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## Mechanical and psychological effects of electoral reform

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# Mechanical and Psychological Effects of Electoral Reform

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# Mechanical and Psychological Effects of Electoral Reform

## Abstract

Duverger (1954) noted that changes in electoral systems will have two types of effects: mechanical effects, and reactions of political agents in anticipation of these, which he referred to as psychological effects. It is complicated to empirically separate the two effects since these occur simultaneously. In this paper we use a large set of counterfactual election outcomes to address this issue. Our application is based on a nationwide municipal electoral reform in Norway, which changed the seat allocation method from d'Hondt to modified Sainte-Laguë. Even though this electoral reform is of a relatively small magnitude, we document substantial psychological effects.

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# 1 Introduction

Electoral reforms stimulate strategic behavior from all agents who care about the election's outcome (Cox (1997)). Strategic behavior can occur both on the demand and the supply side of the political system: citizens are eager not to waste their votes; political elites are eager not to waste their effort and resources. In the terminology of Duverger (1954), political agents' responses in anticipation of the electoral law's mechanical constraints, constitute the psychological effects of the electoral reform. Mechanical effects capture how vote counts translate into seats. To empirically separate mechanical from psychological effects is complicated since these occur simultaneously. In this paper we combine an exogenous political reform with a novel method to empirically disentangle the two types of effects.

While most existing analyses of electoral reforms are based on national data, often comparing majoritarian to proportional elections system, we study a Norwegian municipal electoral reform within the class of proportional election systems.<sup>1</sup> Two specific features of this reform allow us to treat it as exogenous to local politics. First, and most important, the municipal-level reform was uniformly imposed by the national government. This feature eliminates the potential endogeneity issue that the reform is a product of bargaining among existing parties. This concern is an important limitation of studies at the national levels (as discussed by Shugart (1992) and Benoit (2004)). Second, while the reform we study changed the allocation formula in use at the municipal level, it did not affect the allocation formula used in the county elections held simultaneously. Having voting data for a separate office, for the same electorate, where the electoral formula remained constant is useful because it allows us to isolate the electoral reform's effect of electoral reform from any other general time trends.

Studying a reform at the municipal rather than national level provides additional

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<sup>1</sup>There are some examples of studies looking at differences within countries such as Cox (1997) and Benoit (2001). Also, there is a growing literature using regression discontinuity designs to exploit population thresholds for differences in local political systems (e.g. Fujiwara (2008), Pettersson-Lidbom (2008), Eggers (2010)).

benefits. The most important is that we can evaluate how a large set of homogenous political entities respond to the same electoral reform. The large sample offers a unique opportunity to trace patterns in the seat allocations that studies conducted at the national level cannot offer.

Our empirical approach of separating mechanical from psychological effects builds on the method proposed by Blais et al. (2011). The basic idea is to utilize the electoral system's formulaic structure to generate a large set of counterfactual election outcomes. While Blais et al. (2011) compare election outcomes between two simultaneous elections with different electoral rules, we utilize an electoral reform regarding the seat allocation method. The empirical strategy, utilizing variation in electoral systems over time, allow us to overcome some of the potential limitations in Blais et al. (2011).

The particular reform we examine is a switch from a d'Hondt (DH) to a modified Sainte-Laguë (MSL) seat allocation formula, effective from the 2003 municipal elections. A change from the DH to MSL method mechanically increases the proportionality of the seat allocation - mostly because of a reduction in the effective electoral threshold. The main expected psychological effects can be derived from agents' anticipating the consequences of the lower electoral threshold. For citizens, the incentives to vote for small parties increases after the reform since in the MSL system small parties are more likely to reach the electoral threshold. For small parties, the mechanics of the electoral system incentivizes strategic entry. This effect will be magnified the stronger the belief about the fraction of strategic voters in the population.<sup>2</sup>

Lijphart (1994) suggests that an important effect of electoral reform is that the parties that would have benefited from the status quo will act to reduce the reform's effects. In our setting, pre-reform incumbents may use their discretion to set the size of the council for this strategic purpose. Reducing the council's size will increase the effective electoral threshold, thus offsetting the effect of the electoral reform.

Our results confirm our prior expectations and show that both political parties and

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<sup>2</sup>Strategic voters are those who make voting decisions conditional on the expectations that their votes will be pivotal in the elections's outcome(Kawai and Watanabe (2010)).

voters responded to the change in seat allocation method. More parties ran in the municipal elections, and also made it into the municipal council. Citizens voted for small parties to a larger extent, shifting the vote distribution towards small parties. We also document that pre-reform incumbents tended to decrease the council size, which reduced the effect of the reform. We argue that our identification strategy allows us to give our results a causal interpretation. This is supported by our results being insensitive to controlling for general changes in party support common to municipal and county elections.

The rest of this paper is organized as follows. In section 2 we present the electoral reform and the expected consequences of the reform. We provide the institutional background and descriptive statistics in Section 3. In Section 4 we present our empirical strategy and relate our approach to the one pursued by Blais et al. (2011). The results are presented in Section 5, while Section 6 concludes.

## 2 Electoral Reform

In October 1997 Norway's national government appointed an electoral reform commission with the mandate to simplify and revise the electoral system. In January 2001 this commission presented a report with proposed electoral reforms. One of the proposed reforms was to change the allocation formula used at the municipal level for translating votes into seats from a d'Hondt (DH) to a modified Sainte-Laguë (MSL) formula.<sup>3</sup> In this paper we study the consequences of this electoral reform, which in June 2002 were incorporated in the electoral law.<sup>4</sup> Before we consider the predictions of the electoral reform, we explain the mechanics of these two seat allocation methods.

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<sup>3</sup>The seat allocation formula in use at the municipal level in Norway before the electoral reform consisted of two steps, which were a mix between a largest remainder method and a highest average method. It can be shown that the first step is superfluous and that the seat allocation method is equivalent to a DH method (Hylland (2010)).

<sup>4</sup>The electoral reform commission other proposals were mostly relevant at the national level of government.

## 2.1 Seat Allocation Methods

D'Hondt (DH) and modified Sainte-Laguë (MSL) are seat allocation methods within the class of highest average methods, the basic principle of this method class is to distribute seats in consecutive rounds to the party that “most deserves” a seat. This is achieved by using a series of divisors, which depend on the seats previously awarded to the party. The division series is used to calculate “comparison numbers” and the party with the highest comparison number is awarded the seat. This procedure is repeated until all seats have been allocated.

Highest average methods are differentiated by what divisor series is used. The DH method uses the divisor series (s) “1, 2, 3, 4,...”, the regular (unmodified) SL method uses the divisor series “1, 3, 5, 7,...”, and the MSL method uses the divisor series “1.4, 3, 5, 7,...”. The formula for calculating the comparison number is then  $v/(1+s)$ , where  $v$  denotes the total number of votes.

The main difference between these three methods is how proportional the seat allocation is in relation to the vote shares. On average, SL gives a seat allocation that is directly proportional to the vote share, while DH gives an advantage to large parties. MSL yields a seat allocation that falls somewhere in between the other two methods in terms of proportionality. In the Appendix we explain this in more detail. We also illustrate how different seat allocation methods work using simulated data.

