Mechanical and Psychological Effects of Electoral Reform*

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Abstract

To understand how electoral reform affects political outcomes, one needs to assess its total effect, incorporating how the reform affects the outcomes given the political status quo (the mechanical effects) and the additional reactions of political agents (the psychological effects). We present a framework for quantifying the two types of effects. Our research design is based on a set of pairwise comparisons of actual and counterfactual seat allocation outcomes that allows us to ascertain the relative magnitude of mechanical and various psychological effects. We use the design to analyze a nationwide municipal electoral reform in Norway, which changed the seat allocation method from D'Hondt to Modified Sainte-Lagüe. Even though this electoral reform is of a relatively small magnitude, we document clear psychological effects.

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1 Introduction

Electoral rules shape party systems through "two factors working together: a mechanical and a psychological factor" (Duverger, 1954, p. 224). Mechanical effects capture how vote counts translate into seats. Political agents' responses in anticipation of the mechanical constraints constitute the psychological effects (Cox, 1997). To understand the consequences of electoral reform both types of effects should be considered. Psychological effects have, however, proven hard to quantify. As a result, political debates about electoral reform often pay little attention to these effects.[1]

In this paper we propose a framework for quantifying psychological and mechanical effects of electoral reform. Our research design is based on a set of pairwise comparisons of actual and counterfactual seat allocation outcomes. The mechanical effect isolates the partial effect of electoral reform, as the competing parties and how the votes are cast remains constant. The psychological effect consists of two components: first, how the parties and voters adjust in response to the new system and, second, how these strategic responses change the mechanical effect.

Electoral reforms do not arise from a vacuum, but from political debate and struggle (Taagepera and Shugart, 1989). The strategic behavior of political elites played, for example, a key role in the adoption of proportional representation in European countries at the turn of the century (Rokkan, 1970, Boix, 1999). The endogeneity of the electoral structure follows implicitly from Duverger's law: if electoral rules do affect the ability of political parties to survive, then parties will seek to manipulate those rules to their own advantage (Cox, 1997, p. 17). Case studies of electoral system change, such as Bawn (1993), also indicate that political parties tend to favor electoral systems that increase their chances of participating in government in the future. Consequently, electoral reforms cannot, in general, be treated as exogenous to (changes in) the political system. This is an important limitation of studies of electoral reform at the national level.

[1]For example, this can be seen in popular press debates about electoral reform in Great Britain and Italy.

Separating the different effects of an electoral reform is important not only for understanding the effects of an electoral reform itself. It is also a key element for understanding the strategic behavior of political elites in implementing reforms. Studies of electoral reforms typically start by analyzing the purely mechanical effects of an reform to define the incentives for political elites. By understanding the expected psychological effect and its impact, we can also get a better understanding of the incentives for implementing an electoral reform.

Early attempts at capturing Duverger´s mechanical and psychological effects relied primarily on cross-country data (cf. Taagepera and Shugart (1989)). Cross country analyses of electoral systems are, however, problematic since countries differ along many dimensions, making identification of causal effects difficult. To mitigate this potential omitted variable problem some scholars have exploited within country variation in electoral laws.[2]

To date, the best attempt to separate the psychological and mechanical effects is Blais et al. (2011). Our empirical approach builds on the method proposed in this paper. Like Blais et al. (2011), our 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).[3]

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 Norwegian municipal elections. A change the from the DH to MSL method mechanically increases the proportionality of the seat allocation – mostly because of a reduction in the effective

[2]Examples of within country studies are Cox (1997), Cox, Rosenbluth and Thies (2000) 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 2011)).

[3]Blais et al. (2011) find that psychological effects pertaining both to voters and parties are empirically relevant. However in most of the simultaneous elections they consider, the mechanical effects are the largest in magnitude.

electoral threshold. The main expected psychological effects can be derived from agents' anticipating the consequences of the lower effective 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 be winning representation. 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.[4] In our setting, pre-reform incumbents may use their discretion to set the size of the council. Reducing the council's size will increase the effective electoral threshold, thus offsetting the effect of the electoral reform.

Since the electoral reform we study was uniformly imposed by the central government, it seems plausible that the reform can be treated as exogenous with respect to local political outcomes. However, such an analysis may produce biased results if national parties shape the electoral reform in anticipation of broad political changes. To avoid attributing any general changes in voter sentiment between the pre- and post-reform elections, we utilize data for the same electorate, voting for a separate office, where there was no electoral reform. While the reform we study changed the allocation formula at the municipal level, it did not affect the allocation formula for the simultaneously held county elections. This institutional feature allows us to isolate the electoral reform's effect from any other general time trends.

Studying a reform at the municipal rather than national level provides additional 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 results confirm our prior expectations and show that both political parties and 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

[4]Strategic voters are those who make voting decisions conditional on the expectations that their votes will be pivotal in the election's outcome (Kawai and Watanabe, 2012).

parties to a larger extent, shifting the distribution of votes towards these parties. We also document that pre-reform incumbents tended to decrease the council size, which reduced the impact of the reform. Controlling for general changes in party support common to municipal and county elections leave the results basically unaltered. We therefore argue that our results should be given a causal interpretation.

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.[5] The reform commission argued that this change would be advantageous since it would give the same electoral rules across all governmental tiers. The MSL formula had been in use at the national level since 1953 and at the county level since their first election in 1975.

In this paper we study the consequences of this electoral reform, which in June 2002 were incorporated in the electoral law. The electoral reform commission's other proposals were mostly relevant at the national level of government. However, the commission's report resulted in three additional small changes in the electoral law that were relevant for the municipal level. First, there was a reduction in the requirement concerning the number of candidates parties would have to list on the ballot. Second, there was a change concerning the number of citizen signatures party independent local lists needed to be allowed to be running in the local election. Third, the scope for casting preferential votes was reduced. These changes in the electoral law are unlikely to be confounding factors in our analysis, but we do discuss them in more detail in the Appendix.

[5] The seat allocation formula in use at the municipal level in Norway before the electoral reform consisted of two steps, which where 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).

Before we consider the predictions of the electoral reform, we explain the mechanics of the D'Hondt (DH) and modified Sainte-Laguë (MSL) seat allocation methods.

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 in previous rounds. 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 results in 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 these differences in more detail. We also illustrate how different seat allocation methods work using simulated data.

There is no explicit threshold for when a party will receive its first seat in any of the seat allocation methods. This is because the seats a party gains depend not only the share of votes it receives, but also on the vote shares of all the other parties. Following Lijphart (1994), Boix (1999) and others, we define the effective electoral threshold as the proportion of votes that secures representation to any party with a probability of at least 50 percent. Then, the effective threshold for the respective methods are $100/(seats + 1)$

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 3.85 percent to 2.86 percent for a 25-member council size (the median size in Norwegian municipalities).

2.2 Predicted Effects of the Electoral Reform

Maurice Duverger famously stated that "the simple-majority single-ballot system favors the two-party system" (Duverger, 1954, p. 217), a proposition generally referred to as "Duverger's Law" (Riker, 1982). Duverger's conclusion that a first-past-the-post system (FPTP) electoral system will lead to the development of two dominant political parties rests on "two factors working together" (1954, p.224). "The mechanical factor" captures the fact that third parties will be systematically underrepresented relative to their proportion of the popular votes. "The psychological factor" captures that instrumentally motivated voters will seek to avoid wasting a vote on a candidate who has no chance of winning.

