

**AN M.M.P. SYSTEM FOR QUEBEC: WHAT CAN BE LEARNT  
FROM SIMULATIONS OF PREVIOUS ELECTIONS**

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## **AN M.M.P. SYSTEM FOR QUEBEC: WHAT CAN BE LEARNT FROM SIMULATIONS OF PREVIOUS ELECTIONS**

### **Abstract**

This paper will outline various scenarios for a mixed member proportional system (MMP) tailored for Quebec's provincial elections, and test their probable consequences, by simulating previous elections. Assuming a 60:40 ratio between constituency seats and list seats, the paper will test five possible regional delimitations, three methods for allocating list seats, and three techniques (D'Hondt, largest remainder and Sainte-Laguë) for each method. Combining these three variables results in 42 scenarios. Two elections (1998, 2003) will be simulated. The research breaks new ground by shedding light on the symmetry of the various formulas, i.e. their ability to provide the same number of seats to each party with the same number of votes. The results will be analyzed through various dimensions: which variables provide the smallest vote-seat distortions, facilitate the emergence of new parties, guarantee that the system will work in a symmetrical way or would lead to the creation of overhang seats. The research will also detail the practical problems generated by the use of some methods and techniques.

## AN M.M.P. SYSTEM FOR QUEBEC: WHAT CAN BE LEARNT FROM SIMULATIONS OF PREVIOUS ELECTIONS

This paper builds on research that was carried by the authors for the Quebec government in the preparation of a proposal for an MMP system that was made public in December 2004. We tried to identify relevant features of an MMP system and to gauge their consequences on the representation of parties and regions.

For that purpose, we conducted simulations based on previous elections held under first-past-the-post. Blais and Nadeau (1996) found that strategic voting in Canada is fairly low, which encourages us, in the footsteps of earlier research of that type (Bilodeau 1999, Weaver 1997, Monroe and Rose 2002, Glasgow and Alvarez 2005), to assume that voters would have supported the same party they voted for.

### **Methodological Considerations**

Better to concede at the outset what everyone knows or guesses: it is impossible to anticipate with certainty all of the consequences that will result from a new electoral system in a given country. There are just too many variables in play. What will be the future political landscape? Will parties break up and new parties emerge? How will support for existing parties change? How will their support be spread over the territory? In the face of such unknowns, we should each humbly recognize our inability to foresee everything.

Science cannot predict everything, but at this stage of its development it can at least greatly enlighten lawmakers and the public. In his classic work, Douglas Rae (1971, 67-68) offers an interesting distinction between the *proximal effects* and *distal effects* of electoral systems. The former refer to the way the different systems convert votes for parties into parliamentary seats. The latter refer to the longer-term effects that an electoral system may exercise on the general pattern of political forces in a country. If you assert that the first-past-the-post system clearly leads to a 2-party system, you are alleging this electoral system has a *distal effect*, which is proven by the experience of many societies but disproved by numerous cases. Whoever prefers to stick to *proximal effects* will instead assert, for example, that a proportional electoral system where the whole country forms one constituency and where seats are distributed using the Sainte-Laguë technique, with no threshold to exclude the weakest parties, will produce a Parliament where each party gets a number of seats very close to its share of the popular vote. The language here is more technical, and the assertions much likelier to be proven by experience, if based on rigorous methods of measurement. We will stick here to *proximal effects*.

### ***Simulation program***

We started with a model that assumed a 60:40 ratio between constituency and list seats, and we tried to determine what kind of outcomes could result under different combinations of district magnitudes, methods of compensation and techniques.

The objective of our exercise was to estimate the distribution of seats among parties in the Quebec provincial elections held in 1998 and 2003 under these scenarios. To be more precise, we wished to see how different variables would affect party representation, the size of vote/seat distortions and, potentially, how many overhang seats there would be. We also wanted to see whether the different approaches would perpetuate, reduce, or eliminate the asymmetry that characterizes the way the current electoral system works.

Taking election outcomes achieved under First-past-the-post and computing how many seats each party would have got under a standard PR list system is relatively easy to do. With MMP, this operation is more complex because two different sets of boundaries must be used.

### ***The single-member constituencies (common factor in all simulations)***

The model we started with envisaged an Assembly of 125 Members, 75 constituency seats plus 50 list seats. This raised a challenge, because actual elections were held in 125 constituencies. We might have kept all 125 existing constituencies, and added some 80 compensatory seats, thus producing a National Assembly with over 200 seats, but no one seems to have envisaged such numbers, judging by past proposals, and a size of 125 seemed to reflect the most widespread sentiment. The obvious alternative was to transpose the results of previous elections in a boundary delimitation of 75 districts. Fortunately, such a delimitation did exist. For the election of Members of the House of Commons, Quebec is divided in 75 constituencies, whose boundaries are described in the Representation Order published in the *Canada Gazette* in August 2003. These boundaries were determined on the basis of the 2001 census by an independent boundary commission that held regional hearings on a draft proposal. They came into force in the 2004 federal election. Population imbalances among the constituencies are minimal and the delimitation is a highly equalitarian one.<sup>1</sup>

We requested the Office of the Chief Electoral Officer to transpose the 1998 and 2003 election results into these 75 constituencies. It would have been useful to look at earlier elections for a better appreciation of the different approaches. This would have required lengthy manual computations and been time-consuming.