There is no explicit effective threshold for when a party will receive its first seat in any of the seat allocation methods. This is because the seats for a party depend not only the share of votes it receives, but also on the vote shares of all the other parties. However, the effective threshold for the respective methods are approximately  $100/(seats + 1)$  for DH,  $100/(seats * 1.4)$  for MSL, and  $100/(seats * 2)$  for SL. For example, changing from DH to MSL will reduce the effective electoral threshold from approximately 3.57 percent to 2.65 percent for a 27-member council size (the average size in Norwegian municipalities).

## 2.2 Predicted Effects of the Electoral Reform

The mechanical effects of the electoral reform follow from the discussion in the previous section. In the absence of any adjustments from citizens or elites (psychological effects), changing from the DH to MSL method is expected to give more proportional election outcomes. Due to the lower effective electoral threshold, we also expect the (effective) number of parties gaining representation to increase.

The lower effective threshold may also give rise to three types of psychological effects, described below.

*Strategic voters:* The rational choice theory of voting stresses that individuals are motivated to vote because they can affect the election's outcome (Downs (1957)). If voters are instrumentally motivated, the electoral reform is likely to affect voter behavior. Votes for small parties that were previously viewed as wasted are now more likely to be seen as going to a party that has a chance for winning representation. After the reform, instrumentally motivated voters are therefore more likely to cast their vote for minor parties.<sup>5</sup> In the terminology of Cox (1997) this implies that strategic desertions from minor parties are expected to be lower after the reform. Cox provides empirical evidence of strategic desertion in Chile, Columbia and Japan. Based on these arguments we expect a larger share of votes will be cast for small parties.

*Strategic parties:* Duverger's prediction that plurality systems will essentially converge to a two-party system rests on the idea that the entries and exits of political parties are sensitive to anticipated defeat (Duverger (1954)). It is expected that the same type of mechanisms also will be found in proportional election systems (Cox (1997)). Cox refers to this type of behavior as strategic entry. Here the key factors are the district magnitude and electoral formula, which together decide the representation and the disproportionality

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<sup>5</sup>The extent to which voters are instrumentally motivated is debated. Clearly, the simplest formulation of the rational choice theory of voting cannot explain observed turnout levels in large-scale elections. The instrumental motive may, however, still be important on the margin and in the small-scale elections that we study (Blais (2000)). Kawai and Watanabe (2010) draw an important distinction between misaligned voting (voting for a candidate other than the most preferred) and strategic voting (votes cast conditional on the event that their votes are pivotal) and find a large fraction of strategic voters in Japanese general-election data.

of the seat allocation. Since entry is costly, both in terms of effort and resources, parties will enter the election only if the benefits from running outweigh the costs.<sup>6</sup> For small parties, the expected benefits from participating in the election increases after the reform is implemented. We therefore expect more parties to run in a given district after the reform. We also expect parties to be less likely to form joint lists.

*Strategic incumbents:* In our empirical setting, a municipality's discretion to set the size of its council may be used to offset the effect of the reform. Reducing the council size will increase the effective electoral threshold and increase the advantage for large parties. Thus we would expect to see a reduction in the council sizes at the time of the reform. Such "defensive behavior" is expected to dampen the reform's effect on the (effective) number of parties obtaining representation. We could naturally expect other types of strategic behavior from the incumbents, such as trying to capture policy issues from small parties and increased campaigning. These types of behaviors, however, are difficult to quantify which is why we omit leave them from the analysis.

While the mechanical effect of changing the electoral system would be to *increase* proportionality, the psychological effects go in the opposite direction. Shifting the vote distribution towards smaller parties, either as a consequence of strategic behavior from voters or parties, would *reduce* the disproportionality of the system. "Defensive behavior" from incumbents would also dampen the effect of the reform, thus contributing to *reducing* the disproportionality of the system.

After the reform the mechanical effect on the (effective) number of parties gaining representation is expected to be positive. More parties running (strategic parties) and an increased fraction of votes for small parties (strategic voters) would, naturally, also lead to more parties, while a reduction in council size (strategic incumbents) would lead to a reduction of parties running.

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<sup>6</sup>Cox (1997) argues that parties that would suffer from a disproportionate seat allocation will be less likely to participate. He shows, using data from Japan, that an increased proportionality of the seat allocation leads to more parties participating in the elections.

## 3 Institutional Setting and Data

### 3.1 Institutional Setting

Norwegian municipalities are multipurpose authorities responsible for conducting important services provided by the welfare state. Each municipality is run by a local council that makes decisions based on simple majority. The local councils are elected every fourth year in September in an open list proportional representation election system. Norway has three tiers of government in Norway: municipal, county, and national governments. Municipal elections coincide with elections for the county (regional) level of government, a feature that we exploit in our empirical strategy.<sup>7</sup> There are 19 counties in total.

Most of the available party lists that participate in municipal elections also are represented in the national political arena. These eight parties are the Red Electoral Alliance, Socialist Left Party, Labor Party, Centre Party, Christian Democratic Party, Liberal Party, Conservative Party and Progress Party. With the exception of the Red Electoral Alliance and the Liberal Party, these six parties have been represented in the national assembly continuously since 1981. There are also smaller political parties that obtain little nationwide support and party independent local lists.<sup>8</sup> Finally, parties may form joint lists where the seats are allocated to the parties jointly.

In addition to voting for a party list, voters can also affect the election outcome by expressing candidate preferences (for candidates from any party list). In the 2007 municipal election about 40 percent of voters took the opportunity to do so. This has substantial implications for the allocation of seats in the local councils.<sup>9</sup>

The number of council member is chosen by the previous local council (within the first three years of the election period), but the local discretion is subject to restrictions

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<sup>7</sup>National elections also have a fixed four-year election cycle, but these elections lag the municipal and county elections with two years.

<sup>8</sup>None of these parties have been able to obtain parliamentary representation except for the Communist Party of Norway (which historically received substantial support) and the Coastal Party (who received one mandate in the 1997 election).

<sup>9</sup>About 67 percent of seats in the local councils were decided by preferential votes. 25 percent of all candidates that were elected, got elected exclusively due to preferential votes (Bergh et al. (2010)).

imposed by the electoral law. The minimum size of the local council depends on the size of the population.<sup>10</sup> This constraint is only binding in a limited number of cases.<sup>11</sup>

## 3.2 Descriptive Statistics

As discussed in section 2.2 we expect the electoral reform to have consequences for the proportionality of the system, the number of party lists in the running, the number of party lists obtaining representation, the extent of joint lists, and the size of the local council. These are the outcome variables of our study.

As a measure of disproportionality, we use the index of disproportionality proposed by Gallagher (1991). The Gallagher index is based on the vote-seat share deviation of all available parties. By weighting the deviations by their own values, large deviations count more in the index. More formally, the index is defined as

$$Index = \sqrt{1/2 \sum_{i=1}^N (VoteShare_i - SeatShare_i)^2}.$$

For ease of interpretation, we multiply the index by 100. The index can then take values from 0 (complete proportionality) to 100 (complete disproportionality).