Over the last 60 years Duverger's propositions have been developed and extended, in particular by Taagepera and Shugart (1989) and Cox (1997).[6] Blais and Carty (1991) emphasize that, not only voters, but all agents that care about the election's outcome would react strategically to the mechanics of the electoral system. The psychological effect therefore encompasses strategic behavior pertaining to both citizens and political elites (see also Cox, 1997).

Mechanical Effects of Electoral Reform In the absence of any adjustments from citizens or elites (psychological effects), changing from the DH to MSL method is expected to give a seat allocation that is more proportional to the vote shares. Due to the lower effective electoral threshold, we also expect the (effective) number of parties winning representation to increase.

[6] For a review of the literature see Benoit (2006).

Psychological Effects of Electoral Reform Duverger did not adapt his model of plurality rule to PR or runoff systems. Rather, he dismissed out of hand the possibility of psychological effects in these electoral systems (Cox, 1997, p. 270). It is, however, clear that strategic behavior on both the demand and supply side of the political system should reappear in PR systems (Sartori, 1968, Cox, 1997). Citizens are eager not to waste their votes; political elites are eager not to waste their effort and resources. It follows that changing the electoral system from DH to MSL gives 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 been 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.In the terminology of Cox (1997), this implies that strategic desertions from minor parties are expected to be lower after the reform.

Strategic parties: The idea that parties' entry and exit decisions are sensitive to anticipated defeat is implicit in Duverger's prediction that FPTP systems will essentially converge to two-party systems. 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 taken together determine the representation and the disproportionality 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.[7] 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

[7] 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.

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. While changes in council size show up in election statistics, other types of "defensive behavior" are harder to quantify and we therefore do not deal with them explicitly in 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 tend to *reduce* the proportionality of the system. "Defensive behavior" from incumbents would also dampen the effect of the reform, thus contributing to *reducing* the proportionality 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 winning representation, while a reduction in council size (strategic incumbents) would lead to a reduction in the number of parties winning representation.

3 Institutional Setting and Data

3.1 Institutional Setting

Norwegian municipalities are multipurpose authorities responsible for supplying important services provided by the welfare state. Each municipality is run by a local council

that makes decisions based on simple majority rule. The local councils are elected every fourth year in September in an open list proportional representation election system. The open list proportional representation system offers both voters and parties instruments for affecting candidate selection.[8]

All municipalities consist of one electoral district. There are 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.[9] 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, the Socialist Left Party, the Labor Party, the Centre Party, the Christian Democratic Party, the Liberal Party, the Conservative Party, and the 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. Finally, parties may form joint lists where the seats are allocated to the parties jointly.

The number of council members is chosen by the previous local council (within the first three years of the election period), but the local discretion is subject to restrictions imposed by the electoral law. The minimum size of the local council depends on the number of inhabitants.[10]

[8] In the 1999 election voters could cast personal votes to particular candidates (from any party lists) and delete candidates from their chosen party lists. In 2003 the option to delete candidates from the chosen party list was abolished. This institutional change is likely to matter for candidate selection *within party lists*, but not *across party lists* (cf. Bergh et al., 2009)

[9] National elections also have a fixed four-year election cycle, but these elections lag the municipal and county elections by two years.

[10] 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.

3.2 Descriptive Statistics

Our empirical analysis is based on data from 387 municipalities for the election preceding the reform (1999) and the election following the reform (2003).[11]

Table 1 offer descriptive statistics on the main outcome variables we use in the empirical analysis. These are the number of parties winning representation (NoP), the effective number of parties (ENoP), an index developed by Laakso and Taagepera (1979), and the index of disproportionality proposed by Gallagher (1991). In addition we provide descriptive statistics for some underlying factors that may also be affected by electoral reform. These are the number of parties running, the effective number of parties based on votes cast (ENoP^{Votes}), the number of joint lists and the council size.

There is substantial variation across municipalities in the number of parties winning representation. As shown in Table 1 the average number of parties is 6.10, and varies from 2 to 11. The number of parties running is on average 6.54, implying that 93 percent of parties running win representation.

The effective number of parties is given by

$$ENoP = \frac{1}{\sum_{i=1}^{n} SeatShare_i^2},$$

where $SeatShare_i$ is the proportion of seats of the i-th party. The ENoP index accounts for both the number of parties represented and their relative strengths. It is widely used for describing party systems at the national level (Lijphart, 1999). The average value in our sample 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

[11] 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).

in Norway. The advantage given to large parties by the seat allocation method results in a slightly higher ENoP based on votes cast relative to ENoP based on the allocation of seats.

Table 1: Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.
Main Outcomes				
Number of Parties (NoP)	6.099	1.603	2.000	11.000
Effective Number of Parties (ENoP)	4.242	1.080	1.665	7.367
Disproportionality Index	2.659	1.020	0.254	6.711
Underlying Factors				
Parties Running	6.536	1.966	2.000	15.000
ENoP^{Votes}	4.420	1.111	1.652	9.249
Number of Joint Lists	0.076	0.275	0.000	2.000
Council Size	26.729	10.590	11.000	85.000

Note: The main outcome variables are the number of party lists represented in the council (NoP), the effective number of parties (ENoP), and the Gallagher index measuring the disproportionality of the electoral system (Index). Descriptives based on municipal elections in 1999 and 2003 (n=774).

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

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

where $SeatShare_i$ ($VoteShare_i$) is the proportion of seats (votes) of the i-th party. For ease of interpretation, we multiply the index by 100. The index can then take values from 0 (complete proportionality) to 100 (complete disproportionality). In our sample the average value of the Gallagher index is 2.66. This is similar to the historically observed level in countries such as Germany and Switzerland and 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 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) vote share 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.

Table 2: Descriptive Statistics by Party List

Party List	*Running*	*Council*	*Votes Municip.*	*Votes County*
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 List	0.370	0.349	0.057	0.000
Other Lists	0.213	0.149	0.015	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 municipal and county elections in 1999 and 2003 (n=774). Reported are (i) the fraction of municipalities where the party list is running, (ii) the fraction of municipalities where the party list is winning representation in the council, (iii) the fraction of votes cast for the party list at the municipal election (iv) the fraction of votes cast for the party list at the county election.