The outcomes of these transpositions are quite interesting. For 1998, the PQ would have obtained 47 seats, the QLP 28, and the ADQ none. For 2003, the QLP would have got 47 seats, the PQ 25, and the ADQ 3. Although this boundary delimitation is more equalitarian than the existing provincial one, it would not have eliminated the anomalous 1998 “wrong winner” result, and would have produced in 2003 an outcome as disproportional as the actual one. Such outcomes did not come as a surprise, though it is hoped they will help to dispel the illusion, still persistent among some, that the distortions in Québec elections could be eliminated just by altering the electoral boundaries.

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<sup>1</sup> The minimum majority index (Dauer-Kelsay) of the new federal boundary delimitation reaches 48% (50-51% being the maximum level of equality possible) versus 44% for the current provincial delimitation. Population differences range from 74,475 to 105,678.

Each simulation made included the appropriate transposed results (1998 or 2003) for the 75 single-member constituencies. For the distribution of the 50-odd list (compensatory) seats, we envisaged several scenarios that combined three variables: regional boundary delimitations; methods for distributing seats; and computation techniques.

### **The Compensatory (list) seats:**

#### FIVE REGIONAL BOUNDARY DELIMITATIONS OPTIONS

Compensation could be provincewide, with all of Québec forming a single constituency for that purpose. If compensation were done regionally, then the basic single-member constituencies had to be grouped into larger regions. Our various boundary delimitations were arrived at by grouping the 75 federal constituencies differently. For the purposes of our research, we devised four regional boundary delimitations, in addition to provincewide compensation.

#### *Boundary delimitation "A" (26 regions)*

In this option, the 75 constituencies are grouped into regions typically including 3 constituencies and 2 compensatory seats, for a total of 5 seats.<sup>2</sup> In the case of a few large remote regions (Abitibi, Côte-Nord, Gaspésie, Bas-Saint-Laurent), it was deemed preferable to produce 3-seat regions (2 constituencies and 1 compensatory seat). A south-shore Montréal region ended up with 7 seats (4 constituencies and 3 compensatory seats). There are only a few such cases and the overwhelming majority of the regions have a 60/40 ratio between the two types of seat. This boundary delimitation includes 26 regions, with a total of 49 *compensatory seats* (instead of the 50 envisioned). Adding these to the 75 *single-member constituencies* produced a 124-seat assembly. With a district magnitude of 4.8, this boundary delimitation produces relatively small regions, probably the smallest that may be reasonably envisaged. We hypothesized that with such regions, the distortions would likely be higher, the chances of small parties making a breakthrough, slim, and the number of overhang seats, high.

For the three next boundary delimitations the basic 26 regions were grouped in a different way.

#### *Boundary delimitation "B" (16 regions)*

In this option, we stick closer to the administrative regional boundaries of Quebec. Most of the regions would remain identical to boundary delimitation "A", but in some places would be appreciably larger in order to square with administrative boundaries, and accordingly would have more seats.<sup>3</sup> As a general rule, the more densely populated a region is, the higher the number of

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<sup>2</sup> For example, the region of Saguenay—Lac-Saint-Jean encompasses the 3 federal constituencies of Chicoutimi-Le Fjord, Jonquière-Alma, and Roberval. It was assigned 2 compensatory seats for a total of 5 seats, i.e., the region's current representation in the National Assembly.

<sup>3</sup> Île-de-Montréal would be a large 30-seat region (18 constituencies and 12 compensatory seats) and Montérégie would have 22 seats (13 constituencies and 9 compensatory seats). In contrast, Québec and Lanaudière would each have 10 (6 constituencies and 4 compensatory seats).

seats to be allotted therein. Non-metropolitan regions have fewer seats, given their more dispersed population. In total, this boundary delimitation produces 16 regions, with a district magnitude of 7.7.<sup>4</sup>

*Boundary delimitation "C" (13 regions)*

Another option is to group the basic regions of boundary delimitation "A" into larger blocs. Typically, the regions will have 10 seats (6 constituencies plus 4 compensatory seats) instead of 5 (3 constituencies plus 2 compensatory seats). Most regions have the same number of seats, which necessitates Montréal being divided into regional districts with about ten seats each, like the other regions.<sup>5</sup> In total, this boundary delimitation has 13 regions, with a district magnitude of 9.5. We hypothesized that there should smaller distortions, better representation of third parties, and fewer overhang seats.

*Boundary delimitation "D" (4 regions)*

The fourth option produces much larger regional blocs than the previous ones. There are four blocs: Ile-de-Montréal, the periphery (north and south) of Montréal, Centre-du-Québec, and a vast region stretching from Outaouais to Gaspésie, encompassing Abitibi, Saguenay, and Côte-Nord. The aim here was to produce districts for computation that were large enough to reduce distortions, to give small parties better representation, and to avoid creating too many overhang seats.

*Boundary delimitation "E" (provincewide compensation, no regions)*

Finally, there might be no region at all and compensation could be provincewide, with all of Québec forming a single district for that purpose. There should thus be high proportionality and low distortion, very accurate representation of smaller parties, and a minimal number of overhang seats.

All five boundary delimitations all produce a total of 124 seats: 75 constituency seats and 49 compensatory seats.

## **METHOD FOR DISTRIBUTING SEATS: THREE OPTIONS**

The general principle of the compensatory method is to give parties extra seats in order to reduce the distortions generated by first-past-the-post. We identified three methods by which this principle can be achieved.

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<sup>4</sup> Nord du Québec has too few people to be a separate region in itself and has been joined to Abitibi.

<sup>5</sup> Some regional blocs may seem unrealistic (Saguenay and Côte-Nord, Abitibi and Outaouais).

