parties reflects what these two actors can really expect out of actual elections. Just as in real-life elections, voters derive utility from being as close as possible to the position of the party ultimately elected. The closer they are to the winning party on the 11-point scale, the bigger their gain. Considering that this scale represents the overall policy space, and the position of voters represents their policy preference, the payoff reproduces a very intuitive situation: voters are happy when a party that shares similar policy preference is elected.

The structure of payoffs of parties is also close to the reality of elections. In our experiment, we consider that the gains parties get out of an election is essentially a function of whether they win or lose. Furthermore, we allow parties to form alliances to maximize their chance of winning. It is reasonable to assume that in reality when a party decides not to participate, she can negotiate some compensation with proximate parties. As mentioned above, we vary the distribution of gains in alliances in order to cover various situations where parties have more or less bargaining power.

Second, to our knowledge, our laboratory experiment is one of the first, if not the first, where elections are organized, and where both parties and voters are played by real subjects. Usually,

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(F'note continued)

the alternative framing could also be problematic. If we had used a neutral framing for the game, the subjects might have been more rationalistic/calculator than in real-life elections.

[5] In case of a tie, the winning party is selected randomly among the tied parties.

[6] To limit the duration of the experiment and subjects' fatigue, we fixed a time limit for parties to make alliances (50 seconds to propose a deal and 30 seconds to accept or refuse the deal) and voters to cast a vote (30 seconds). They had more time in the first election of a series. At the expiration of the time limit the parties were assumed to form no alliance and the voters were deemed to abstain. This only concerns 1 percent of all the decisions that were made.

at least one of the roles is "played" by the computer according to a more or less realistic algorithm (see Bol et al. 2016). In reality, parties and voters do interact with each other. Elections after elections, voters adapt their behavior depending on the behavior of parties, and vice versa. We reproduce this situation in our experiment. That is also why we fix the role and position of all subjects for five elections. During these five elections, subjects are able to interact in a sort of feedback loop, just as parties and voters do in reality.

However, we also had to make several simplifications compared with real-life elections in our protocol. First, our experimental elections are aimed to reflect elections held in a district. In reality, a district election takes place within a larger election in which a whole assembly is elected, and a government is formed. In leaving this particularity aside, we are ruling out the effect of other considerations located at this higher level on voting behavior and party strategies. For example, in reality, two parties might negotiate their participation over several districts such as they each participate in at least one district election but never compete against each other.

Second, in reality, parties decide their location on the policy space as to maximize their chance to win the election. In our experiment, we limit the possibility for parties to develop this strategy by only allowing them to take the position there are assigned to or the one of the party they are paired with in case of an alliance. However, this limitation also reflects another aspect of real-life elections in which parties fear losing their credibility if they adopt a policy position that is too far away from their former position.

Third, in our experiment, subjects are randomly selected to play successively the role of voters and parties. In real life, most voters have no experience of running for elections. We can assume, however, that most voters understand that parties are seeking to win elections and are willing to make alliances if that increases their chance of winning.

Finally, it is important to note that our protocol differs in several ways from the classic theoretical literature on party entry (Palfrey 1984; Shepsle 1991; Osborne and Slivinski 1996; Besley and Coate 1997; Grosser and Palfrey 2014). First, we consider party entry as a bargaining game between two ideologically proximate parties. In many theoretical models, the decision to enter an election is considered to be a decision made by each party individually. Parties are then expected to exit elections when participating is not in their best interest. In our design, we made a different choice. Several empirical studies show that in many countries the cost for a party to enter an election is minimal and that it is fairly easy for a party to nominate a candidate in each district (Lago and Martinez 2007; Guinjoan 2014). We thus consider that the default decision for a party is to compete in the election, and that it only exits when it expects to increase its payoff by forming an alliance. We acknowledge that this assumption might not be very realistic in some contexts, especially in the United States where the cost of entry for a party is very high, but is much more realistic in other contexts. For example, in Canada, the two right-wing parties, that is, the Reform Party, and the Progressive Conservative Party, which have been competing separately from 1988 to 2000, decided to form an alliance, called the Conservative Party, in 2003 (Bélanger and Godbout 2010).