County Elections As mentioned in the introduction, an important part of our identification strategy is that we can use the county election returns in each municipality to

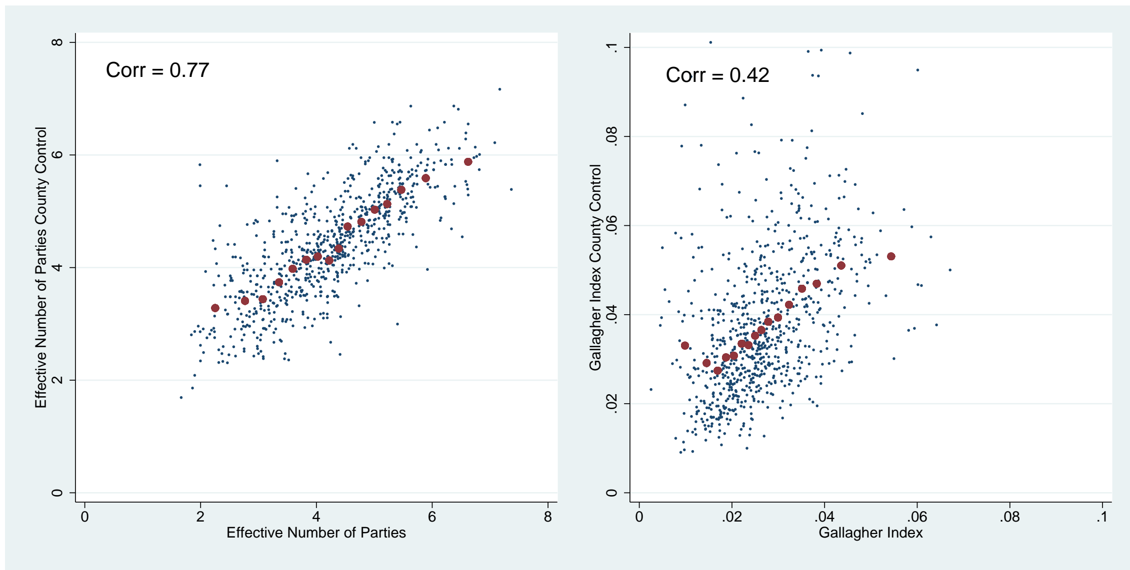
control for general time trends in party support. Table 2 documents that voting behavior for the two offices are closely related.[12] Our outcomes of interest are also similar if we use the county election returns to calculate them: In Figure 1 we show the relationship between the actual municipal outcomes and the counterfactual outcome where we use the votes for the county election to allocate the seats, but keep everything else constant. We show both the scatterplot and the binned averages of the county controls as a function of the actual outcome. For both ENoP and Gallagher's Index there is a strong and essentially linear relationship. What sets the two apart is that there is more noise in the relationship for the Gallagher Index, which has a correlation coefficient of 0.42, than for the effective number of parties, which has a correlation coefficient of 0.77. For the number of parties represented (NoP), for which we do not graph the relationship, the correlation is 0.69. The clear and strong relationships provide a strong rationale for our identification strategy, which will be laid out in more detail below.

Pre- and Post-Reform In Table 3 we offer separate descriptive statistics for the election preceding reform (1999) and the election following reform (2003). We document an increase in the number of lists represented in the local council (NoP) and the effective number of parties (ENoP). The disproportionality index is lower after the reform. All these changes are in line with our empirical predictions regarding the mechanical effects of the reform, and will be explored in more detail below.

We also find that the average number of parties running is higher after the electoral reform. The average jumps from about 6.35 to 6.73. When calculating the effective number of parties based on votes cast, rather than on the allocation of seats, we find an indication of a shift in the vote distribution shifts towards small parties. ENoP^{Votes} is higher after the reform, the effects is, however, not statistically significant. We also note that there are are fewer joint lists after the electoral reform, but the effect is relatively

[12] Voter turnout tends, however, to be slightly higher for the municipal election (national average of 60.4 (59.0) percent in 1999 (2003)) relative to the county election (national average of 56.8 (55.6) percent in 1999 (2003))).

Figure 1: Municipal Outcomes and the County Control



Note: The scatterplot to the left shows the the relation between the effective number of parties based on the local council and the effective number of parties of a counterfactual local council based on votes for the county election (measured at the municipal level). The scatterplot to the right shows the the relation between the Gallagher index based on municipal vote and seat data and the corresponding variable for the county level voting and (hypothetical) seat data (measured at the municipal level). The data are from municipal and county elections in 1999 and 2003. The larger circles are binned averages.

small. Finally, we see a substantial reduction in the average council size.

Table 3: Descriptive Statistics, Pre- and Post Electoral Reform

	(1)		(2)		(3)	
	Pre-reform		Post-reform		Difference	
	Mean	SD	Mean	SD	Estimate	SE
Main Outcomes						
NoP	6.000	(1.601)	6.199	(1.601)	0.199*	(0.115)
ENoP	4.112	(1.016)	4.372	(1.126)	0.261***	(0.077)
Index	2.913	(1.108)	2.406	(0.853)	-0.507***	(0.071)
Underlying Factors						
Parties Running	6.346	(1.892)	6.726	(2.021)	0.380***	(0.141)
ENoP^{Votes}	4.397	(1.085)	4.443	(1.140)	0.046	(0.080)
Number of Joint Lists	0.085	(0.280)	0.067	(0.271)	-0.018	(0.020)
Council Size	27.966	(11.089)	25.491	(9.927)	-2.475***	(0.757)
N	387		387		774	

*Note: The main outcome variables are the number of party lists represented in the council (NoP), the effective number of parties (ENoP), and the Gallagher index measuring the disproportionality of the electoral system (Index). Descriptives based on municipal elections in 1999 and 2003. For the difference estimates: * p < 0.10,** p < 0.05, *** p <0.01.*

Council Size Reductions Given that the strategic manipulation of the council size is an option incumbents may utilize, we provide some additional information on this aspect. In Table 4 we provide descriptive statistics on the average council size, the number of reductions and increases, and the share of councils at the legal minimum size. The descriptive statistics is based on a balanced panel of municipalities for the period 1975–2007. During the 1980s the average sized council had around 30 members. In the 1990s there was a gradual decline in average council size. The most noticeable change, however, occurs at the time of the implementation of the new electoral law. From the 1999–2003 to the 2003–2007 election period the average council size fell by 2.5 members, corresponding to an average reduction of about 10 percent. Above one third of the municipalities reduced the council size, while only one municipality increased it. Another

important fact documented in Table 4 is that the legal constraints concerning minimal size is only binding in a limited number of cases, even after the large reductions at the time of the reform.

Table 4: Descriptive Statistics on Council Size

Election Period	*Avg. Council Size*	*Reductions*	*Increases*	*Electoral Law Binding*
1975-1979	30.0	1	21	0
1979-1983	30.2	1	16	0
1983-1987	30.3	5	14	0
1987-1991	30.3	7	9	0
1991-1995	29.6	29	0	0
1995-1999	29.1	28	12	0
1999-2003	28.2	48	1	5
2003-2007	25.7	139	1	10
2007-2011	25.4	30	9	10

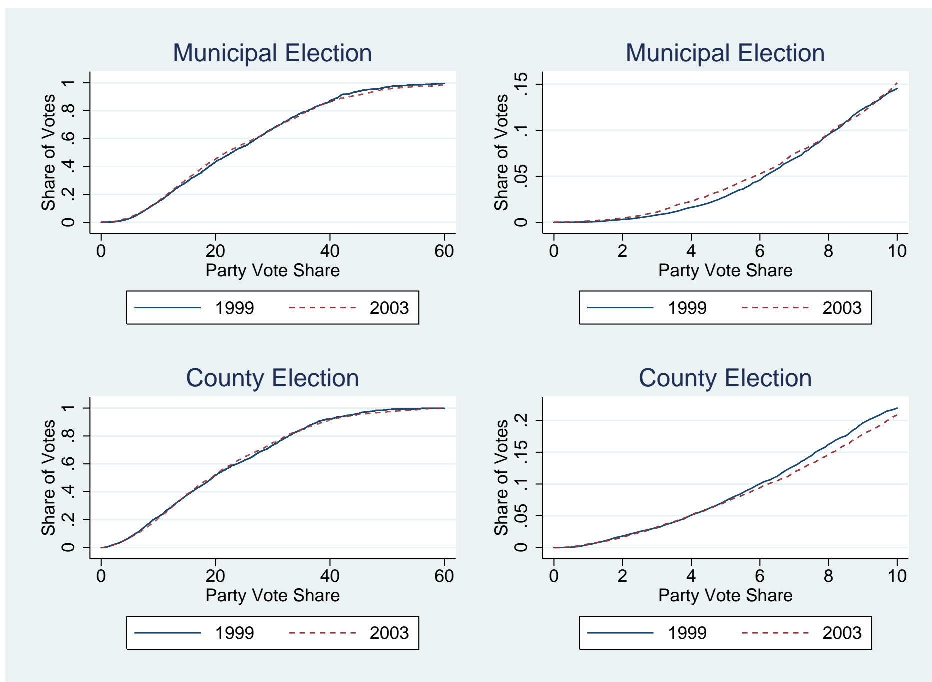
Note: Descriptive statistics is based on a balanced sample of 370 municipalities for the period 1975–2007.