### *Regional compensation, German-style*

Compensation in this case is made separately within each region. For each region, all seats (constituency plus list seats) are allotted among parties on the basis of the popular vote and then compared with the number of constituency seats won by each party. Whenever the number of constituencies won by a party is smaller than the number of seats it is entitled to, the party receives a number of list seats corresponding to the difference. If a party has won more constituency seats than the total it should have, the number of list seats for the region is increased by the same amount. This computation procedure was used in the first two Bundestag elections (1949 and 1953).

### *Provincewide compensation followed by redistribution among the regions of seats won by each party*

This very complex method has been used in Germany since 1956. First, the seats are distributed among the parties on a Québec-wide basis. Second, the seats received by each party are redistributed among the regions using the number of valid votes cast for the party in each region. This method results in a kind of inter-regional equalization. The number of constituencies up for grabs in each region is of course invariable, but the number of list seats for each region may differ from the number originally assigned, depending above all on the region's relative voter turnout. A higher turnout may give a region a few more compensatory seats than initially provided, and this transfer works to the detriment of regions with below-average turnout. The total number of compensatory seats (49) does not vary, except for overhang seats that may arise in some regions. Overhang seats may appear and will have the same effect as with the previous method.

### *Regional compensation, Scottish-style*

The two methods above may produce overhang seats. The latter have two consequences that may seem undesirable: the regional balance of representation is upset, as some regions get overhang seats and others do not; and the total number of MNAs temporarily increases. The Scottish method avoids this. The number of votes for each party within a region is divided *by the number of constituency seats already obtained, plus one*.<sup>6</sup> The consequence is that the overhang seats eventually won by a party do not lead to an increase in the total. Rather, the number of seats that go to the other parties is reduced accordingly. To some extent, this method penalizes the smaller parties and rewards the big ones.

## **COMPUTATION TECHNIQUE: THREE TYPES**

The distinction between "method for distributing seats" and "computation technique" may seem at first slight, but it is a necessary one. Each of the methods outlined above can be combined with

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<sup>6</sup> In practice, this technique produces exactly the same result as does the German method when no party has won overhang seats. It may therefore be limited to regions where an overhang seat has been won.

the three standard techniques: *D'Hondt*,<sup>7</sup> *Largest Remainder*,<sup>8</sup> and *Sainte-Laguë*.<sup>9</sup> Each technique may produce slightly different outcomes, especially if there are few seats per region.

Each of the three techniques is compatible with the German method, but the Scottish method has to date been combined only with the D'Hondt technique. We have devised original computation procedures that adapt this method to the Sainte-Laguë and Largest Remainder techniques.

The development of specialized software, has greatly facilitated the computations.<sup>10</sup> Computations for provincewide compensation followed by regional redistribution largely had to be done manually.<sup>11</sup> The same was true for computations required by the Scottish method.

Combining these three variables produced 42 different scenarios, all of which were tested for both 1998 and 2003.

### *Assumptions common to all simulations*

Computations were made on the basis of three assumptions:

- Voting figures used were the votes cast for party candidates in the two Québec elections under study. It was assumed that voters would have voted exactly the same way, independently of the local candidate's merits. We did not speculate on how voters would have voted if they had had the option of casting a second (party) vote;
- A 5% provincewide threshold was applied and was not waived for any party that failed to reach this threshold but still managed to win a constituency seat. Any party with less than 5% of all valid votes throughout Québec was excluded from the computation. Of course, such a party would still retain any constituency seats it won.<sup>12</sup> Votes cast for independent candidates or candidates with no party label were also ignored;

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<sup>7</sup> The D'Hondt technique (largest average) is to divide the number of votes for each party successively by 1, 2, 3, etc., and to give the seats to the parties with the highest quotients. It normally favours the strongest parties.

<sup>8</sup> The Largest Remainder technique (called, in Germany, the Hare-Niemeyer technique) first requires calculating a quotient: the total number of votes for eligible parties divided by the number of seats. The votes for each party are then divided by this quotient. The resulting whole number is the number of seats that go to each party. If this operation is insufficient to distribute all of the seats, the ones not distributed go to the parties that, after division by the quotient, have the largest remaining amounts, until all seats have been filled. This technique is recognized as being more proportional than the previous one, and more favourable to small parties, to the point of overrepresenting small parties in some cases.

<sup>9</sup> The Sainte-Laguë technique divides the number of votes for each party by successive odd numbers (1, 3, 5, 7, etc.), and gives the seats to the parties with the highest quotients. Although it resembles the D'Hondt technique in its operation, it produces more proportional outcomes.

<sup>10</sup> Our work tool was the software application on the website *Wahlen in Deutschland*, at: [www.election.de](http://www.election.de), under "Mandate-Rechner". This application has the advantage of simultaneously distributing the seats for the three techniques.

<sup>11</sup> The "Mandate-Rechner" has only a limited number of boxes for entering party votes. Because we had to distribute the party seats among 13, 16, or 26 regions according to our boundary delimitations, this application was not used.

<sup>12</sup> This never happened in our simulations. It could have happened in 1989 to the benefit of the Equality Party.



- No projection was made on the identity of elected MNAs. It was impossible to know who would have run in the hypothetical constituencies, who would have been on the party lists, and in what order. We did, however, identify within each party the "best losers" who might be entitled to compensatory seats. To be more precise, within each region that received compensatory seats, we identified which constituency would have got the compensatory seat won by each party.

### *Analysis summary*

We prepared tables outlining the overall outcome of each simulation. They include the total number of seats for each party (in absolute numbers and as percentages of the total) and the resulting number of overhang seats, if applicable.