We will also consider the index of the effective number of parties (ENOP) developed by Laakso and Taagepera (1979) as an outcome variable. This measure is given by

$$ENOP = \sum \frac{1}{SeatShare_i^2},$$

where  $SeatShare_i$  is the proportion of seats of the  $i$ -th party. ENOP takes into account both the number of parties represented and their relative strengths. It is widely used for describing party systems at the national level (Lijphart (1999)).

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<sup>10</sup>The number of council members must be an uneven number. With less than 5,000 inhabitants the number of council members must be at least 11. Above 5,000 but below 10,000 inhabitants, it must be at least 19. Above 10,000 but below 50,000 inhabitants, it must be at least 27. Above 50,000 but below 100,000 inhabitants it must be at least 35. Above 100,000 inhabitants it must be at least 43.

<sup>11</sup>For the 2007-2011 election period, only five municipalities have the minimum allowed number of council members.

Table 1 offer descriptive statistics on the outcome variables we use in the empirical analysis. The analysis is based on data from 387 municipalities for the election preceding the reform (1999) and the election following the reform (2003).<sup>12</sup>

There is substantial variation across municipalities in the number of party lists available. As shown in Table 1 the average number of party lists available is 6.54, and varies from 2 to 15. On average, 6.10 party lists obtain political representation in the local council. The average value of the effective number of parties is 4.24, considerably lower than the average number of parties that are represented in the local council, which reflects that parties are generally not equal in strength. This is similar to the effective number of parties found at the national level in Norway.

In our sample the average value of the Gallagher index is 2.66. This is similar to the historically observed level of disproportionality in legislative elections in countries such as Germany and Switzerland. It is somewhat smaller than what is observed at the national level in Norway (Lijphart (1999)).

Finally, we note that the average local council consists of about 27 council members. Variation in size of the local council is closely related to municipality's population (with a correlation coefficient of 0.80).

In Table 2 we offer separate descriptive statistics for each election period. These tables illustrate how key variables change from the election held prior to the electoral reform (1999) to the first election held following the reform (2003). We find that the number of parties available is, on average higher after the electoral reform. The average jumps from about 6.35 to 6.73. There also is a positive response in the number of lists represented in the local council, also reflected in the measure of the effective number of parties (ENOP). The disproportionality index is lower after the reform. All these changes are in line with

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<sup>12</sup>In 2003 the total number of municipalities is 434. We drop 41 municipalities where, for any election, the distribution of votes is inconsistent with the distribution of seats in the data that we have available. In most of these cases the inconsistency is minor, and our results are basically unaltered if we include these observations in our empirical analysis. In addition we exclude municipalities that have parliamentary systems (two municipalities), have a majoritarian electoral system (one municipality), municipalities that were involved in mergers during this time period (two municipalities) and that have missing data (one municipality).

the empirical predictions of the mechanical effect that occurs when changing from DH to MSL, and will be explored in more detail below. Finally, we note that the average size of local councils are substantially lower after the electoral reform. The average decrease is almost three representatives, corresponding to a decrease of about 10 percent in the average local council.

### **3.3 Distribution of Votes**

In Table 3 we offer descriptive statistics by party lists. The Labor Party is the largest party, and is represented in almost all municipalities. During the period that we study the average (unweighted) voteshare is 30 percent. The other parties represented at the national political arena also are present in most, but not all municipalities. The smallest of these parties is the Red Electoral Alliance, which was present in only about 22 percent of the municipalities and represented on local councils in about 9 percent of the municipalities. Independent local lists are common, and in 37 percent of the municipalities at least one independent local list is available. Party lists that are rarely seen at the national political arena are present in about 21 percent of municipal elections. Joint lists are available in about 7 percent of the municipal elections.

The final column of Table 3 reports vote shares for each party (or group of parties) based on voting data from the county election. A comparison with vote shares for the municipal election (column 4) clearly illustrates that the party structure and voter support are similar across the two government tiers.

Figure 1 gives the vote distribution before and after the electoral reform. The vote distribution before the reform is shown by the wider and darker bars, while the vote distribution after the reform is shown by the lighter narrower bars. We can see that there is a shift towards the left in the vote distribution. That is, there is a larger share of votes for small parties after the reform. For example, the share of votes for parties that receive less than 5 percent of the total votes increases by one third.

### 3.4 Seat Share - Vote Share Curvature

In Figure 2 we document how the seat share-vote share curvature, meaning the difference between the seat share and vote share, depends on a party's vote share before and after the reform. The data from before the reform, when DH was used, are shown by the solid circles, while data from after the reform, when MSL was used, are shown by the X's. Rather than showing data for each party in each municipality (which would give about 2,500 observations for each election), Figure 2 is constructed by grouping (binning) parties together based on their vote share, using a bandwidth of 1 percentage point.

As expected, the advantage given to larger parties is larger when using DH than when using MSL. A party that received 40 percent of the votes before the reform would on average receive a "seat share bonus" of about 1 percentage points, while it received a bonus of about half a percentage point after the reform. The difference between the two seat allocation methods is smaller than in the simulated data (see the appendix), possibly reflecting strategic voting. If voters abandon small parties with a little chance of getting on the local council, the advantage for large parties will be smaller than in the simulated data (which ignores strategic voting).

## 4 Empirical Strategy

When studying the effects of an electoral reform the main concern is that reforms are endogenous to political outcomes and commonly a product of bargaining between parties (Cox (1997); Benoit (2001)). Any observed differences in the outcomes of interest could thus be a product of changes in the political structure. In our case this is not a concern because the electoral reform is not a product of bargaining within the municipalities. The decision to implement the reform was taken at the national level. Thus, the reform will be exogenous with respect to political outcomes at the municipal level. We rely on a regression of the type:

$$Y_{i,t} = \alpha_i + \beta Reform_t + \gamma Y_{i,t}^{County} + \varepsilon_{i,t}, \quad (1)$$

where  $Y_{i,t}$  is an outcome variable based on the election in municipality  $i$  held at time  $t$  (ListsCouncil, ENOP, Index).  $\alpha_i$  is a set of municipal fixed effects.  $Reform_t$  is a dummy equal to one after the electoral reform, and zero otherwise.  $\beta$  is the parameter of interest capturing the effect of the electoral reform on  $Y_{i,t}$ .