Distribution of Votes In Figure 2 we show the cumulative vote distribution, both for the counties and the municipalities, before and after the electoral reform. Since we expect to see the clearest shift in votes towards small parties we show both the full distribution and for parties below 10 percentage points of the vote share. The vote distribution before the reform is shown by the solid line, while the vote distribution after the reform is shown by the dotted line. In the municipal elections we do not see a clear shift in the full the vote distribution. However, when we focus on parties under 10 percentage points of the vote share, we can see a clear shift in votes towards 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 about one-third. For the county elections there is no such a shift.

Seat Share-Vote Share Curvature To show how the change in the seat allocation formula changed the relationship between votes and seats we show the seat share-vote share curvature before and after the reform in Figure 3.[13] The relationship before the

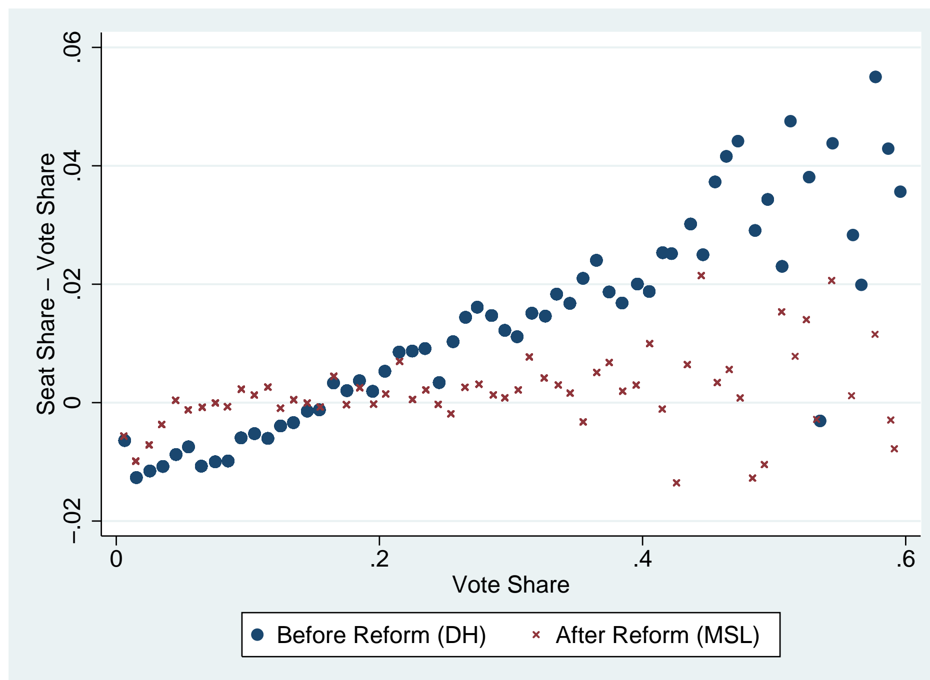
[13]More specifically, this is the relation between a party's vote share (measured on the x-axis) and the difference between seat and vote shares (measured on the y-axis).

Figure 2: Cumulative Vote Distribution



Note: Figures to the left gives the entire vote distribution, while figures to the right give the vote distribution only for parties with less than 10 percent of the vote. The data are from municipal and county elections in 1999 and 2003.

Figure 3: Seat Share-Vote Share Curvature, Before and After Reform



Note: The figure is constructed by grouping (binning) parties together based on their vote share, using a bandwidth of 1 percentage point. The data are from municipal elections in 1999 and 2003.

reform, when DH was used, are shown by the solid circles, while the relationship 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 3 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 large parties is greater 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 2 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 Research Design

In this section we present our method for quantifying the mechanical and psychological effects of electoral reform. First, we illustrate why counterfactual seat allocation outcomes is useful for isolating different components of electoral reform. Next, we introduce our estimation strategy, which includes the county elections as a means to net out general changes in voter sentiment between pre- and post-reform elections.

4.1 Counterfactual Seat Allocations

As described in the introduction, our empirical approach for separating the psychological and mechanical effects builds on the idea of constructing counterfactual seat allocations. In doing this we can change one parameter at a time to see how it impacts the outcomes of interest.

To illustrate our empirical strategy we use Figure 4, which shows the actual pre- (A) and post- (D) reform outcomes and the counterfactual seat allocations (B and C). The latter shows us the effect of changing the seat allocation method but keeping everything else, such as party behavior, voter behavior and the council size, constant. To find the total effect of the reform we simply compare A, applying DH to the 1999 outcome, to D, applying MSL to the 2003 outcome. To assess the impact of the reduction in council size we also show counterfactual outcomes for both cell C and D, in which we use the 1999 council size. In each of the cells of Figure 4 we show the mean values for our three main outcome variables, which will be closely discussed in Section 5.

To capture the mechanical effect of the reform we measure what would have happened if we had changed the seat allocation formula, but kept everything else constant. This is cell B, where we apply MSL to the 1999 election outcome. To get the mechanical effect of the reform we simply compare B to the actual pre-reform outcome, A.

To measure the total psychological effect we contrast the counterfactual outcome B to the actual post-reform outcome D. The psychological effect can be partitioned into two

subcomponents: First, how political agents adjust in response to the new system, and, second, how these strategic responses change the mechanical effect. For example, a shift in votes towards smaller parties will in itself increase the (effective) number of parties, but in addition it will accentuate the mechanical effect (the impact of a lower effective electoral threshold). The first part is quantified by comparing A to the counterfactual outcome C, where we apply DH to the 2003 election outcome. The second part is quantified by comparing the post-reform impact of using MSL (C to D) to the mechanical effect (A to B).

Finally we examine the impact of reducing the council size. We can see this by comparing the actual outcome in D to what it would have been if the council size had not been reduced. By using the counterfactual outcomes where we keep the council size constant we can also assess the impact of shifts in the voting distribution independently.

