The Mechanical and Psychological Effects of Electoral Systems:

An Appraisal with Experimental Data[1]

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Abstract: The paper proposes a way to measure the mechanical and psychological effects of majority runoff versus plurality. Building on a series of laboratory experiments on presidential-type elections, we evaluate these effects with respect to the probability of election of a centrist candidate. In our experiment, the runoff system slightly favours the centrist candidate, but this total effect is small because the mechanical and psychological effects tend to cancel each other. The mechanical effect of run-offs is to systematically advantage the centrist, as usually assumed; but our study detects an opposite psychological impact, to the disadvantage of this candidate.

Résumé: Cet article propose une comparaison des modes de scrutin uninominaux majoritaires à deux tours et à un tour, dans leur propension à élire les candidats situés au centre de l'échiquier politique. En s'appuyant sur une série d'expériences en laboratoire, on montre que le scrutin à deux-tours est légèrement plus favorable au candidat centriste que ne l'est le scrutin à un tour. L'effet est faible, on montre qu'il s'agit de la résultante de deux effets, mécaniques et psychologiques, qui jouent en sens contraires et tendent à s'annuler l'un l'autre.

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Most of the literature about electoral systems is based on Maurice Duverger's (1951) intuitions. Duverger claims that electoral systems have systematic effects (hence the well-known "laws") on the structures of electoral competition. In particular, plurality entails a two-party system whereas majority runoff leads to multiparty competition. Duverger argues that these consequences are explained by the conjunction of two effects: a mechanical effect and a psychological effect.

The mechanical effect is the process by which a distribution of votes is transformed into a distribution of seats. This effect is purely mechanical because it results from the strict application of the provisions of the electoral law. The psychological effect is, according to Duverger, the anticipation by voters and political actors of the mechanical effect. Because actors know the distortion entailed by the transformation of votes into seats, they adapt their behaviour so as to make votes count (Cox 1997). This is commonly viewed as strategic voting on the side of voters and strategic entry on the side of parties and candidates.

Duverger starts with the plurality rule, which he calls one-round simple majority. He contends that such a rule leads to a two-party system. He even argues that of all the hypotheses formulated in his book, this one is the closest to a true sociological law (Duverger, 1951, 247). As mentioned above, Duverger explains that the plurality rule is biased against « third » parties in two complementary ways: a mechanical under-representation of small parties and voters' psychological motivation not to waste their vote on losers (see Riker 1982, 761).

There is a vast literature on the mechanical effect of the plurality rule, that is, its propensity to advantage big parties to the disadvantage of small ones (Rae 1969; Taagapera and Shugart 1989; Lijphart 1994; Benoit 2002; McDonald 2009). Furthermore, plenty of studies

document the existence of strategic voting in first past the post elections (Blais et al. 2009; Burden et al. 2009; Abramson et al. 1992; Alvarez et al. 2006; Blais et al. 2001; Cox 1997; Merolla and Stephenson 2007; Blais et al. 2010a).

Duverger contrasts the plurality rule with proportional representation and majority run-off, which are predicted to produce multi-party competition. Duverger is more nuanced with respect to the impact of these systems, noting some exceptions, and he refrains from referring to a law (Riker 1982, 758). He is particularly cautious in the case of two-round as he admits that its effect is more difficult to specify (Duverger 1951, 269). Duverger simply notes that there is no need for coordination in the first round since this can be taken care of in the second and final ballot. This is contested by Cox (1997, 128), who argues that in a runoff election there are two winners on the first round and that there should thus be only three viable candidates.

The literature on the impact of two round systems is much more limited, for the simple reason that France is the only established democracy with such a rule for its parliamentary elections.[2] There is some evidence, however, that the mechanical bias against small parties is as strong as in first past the post (Blais and Loewen 2009). As for psychological effects, the standard view (implicit in Duverger's argumentation) is that there is little strategic voting in such a system. As it is often put bluntly, in runoff systems the first round is to express a preference while the second round is to eliminate the worst alternative. The empirical evidence is limited and somewhat inconsistent. From historical records, Blais (2004a) notes that the pattern of electoral competition resembles that under proportional systems. However, the disproportionality of the system is higher than in plurality, which

[2] Note, however, that run-off elections are very frequent for presidential elections (Blais et al. 1997).

suggests that runoff systems represent the best example of strong mechanical effects not leading to the strategic adaptation of parties and voters. Other studies reveal other peculiar behaviours such as the 'inverse strategic voting' depicted by Blais (2004b) where voters desert their first preference to the benefit of fringe candidates.