As mentioned above we are also concerned that our estimate of  $\beta$  could be contaminated by general changes in party support at the time of the reform. To address this potential bias we exploit the fact that municipal and county governments elections are held simultaneously. More explicitly we utilize the information we have on voting behavior by the same electorate for a separate office, but where the electoral formula remained constant both before and after the municipal electoral reform. Even though the seat distribution at the county level is determined by considering the entire county jointly, we exploit the voting data we have for this office measured at the municipal level.<sup>13</sup> Based on this reasoning we include the variable  $Y_{i,t}^{County}$ . This variable is the outcome variable in municipality  $i$  in election held at time  $t$  (ListsCouncil, ENOP, Index) if the votes for the county election were used to generate a local council based on the DH method and the local council size in use pre-reform. As indicated in Table 3, voting behavior for the two offices are closely related.<sup>14</sup>

$\beta$  captures the causal effect of the electoral reform on  $Y_{i,t}$  as long as  $Cov(Reform_t, \varepsilon_{i,t}) = 0$ . The identifying assumption is that after conditioning on  $Y_{i,t}^{County}$  there are no time varying factors (correlated with reform) that have an independent impact on  $Y_{i,t}$ . Since  $Y_{i,t}^{County}$  is potentially endogenous to  $Y_{i,t}$  we report results both with and without county controls.

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<sup>13</sup>Andersen et al. (2010) study voter motivation using Norwegian data and a similar identification strategy.

<sup>14</sup>Voter turnout tends to be slightly higher for the municipal election (about 65 percent) relative to the county election (about 60 percent)(Andersen et al. (2010)).

## 4.1 Mechanical and Psychological Effects

To illustrate our empirical strategy of separating the psychological and mechanical effects, we use Figure 3 to show the actual outcomes (A and D) and the two main counterfactual seat allocations (B and C). Our estimates of the reform's total effect, is basically a comparison of A, applying DH to the 1999 election outcome, to D, applying MSL to the 2003 election outcome. Assume that instead we want to isolate the mechanical effects of electoral reform. We can do this either by comparing A to B (applying counterfactually MSL to the 1999 election outcome or by comparing C (applying counterfactually DH to the 2003 election outcome) to D. In a similar manner we can examine the psychological effects by comparing either A to C or B to D. In the following paragraphs we explain this approach in more detail.

**Mechanical Effect** To estimate the mechanical effect, we use the voting data from a specific election and create a counterfactual seat allocation using an alternative method for allocating the seats. We then compare the counterfactual seat allocation to the actual seat allocation used in the election of interest. In essence this means that we keep everything, except for the seat allocation method, constant. This analysis allows us to estimate the mechanical effect of switching from DH to MSL, conditional on the election outcome.

We first use the pre-reform election outcome and apply MSL to create the counterfactual seat allocation. We compare the counterfactual MSL seat (B in Figure 3) allocation to the actual DH seat allocation (A in Figure 3). Thus, we will estimate the mechanical effect of switching from DH to MSL, conditional on the pre-reform voting outcome. The results from this exercise yields the total effect of electoral reform in the absence of any strategic responses by voters, parties or incumbents. For this analysis, the inclusion of any county control is irrelevant since we evaluate the reform's effect for a given vote distribution. We then repeat this exercise using the post-reform voting data. That is, we estimate the mechanical effect of switching from DH to MSL, conditional on the

post-reform voting outcome (from C to D in Figure 3).

**Psychological Effect** We use the same approach to estimate the psychological effect as we used for estimating the mechanical effect. We first estimate the psychological effect conditional on the seat allocation method and having the same council size as prior to the reform. In other words, we measure the effect of changes in voter and party behavior, conditional on the pre-reform seat allocation mechanics (from A to C in Figure 3). The results from this exercise should be interpreted as what the effect of the reform would have been if the mechanical factors had not changed. We then repeat the exercise for the post-reform seat allocation (MSL) method (from B to D in Figure 3) using the same council size as after the reform. This will give us the contribution that the changes in the vote distribution, either driven by strategic voters or strategic parties, made to the reform's total effect.

Finally, we repeat the exercise, but use the actual council size to estimate the combined effect of the changes in strategic voting, strategic behavior by parties and strategic behavior by incumbents, conditional on the seat allocation method used. We do this for both seat allocation methods (i.e. both A to C and B to D in Figure 3).

## 4.2 Previous Research

As mentioned above, our empirical strategy is closely related to the one proposed by Blais et al. (2011).<sup>15</sup>

The empirical analysis of Blais et al. (2011) is based on both lower and upper house elections in Switzerland and two simultaneous elections for the Japanese Lower House. For example, they estimate the psychological effect by determining how different the vote obtained by various parties would have been, given the same set of choices but in the absence of differences in electoral rules. For this strategy to produce unbiased estimates

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<sup>15</sup>Previous attempts to separate mechanical from psychological effects are Blais and Carty (1991), Clark and Golder (2006), which both rely on cross country variation in electoral systems. Van der Straeten et al. (2010) provides experimental evidence.

one needs to assume that all factors affecting voter and party behavior, except electoral rules, are similar across both elections. While this is a substantial improvement relative to the existing literature, it is not obvious that the identifying assumption is satisfied. Our empirical approach, utilizing an arguably exogenous change in the electoral system, rests on a weaker identifying assumption. In contrast to Blais et al. (2011), it is not problematic for our empirical strategy if there are omitted factors impacting the political system as long as these factors remain constant over time.

A related problem is that simultaneous elections can be expected to have an independent effect on both voting and party behavior. The existence of electoral balancing is a well-documented phenomena, both in majoritarian (see for example Bafumi et al. (2010)) and in proportional election systems (see for example Kern and Hainmueller (2006)). Thus, voter behavior in one election will be conditional on the expected outcome in the other election. Simultaneous elections can also affect party behavior. For example, consider the case of the Swiss simultaneous elections to the upper and lower house used by Blais et al. (2011). Here, the lower house elections are proportional, while the upper house elections are conducted in single- or two-member districts. Small parties therefore have incentives to put their best candidates in the lower house elections, since they have little chance of winning representation in the upper house election, which also would give biased results.

Electoral balancing across Norwegian municipal and county elections is unlikely to be a concern since the elections are held for different levels of government with different responsibilities. However, to check whether our results may be sensitive to electoral balancing we present results both with and without the county controls.

## 5 Results

### 5.1 Total Effect

In Table 4 we present results capturing the total effect of the electoral reform (from A to D in Figure 3) on lists represented in the council, the effective number of parties and the disproportionality index. In line with the descriptive analysis presented above, we find that the reform increased the number of party lists in the council by 0.20. This is a non-trivial effect which is statistically significant at the 1 percent level. If no municipality increases the number of party lists by more than one, the point estimate indicates that an additional party list will be present in one out of five municipalities. The county control is also statistically significant with the expected positive sign, but it leaves the estimate of the reform effect basically unaltered.

The effective number of parties increases by 0.26 as a consequence of the electoral reform, which corresponds to about one-fourth of a standard deviation. This effect is statistically significant at the 1 percent level, and also basically unaltered if we include the county control, which suggests that electoral balancing across the two elections does not seem to be a source of bias. The positive effect of the county control implies that when the vote distribution for the county government become more fragmented, i.e. a higher level of ENOPCountyDH, the effective number of parties at the local council also increase.

The disproportionality index is reduced by 0.4 percentage-points, which corresponds to almost one-half a standard deviation decrease in disproportionality. The county control for this variable is statistically insignificant.