Second, unlike theoretical models on party entry, we do not consider that parties' payoff (partially) depends on how close they are, ideologically speaking, to the winning party. We acknowledge that, even if they do not win, parties are likely to prefer a situation in which they share some policy preferences with the winner. However, in line with other empirical studies on party strategies, we assume that this benefit is marginal compared with the benefit of winning in election (Stimson, MacKuen and Erikson 1995; Meguid 2005). We thus consider that parties are first and foremost driven by their willingness to hold office. In doing so, we adopt a standard Downsian perspective under which parties are assumed to maximize the probability of winning the election (Downs 1957).

To sum up, as in any laboratory experiment, our protocol cannot reproduce the full complexity of elections. We believe, however, that it faithfully reflects some basic components of reality. There are voters and parties. The parties have to decide to make alliances with other parties or not. And the voters have to decide to vote sincerely or strategically.

HYPOTHESES

We have several theoretical expectations concerning the behavior of subjects in our experiment. From these expectations, we derive three hypotheses about the impact of the two experimental conditions on the degree of reduction of party system fragmentation, and about which among parties and voters are the more responsible for this reduction. As mentioned above, the reduction effect of the plurality rule is partly due to voters strategically not voting for non-viable parties and to parties not participating in an election in which they are not viable.

Similarly to classic spatial "one-dimensional" voting models (see e.g., Downs 1957), the use of the plurality rule in our experimental elections creates incentives for voters to vote for one of the two viable parties. This behavior then leads to a reduction of party system fragmentation. To understand this point, let us consider the strategy of the most extreme left-wing[7] voter located at position 0 on the 11-point scale, who faces a situation where the six parties participate in the election under the uniform distribution (see Table 1).

At first glance, the most extreme left-wing voter may be tempted to vote for the most extreme left-wing party (party A). This party is located at the same position as her and if it wins she will gain the maximum amount of points. This would be a sincere vote. Yet, she also needs to think about what other voters will do if she wants to maximize her payoff. In particular, she may doubt that other left-wing voters (those located at positions 1–4) will vote for party A since this party is remote from some of them. So, if she votes for this extreme party, she threatens the winning prospect of the entire left-wing camp. If right-wing voters coordinate and vote for the same party, this party will win. This is not good for the most extreme left-wing voter who has a better payoff if one of the two moderate left-wing parties wins. If all right-wing and left-wing voters maximize their payoff, they will follow this strategy and the votes should concentrate on two viable parties.

We can identify the two viable parties that should attract all the votes in all configurations of competing parties. In line with the theory described above, we define viable parties as the two parties that have the highest chances of winning. If parties C and D participate, they are automatically the two viable parties. If they form an alliance, and, for example, party C does not participate, then party B becomes viable (and party E becomes viable if party D does not participate). Then, if parties B and C do not participate, because they form an alliance with their respective partners, the situation gets a little bit more complex. Most of the time, parties A and D are the two viable parties (or parties C and F by symmetry). However, under the uniform distribution of party positions, if party C does not participate but party E does, there is another couple of viable parties: parties D and E (or B and C). In those situations, the most extreme right-wing voters pull the viable party of their camp closer to their position as they do not fear the left-wing party to win (because this party is too extreme for moderate left-wing voters).

The concentration of votes on the theoretically identified viable parties only holds if all the voters maximize their payoff. If we relax this assumption, it may become profitable for a voter to vote for another party. For example, the most extreme left-wing voters may assume that the

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[7] In our experiment, there was no mention of left or right. We use it here for the sake of demonstration.

right-wing camp will fail to fully coordinate and may thus be willing to vote for party A or B, even when C participates, in order to increase their payoff. This would result in higher levels of party system fragmentation. We expect this tendency to be stronger under the central distribution of party positions. Parties A, B, E, and F are then all closer to the center of the 11-point scale than under the uniform distribution. Therefore, these parties are less likely to be deserted by moderate voters. More extreme voters may thus be willing to take a chance and bet on the lack of coordination of the other camp. Our first hypothesis is thus the following:

HYPOTHESIS 1: The degree of reduction that is due to voters is higher under the uniform distribution of party positions.