4.2 Estimation Strategy

The basic principle of the estimation strategy is a pair-wise comparisons of the outcomes in Figure 4, in different pairs of cells, c. The regressions analysis takes the following form:

$$Y_{i,c} = \alpha_i + \beta Reform_c + \gamma Y_{i,c}^{County} + \varepsilon_{i,c}, \tag{1}$$

where $Y_{i,c}$ is an outcome variable based on the outcome (NoP, ENoP, Index) in cell c for municipality i. α_i is a set of municipal fixed effects. $Reform_c$ is a dummy variable equal to one for the cell that corresponds to a post-reform cell, and zero for the pre-reform cell. For example to estimate the mechanical effect (A to B) we define $Reform_A = 0$ for cell A and $Reform_B = 1$ for cell B. β is the parameter of interest capturing the effect of the electoral reform on $Y_{i,c}$. We cluster standard errors at the municipality level to allow for arbitrary correlation within each municipality.

As mentioned above we are concerned that our estimate of β could be contaminated by general changes in party support at the time of the reform. To address this potential

Figure 4: Illustration of Empirical Strategy

	Outcome	DH			MSL		
1999	*NoP*	A	**6.00**		B	**6.12**	
	ENOP		**4.11**			**4.37**	
	INDEX		**2.91**			**2.16**	
		Mechanical			Psychological		
	Council Size		*2003*	*1999*		*2003*	*1999*
2003	*NoP*	C	**5.99**	*6.07*	D	**6.20**	*6.26*
	ENOP		**4.08**	*4.12*		**4.37**	*4.39*
	INDEX		**3.34**	*3.05*		**2.41**	*2.17*

Note: The figure shows the actual pre- (A) and post- (D) election outcomes and the counterfactual election outcomes (B and C). Reported are also counterfactual outcomes for both post-reform outcomes (C and D), in which we use the pre-reform council size. Reported are mean values of the number of party lists represented in the council (NoP), the effective number of parties (ENoP), and the Gallagher index measuring the disproportionality of the electoral system (Index).

bias we exploit the fact that municipal and county governments elections coincide in time and space. 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 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. Andersen, Fiva and Natvik (2010) study voter motivation using Norwegian data and a similar identification strategy.

β captures the causal effect of the electoral reform on $Y_{i,c}$ as long as $Cov\left(Reform_c, \varepsilon_{i,c}\right) = 0$. The identifying assumption is that after conditioning on $Y_{i,c}^{County}$ there are no time varying factors (correlated with reform) that have an independent impact on $Y_{i,c}$.

In a related analysis, Blais et al. (2011) utilize differences in electoral rules across simultaneous elections to identify psychological and mechanical effects. For this strategy to produce unbiased estimates one needs to assume that all factors affecting voter and party behavior, except the electoral rules, are similar across both elections.

A specific concern with the approach of Blais et al. (2011) is that simultaneous elections in themselves can be expected to have an independent effect on both voting and party behavior (see, e.g., Kern and Hainmueller 2006). Voting behavior in one election will be conditional on the expected outcome in the other election. For example voters might engage in balancing across legislatures. 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.

Our empirical approach, utilizing an arguably exogenous change in the electoral system, rests on a weaker identifying assumption. 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. Yet, interaction or contamination effects across simultaneous elections may still bias our results. For example, if electoral reform incentivizes strategic entry at the municipal level, it may increase the number of parties running at the county level as well. Such lack of independence across elections would bias our tests against finding any effect of electoral reform (Cox, Rosenbluth and Thies (2000)). We therefore report results both with and without county controls.

5 Results

In Table 5 we present our main results. In the first row we show the estimates for the total effects of electoral reform (A to D). This is followed by the estimates of the mechanical effect (A to B), the psychological effect (B to D), the two subcomponents of the psychological effect (A to C) and (C to D minus A to B) and then finally the effect of the council size reduction.

For the mechanical effect, the county control is irrelevant since we evaluate the reform's effect for a given vote distribution. This is also the case when we evaluate the effect of the council size change. All other regressions are run both with and without the county control, but we only report the estimates for the county control for the total effects.

Number of Parties The results for the number of parties (NoP) represented in the council are shown in columns 1 and 2 of Table 5. In line with the descriptive analysis, we find that the reform increased the number of party lists in the council by 0.20. This is a nontrivial 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 including it leaves the estimate of the reform effect basically unaltered.

The mechanical and psychological effects are of a similar magnitude, and give about equal contributions to the total effect. The psychological effect (B to D) is only statisti-

cally significant at the 10 percent level (and only when the county control is included). However, if we counterfactually hold the council size constant, the psychological effect almost doubles and becomes statistically significant (compare row 4 and 5). When we separate the two components of the psychological effect (row 6 and 7) we see that most of the effect operates through the impact of the mechanical effect.

The psychological effect can be driven by dynamic adjustment on the political system's supply (i.e. strategic entry) or demand side (strategic voting), or both. We cannot fully separate between the two types of mechanism since strategic responses of parties could take two broad forms. The first concerns the decision to run in an election. The second concerns changes in behavior given that a party decides to run (for example increased campaigning). We can, however, split the sample according to whether the number of list was constant, or new lists were running to shed some light on this issue. Conducting such an analysis we find there is only a positive psychological where there were new lists running. This is a clear indication that the effect is, at least partly, driven by strategic responses at the supply side.[14]

Finally the results show that the effect of reducing the council size (row 8) is statistically significant and that it reduced the number of represented parties by almost 0.06 per municipality, which corresponds to a little under a quarter of the total effect. In the aggregate this means that the reduction in council size stopped about 22 party lists from getting into a municipal council.

Effective Number of Parties As reported in column 3 of Table 5, the effective number of parties increases by 0.26 as a consequence of the electoral reform. This corresponds to about one-fourth of a standard deviation. This effect is statistically significant at the 1 percent level, and basically remains unaltered if we include the county control (column

[14]Entry effects are primarily driven by two parties, the Socialist Left Party (SV) and the Progress Party (FrP). In our sample, SV and FrP were running in 61 and 59 percent of the municipalities before the reform. After the reform they were running in 75 and 73 percent of the municipalities, respectively. The fraction of municipalities where these parties obtained representation also increased with almost similar fractions.

Table 5: Decomposition of Mechanical and Psychological Effects

Outcome	(1) NoP	(2) NoP	(3) ENoP	(4) ENoP	(5) Index	(6) Index
Total Effect						
$A \rightarrow D$	0.199***	0.216***	0.261***	0.247***	-0.422***	-0.424***
	(0.05)	(0.05)	(0.03)	(0.03)	(0.06)	(0.06)
County Control		0.185***		0.429***		3.192
		(0.06)		(0.06)		(4.94)
Mechanical Effect						
$A \rightarrow B$	0.121***		0.250***		-0.747***	
	(0.020)		(0.012)		(0.044)	
Psychological Effect						
$B \rightarrow D_{03}$	0.075	0.089*	0.010	0.005	0.244***	0.243***
	(0.048)	(0.048)	(0.035)	(0.032)	(0.045)	(0.045)
$B \rightarrow D_{99}$	0.132***	0.144***	0.024	0.019	0.004	0.006
	(0.047)	(0.047)	(0.035)	(0.032)	(0.041)	(0.041)
Components Psychological Effect						
$A \rightarrow C_{03}$	-0.013	0.007	-0.030	-0.044	0.431***	0.429***
	(0.051)	(0.051)	(0.035)	(0.032)	(0.080)	(0.079)
$[C_{03} \rightarrow D_{03}] - [A \rightarrow B]$	0.088***	0.088***	0.040**	0.040**	-0.188***	-0.188***
	(0.028)	(0.028)	(0.016)	(0.016)	(0.064)	(0.064)
Effect of Council Size Change						
$D_{99} \rightarrow D_{03}$	-0.057***		-0.014*		0.239***	
	(0.013)		(0.007)		(0.030)	
N	776	776	776	776	776	776
County Control	No	Yes	No	Yes	No	Yes

Note: Outcomes refer to notation presented in Figure 4. The dependent variables are the number of party lists represented in the council (NoP), the effective number of parties (ENoP), the Gallagher index measuring the disproportionality of the electoral system (Index). The county control is computed by using municipal level voting data for the county elections. The county elections coincide in time and space with the municipal elections, but the allocation formula in use did not change. Outcome subscripts denote the council size used to allocate the seats. Municipality fixed effects included in all specifications. Standard errors clustered at the municipality level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4). This suggests that electoral balancing across the two elections does not seem to be a source of bias.