The present paper proposes an appraisal of these mechanical and psychological effects, building on a series of laboratory experiments on presidential-type elections under plurality and majority runoff rules.

1. Measuring mechanical and psychological effects

There is no absolute measure of the strength of the mechanical and psychological effects of electoral systems. First, one has to choose a criterion. In this paper we look at the propensity of different voting rules to elect a Condorcet winner centrist candidate (CW). Second, these effects are conditional on the distribution of preferences among voters and the positions of the parties, even in a simple setting where positions and preferences are defined along a single continuum.

Positions and preferences, together with the voting rule, are precisely what can be manipulated in the laboratory. We conduct a series of laboratory experiments having elections held under plurality (labelled "1R") and majority runoff ("2R") rules. Specifically, we are interested in comparing the probability that a Condorcet winner is elected in 2R vs 1R elections, given voters' preferences over a fixed set of candidates.

Consider voters, facing a fixed set of candidates over which they have some given preferences. Voting under 1R, they elect the CW with some probability. What would this probability be if the voting rule was changed to 2R? The *total effect* of the 2R system versus the 1R system is the difference in the CW election probability when voters vote under 2R, compared to when they vote under 1R. We propose to decompose this total effect into its mechanical and psychological components. Note that we focus exclusively on psychological effects on *voters*, as candidates' positions are fixed.

It is important here to specify that, in this study, we are comparing election outcomes in 1R and 2R elections, and that the former are used as the reference point. The objective is to determine how different 2R outcomes are, relative to those observed under 1R. Thus, we aim at ascertaining how different election outcomes are under 2R compared to 1R, and how much of this difference should be imputed to mechanical and psychological effects. Often, the (explicit or implicit) reference point in the literature is a hypothetical pure PR system with no mechanical or psychological effect, that is, seat shares equal vote shares and all voters voting sincerely. In this study, we contrast two concrete electoral systems, and the effect of the 2R system is defined in comparison with 1R. Our approach is thus similar to studies based on quasi natural experiments, comparing the outcomes of simultaneous PR and non PR elections (see Blais et al. (2010b), on elections in Japan and Switzerland, and Fauvelle-Aymar and Lewis-Beck (2008), on French local elections).

The mechanical effect refers to the transformation of votes into seats, or more precisely, in our case, into winning and losing candidates (or parties). The effect takes place after the vote. The question that we ask is simply: How different would have been the outcome of plurality elections if voters' choices had been the same but the rule had been runoff? The

answer derives from simple counter factual simulation, changing the rule of the game *ex post*.

The psychological effect occurs before the vote, and stems from the fact that people vote differently under runoff than they would under plurality. The question is: How different would have been the outcome of two round elections, if the rule had been the same (runoff) but people had voted as they do under plurality? In practical terms, the psychological effect is the simple difference between the total effect and the mechanical effect.

What is the expected sign of this mechanical effect? Under 1R, the CW is elected if he is ranked first according to the obtained scores. Under the 2R system, he is elected if he is one of the top two candidates on the first round. Indeed, we can neglect the possibility that some other candidate obtains more than 50% of the votes at the first round, and the CW is elected whenever he makes it to the second round. By definition, a majority of the voters prefer him over his opponent, whoever this opponent may be. The mechanical effect is therefore expected to be positive: the election of the CW should be more frequent under 2R than under 1R, given the distribution of votes.

The sign the psychological effect depends on how voters respond to changes in the voting rule and is a priori ambiguous. We revisit this point below.