Using this information, we prepared tables giving the *overall distortion level* produced by each simulation. Several indices try to capture this level in a single number. We chose the index developed by Michael Gallagher (1991). We also prepared a table giving the *majority bonus* in each simulation, i.e., the difference (in percentage points) between the percentage of valid votes for the strongest party (in votes cast) and the percentage of seats for this party. The outcomes were also analyzed in terms of presence or absence of *regional monopolies*, i.e., the cases where a party managed to get all seats up for grabs in a region. We compiled the number of *overhang seats* produced by the methods that could produce any. We also looked at whether a method would or would not correct *reversals of party standings*, as happened in 1998. Finally, we tried to see to what degree the different approaches worked *symmetrically or not*.

### **Four key findings**

Our broader research followed two research strategies: analysis of experiences in foreign countries using MMP systems, and simulation of previous Québec elections. *Both produced concurrent findings*. Without causing any great surprises, our simulations nevertheless revealed much more clearly the consequences of various options:

- *Only electoral system reform will correct the anomalies of the current first-past-the-post system*. This lesson clearly emerges from the transposition of the 1998 and 2003 election results into the new federal boundary delimitation. Although this delimitation produce electoral district with fairly equal population, the distortions between popular vote and party seat standings remain virtually intact. The ADQ would not have won any seat in 1998 despite getting 12% of the popular vote and the PQ would have gained a comfortable parliamentary majority (47 seats) despite a lower standing in the popular vote. In 2003, each party would have got a share of the 75 seats very close to what it did get. To those who still think that merely tinkering with electoral boundaries would solve the problems of the first-past-the-post system, our simulations provide a predictable and eloquent response;

- All of our scenarios produce *outcomes clearly more proportional* to the popular vote than does the current first-past-the-post system. The compensatory mixed system reduces distortions and may even eliminate them. The least proportional approach would give the strongest party a bonus of up to 7 percentage points in 2003 (46% of the vote and 53% of the seats). Even in this case, the distortions are noticeably smaller than those generated by the current electoral system;
- MMP would end the “regional monopolies” (cases when one party gets *all* seats in a region) and encourage much more party diversity within each. In 1998, out of 26 regions, a pure first-past-the-post system created **19 regional monopolies**: 13 for the PQ and 6 for the QLP. Only 7 regions had MNAs from different parties. In 2003, the first-past-the-post system created **17 regional monopolies**: 12 for the QLP and 5 for the PQ. All our scenarios produce much fewer regional monopolies, if any.
- **Overhang seats (in German: *Überhang*) are not a marginal issue, but a serious problem.** First, they are not rare occurrences. *Overhang seats arise in almost all simulations that can produce any.* Only provincewide compensation results in none. Second, *their number is relatively high*, as many as 11 in some cases. This would increase the total membership of the National Assembly to 135. Third, overhang seats *upset the regional balance* of representation by population because certain regions get some and others do not. Further, they are obtained by pretty much the same areas. Ile-de-Montréal would almost never get any, like several other regions, whereas Québec City would almost always get some. Fourth, *overhang seats are more often won by one of the two main parties than by the other.* The ADQ would never have any, a factor that would accentuate its underrepresentation. Fifth, *overhang seats occasionally give a plurality of seats to a party that does not have a plurality of the vote.* This anomaly appears several times in our simulations (in every case for the 1998 election).

## Impact of the different variables

We will now analyze the impact of the three main variables: regional boundary delimitations, seat distribution methods, and computation techniques.

### *Regional boundary delimitations*

As we expected, provincewide compensation produces minimal distortion and a very small bonus for the big parties. With a 5% threshold, no party other than the three now in the National Assembly manages to secure a seat in our simulations. Without such a threshold, this outcome would be possible. No simulation with provincewide compensation produces overhang seats.

As soon as compensation is done within 4 large regions, major party bonuses emerge and distortions increase. These two phenomena are accentuated with a 13- or 16-region delimitation and reach their highest with a 26-region one. Such findings do not come as a surprise, as they square with the literature. An original finding, fully consistent with our analysis of German

elections, is that the higher the number of regions, the higher the number of overhang seats. Some 26-region simulations produce up to 11, bringing the membership of the National Assembly to 135.

### *Methods for distributing seats*

Regional compensation, German-style

In our simulations, the method proved versatile by producing distortion levels and majority bonuses of varying magnitude. Even with 26 regions, it is possible to obtain low distortion levels and a small majority bonus by using the Largest Remainder technique. If a more substantial majority bonus is desired, one needs only use the D'Hondt technique with the same regional boundary delimitation.

[TABLES 1 & 2 ABOUT HERE]

**The German method's main weakness is the high number of overhang seats it tends to produce.** Only provincewide compensation produces no overhang seats. Other boundary delimitations produce overhang seats to some degree. **The more regions there are, the likelier there will be overhang seats,** because distortions tend to be greater in some regions than in Québec as a whole.

The number of overhang seats is clearly higher with the Sainte-Laguë (43) or Largest Remainder technique (42) than with the D'Hondt technique (26). The explanation is simple. The D'Hondt technique tends to give the strongest party more seats than the other techniques. If the D'Hondt technique gives 3 seats in a region to the strongest party, whereas the other techniques give it only 2, the party's third constituency seat in the region is an overhang seat according to the Sainte-Laguë and Largest Remainder, but not according to D'Hondt.

The increase in the total number of MNAs produced by the appearance of overhang seats is not trifling. Some scenarios produce up to 135 MNAs instead of 124. The increase can be seen in the seat distributions of Table 3.