We also have expectations regarding the behavior of parties. Parties reduce party system fragmentation by not entering elections for which they are not viable. Party viability, however, is hard to evaluate in our experimental elections since it depends on the choices made by the other parties. The only exception concerns parties C and D. As soon as they participate, they are viable.

All other things being equal, parties have more chances of gaining if they form an alliance with the party they are paired with. In case they do, there is one contender less in the election. However, this also decreases the number of points they may potentially gain if they win. There is thus a trade-off. Forming an alliance increases the chance of gaining some points but it decreases the potential payoff.

We expect alliances to be more frequent, and thus party system fragmentation to be lower, when the distribution of gains between partners is equal. If we assume that all voters maximize their payoff, parties C and D will win with a probability of 1 if their form an alliance and with a probability of 0.5 if they do not. In all the configurations of viable parties described above, the central parties are always those that should receive the most votes. If they both participate, it is the central voter that decides who among them will win (because she is equally close to both). Their decision therefore depends on the distribution of gains: if this distribution is equal, the utility of forming an alliance (gain of 20 points times a probability of winning of 1) equals the expected utility of not forming an alliance (gain of 40 points times a probability of winning of 0.5). If they are risk-adverse they should form an alliance, if not, they are indifferent. However, as soon as the distribution is not equal, they should never form an alliance as this equality of utilities disappears.

The most extreme parties also have more chances of winning if they form an alliance, although in general they have less chances of winning than central parties. However, in the same vein, we expect the conclusion of such an alliance to be easier to achieve when the distribution of gains between partners is equal, as the partner agreeing not to participate is less likely to feel being unfairly treated (Forsythe et al. 1994). Our second hypothesis is thus the following:

HYPOTHESIS 2: The degree of reduction that is due to parties is higher when the distribution of gains between partners is equal.

Our third hypothesis relates to the relative contribution to the reduction of party system fragmentation that is due to parties and voters. We expect the degree of reduction due to parties to be greater than the one due to voters for two reasons. The first reason relates to the complexity of the coordination problem. Just as in real-life elections, it is harder for voters to coordinate toward two viable parties than for parties to form alliances. While the first operation

TABLE 2   *Percentage of Elections Won by Each Party*

Party	Party positions		Distribution of gains		Total
	Uniform	Central	Equal	Unequal	
A	0%	8%	3%	5%	4%
B	23%	35%	43%	15%	29%
C	45%	10%	28%	28%	28%
D	33%	20%	28%	25%	26%
E	0%	15%	0%	15%	8%
F	0%	12%	0%	13%	6%
Observations	40	40	40	40	80

involves 11 subjects (much more in reality) trying to anticipate each other's decision, the second consists in two actors that have to find an agreement between them.

The second reason relates to the payoff structure. In order to reproduce the reality of elections, our experimental game is constructed such that parties have much more to gain (a maximum of 40 points) than voters (a maximum of 10 points). Therefore, parties have more incentives to behave strategically, and thus to reduce party system fragmentation, than voters. Our third hypothesis is the following:

HYPOTHESIS 3: Parties are more responsible for the reduction of party system fragmentation than voters.[8]

It is important to note that our prediction that the most extreme of the paired parties are likely to seek an alliance with their partner to maximize their chances of winning is at odds with the predictions of some theoretical models. Because these models assume that there is a cost associated to party entry and that parties care about the policy preferences of the winner, they usually predict that extreme parties enter elections while central parties exit (Grosser and Palfrey 2014). These predictions seem to be borne out in contemporary US politics. But we note that in general polarization has not increased, in fact it has slightly decreased, in democracies using plurality rules (Adam, Green and Milazzo 2012).