To put these results in context, Lijphart (1994) found that the national reform of moving to DH to MSL in Norway in the 1950s lead to an increase in the effective number of parties of 0.35, while enacting the same reform in Sweden lead to an increase of 0.05. The results we find are thus comparable to the national reforms. The same reforms lead to a decrease disproportionality of 4.15 percentage-points in Norway and 1.15 percentage-

points in Sweden.

## 5.2 Mechanical Effect

Our estimates of the mechanical effect of the electoral reform is reported in Table 5. In columns 1, 3, and 5 we present results based on voting data from *before* the electoral reform (from A to B in Figure 3). In columns 2, 4, and 6 we present results based on voting data from *after* the electoral reform (from C to D in Figure 3).

When taking a given election result and applying the counterfactual seat allocation method, we find a mechanical effect on the number of parties represented in the council of 0.12 for 1999 and 0.21 for voting data from 2003. The difference between the two estimates of the mechanical effect is caused by differences in the distribution of votes from 1999 to 2003. That the effect is stronger when we use the 2003 voting data indicates a shift in voting towards smaller parties, a psychological effect. This highlights the fact that the mechanical effect is dependent on voting outcomes.

For the effective number of parties (ENOP), as shown in columns 3 and 4, we find that the mechanical effect has the same basic magnitude as the total effect when we use data prior to the reform, but is somewhat larger if we use the post-reform data.

Even if there are substantial psychological effects, it is not unreasonable that the mechanical effect is similar to the total effect, the reason is that the effective parties measure takes the whole distribution of parties into account, and will be relatively insensitive to the voter support for minor parties, as well as the minor parties' decision to run in the election.

For the Gallagher Index of disproportionality the mechanical effect is double the size of the total effect, which indicates that psychological effects dampen the total effects of the electoral system change.

### 5.3 Psychological Effects

Following the discussion in section 2.2, the psychological effects that seem to be present may be driven by the strategic behavior of voters, parties, or incumbents. There could be a “supply effect” where more party lists are available for voters and smaller parties exert more electoral effort. Also there could be a “demand effect” where voters are more likely to cast their votes for smaller parties. Naturally there could also be a combination of the two. In addition, if pre-reform incumbents strategically change the total number of seats on the local council to be allocated in the next election, this may work as a countervailing effect, moderating both supply and demand effects.

We start the analysis by examining three outcome variables that can be expected to be affected by the reform: the total lists available for voters, the number joint party lists, and the council size based on actual election outcomes (from A to D in Figure 3).

The results for these three outcomes are presented in Table 6. We document a considerable “supply effect” of available party lists. The point estimate when ListsAvailable serves as the dependent variable is 0.38 and statistically significant at the 1 percent level. We find that this estimate is slightly lower, 0.30 if we control for the corresponding variable at the county election.

Our results for the number of joint lists show that the results for the number of available lists is not driven by parties from the same political block that stop forming joint party lists after the reform. The point estimate does suggest that there are fewer joint lists as a consequence of the reform, but the effect is small and not statistically significant at conventional levels. Including a dummy for the availability of joint lists at the county level does not change this conclusion. This variable is negatively associated with the number of joint lists at the local level, which is contrary to what one would expect. This variable is, however, not a very relevant control variable. The electoral support that joint lists receive at the county level is minuscule (see Table 3).

As noted above, pre-reform incumbents may also respond to the electoral reform. Incumbent politicians may strategically decrease the total number of seats on the local

council to maintain part of their advantage after the electoral reform.<sup>16</sup> Our results support this conjecture. On average, the size of the local council is reduced by about 2.5 council members, which corresponds to an average decrease of slightly below 10 percent.<sup>17</sup> The effect is statistically significant at the 1 percent level, and does not change if we control for the council size at the county level.

We next look at the same outcomes for the psychological effects as for the total and mechanical effects, and do the counterfactual analysis explained in Section 4. The results from using the actual vote outcome prior to the reform are compared to what the outcome would have been if the seats were still allocated using DH and the pre-reform council size are reported in columns 1, 3 and 5 in Table 7 (going from A to C in Figure 3). We also present the alternative counterfactual, based on MSL, in columns 2, 4, and 6 (from B to D in Figure 3). These estimates allow us to compare psychological effects to the total effects of the electoral reform. The difference between the estimates for the first and second counterfactual can be interpreted as how the psychological effects influence the size of the mechanical effect.

The results for the number of parties represented on the council illustrate an interesting finding. When we use MSL to allocate the seats the change in the number of parties represented is statistically significant at the 1 percent level and is larger than when we use DH (which is statistically significant only at the 10 percent level). The reason for this is that the votes for “new” parties would in some cases not have been enough to surpass the electoral threshold under DH, while it would for the electoral threshold using MSL. This finding supports the idea that voters and parties react strategically to changes in the effective electoral threshold. Under DH there would not have been any reason to vote for some of these marginal parties, or for these parties to run, since they would have a low chance of getting seated on the municipal council.

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<sup>16</sup>The number of council members to be allocated in the next election must be chosen within the first three years of the election period. Since the white paper that led to the reform were published January 2001, it implies that incumbent politicians had about a year to change the number of seats available.

<sup>17</sup>For the average-sized local council of 27 members the pure mechanical effect of changing from DH to MSL is a reduction in the effective threshold from about 3.57 percent to 2.65 percent. A decrease in the council size of 2.5 council members would increase the effective threshold from 2.65 to 2.91 percent.

For the effective number of parties we do not find that the change in the vote distribution has any effect. This is in line with the results presented in the previous section, where we found the mechanical effect to be about the same size as the total effect.

Similarly to the effect for the effective number of parties, we only find a small effect on the disproportionality index, which is statistically significant only when we use DH.

In Table 8 we present results when we do not hold the council size constant, but instead use the actual council size. This table allows us to show the combined effect of strategic voters, parties, and incumbents. We find that in comparison to Table 7, which only included strategic voters and strategic parties, there is no longer any effect on the number parties represented when using DH. For MSL, the effect is reduced, and statistically significant only at the 10 percent level. This shows that the strategic reduction in seats indeed had the expected effect of counteracting the effect of the electoral reform.

When we allow council size to vary, we also do not find any change in the effective number of parties. For the disproportionality index we find a fairly large effect, in the opposite direction of the mechanical effect. The combined effect of strategic voters, parties and incumbents is about half the size of the mechanical effect (in absolute value). Hence the psychological effects dampens the total effect with about 50 percent. This is mainly driven by the reduction in council size, which we see by comparing the point estimates in Table 8 with those in Table 7.

## 5.4 Time Trends

Our identification strategy is based on the assumption that there are no time trends in our outcome variables which are specific to the municipal elections. To investigate the plausibility of this assumption we add information from one election preceding the reform (1995) and one election following the reform (2007).<sup>18</sup>

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<sup>18</sup>In our baseline specification, the results are based on vote shares that take preferential voting into account. We do not have such voting data available for all municipalities for the 1995 election. For this election, we only have complete voting data for municipalities that had no more than a maximum of one independent party list, one “other” party list, or one joint list (about 90 percent fulfill this criteria). This incomplete data has two implications. First, the Gallagher index will be based on slightly different

Table 9 presents results based on the full sample, where the reform dummy is (as in our baseline specifications) equal to one for elections based on MSL (2003 and 2007) and zero otherwise. We find results very similar to those reported in our baseline specification (Table 4 and Table 6). This also holds when we add a linear time trend for each of these specifications, reported in Table 10. The exception is the reform’s effect on the council size, which is reduced by about 40 percent when we allow for a linear trend. It is, however, still statistically significant at the 1 percent level.