[TABLE 3 ABOUT HERE]

**Overhang seats occur unequally in the different regions, and the resulting deformation of regional representation is not minor.** They virtually never appear on the Ile-de-Montréal, and almost always appear outside this region. They are produced disproportionately in Québec City. They thus increase the relative weight of Québec outside Montréal. The reason is simple. In the two simulated elections, distortions generated by first-past-the-post in constituencies were smaller on Île de Montréal than elsewhere in Québec, and reached their highest level in Québec City.

When regions are small (e.g., a 26-region boundary delimitation), overhang seats have a maximum impact on the overall representation of the region getting them. The region gets 6 seats

instead of 5, i.e., a 20% increase. Such a phenomenon will probably not go unnoticed in an adjacent region where the vote produces no overhang seats.

**Overhang seats have nothing to do with the relative size of a region's population or its voter turnout.** They are simply due to the degree of distortion between the distribution of valid votes and the distribution of constituency seats in each region. In other words, the higher the distortion is within a region, the likelier the region will get an overhang seat. The seat gives the region a sort of distortion bonus.

**Overhang seats do not randomly affect party standings.** They more often go to the PQ than to the QLP, and never to the ADQ. This is because the PQ has been relatively more popular outside Île-de-Montréal, especially in 1998, and because the ADQ does not manage to sweep any region. In many 1998 election simulations, overhang seats have the effect of creating a “wrong winner” problem.

Provincewide compensation with party seats redistributed among the regions

This method is the most complex one of all. It almost squares the circle. Seats are first distributed on a provincewide basis – a high degree of proportionality is thus guaranteed in principle – and then redistributed among the regions – list MNAs are thus tied more closely to a more concrete territory.

The transpositions reveal that this method produces very similar outcomes, whatever the boundary delimitation or the computation technique used. In simulations based on this method (12 for each election), the total number of seats received by each party varies very little. For the 1998 election, the QLP would get 55 or 56 seats, the PQ 54 to 57, and the ADQ 15 in every case (Table 4). For the 2003 election, the QLP would get 60 to 63 seats, the PQ 43 to 47, and the ADQ 23 in every case (Table 5). The reason is quite simple. The seats are first distributed provincewide, so the impact of the computation technique is minimized. The subsequent variations are largely due to the appearance of overhang seats, to the benefit of certain parties, after seats have been redistributed among the regions.

[TABLES 4 & 5 ABOUT HERE]

This method tends to produce a very low overall distortion level, lower than with German-style or Scottish-style regional compensation for the same number of regions. The strongest party's majority bonus is clearly lower than with the other two methods.

Like German-style regional compensation, this method produces overhang seats. Fewer are created, but their numbers remain significant. The highest number produced by any simulation is 8, pushing the size of the Assembly at 132. In the 1998 election, in most cases, overhang seats would give a plurality of seats to the party that came second in the popular vote. As with the previous method, the number of overhang seats tends to increase with the number of regions.

The most problematic feature of that method is that the total number of seats that each region will finally get remains uncertain until votes are counted. With German-style regional

compensation, each region can count on a fixed minimum of compensatory seats, to which may be added an overhang seat. With this more complex method, it becomes much harder to predict how many seats each region will get. For the 1998 election, for example, with whatever computation technique, the number of compensatory seats (and therefore the total number of seats) would differ from the expected total in 15 or so of the 26 regions. For the 2003 election, 16 to 20 regions would be in the same boat. In other words, **the final number of compensatory seats in each region becomes highly unpredictable, and the chances are two out of three that it will differ from the expected total.** As predicted, the method leads to much inter-regional electoral transfer, according to each region's relative voter turnout. This is all the better for regions with high turnouts, which may hope to pick up extra seats, and all the worse for the others, which will have less representation than expected.

The simulations also reveal that, in some cases, **a region may receive no compensatory seats** because of its relatively low turnout. The phenomenon does not occur in 1998, but it arises in several 2003 election simulations and sometimes affects 2 of the 26 regions.

### Regional compensation, Scottish-style

The Scottish method gives outcomes of the same order as does German-style regional compensation. In regions with no overhang seats, the two methods produce exactly the same outcome. Wherever a party exceeds its quota, this method settles the problem to the detriment of one of the weaker parties.<sup>13</sup> As we expected, distortions and major party bonus are a bit higher, but do not exceed the limits of PR. It is the price to be paid to keep overhang seats from raising the total number of members and upsetting the regional balance of representation.

[TABLES 6 & 7 ABOUT HERE]

As we mentioned above, we designed a computation procedure that adapts the Scottish method to the Sainte-Laguë and Largest Remainder techniques. Such procedures reduce the overall distortion level. Other than that, the outcomes are rather strange. In the 1998 election, some scenarios would give the second party in the popular vote 59 seats versus 50 for the first party. This predictable outcome arises because, as already noted, the Sainte-Laguë and Largest Remainder techniques tend to create many overhang seats, because overhang seats tend to be won more often by one party than by the others, and because the Scottish method gives the party that wins overhang seats a clearer benefit.

### Regional PR

Regional PR, a straight party list system eliminating single-member constituencies, was proposed by different official Québec documents since the 1970s. It was not considered in the present reform effort. Our computations, however, have provided us with the outcomes that this approach would have produced. We felt it worthwhile to go over these outcomes below.

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<sup>13</sup> To be more precise, the Scottish method hurts the runner-up party in a region if two compensatory seats are at stake, and the weakest party when one is.

[TABLES 8 & 9 ABOUT HERE]

Regional PR works as suggested by the literature. Distortions and majority bonus are at a minimum with a 4-region boundary delimitation and steadily increase with the number of regions. These two indices reach a level very close to that of German-style regional compensation, but still a little below. The difference is entirely due to overhang seats. Here again, the regional boundary delimitation and the technique determine the distortion level (tables 8 and 9).