RESULTS

We present the results in two parts. First, we report some descriptive statistics about the winning rate of each party and the overall strategic voting and party strategic entry rate; then, we systematically test the three hypotheses presented above using regressions predicting (1) the behavior of voters and parties that are responsible for a decrease in party system fragmentation, and (2) the degree of reduction directly due to these two actors.

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[8] It is worth noting that our protocol is somehow biased against parties regarding the reduction of party system fragmentation. There is no direct cost associated with the participation of parties in elections (unlike some theoretical works that consider there is a cost associated with the very fact of entering in an election). If a party does not reach an agreement with another party, she automatically participates in the election. This protocol should favor the participation of many parties, although there is an indirect cost of participation associated with the lower probability of winning when both members of a pair are present. Our measure of the reduction effect due to parties is thus rather conservative.

TABLE 3   *Predicting a Viable Vote*

	Model 1
Marginal effects (SE)	
Uniform positions	0.08** (0.04)
Equal distribution	−0.04 (0.04)
Extremeness of voters	−0.10*** (0.01)
Number of alliances	0.07*** (0.02)
Election	<0.01 (0.01)
Series	<0.01 (0.07)
Session dummies	Yes
χ^2	136.96***
Observations	880
Predicted probabilities	
Uniform positions	65%
Central positions	57%
Equal distribution	59%
Unequal distribution	63%

Note: Entries are marginal effects and predicted probabilities estimated with logit models. SE clustered by subjects are in parentheses. They are calculated in setting all other variables at means. The dependent variable is whether the voter casts a viable vote or not. *p < 0.1, **p < 0.05, ***p < 0.01 (two-tailed).

Table 2 reveals the number of elections won by each party, in total and per experimental conditions. As expected, we see that the central parties (C and D) won more elections than all other parties. Taken together, they won 54 percent of the 80 elections held in the four sessions. Still in accordance with our expectations, the most extreme parties (A and F) only won 10 percent of the time. This tendency is particularly strong when the distribution of party positions is uniform (C and D won 74 percent of the 40 elections held under this distribution).

In contrast, we see that the moderately extreme parties (B and E) won a substantive number of elections (37 percent). Actually, party B won 29 percent of the 80 elections. This is rather surprising given that these parties are not supposed to win if each subject maximizes her payoff. However, as explained above, extreme voters maximize their payoff in voting for B or E if the other camp fails to coordinate toward a single party.

To test our hypotheses, we run a series of regressions. As a first test of Hypothesis 1, we estimate a logit model predicting whether voters vote for a viable party in each election (Table 3). As mentioned above, this behavior is responsible for a reduction of party system fragmentation. In the analysis presented here, we use a theoretical definition of viable party. In the online appendix, we replicate the same analysis with an empirical definition of viable party. The results are essentially similar (see Table A2). We define a party as theoretically viable if it is one of the two parties that have the best chances of winning (as defined above in the Hypotheses section).

As predictors, we include two dummy variables with the two experimental conditions, and a variable capturing the extremeness of voter's position on the 11-point scale. This variable ranges from 0, for voters who had a central position (at 5 on the 11-point scale) to 5 for voters who had an extreme position (at 0 or 10 on the 11-point scale). We also include two variables that capture a potential temporal or learning trend: the number of series, from 1 to 4, and the number of elections within a series, from 1 to 5. Also, we need to consider the fact that the behavior of voters is likely to be affected by the behavior of parties that made their decision first in the experimental game. In particular, the probability of casting a viable vote is higher when

the number of parties is small. Therefore, we also include as a predictor the number of alliances. Finally, we add session dummies to account for potential group effects, and cluster the standard error by subjects.

Voters vote for a viable party 60 percent of the time. If all voters maximized their payoffs, this proportion should be 100 percent. However, our results show that many subjects engaged in strategic voting. As a matter of comparison, the proportion of theoretical viable votes would have been 36 percent if all subjects voted sincerely, that is, in favor of the party that was the closest to their position, under the uniform distribution and if the six parties decided to participate.