As expected from Figure 4 we see that the mechanical effect is driving the total effect almost in its entirety. The shift in the voting distribution towards smaller parties increases ENoP, but the effect is small and statistically insignificant. The reduction in council size did, however, contribute to a slightly lower ENoP level, but in relationship to the total effect the contribution is small.

The reason for why the mechanical effect overwhelms the psychological effects is evident in Figure 3. Under MSL, only the small parties around the threshold for the first seat are disadvantaged. Under DH all small parties are disadvantaged. This results (mechanically) in a much more even distribution of seats under MSL than under DH. The comparable shift in the vote distribution is much smaller. Thus, the psychological effect will only impact a small subset of the parties, while the mechanical affects all parties.

Gallagher's Disproportionality Index The results for the disproportionality index are provided in column 5 and 6 of Table 5. The total effect of about -0.4 percentage-points corresponds to almost one-half a standard deviation decrease in disproportionality. The county control is statistically insignificant.

For the disproportionality index the psychological and mechanical effects go in opposite directions. Given that DH causes a systematic divergence between the seat share and the vote share, as we can see in the vote share-seat share curvature in Figure 3, the mechanical effects contributes to a reduction in disproportionality. The psychological effects go in the opposite direction. This dampening effect is driven by the reduction in council size (compare row 4 and row 5, see also row 8). Given that the average deviation between the seat share and vote share will automatically increase as we reduce the council size, this result is naturally what we would expect. The shift in the voting distribution towards smaller parties does not contribute to a change in the disproportionality index. This is because there is only a weak relationship between the vote share and the difference

between the seat share and vote share under the MSL, which we see in Figure 3.

Magnitude of Effects: Historical Context In 1953 a similar electoral reform to the one that we study was implemented at the national level in Norway. Since the national electoral reform was a compromise between the Labor Party and the opposition parties one should be cautious about giving changes in outcomes over time causal interpretations.[15] They are nonetheless useful for putting our results in context. Lijphart (1994) found that the national reform of moving from DH to MSL in Norway in the 1950s lead to an increase in the effective number of parties of 0.35 and a decrease of the disproportionality index of 4.15 percentage points. The results we find for the effective number of parties are thus comparable to the national reform, while the effect on the proportionality of the election system is much smaller. One explanation for this difference is that the pre-reform level of disproportionality was higher at the national than at the municipal level.

Council Size Reductions As seen above the reductions in council size did play an important role in reducing the impact of the reform. However, looking at the full sample we get the average across those places where there was a reduction in the council size and where there was not. To assess the impact of the reduction we should turn to the places where there actually was a reduction in their council size. If these reductions were intended to reduce the impact of the reform we should also expect the reductions to have a large effect. In Table 6 we will present the most important estimates, including the total effect (A to D), the mechanical effect (A to B) and the psychological effect (B to D_{99}). Each effect is estimated separately for the municipalities that kept the council size constant (column 1, 3, and 5) and those that reduced it (column 2, 4, and 6).

We first turn to the results for the number of represented parties. Where the council

[15] While the opposition wanted to change from DH to a largest remainder method, the Labor party wanted to keep the DH method. Labor MPs explicitly argued that an executive bonus for the largest party was necessary in order to provide stable government (Aardal, 2002, p. 191). As a compromise between Labor and the opposition the MSL method was implemented (cf. Rokkan, 1970, p. 158-161)

Table 6: Electoral Reform Effects Splitted According to Council Size Reductions

Outcome	(1) NoP	(2) NoP	(3) ENoP	(4) ENoP	(5) Index	(6) Index
$A \rightarrow D_{03}$	0.283***	0.048	0.259***	0.261***	-0.718***	-0.155*
	0.059)	(0.081)	(0.044)	(0.057)	(0.081)	(0.090)
$A \rightarrow B$	0.129***	0.103***	0.248***	0.255***	-0.759***	-0.731***
	(0.027)	(0.025)	(0.016)	(0.017)	(0.060)	(0.063)
$B \rightarrow D_{99}$	0.154**	0.103	0.012	0.047	0.041	-0.068
	(0.061)	(0.072)	(0.045)	(0.057)	(0.058)	(0.052)
$D_{99} \rightarrow D_{03}$		-0.158***		-0.040**		0.644***
		(0.033)		(0.020)		(0.066)
N	480	292	480	292	480	292
County Control	No	No	No	No	No	No
Constant Council	Yes	No	Yes	No	Yes	No

Note: For explanatory details, see Table 5.

size was constant the total effect was an increase of almost 0.3 parties per municipality, while there was no increase in municipalities that reduced the council size. If the goal of council size reductions was to counteract the reform and not allow for any increase in the number of represented parties, this goal was achieved. There was essentially no difference in the mechanical effect between the two groups (second row). The psychological effect is about 50 percent larger where the council size was not changed (third row). Although the difference is not statistically significant it suggests that voters and parties were more responsive when the implicit electoral threshold was reduced the most. Finally, in the municipalities where there was a reduction, the total impact was to reduce the average number of parties with 0.16.

For the effects on the effective number of parties we do not see much of a difference between the places where there was a reduction and those where there was not. This reinforces the findings from Table 5 that the council size reduction only had a minor impact.

For the Gallagher Index the reduction in council size does have an important impact.

When we compare the total effects we see that the council size reductions essentially wiped out the effect of the reform. This is due to the fact that when there are fewer seats to distribute the average deviation between the seat share and vote share becomes larger. Again, there is no difference in the mechanical effect between the two groups. As we saw in Table 5 the shift in the vote distribution did not have any impact on the disproportionality, which is also the case when we look at the two groups of municipalities individually (B to D). In the municipalities where there was a reduction, the total impact was almost of the same size of the mechanical effect, but of the opposite sign.

Robustness 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 elections held in 1995 and 2007 and conduct two sets of placebo analyses, which we present in detail in the appendix. This analysis shows that although we find that significant changes in the several of the outcomes around these elections these effects go away in all case but one as we introduce the county controls. From this we draw two conclusions. First, that general time trends cannot explain our results and secondly that our county controls work.

As mentioned in Section 2, the electoral reform that we study is not fully clean. In the appendix we describe and analyze the potential impact of other changes in the electoral law in more detail. The conclusion from this analysis is that these changes cannot explain the effects of the reform that we find.

6 Conclusion

Ever since Duverger (1954) there as been a long standing interest in the mechanical and psychological effects of electoral laws. In this paper we propose a framework for uncovering the causal effects of electoral reform which allows us to ascertain the relative magnitudes of these two effects.