### *Computation techniques*

Computation techniques affected distortion level exactly as we expected. Distortions and winner's bonus are at a maximum with the D'Hondt technique and fall to a clearly lower level with the Sainte-Laguë or Largest Remainder techniques.

The impact of computation techniques varies depending on the regional boundary delimitation. Choosing one technique over another matters if compensation is done within regions, and all the more so when the number of regions is higher. It is in a 26-region boundary delimitation that the D'Hondt technique most clearly favours the larger parties, and it is also in such a case that the Largest Remainder technique most strongly boosts the weakest of the three parties represented in the National Assembly. Finally, as we noted above, the differences produced by using one computation technique rather than another vanish if compensation is provincewide, regardless of whether or not the compensatory seats are then redistributed among the regions.

All of this was largely expected. A novel finding was that the D'Hondt technique has the effect of decreasing the number of overhang seats, all things being equal, whereas the other two techniques increase them.

### *Overall distortion level and majority bonus*

As we mentioned above, several indices try to capture an election's overall distortion level in a single number. Gallagher's index, the one chosen for our study, is obtained by adding up the squared difference between each party's percentage of the popular vote and its percentage of the seats. The sum is then divided by 2, and the square root of the resulting quotient is the index. Thus, 15.33 and 15.05 respectively are the indexes for the actual 1998 and 2003 Québec election results.

The highest distortion level in our simulations is 7.31 (Scottish-style regional compensation, 26 regions, D'Hondt technique, 2003 election). The lowest is 0.95 (provincewide compensation, 1998 election). Tables 10 to 15 give the distortion level for each simulation.

[TABLES 10, 11, 12, 13, 14 & 15 ABOUT HERE]

In the 1998 and 2003 elections, the current first-past-the-post system produced a mean distortion level of **15.19**. In our corresponding simulations, the level is 1.57 with provincewide compensation followed by regional redistribution of the seats, 2.36 with German-style regional compensation, and 2.94 with Scottish-style regional compensation. Within these three simulation categories, the distortion level increases, sometimes noticeably, as the number of regions increases (figures 1 and 2).

[FIGURES 1 & 2 ABOUT HERE]

Such data can be better appreciated only from a comparative perspective. In Table 16, we list the mean distortion level in each election from 1945 to 1996 in 36 democracies. We added the corresponding figure for Québec and other Canadian provinces during the same period (elections held after 1996 are excluded).

[TABLE 16 ABOUT HERE]

Finally, we calculated the majority bonus of the leading party in terms of popular vote. This bonus was obtained by calculating the spread between this party's percentage of the popular vote and its percentage of the seats (figures 3 and 4).

[FIGURES 3 & 4 ABOUT HERE]

In the 2003 election, the winner's majority bonus was 14.81 percentage points. The highest majority bonus ever produced by our simulations is 7.24 points (Scottish-style regional compensation, 26 regions, D'Hondt technique, 2003 election), and the lowest is -0.47 ("negative" bonus produced by provincewide compensation with regional redistribution of seats, 16 regions, D'Hondt technique, 1998 election).

### *To what degree do the different approaches work symmetrically?*

The issue

A possible yardstick for assessing different electoral systems is the symmetry of their operation. In an election, Party "X" receives 40% of the vote, 3 points more than Party "Y", and this score wins it 45% of the seats. In the next election, suppose the tables are turned and Party "Y" receives 40% of the vote, 3 points more than its rival. It too *should* win 45% of the seats. If it does, the system is said to work symmetrically. If not, and if such differences occur continually, the electoral system may be said to work *asymmetrically*.

Such is the case with Québec's first-past-the-post system, if we go by the results of the last three elections. In 1994, a margin of 13,000 votes over the QLP in the entire province gave the PQ 77 seats out of 125, a 30-seat edge. This result is apparently normal, the strongest party getting more than its fair share of seats. In 1998, however, the QLP led the PQ in the popular vote (by 27,000 votes) and yet won 28 seats *fewer* than did the PQ. Or to put it differently, when both parties get roughly the same number of votes, one of them gets invariably almost 30 seats more.

We will now compare the 1998 and 2003 elections. In each case, the winning party won 76 of the 125 seats. To win them, the QLP needed a 13-point lead in the popular vote. The PQ won just as many in 1998, but with a difference of half a point in the popular vote—half a point *behind* its rival.

One of the criticisms against the first-past-the-post system in Québec is that it treats the two main parties differently when they perform equally well in the popular vote. In neutral language, the system works asymmetrically, and this asymmetry is pronounced. In more polemical language, it is systematically biased toward one of the two big parties and against the other.

## Our method

It is not easy to measure asymmetry. Only rarely, as in the last three Québec elections, does chance produce exactly reversed election results that highlight the system's asymmetry for those who wish to see it.

This type of approach has inspired a significant body of literature since the 1950s.<sup>14</sup> Of all the approaches explored, the one developed by David Butler and his associates has proven to be the most productive one and is today used in many countries. This method had the quasi-blessing of officialdom in the 1998 Jenkins Committee proceedings. It involves making projections based on previous election results.

The starting point for such an approach is the constituency-by-constituency result of a given election (called here the "reference election"), with the number of votes for each party being expressed into percentages of all valid votes. To find the resulting seat distribution if 1 point of the popular vote shifts (in relation to the reference election) from Party "X" to Party "Y", we assume that a shift of the same magnitude will occur in each constituency by reducing Party X's percentage of the vote by one point and increasing Party Y's by the same. Next we compute the number of constituencies that would switch allegiance compared with the reference election.