Table 3 reveals that the proportion of viable votes is higher under the uniform distribution of party positions. We see that the effect of this experimental condition is significant at a level of $p < 0.05$, and the predicted probability of casting a viable vote is 65 percent under this experimental condition. This is an 8 percentage point difference compared with the proportion of viable votes under the central distribution of party positions. We thus find evidence supporting our first hypothesis: the probability of casting a viable vote is higher under the uniform distribution of party position. This suggests that some of the extreme voters try to increase their payoff under the central distribution by betting on a lack of coordination of the other camp. This also explains why we observe that the winning rate of central parties is lower under this distribution (see Table 2).

It is worth noting that we do not observe any effect of the second experimental condition, that is, the distribution of gains between allied parties. In the same vein, we do not see any temporal or learning trend. Table 3, however, reveals that, as we expected, the number of viable votes increases as the number of participating parties decreases (and thus the number of alliances increases). Similarly, we observe that the extremeness of the voter on the 11-point scale affects her probability to vote for a viable party. For each 1-unit increase in extremeness (on a maximum of five), the probability to vote for a viable party decreases by 10 percentage points. This effect is statistically significant at a level of $p < 0.01$. Also, the learning effect is limited. The probability to cast a viable vote increases by 1 percentage point at most per election within a series. This effect is not statistically significant. There is no clear pattern when it comes to the evolution of the probability to cast a viable vote from series to series.

As a first test of Hypothesis 2, we also estimate a logit model predicting the behavior of parties that is responsible for a reduction of party system fragmentation, that is, whether pairs of parties form an alliance in each election (Table 4). The predictors are similar than those we used for predicting the probability of a voter to cast a viable vote, except that we do not include the behavior of voters as a control, given that voters made their decision after parties in our experimental game. Another difference is that the variable capturing the position of the pair of parties on the 11-point scale is dichotomous, differentiating between central (parties C and D) and extreme pairs (parties A and B, or parties E and F).

On average, pairs of parties formed alliances 58 percent of the time. Table 4 reveals that the proportion of alliances between pairs of parties is not strongly affected by the distribution of gains between partners. The coefficients associated to the experimental conditions are not statistically significant at a level of $p < 0.1$. However, the coefficients are leaning toward the right direction. As reported by predicted probabilities, we see that there is a 9 percentage point increase in the number of alliances when the distribution of gains between partners is equal compared with when it is unequal. Also, we do not observe neither any statistically significant effect of the central/extreme position of the pairs of parties on the probability to form an alliance, nor any statistically significant learning trend.

To properly test our three hypotheses, we calculate party system fragmentation in each of our 80 elections (Table 5). In line with most of the literature in the field, we use the ENEP, which is

TABLE 4   *Predicting the Conclusion of Alliances*

	Model 2
Coefficients (SE)	
Uniform positions	−0.03 (0.06)
Equal distribution	0.09 (0.06)
Central pair of parties	0.05 (0.07)
Election	<0.01 (0.02)
Series	0.04 (0.12)
Session dummies	Yes
χ^2	8.74
Observations	240
Predicted probabilities	
Uniform positions	57%
Central positions	60%
Equal distribution	63%
Unequal distribution	53%

Note: Entries are marginal effects and predicted probabilities estimated with logit models. SE clustered by subjects are in parentheses. They are calculated in setting all other variables at means. The dependent variable is whether the pair of allied parties concludes an alliance or not. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$ (two-tailed).

TABLE 5   *Degree of Effective Number of Electoral Parties (ENEP) Reduction by Voters and Parties*

	Party positions			Distribution of gains			
	Uniform	Central	Significance	Equal	Unequal	Significance	Total
Reduction by voters	47%	30%	**	36%	40%		38%
Reduction by parties	63%	57%		64%	57%		60%
ENEP	3.00	3.27	*	3.10	3.18		3.14

Note: Differences between the degree of reduction by voters and parties is significant at least at a level of $p < 0.05$ (two-tailed) in total, and in all configurations of experimental conditions. The number of observation is of 80 elections.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$ (two-tailed).

a count of the number of parties, weighted by the vote share of each of these parties. Table 5 shows that, on average, ENEP in our experimental elections is 3.14. This number is remarkably close to the average district ENEP observed in real-life national elections held under the plurality rule in the United Kingdom and Canada (Gaines 2009; Johnston and Cutler 2009).