## 6 Conclusion

In this paper we uncover the causal effects of changing the seat allocation method from d’Hondt to modified Sainte-Lagüe for Norwegian municipal elections. To separate the psychological and mechanical effects of electoral reform, we utilize the concept of counterfactual seat allocations. We find that the electoral reform increased the proportionality of the seat allocation, the number of parties represented and the effective number of parties. This result was driven by a combination of psychological and mechanical effects. The psychological effects of the electoral reform served to dampen the mechanical effects on proportionality.

The psychological effects are partly driven by dynamic adjustment on the political system’s supply side: on average, the number of party lists running in a given district increases after the reform. We also document that the vote distribution shifts towards smaller parties. Whether a shift in the vote distribution towards smaller parties would have occurred in the absence of any strategic entry of party lists, we cannot say. An important topic for future research is to look more closely at the relative importance of strategic responses in the mass electorate vis-a-vis strategic responses in the elite strata.

Our analysis demonstrates that to understand the consequences of electoral reform, data. In practice, this is a minor problem. The two alternative Gallagher Indexes show a raw correlation of 0.98 for the 2003 election. Second, the analysis of the Gallagher index needs to be limited to those municipalities that had no more than a maximum of one independent party list, one “other” party list or one joint list for the 1995 election. To be consistent we also do this for the period 1999-2007 period.

one needs to take into account not only mechanical effects, but also the strategic responses from political agents in anticipation of these. Such psychological effects are likely to be even larger for quantitatively larger electoral reforms, such as a change from majoritarian to proportional elections systems.

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Table 1: Summary statistics 1999 and 2003 elections

Variable	Mean	Std. Dev.	Min.	Max.
ListsAvailable	6.536	1.966	2	15
ListsCouncil	6.099	1.603	2	11
ENOP	4.242	1.08	1.665	7.367
Index	2.659	1.02	0.254	6.711
JointLists	0.076	0.275	0	2
SizeOfCouncil	26.729	10.59	11	85
N		774		

Table 2: Summary statistics

	(1)		(2)	
	Pre-reform mean	sd	Post-reform mean	sd
ListsAvailable	6.35	(1.89)	6.73	(2.02)
ListsCouncil	6	(1.60)	6.20	(1.60)
ENOP	4.11	(1.02)	4.37	(1.13)
Index	2.91	(1.11)	2.41	(0.85)
JointLists	0.085	(0.28)	0.067	(0.27)
SizeOfCouncil	28.0	(11.1)	25.5	(9.93)
N	387		387	

Table 3: Descriptive statistics by party list

Party list	Fraction Available	Fraction Council	Voteshare	VoteshareC
Red Electoral Alliance (RV)	0.216	0.089	0.006	0.011
Socialist Left Party (SV)	0.683	0.676	0.070	0.086
Labor Party (DNA)	0.995	0.995	0.299	0.290
Liberal Party (V)	0.660	0.572	0.045	0.043
Centre Party (SP)	0.902	0.879	0.167	0.175
Christian Democratic Party (KrF)	0.753	0.733	0.083	0.099
Conservative Party (H)	0.863	0.855	0.141	0.135
Progress Party (FrP)	0.658	0.641	0.087	0.124
Independent Lists	0.370	0.357	0.067	0.000
Other Lists	0.213	0.149	0.016	0.037
Joint Lists Left	0.014	0.013	0.002	0.001
Joint Lists Right	0.061	0.059	0.017	0.000

*Note: Descriptives based on data from 1999 and 2003 elections*

Table 4: Total effect of electoral reform on number of party lists represented in council, effective number of parties, and disproportionality of the electoral system

	(1)	(2)	(3)	(4)	(5)	(6)
	ListsCouncil	ListsCouncil	ENOP	ENOP	Index	Index
	b/se	b/se	b/se	b/se	b/se	b/se
Reform	0.199*** (0.05)	0.216*** (0.05)	0.261*** (0.03)	0.247*** (0.03)	-0.422*** (0.06)	-0.424*** (0.06)
ListsCouncilCountyDH		0.185*** (0.06)				
ENOPCountyDH				0.429*** (0.06)		
IndexCountyDH						0.032 (0.05)
_cons	6.000*** (0.02)	4.797*** (0.39)	4.112*** (0.02)	2.299*** (0.25)	2.831*** (0.03)	2.694*** (0.22)
<i>N</i>	774	774	774	774	774	774
<i>R</i> <sup>2</sup>	0.043	0.069	0.126	0.264	0.111	0.112

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 5: Mechanical effect of electoral reform on number of party lists represented in council, effective number of parties, and disproportionality of the electoral system

	(1)	(2)	(3)	(4)	(5)	(6)
	ListsCouncil	ListsCouncil	ENOP	ENOP	Index	Index
	b/se	b/se	b/se	b/se	b/se	b/se
reform	0.121*** (0.02)	0.209*** (0.02)	0.251*** (0.01)	0.290*** (0.01)	-0.751*** (0.04)	-0.938*** (0.05)
_cons	6.003*** (0.01)	5.990*** (0.01)	4.112*** (0.01)	4.082*** (0.01)	2.913*** (0.02)	3.344*** (0.03)
<i>N</i>	774	774	774	774	774	774
<i>R</i> <sup>2</sup>	0.091	0.182	0.540	0.547	0.429	0.465
Voting Data	1999	2003	1999	2003	1999	2003

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 6: Total effect of electoral reform on number of party lists running, extent of joint lists, and the size of the local council

	(1)	(2)	(3)	(4)	(5)	(6)
	ListsAvail	ListsAvail	JointLists	JointLists	SizeOfCouncil	SizeOfCouncil
	b/se	b/se	b/se	b/se	b/se	b/se
Reform	0.380*** (0.05)	0.298*** (0.06)	-0.018 (0.01)	-0.017 (0.01)	-2.475*** (0.20)	-2.347*** (0.34)
ListsAvailableCounty		0.074* (0.04)				
JointListsCounty				-0.049 (0.05)		
SizeOfCouncilCounty						0.015 (0.04)
_cons	6.346*** (0.03)	5.570*** (0.40)	0.085*** (0.01)	0.089*** (0.01)	27.966*** (0.10)	27.221*** (1.80)
<i>N</i>	774	774	774	774	774	774
<i>R</i> <sup>2</sup>	0.119	0.127	0.004	0.008	0.280	0.280

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 7: Psychological effect of electoral reform on number of party lists represented in council, effective number of parties, and disproportionality of the electoral system. Size of council held constant