Butler and Curtice have used two yardsticks to measure the degree of asymmetry. First, they project both larger parties at the same percentage of the vote, and the difference between the number of seats each then obtains measures the extent of the asymmetry. For example, based on the 2003 election result, if *both* major parties receive 39.6% of the vote, with the ADQ staying at 18.2%, the PQ would win 67 seats, the QLP 50, and the ADQ 8. The difference between the two parties is therefore **17 seats**.

The second yardstick necessitates instead determining, again by way of projections, the percentage of the vote obtained respectively by the two larger parties at the stage when both will *win the same number of seats*. Based on the 2003 election result, a uniform swing of 3.71 points from the QLP to the PQ is enough to give them the same number of seats (60), the 5 others going

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<sup>14</sup> The concept of asymmetry or bias has been investigated in many sources. See on this point Curtice 2001, Johnston *et al.* 1998, Curtice and Steed 1997, Jackman 1994. See also the JENKINS COMMISSION report, *Make Votes Count. The Report of the Independent Commission on the Voting System*, 1998, t. 1, paragraphs 40-43. See also in JENKINS COMMISSION, *op. cit.*, t. 2, "Report of Group of Academics Chaired by Professor David Butler, Nuffield College, Oxford University, August 7, 1998", pp. 4-7. Also see the many older sources cited in Massicotte 1995.



to the ADQ. At this stage, the QLP would receive 42.28% of the vote and the PQ 36.95%, with the ADQ staying at 18.18%. The difference between the two main parties is **5.33 percentage points**. Out of 3.8 million valid votes, that amounts to about 200,000 votes.

When applied to Québec's 1998 election results, this method reveals that the QLP would have needed a margin of 300,000 votes over the PQ (7.5% of the total vote) just to win an equal number of seats. This type of difference has been a constant of the Québec electoral landscape since 1944, and it always runs in the same direction.<sup>15</sup>

To what extent is this true for the other scenarios tested in our simulations? Based on the 2003 election results, we applied the same technique of uniform swings to a representative sample of scenarios:

- A single-member first-past-the-post system in the 125 constituencies used at the 2003 election;
- A single-member first-past-the-post system in the 75 constituencies used at the 2004 federal election;
- Scottish-style regional compensation in the 26 proposed regions, using the D'Hondt technique;
- German-style regional compensation in the 26 proposed regions, using the D'Hondt technique;
- Moderate (straight) list PR in the 26 proposed regions, using the D'Hondt technique; and
- Provincewide compensation using the D'Hondt technique.

The essence of the method is to estimate, assuming uniform shifts of votes, the number of seats that each of the two big parties would win for the same percentage of the vote. In these projections, the ADQ vote (18%) is always held constant, both in overall volume and in geographical distribution, whereas the vote for each of the two big parties is modified, one party's gain becoming the other's loss. We start with the 2003 provincewide popular vote scores of 46%-33%-18%, and then adjust them to project the effects of a 1-point swing (45-34-18), a 2-point swing (44-35-18), and so on until the ratio between the two larger parties is exactly reversed from that of the 2003 election (33-46-18).

## Findings

**Unsurprisingly, the first lesson that emerges is the high degree of asymmetry produced by the first-past-the-post system.** For any percentage of the vote, the QLP would *always* win fewer seats than would the PQ with an identical percentage of the vote. For example, with the current 125 constituencies, 46% of the vote for the QLP (versus 33% for the PQ) gave it 76 of the 125 seats (i.e., 60.80% of the total), whereas 46% of the vote *for the PQ* (versus 33% for the QLP) would give the PQ 94 of the 125 seats (75.20% of the total). The difference between the two seat percentages (60.80 and 75.20) here is 14.40 points. For all of the possible scenarios, the mean size of the difference is 16.06 percentage points.

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<sup>15</sup> See Massicotte and Bernard 1985, Massicotte 2002, Massicotte and Blais 1999.

The difference is barely smaller if we use the 75 federal constituencies of the 2002 election. It then stands at 13.62 percentage points.

Such differences are greatly reduced with Scottish-style regional compensation, falling on average to 2.29 percentage points. In all cases simulated, this approach gives the most seats to the party with the most votes.

The mean spread is reduced a little more with German-style regional compensation, falling to 1.00.

The spread is still lower with moderate regional PR (-0.63 point) and almost zero with provincewide compensation (0.23 point).

The direction of the spreads is almost always biased to the PQ. With equal percentages of the vote, the PQ tends to win more seats than does the QLP. This is true for all approaches, albeit with substantial differences of degree. The only exception is regional PR, where the mean spread (-0.63 point) favours the QLP.

These outcomes were predictable. Provincewide compensation has a very high "district magnitude" and necessarily produces a very proportional result. It is therefore largely symmetrical in its effects. Moderate regional PR produces a less proportional result but operates fairly symmetrically. The regional compensation systems (Scottish- and German-style) both operate in a slightly more asymmetrical manner (and more biased to the PQ) essentially because of overhang seats, which more often go to the PQ than to the QLP.

Figure 5 show the mean spreads between the standings of the two big parties. The difference is considerable under the first-past-the-post system with either the current 125 constituencies or the 75 federal constituencies. It declines markedly with the regional compensation systems and to almost nothing with the other approaches.