2. The experimental protocol

We use data from the laboratory experiments done by Blais et al. (2007). Groups of 21 subjects are recruited in Paris, Lille (France) and Montreal (Canada). Subjects are invited to vote in series of elections. The same group of people vote under the two systems: 1R and 2R, people voting in series of four consecutive elections with the same electoral system. In each election, there is a fixed number of candidates, located at distinct positions on an axis that goes from 0 to 20: see the second line of Table 1.

[Table 1 about here]

In each series of elections, subjects are assigned a randomly drawn position on the same 0 to 20 axis. There are a total of 21 positions and each of the 21 participants has a different position. The participants are informed about this distribution of positions. After the initial series of four elections, the group moves to the second series of four elections, held under a different rule, with the same set of candidates, and participants are assigned new positions. The results of each election (scores of all candidates and identity of the elected candidate) are publicly announced after each election.

The participants are informed from the beginning that one of the 8 elections will be randomly chosen as the "decisive" election, which determinates payments. They are also told that they will be paid 20 euros (or Canadian dollars) minus the distance between the elected candidate's position and their own assigned position in that election.[3] For instance, a voter whose assigned position is 11 will receive 10 euros if candidate A wins in the decisive elections, 12 if E, 15 if B, 17 if D, and 19 if C. We thus generate single-peaked preference profiles on the 5 candidate set.

[3] Participants are also paid a fixed sum of 5 euros for showing up at the experiment.

If subjects vote sincerely, the distribution of votes among candidates is almost uniform. In expectation (with ties broken randomly), the extreme candidates A and E each receive 4 votes, each of the moderate candidates B and D get 4.5 votes, and the centrist candidate C the remaining 4 votes. See the last line of Table 1.

3. Findings

Total effect

In 23 sessions, we ran a total of 92 elections under each voting rule. The extreme candidates were never elected. The centrist candidate was elected in 49% of the 1R elections (first row of Table 2) and in 58% of the 2R elections (third row of Table 2). There is thus a slight (58-49=+9 percentage points) positive total effect of runoff (over plurality) with respect to the election of the centrist candidate (last row of Table 2).

Mechanical and psychological effects

To compute the mechanical effect, we ask: How often would the centrist candidate be elected if one applies the 2R system on actual 1R votes? In order to answer this question, we examine the 92 1R elections. For each of those elections, we consider the scores obtained by the 5 candidates, and we apply the 2R system. If one candidate has an absolute majority (at least 11 votes), he would have been elected under 2R. If no candidate has an absolute majority, there would be a runoff between the top two candidates. We assume that the centrist candidate would be elected whenever he is present in a runoff for the simple reason that he is a Condorcet winner (that is, in any pair-wise comparison the

centrist candidate's position is closer to a majority of voters), which is indeed the case in more than 95% of the second round elections in our experiments. This assumes that on the second round voters vote for the candidate whose position is closest to theirs. We then find that the centrist candidate is elected in 71% of the cases (second column of Table 2).[4]

[Insert Table 2 about here]

The mechanical effect is then defined as the difference in the probability that the centrist candidate is elected keeping the 1R votes but using a 2R rule (71%) minus the actual observed probability of the centrist candidate's victory with the same 1R votes and the plurality rule (49%), that is 22 percentage points. Keeping the votes constant, moving from 1R to 2R increases the probability that the centrist candidate is elected by 22 percentage points.

The psychological effect is the difference in electoral outcomes that is due to the fact that voters behave differently in 2R and 1R elections, keeping the mechanical effects of the electoral system constant. We know that the centrist candidate won 58% of the 2R elections (third row of Table 2). We also know that the same centrist candidate would have won 71% of the time with the same 2R system but using the distribution of votes observed

[4] Note that in 2R elections in the experiment, when there was a tie in deciding which candidates will go to the runoff, we tossed a coin. In the analysis here, in case of such a tie, we reason in terms of probabilities. Consider for example the following scores: A:0, B:8, C:6, D:6, E:1. There is a tie between candidates C and D. We then compute that with probability ½ the run-off is between B and C, in which case C is elected, and with probability ½, the run-off is between B and D, in which case C is not elected. With such a distribution of votes, we say that C is therefore elected with probability ½.

in 1R elections. As a consequence, the psychological effect is -13 points. This means that voters are less inclined to vote for the centrist candidate in 2R than in 1R elections.