The advantage of our experiment is that we know how many parties could potentially participate in the election. We thus have a maximum and a minimum. We use absolute sincere voting, that is, the situation in which the 11 voters vote for the party that is the closest party to their position, as a benchmark. If all parties participate and if all the votes are sincere, the ENEP is of 5.9 when the distribution of party positions is uniform and 4.94 when it is central.[9] We can thus calculate how much the ENEP actually observed in our experimental elections deviates

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[9] In case a voter is equally close to two parties, we attributed 0.5 vote to each party.

from this theoretical maximum, and the part of reduction that is due to parties forming alliances and to voters not voting for viable parties.

Table 5 also reports the mean proportion of reduction voters and parties achieved. On the one hand, the part of reduction due to subjects playing the role of parties is the difference between the ENEP in case of full sincere voting and no alliance and the ENEP in case of full sincere voting but given the actually observed configuration of competing parties remaining after the stage of alliance formation. We then divide this difference by the maximum reduction that could be potentially achieved by parties. This corresponds to the ENEP with full sincere voting and only three competing parties. More precisely, the reduction due to parties is the following:

$$\frac{\text{ENEP}_6^{\text{sincere}} - \text{ENEP}_{3,4,5,6(\text{observed})}^{\text{sincere}}}{\text{ENEP}_6^{\text{sincere}} - \text{ENEP}_{3(\text{min})}^{\text{sincere}}}.$$

On the other hand, the reduction due to voters is the difference between the ENEP if there is full sincere voting given the actual configuration of competing parties and the ENEP ultimately observed after the vote. Similarly, to what we do for calculating the degree of reduction due to parties, we divide this difference by the maximal potential reduction. The lower bound is the minimal ENEP in case all voters vote for the two theoretically viable parties given the configuration of parties actually competing. The upper bound is the ENEP in case of full sincere voting. The formal definition is the following:

$$\frac{\text{ENEP}_{3,4,5,6(\text{observed})}^{\text{sincere}} - \text{ENEP}_{(\text{observed})}}{\text{ENEP}_{3,4,5,6(\text{observed})}^{\text{sincere}} - \text{ENEP}_{3,4,5,6(\text{observed})}^{\text{strategic}}}.$$

Table 5 shows that on average voters reduce 38 percent of the fragmentation they could theoretically by not voting for non-viable parties. This reduction is much higher under the uniform distribution of party positions (47 percent, compared with 30 percent under the central distribution of party positions, significant at a level of $p < 0.05$). This is another piece of empirical evidence for our first hypothesis. Under the central distribution, voters are more tempted to vote for the most extreme, yet most of the time non-viable, parties. The reduction of party system fragmentation is thus lower. This also explains why the ENEP is lower when the distribution of party positions is uniform (3.00).

Table 5 also reveals that parties do their job by reducing fragmentation by 60 percent of the theoretical maximum. We see that the degree of reduction by parties is larger when the distribution of gains within alliances is equal (64 percent, compared with 57 percent when the distribution is unequal). However, this difference is not statistically significant at a level of $p < 0.1$. Our Hypothesis 2 is thus only weakly confirmed.

To test our third hypothesis, we run ordinary least square models predicting the degree of reduction due to voters and parties in each election (Table 6). There are thus two times 80 observations. Similarly to other regressions, we include as predictors, two dummy variables with the two experimental conditions, and two variables that capture a potential temporal or learning trend: the number of series from 1 to 4 and the number of elections within this series from 1 to 5. We also include session dummies.