Our application is based on a nationwide municipal electoral reform in Norway, which

changed the seat allocation method from D'Hondt to modified Sainte-Lagüe. This electoral reform mechanically increased the proportionality of the seat allocation and reduced the effective electoral threshold.

The total effects of the electoral reform are all in line with what we expect: the proportionality of the seat allocation, the number of parties represented and the effective number of parties all increase. For the effective number of parties the mechanical effect drives the total effect. But for the two other outcomes the psychological effects also play an important role.

For the proportionality of the seat allocation the mechanical and psychological effects go in opposite directions. The mechanical effect increases the proportionality of the system, while reductions in the size of the local council, a choice variable for pre-reform incumbents, contribute to reduced proportionality. This psychological effect served to dampen the total effect on the proportionality of the seat allocation.

We find that the number of parties that won seats on the council increased with on average about 0.2 (i.e an extra party in about one out of five councils). About half of this effect is due to mechanics of the seat allocation formula. The other half is due to a shift in the voting distribution towards smaller parties. In the absence of council size reductions, the total effect of the number of parties represented would have been slightly larger.

The psychological effects on the lists winning seats on the council seem to be 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. In line with the conjecture of (Cox, 1997, p. 98), our results indicate that strategic responses in the elite strata are relatively more important than strategic responses in the mass electorate.

The credibility of our empirical strategy is bolstered by the fact that the results remain unaltered when controlling for voting outcomes for county governments elected simultaneously. This suggests that the results are not likely to be driven by changes in voter sentiment between the pre- and post-reform elections.

Our analysis demonstrates that to understand the consequences of electoral reform, one needs to take into account not only mechanical effects but also the strategic responses political agents may make in anticipation of these.

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Appendix 1: Seat Allocation Methods

To illustrate the differences between the seat allocation methods we will first turn to Figure 5. This simplex illustrates the simplest possible setting of a proportional election system, which is the allocation of three seats between three parties. Each 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).

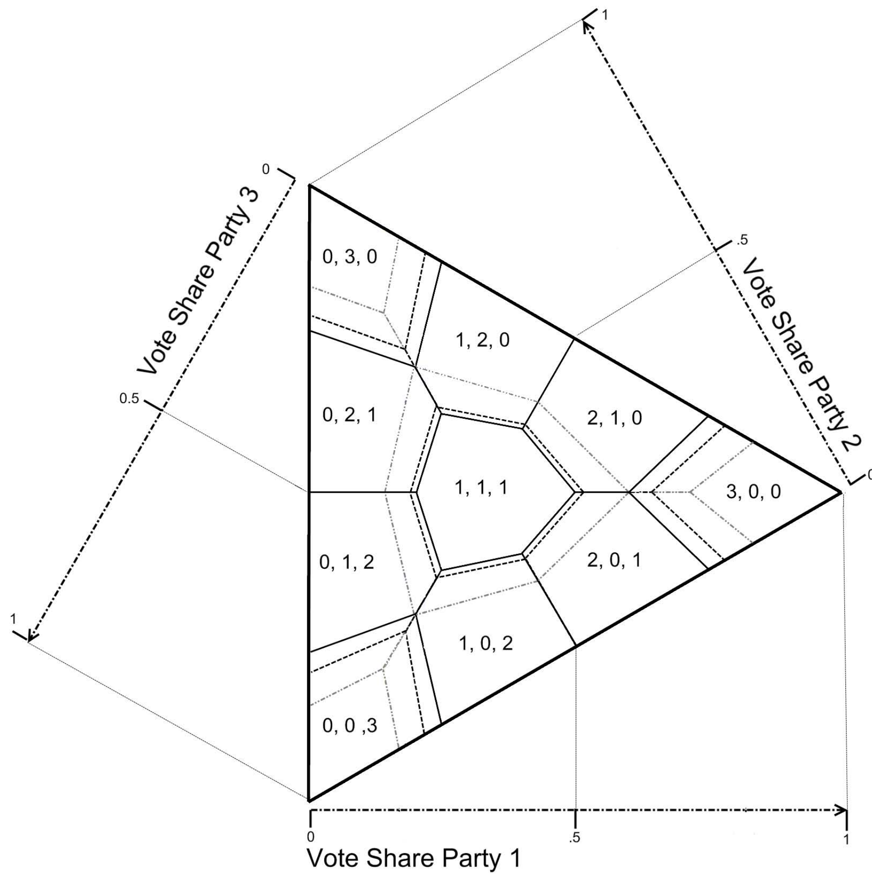
The graph illustrate two main points. The first one is that there is no explicit vote share threshold for when a party will receive another seat. This is because the seats a party is awarded depend not only on its vote share, but also on the vote shares for the other parties. This is true for all seat 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 the 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 real world advantages and disadvantages can be expected to be 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.

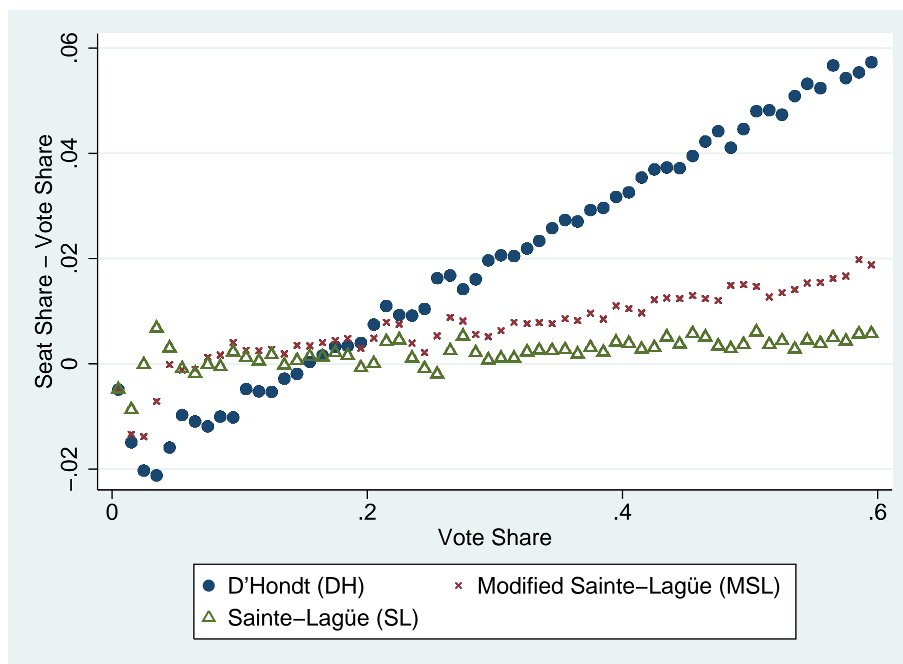
In Figure 6 we show the average difference between the seat share and vote share (seat bias) as function of the vote share for each of the seat allocation methods using the simulated data. The relationships are shown with the solid circles for DH, with X's for MSL, and hollow triangles for SL. What stands 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 3 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 5: Allocation of Three Seats to Three Parties



Note: This simplex illustrates the allocation of three seats between three parties. Each 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. 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.