We see that the mechanical and psychological effects partially cancel each other, yielding a positive total net impact of 22-13 = 9 points. The centrist candidate benefits from the fact that he is certain to win if he makes it to the second round but he is disadvantaged by the slightly weaker support that he is able to garner in the first round (compared to plurality elections).

An explanation for the negative psychological effect

As noticed in the introduction, the sign of the psychological effect is *a priori* ambiguous, depending on how voters respond to changes in the voting rule. We now build on previous individual-level analyses of these experiments to propose an explanation for this negative psychological effect.

Recall that, in our experimental setting, voters were asked to vote by series of four elections, during which everything was kept constant except voters being each time informed of the scores obtained by all candidates. By observing sequences of elections, we can see, in the lab, how each voter changes her votes and adapts to a voting rule. We have shown that voters' adaptation through time amounts to voters coordinating on *two* candidates in 1R elections and on *three* candidates in 2R elections (Van der Straeten et al. 2010). More exactly, we call *Top 2 heuristics* the behavioural rule by which a voter votes for her preferred candidates among the two candidates with the most votes in the previous election. Similarly, according to the *Top 3 heuristics*, a voter votes for her preferred candidate among the three candidates with the most votes. The Top 2 heuristics was

proved to be a good description of individual behaviour in 1R elections and the Top 3 heuristics was shown to be adequate in 2R elections. What is to be expected about the sign of the psychological effect if voters use these heuristics?

In 2R elections, voters' behaviour is adequately described by the Top 3 heuristics. At the first date, extreme candidates are observed to receive few votes, so that they do not belong to the Top 3 set of candidates. As a consequence, their supporters gradually desert them in favour of the two moderate candidates (but not in favour of C). Thereby, the centrist candidate remains among the top three candidates but is more and more often ranked third because its expected vote share under sincere voting is lower than the moderate candidates' (Table 1) and because voters on extreme positions tend to desert their preferred candidate to support moderate rather than centrist candidates (sincere voting in a restricted set of the top 3 candidates). The implication is that the probability of C winning the election under 2R decreases over time.

On the contrary, in 1R elections, voters' behaviour is adequately described by the Top 2 heuristics. At the first date, one pair of candidates emerge as the most two viable candidates, and the votes after that focus on this pair. Therefore, if candidate C initially belongs to the emerging pair, he remains part of it, and if he does not, he has no chance of entering the top-two club. It follows that the probability that C is ranked first or second in 1R votes should be constant through time.

Thus, in a counterintuitive fashion, the centrist candidate is disadvantaged by the Top 3 heuristics that voters use in the 2R elections, relatively to the Top 2 heuristics utilized in 1R elections. With the Top 3 heuristics, the centrist is certain to be viable. But because there are three viable candidates, supporters of the non viable extreme candidates are more

likely to move to either of the two moderate candidates that is closest to their own position, thus weakening the centrist candidate's chances of making it to the second round. In the plurality election, because there are only two viable candidates, at least some of these extreme candidate supporters are willing to vote for the centrist candidate, whenever the moderate candidate on their side of the left/right axis is not one of the top two candidates.

An alternative decomposition

In the above analysis, we ascertained the impact of the 2R system, compared to the (one-round) plurality rule. It is of course possible to do the reverse, that is, to measure the effect of the plurality rule, taking 2R as the reference point. In that case, the total effect is necessarily exactly the same, but with an opposite sign. The total effect of one-round elections on the probability of the centrist candidate's victory would be -9 percentage points (last row in Table 3).

Things are somewhat different with regards to the mechanical and psychological effects. To estimate the mechanical effect of the plurality rule, we need to determine the probability of C winning with the 2R votes (thus keeping votes constant) but using 1R instead of 2R. This amounts to determining how many times C had most votes in the first round of the 2R elections. This occurred in 37% of the elections (second row in Table 3). The mechanical effect is thus 37% minus 58%, which is the percentage of elections won by the centrist candidate in 2R elections (the reference point). The mechanical effect of 1R versus 2R is thus -21 percentage points, which happens to be almost exactly the same (with opposite sign) as the previously estimated mechanical effect of 2R versus 1R. As for the psychological effect, it is the diference in the probability of the CW victory with 1R votes and 1R system

(49%) minus that with 2R votes but the same 1R rule (37%), that is +12 points, again almost exactly the opposite of the -13 points estimated when the reference point is one-round. In this case, it does not matter which system is used as the criterion. It is not difficult, however, to construct examples in which the two computations provide different estimations.