Table 6 shows that on average, parties reduce party system fragmentation, by 60 percent, while voters reduce it by 38 percent. The reduction due to parties is larger than the one due to voters (statistically significant at a level of $p < 0.01$). Our Hypothesis 3 is thus confirmed. Voters' strategic behavior contributes to reducing party system fragmentation in elections held under the plurality rule, but their contribution is weaker than that of parties. We also see that the degree of reduction is greater under the uniform distribution of party positions (statistically

TABLE 6   *Predicting the Degree of Reduction*

	Model 5
Coefficients (SE)	
Uniform positions	0.11** (0.05)
Equal distribution	0.02 (0.05)
Part of reduction due to parties (part of reduction due to voters, as reference)	0.22*** (0.05)
Election	0.02 (0.02)
Series	−0.04 (0.08)
Session dummies	Yes
Constant	0.31*** (0.09)
F	5.54
Observations	160
Predicted degrees of reduction due to	
Parties	60%
Voters	38%

Note: Entries are coefficients (SE) and predicted probabilities, estimated with an ordinary least square model. Probabilities are calculated in setting all other variables at means. The dependent variable is the degree of reduction in party system fragmentation due to parties and voters. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$ (two-tailed).

significant at a level of $p < 0.05$) and that there is no temporal or learning trend. The empirically evidence thus supports our third hypothesis.

This last finding regarding the respective contribution of voters and parties to the reduction of party system fragmentation is strong and robust. First, although it varies across experimental conditions, the difference of reduction is always large (from 16 to 28 percentage points) and statistically significant at a level of $p < 0.05$.

Second, it is important to note that another lower bound could have been chosen to calculate the proportion of reduction imputed to voters. In Tables 5 and 6, we consider that the theoretical minimum ENEP corresponds to the situation in which all voters vote strategically for the closest theoretically defined viable party. However, voters might have all voted for the same party. Although this never happened, this would have lowered down the ENEP to one. If we used this alternative lower bound, the degree of reduction imputed to voters would be even lower.

CONCLUSION

An abundant literature shows that the plurality rule reduces party system fragmentation. This effect is often referred to as Duverger's law. However, the puzzle remains who among voters voting strategically and parties not participating in the election if they are not viable are more responsible for this reduction effect. In theory, this effect should be due to their joint effort but no prior research has attempted to sort out the respective role of parties and voters.

Empirical studies based on observational data can hardly address this issue since we hardly know how many parties envisioned participating in elections at 1 point in time. To fill this gap, we conducted a unique laboratory experiment where some subjects played the role of parties and others the role of voters, and where the two were able to respond to each other just as in real-life elections. When they were a party, they had to decide whether to participate in the election or form an alliance with another party; when they were a voter, they had to decide for which party to vote. We also randomly manipulated the distribution of party positions and the distribution of gains between the parties of an alliance.

Our results suggest that both parties and voters engage in behavior that reduces party system fragmentation. Parties form alliances to maximize their chances of winning and voters tend to vote for viable parties to increase their payoff. Although the results reveal that all subjects do not quite behave as we would expect if they all sought to maximize their utility, the two experimental conditions have the predicted effect on their behavior.

Most importantly, we ascertained the degree of reduction in party system fragmentation that is due to voters and parties. We find that the contribution made by party strategic exit is higher than that due to strategic voting. We explain this difference by the nature of the coordination problem and the amount of gains at stake. Just as in real-life elections, party coordination is much easier to achieve than voter coordination for the simple reason that there are fewer parties than voters to coordinate with and that it is easier to predict what another specific party will decide than how a large number of voters will behave.

Also, in our experimental as in real elections, parties have much more to gain if they win than voters if their preferred party wins. As a consequence, parties have more incentives to behave strategically and to form alliances with partners, if it means increasing their chances of winning. Our finding is very much in line with Cox's intuition according to which coordination takes place at both the elite (parties) and voters' level. Cox states that his "personal bias is strongly towards the elite hypotheses" (1997, 98). There is ample evidence that some voters vote strategically when parties fail to coordinate but much of the story is about the factors that induce some of the potential entrants not to enter.

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