Figure 6: Seat Share-Vote Share Curvature, Simulated Data



Note: The figure is constructed by grouping (binning) parties together based on their vote share, using a bandwidth of 1 percentage point. The simulated data is based on a party structure similar to that actually observed in Norway. 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.

Appendix 2: Robustness

Placebo Regressions

To investigate the plausibility of our identifying assumption we add information from elections held in 1995 and 2007 and conduct two sets of placebo analyses.[16] The upper panel in Table 7 shows the results for an analysis that uses data from 1995 and 1999, while the lower panel shows results for an analysis using voting data from 2003 and 2007. In this analysis we will focus on the psychological effect, and its two subcomponents, since these are the ones that are subject to potential endogeneity problems.

The results will be presented in the following order. In the first row we present the total psychological effect, i.e. from B to D in Figure 4. We then turn to the subcomponents of the psychological effects. Row 2 shows the effect of the shift in the vote distribution while keeping the seat allocation constant, while row 3 shows the part of the psychological effect that operates through the mechanical effect. As in the main analysis we show the results both with and without the county controls.

For the number of parties we do not find any psychological effects on in the placebo regression, either before or after the reform. This is true irrespective if we use the county controls or not.

When we turn to the effective number of parties we find a psychological effect in the placebo regression when we do not include the county control. The magnitude is similar to our estimates of the reform effect, but is negative after the reform. However, unlike the reform effect, the placebo effects go away as we include the county control. This illustrates both that we need to include the county control and that the the county control works.

For the Gallagher index, we do not find any significant effect in the placebo estimates

[16]For the 1995 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). Official election statistics lumps together votes for parties belonging to each of these categories prior to the 1999 election. For the first placebo analysis we therefore construct a panel where we only include observations where we have exact voting data both for 1995 and 1999.

Table 7: Effects of Placebo Reforms in 1999 and 2007

Outcome	(1) NoP	(2) NoP	(3) ENoP	(4) ENoP	(5) Index	(6) Index
Placebo Reform 1999						
$B \rightarrow D_{99}$	0.016	-0.008	0.196***	0.027	0.087**	0.087**
	(0.043)	(0.044)	(0.034)	(0.039)	(0.038)	(0.038)
$A \rightarrow C_{99}$	0.024	-0.010	0.195***	-0.009	-0.024	0.018
	(0.046)	(0.045)	(0.035)	(0.041)	(0.071)	(0.071)
$[C_{99} \rightarrow D_{99}] - [A \rightarrow B]$	-0.008	0.001	0.001	0.001	0.111*	0.093
	(0.026)	(0.027)	(0.015)	(0.015)	(0.061)	(0.063)
N	738	738	738	738	738	738
County Control	No	Yes	No	Yes	No	Yes
Placebo Reform 2007						
$B \rightarrow D_{07}$	-0.022	0.007	-0.217***	-0.011	-0.014	-0.011
	(0.044)	(0.044)	(0.039)	(0.041)	(0.050)	(0.050)
$A \rightarrow C_{07}$	-0.049	0.029	-0.216***	-0.008	0.063	0.060
	(0.044)	(0.042)	(0.037)	(0.037)	(0.083)	(0.089)
$[C_{07} \rightarrow D_{07}] - [A \rightarrow B]$	0.027	0.014	-0.001	-0.001	-0.077	-0.077
	(0.029)	(0.029)	(0.016)	(0.016)	(0.071)	(0.071)
N	732	732	732	732	732	732
County Control	No	Yes	No	Yes	No	Yes

Note: For explanatory details, see Table 5.

in 2007. We do, however, find a small but statistically significant effect in the placebo estimates from 1999, which does not go away when we include the county control. The point estimates suggest that the placebo effect operates through the mechanical effect. There are two important things to note with respect to this. First the effect is quantitatively small (about one tenth of the total effect of the reform). Secondly, and most importantly, it is only in one out of 18 regressions in which we include the county controls that we find an effect. This is about what we would expect to find by pure chance.

Other Changes in the Electoral Law

The electoral law did not only change the seat allocation method from DH to MSL, but also (i) increased the number of citizen signatures required for party-independent local lists, (ii) reduced the scope for casting preferential votes, and (iii) reduced the number of candidates required per party list. The psychological effects on the number of represented parties, reported in Table 5, seem to be driven by entry of new party lists, particularly from two parties, the Socialist Left Party (SV) and the Progress Party (FrP). Could the additional changes in the electoral law be driving these psychological effects? We discuss each of the three changes in turn.

Before the electoral reform party-independent lists needed a number of citizen signatures equal to the size of local council, while after the reform they would need 2 percent of the voting population to sign (but 300 signatures is always sufficient). This may have contributed to the slight reduction we observe in the number of independent party lists running from 39 percent to 35 percent.[17] If anything this change in the electoral law implies that we would underestimate the psychological effects.

The reduction in the scope for preferential voting from the 2003 election onwards, mattered only for candidate selection *within party lists*, but not *across party lists*, and therefore do not incentive either strategic voting nor strategic entry. There is also no evidence that this feature of the reform increased voter turnout. It is therefore unlikely to be a confounding factor for our analysis.

The change in the candidate requirement may, however, be a potentially confounding factor. Until the 1999 election parties, irrespective of expected electoral support, would need to provide a ballot with candidates sufficient to fill at least half the local council. From 2003 onwards, this requirement was relaxed. Party lists needed only a minimum of seven candidates to participate in the election. For small parties this may have re-

[17]For a municipality with a median sized voting population (of about 3000) and a council size of 25 the number of signatures needed for a party independent lists would increase from 25 to 60. Political parties registered in "Partiregisteret" would only need two signatures, both before and after the electoral reform. In 2003, 22 political parties were listed in "Partiregisteret".

duced the cost of running, and could therefore potentially contaminate the estimates of psychological effects.

We have contacted the national party organizations of SV and FrP and asked how the party organization responded to the change in the electoral law. Both national party organizations report that they sent out information about the new electoral law to their local parties and that the candidate requirement was relevant. Interestingly, FrP circulated an electronic spreadsheet where local politicians could plug in votes and council size to calculate the seat allocation based on MSL.

To investigate whether the candidate requirement was a binding constraint for these two parties we relate information on the number of candidates on the ballot and the minimum requirement specified by the electoral law. Prior to the changes in the electoral law there was little bunching on the minimum required number of candidates for either of these parties.[18] We also examined if the party lists emerging in 2003 had a sufficient number of candidates to run if the previous rule had been in place. For the vast majority of new party lists this is the case.[19] Both these results indicate that the reduction in the candidate requirement was not the key explanation for the entry of new lists from these parties.

In conclusion, we argue that other changes in the electoral law are unlikely to have a severe impact on the psychological effects estimates. We cannot rule out that the reduction in the candidate requirement played a role, but it does not seem to be a key explanation.

[18] On average, SV lists have 15 candidates more than the minimum required number. 0.4 percent of the SV lists were exactly on the minimum required number of candidates. On average, FrP lists have 13 candidates more than the minimum required number. Of the FrP lists, 3.9 percent were exactly on the minimum required number of candidates.

[19] We find that 51 of 59 new FrP lists and 55 of 62 new SV lists have a number of candidates above the minimum required level. If we base the minimum required level on the council size existing in 1999 the number of party lists above the threshold falls slightly, to 48 and 52 for FRP and SV, respectively.