[Insert Table 3 about here]

4. Conclusion

We have reported on a series of 23 experimental sessions in which participants were invited to vote in a total of 184 elections, 92 under a one-round (plurality) rule and 92 under a two-round (majority run-off) rule.

We hope to have contributed to a better understanding of the effects of the two-round system, a system which is relatively infrequent in legislative elections but very widespread in presidential elections. One of the major claims of supporters of 2R elections is that they make it easier for centrist candidates to win (Blais 1991). This claim is only weakly supported by our data, as the percentage of centrist candidate victories in these experiments was only nine points higher in 2R than in 1R elections. It remains to be seen whether the same pattern would hold under different distributions of candidate and voter

positions but these results suggest that the 2R bias in favour of centrist candidates may be weaker than expected.

Our study also confirms the usefulness of Duverger's famous distinction between mechanical and psychological effects. We have seen that the total effect of runoff (compared to plurality) is limited only because the mechanical and psychological effects tend to cancel each other. It is true that the mechanical effect of run-offs is to systematically advantage centrist candidates, exactly as usually assumed. But our study has detected an opposite psychological impact, to the disadvantage of centrist candidates.

The usual expectation is that psychological effects amplify mechanical ones. This is the case when voters in plurality elections refrain from voting for weak parties that are bound to be disadvantaged by the electoral system. This study has uncovered an instance where the two effects contradict each other. This is a reminder that we should not take for granted that the two effects work in the same direction.

We have shown that the reason why the centrist candidate does not perform as well in the first round of run-off elections is that extreme candidate supporters, who desert their first choice because it is not viable, have strong incentives to move to the moderate candidate on the left or right rather than to the centrist candidate. This is related to the propensity for voters to use a Top three heuristics in two round elections rather than a Top two heuristics, utilized in one-round elections. This is consistent with Cox's (1997) view that there are three viable candidates rather than two in run-off elections.

Finally this study highlights the advantages of the experimental approach when it comes to ascertaining the impact of electoral systems. The experimental approach is particularly

useful in sorting out the specific role of mechanical and psychological effects. We have proposed here a simple procedure for disentangling these two types of effect with experimental data and we have shown that at least in the case at hand, these two effects go in opposite directions and tend to cancel each other. More research is needed to determine under what set of conditions such pattern holds.

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Table 1: Candidate positions on the 0-20 axis, and expected sincere scores

Candidate	A	B	C	D	E
Position	1	6	10	14	19
Expected sincere score	4	4.5	4	4.5	4

Table 2: Mechanical, psychological and total effects of two round system

1R count of 1R votes	**49%**
2R count of 1R votes	71%
2R count of 2R votes	**58%**
Mechanical effect	+22
Psychological effect	-13
Total effect	**+9**

NB: The first three rows indicate the observed and counterfactual probabilities of electing the centrist candidate: the first (resp. third) line reports the observed probability of electing the centrist candidate in 1R (resp. 2R) elections, the second line reports the counterfactual probability of electing the centrist candidate if one was to count the ballots obtained in 1R elections with the 2R system.

The last three rows indicate the effects (in percentage points) of 2R compared to 1R.

Table 3: Mechanical, psychological and total effects of two round system (using 2R elections as the reference point)

2R count of 2R votes	**58 %**
1R count of 2R votes	37 **%**
1R count of 1R votes	**49 %**
Mechanical effect	-21
Psychological effect	+12
Total effect	**-9**

NB: Like in Table 2, the first three rows indicate the observed or counterfactual probability of the centrist candidate being elected. The last three rows indicate the effect (in percentage points) of 1R compared to 2R.