	(1)	(2)	(3)	(4)	(5)	(6)
	ListsCouncil	ListsCouncil	ENOP	ENOP	Index	Index
	b/se	b/se	b/se	b/se	b/se	b/se
Reform	0.087* (0.049)	0.113** (0.049)	-0.013 (0.031)	0.022 (0.032)	0.138* (0.072)	0.072 (0.045)
ListsCouncilCountyDH	0.222*** (0.062)					
ListsCouncilCountyMSL		0.125** (0.055)				
ENOPCountyDH			0.447*** (0.057)			
ENOPCountyMSL				0.445*** (0.060)		
IndexCountyDH					0.002 (0.059)	
IndexCountyMSL						-0.003 (0.066)
_cons	4.554*** (0.407)	5.240*** (0.376)	2.222*** (0.243)	2.298*** (0.280)	2.904*** (0.259)	2.343*** (0.196)
<i>N</i>	774	774	774	774	774	774
<i>R</i> <sup>2</sup>	0.042	0.023	0.174	0.157	0.009	0.007
Formula	DH	MSL	DH	MSL	DH	MSL
Council Size	1999	2003	1999	2003	1999	2003

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 8: Psychological effect of electoral reform on number of party lists represented in council, effective number of parties, and disproportionality of the electoral system. Size of council allowed to vary

	(1)	(2)	(3)	(4)	(5)	(6)
	ListsCouncil	ListsCouncil	ENOP	ENOP	Index	Index
	b/se	b/se	b/se	b/se	b/se	b/se
Reform	0.007 (0.051)	0.089* (0.048)	-0.044 (0.032)	0.005 (0.032)	0.429*** (0.079)	0.243*** (0.045)
ListsCouncilCountyDH	0.220*** (0.065)					
ListsCouncilCountyMSL		0.143*** (0.054)				
ENOPCountyDH			0.451*** (0.056)			
ENOPCountyMSL				0.460*** (0.062)		
IndexCountyDH					0.041 (0.066)	
IndexCountyMSL						0.008 (0.059)
_cons	4.573*** (0.427)	5.141*** (0.372)	2.205*** (0.236)	2.247*** (0.287)	2.736*** (0.293)	2.137*** (0.173)
<i>N</i>	774	774	774	774	774	774
<i>R</i> <sup>2</sup>	0.034	0.022	0.178	0.166	0.072	0.071
Formula	DH	MSL	DH	MSL	DH	MSL
Council Size	Vary	Vary	Vary	Vary	Vary	Vary

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 9: Total effects of electoral reform, based on panel data from 1995 to 2007

	(1)	(2)	(3)	(4)	(5)
	ListsCouncil	ENOP	Index	ListsAvailable	SizeOfCouncil
	b/se	b/se	b/se	b/se	b/se
Reform	0.245*** (0.04)	0.233*** (0.03)	-0.449*** (0.05)	0.468*** (0.05)	-2.678*** (0.29)
ListsCouncilCountyDH	0.255*** (0.03)				
ENOPCountyDH		0.563*** (0.04)			
IndexCountyDH			0.045 (0.03)		
ListsAvailableCounty				-0.002 (0.02)	
SizeOfCouncilCounty					0.033 (0.03)
_cons	4.344*** (0.21)	1.730*** (0.16)	2.621*** (0.13)	6.308*** (0.25)	26.814*** (1.27)
<i>N</i>	1483	1483	1408	1483	1483
<i>R</i> <sup>2</sup>	0.097	0.312	0.091	0.117	0.308

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 10: Total effects of electoral reform, based on panel data from 1995 to 2007, allowing for linear trend

	(1)	(2)	(3)	(4)	(5)
	ListsCouncil	ENOP	Index	ListsAvailable	SizeOfCouncil
	b/se	b/se	b/se	b/se	b/se
Reform	0.224***	0.258***	-0.409***	0.324***	-1.744***
	(0.07)	(0.05)	(0.10)	(0.08)	(0.29)
trend	0.011	-0.013	-0.020	0.075**	-0.550***
	(0.03)	(0.02)	(0.04)	(0.03)	(0.10)
ListsCouncilCountyDH	0.254***				
	(0.03)				
ENOPCountyDH		0.563***			
		(0.04)			
IndexCountyDH			0.045		
			(0.03)		
ListsAvailableCounty				-0.005	
				(0.02)	
SizeOfCouncilCounty					0.018
					(0.03)
_cons	4.299***	1.786***	2.712***	5.996***	30.059***
	(0.24)	(0.19)	(0.21)	(0.29)	(1.53)
<i>N</i>	1483	1483	1408	1483	1483
<i>R</i> <sup>2</sup>	0.097	0.313	0.091	0.120	0.318

Note: Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Figure 1:

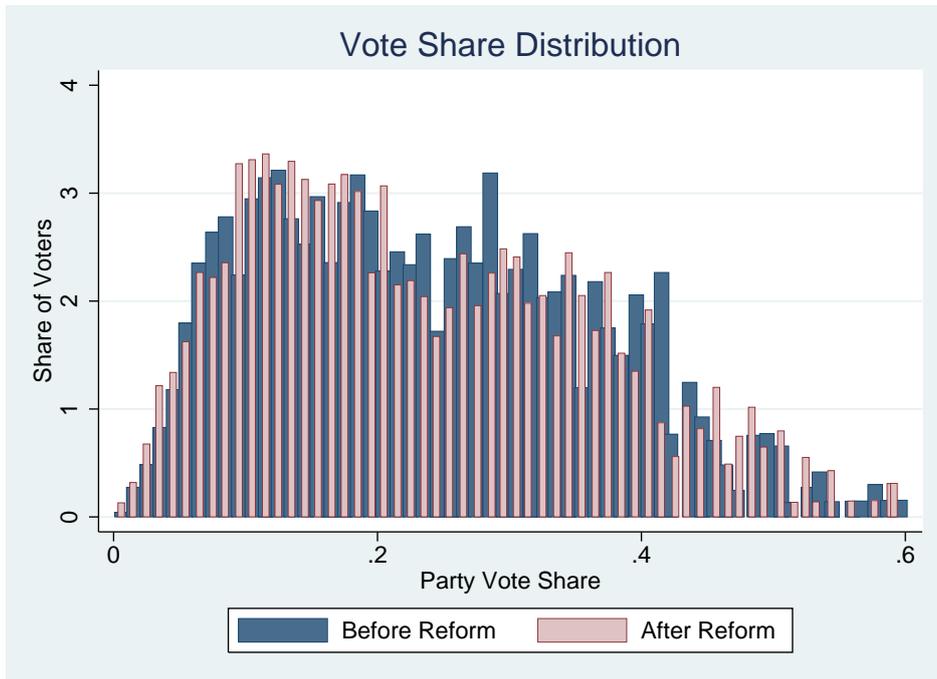


Figure 2:

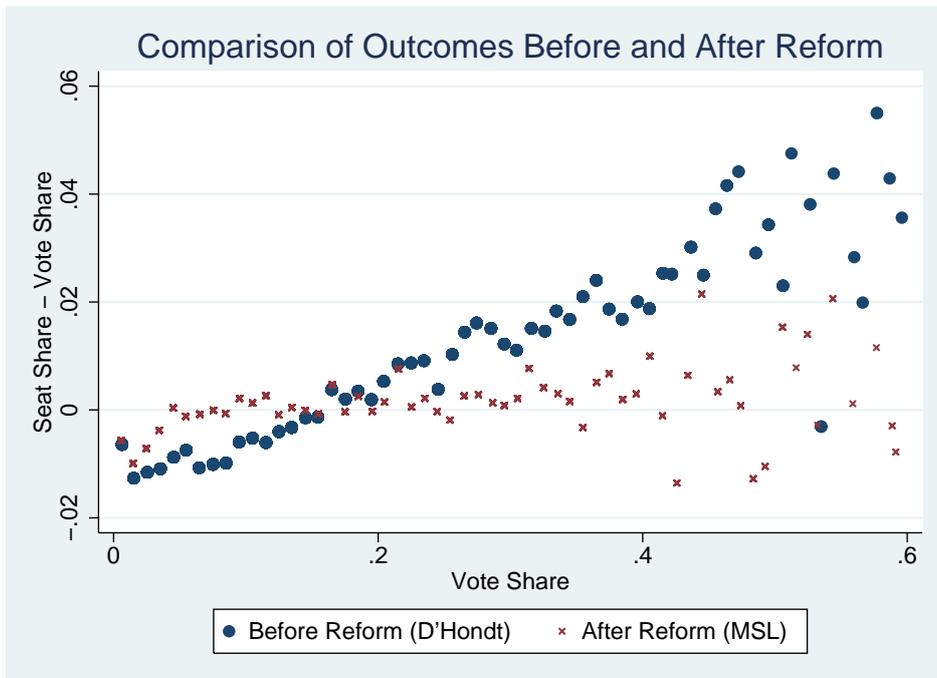


Figure 3: Illustration of Empirical Strategy

Seat Allocation/ Election Year	d'Hondt (DH)	Modified Sainte-Lagué (MSL)
1999 (Pre Reform)	A	B
2003 (Post Reform)	C	D

The diagram illustrates the empirical strategy by showing the transition of seat allocation from the d'Hondt (DH) method to the Modified Sainte-Lagué (MSL) method. In 1999 (Pre Reform), the seat allocation was A under DH and B under MSL. In 2003 (Post Reform), the seat allocation was C under DH and D under MSL. A solid arrow points from A to D, and a dashed arrow points from B to C, indicating the change in seat allocation for each party across the reform.

## 7 Appendix

To illustrate the differences between the seat allocation methods we will first turn to Figure 4. This simplex illustrates the simplest possible setting of a proportional election system, which is the allocation of three seats between three parties. Each contiguous region in the simplex represents a specific seat allocation. This allocation is displayed by three numbers at the center of each region in the simplex. For example, in the region in the bottom left corner, Party 3 receives all seats,  $S=(0,0,3)$ , since the other parties get too few votes. The seat thresholds are the boundaries between the contiguous regions, drawn as solid black lines for DH, dotted black for MSL, and dotted gray for SL. Crossing such a threshold changes the seat allocation. For example, suppose that we start from the bottom left corner and move right along the “bottom” line of the simplex, along which Party 2 holds a vote share of zero. Moving along this line, Party 1 will gain its first seat when its vote share surpasses 17 percent if we use SL, 22 percent for MSL and 25 percent if we use DH. This seat that Party 1 gains was previously held by Party 3. In other words, the seat allocation changes from  $S=(0,0,3)$  to  $S=(1,0,2)$ .

The graph illustrate two main points. The first one is that there is no explicit vote share threshold for when a party will receive another seat. This is because the seats a party is awarded depend not only on its vote share, but also on the vote shares for the other parties. This is true for all seat allocation methods. Also, it is evident that the variation in the vote share threshold increases with the vote share. The second key point is that threshold for getting the first seat is highest using DH, and lowest using SL. Furthermore the threshold for the second and third seats is lowest for DH, while highest for SL. This validates the fact that large parties are advantaged when we use DH.

To illustrate how large the advantages and disadvantages can be expected to be in the real world we turn to a more realistic setting where we simulate probable vote share distributions. In the simulation we use a party structure similar to that in the Scandinavian countries. The average size relationship between the parties is 6, 4, 3, 2, 1,

0.5, 0.5. In the simulations the size coefficient for the party is multiplied by a uniformly distributed term. The simulated votes are then used to allocate seats in 100,000 councils that have the same size distribution as Norwegian municipal councils: an average size of 27 members, a minimal size of 11 members, and a maximum size of 85 members.

In Figure 5 we show the average difference between the seat share and vote share (seat bias) as function of the vote share for each of the seat allocation methods using the simulated data. The relationships are shown with the solid circles for DH, with X's for MSL, and hollow triangles for SL. What stands out in the comparison of the three methods is the large advantage DH gives to large parties. A party holding a vote share of 40 percent, will on average receive a "seat share bonus" of 4 percentage points. The large advantage comes at the expense of all smaller parties, not only those near the threshold for receiving the first seat. For SL the "seat share bonus" is virtually zero, and a little bit less than 1 percentage point for MSL. For MSL the small advantage for large parties comes from the fact the adjusted series make it harder to get the first seat. The disadvantage for small parties does disappear when moving away from the threshold for the first seat. That there is a small advantage for large parties under SL is simply a product of how the votes are simulated. If all parties had the same average size there would be no advantage for large parties.

Figure 4: Allocation of Three Seats to Three Parties

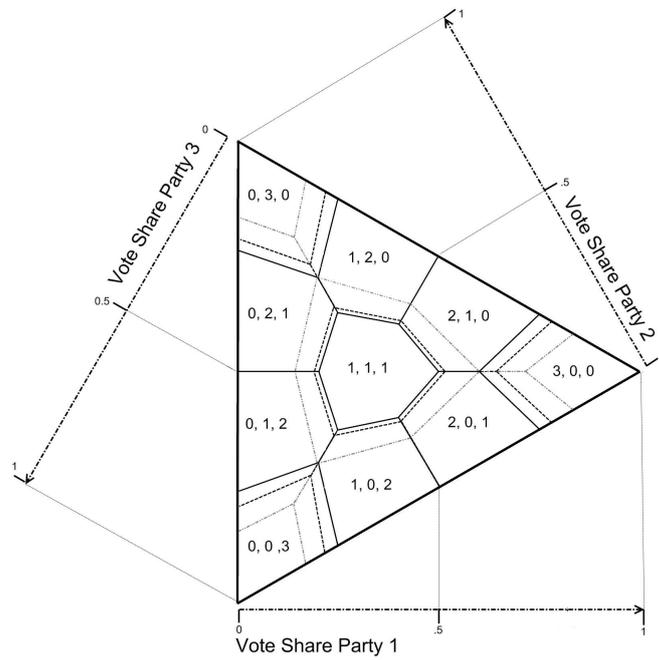


Figure 5: .