[FIGURE 5 ABOUT HERE]

Figure 6 show the spread between the two big parties under each electoral system. For a series of vote percentages from 33 to 46%, we can see the seat percentages that each of the two parties would get. If the electoral system works symmetrically, the two curves should coincide or, at least, be very close. If, on the contrary, the two curves are separated by a constant difference that always favours the same party, we may conclude that the system works asymmetrically and constantly treats one of the two parties better than the other, even with the same popular vote.

[FIGURE 6 ABOUT HERE]

### *The representation of very small parties*

The performance of small parties in the 1998 and 2003 elections was relatively low.<sup>16</sup> The actual voting figures probably underestimate to some extent the real support for these parties. None of them ran candidates in all constituencies and they also might have had more votes under PR. Anyone may speculate as they wish on this point. For our analysis, we took the figures as they were.

Imposing a 5% provincewide threshold for purposes of simulation eliminates all parties that failed to reach this bar in the 1998 or 2003 elections. Consequently, none of the very small parties would win any seats in our simulations.

Under which mechanical conditions would these parties have secured some representation? Clearly, it is indispensable to **remove the threshold** because it invariably bars them. Even a threshold as low as 2% (as advocated by the UFP) would be fatal to each of these parties.

**Yet the absence of any threshold does not necessarily mean that the small parties would be automatically represented in the National Assembly.** The strongest of them, the Union des forces progressistes (UFP) in the 2003 election, would remain unrepresented with either the 26-region boundary delimitation or the 13-region one, even if the Largest Remainder technique were used. This party would manage to win one seat with either 16 regions or 4 regions, because in both cases the Île de Montréal, where most of the UFP vote comes from, is made a single region. Even in these cases, using D'Hondt instead of the other two techniques would be enough to deprive the UFP of this seat. For the 1998 election, none of the four boundary delimitations with regional units would let any of these parties get elected.

**The ideal scenario for the very small parties is provincewide compensation, with or without regional redistribution of party seats,** given the number of votes they actually had. In this case, the UFP would receive one seat in 2003, regardless of the computation technique, and the Bloc Pot would receive one too, if the Largest Remainder technique were used. In the 1998 election, the Parti de la démocratie socialiste would receive one seat, if the Largest Remainder or Sainte-Laguë technique were used.

### *Choosing MNAs for compensatory seats: using the “Best Losers” method*

The simulations did not tell us who would hold the compensatory party seats, only how many of them each party would get. If these seats are assigned from lists, it is impossible to guess who will be elected because we do not know who will be on the party lists. If, however, these seats go to the "best defeated candidates," it is at least possible to find out, using our simulations, which constituencies would get such seats.

We ranked each party's defeated candidates in decreasing order, either of the gross number of votes obtained or of the percentage of valid votes, and declared the best positioned candidates

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<sup>16</sup> In 1998, the Parti de la démocratie socialiste received 0,59% of the vote, the Equality Party 0,31%, the Bloc Pot 0,24%, the Natural Law Party 0,13%, the Parti marxiste-léniniste 0,07%, the Parti innovateur 0,06%, and the Parti communiste 0,05%. In 2003, results were 1,06% for the Union des forces progressistes, 0,60% for the Bloc Pot, 0,44% for the Québec Green Party, 0,11% for the Equality Party, 0,08% the Parti de la démocratie chrétienne, and 0,07% for the Parti marxiste-léniniste.

"elected," up to the number of compensatory seats each party is entitled to. We applied this method provincewide and for each of the 26 regions.

When applied provincewide, the simulation revealed two problems. First, *distribution of compensatory seats favours some constituencies more than others*. This is inevitable with 75 constituencies and only 49 compensatory seats. It is to be expected that many constituencies would have *no compensatory seats*. This is the case with 35 constituencies for both the 1998 and 2003 elections. A strange but predictable outcome is that when more than two parties are running, several constituencies get *two compensatory seats* and thus have three MNAs. These compensatory seats go to the best losers of each of the two parties, and these losing candidates happened to stand in the same constituency. In total, 9 constituencies would have managed this hat trick in both 1998 and 2003. In both years, 31 constituencies would receive no compensatory seat. In other words, a few constituencies would each get three seats and many others only one.

Second, *the method seriously penalizes certain regions and unduly rewards others*, these regions tend to be the same each time. Despite its large population, Ile-de-Montréal would have received only 3 of the 49 compensatory seats in 1998, and *none* in 2003. The Outaouais region would receive no compensatory seats in either 1998 or 2003. Conversely, some regions would hit the jackpot, so to speak. This is especially true for the Québec City area. In 1998 and 2003, the area's six constituencies would receive one compensatory seat each, three (1998) or two (2003) getting two each. The same is true for the three Mauricie constituencies, which both times would pull off not only double seaters, but even in some cases triple seaters. **This approach greatly rewards regions where races are close, to the detriment of regions that massively support the same party: losers score the highest in closely fought regions.** For this reason, not only Ouest de Montréal and Outaouais, but also in 1998 Saguenay—Lac-Saint-Jean and Côte-Nord, would come up empty-handed in the distribution of compensatory seats. In the race for compensatory seats, the advantage goes to constituencies where the vote is divided up fairly equally among the parties. Constituencies that massively support one party are disadvantaged.

Such distortions are problematic. Unless used within regions, the “Best Losers” method leads to a massive and erratic transfer of seats based not on population but on the closeness of electoral wins. It is understandable that Baden-Württemberg, a Land with strong local attachments, prudently chose to apply this method within the bounds of four regional entities to prevent compensatory seats from ending up entirely in a single region.<sup>17</sup>

On the other hand, when applied to a 26-region boundary delimitation, in the 1998 and 2003 elections, the “Best Losers” method produces no serious regional distortions. Each region receives an appropriate number of compensatory seats.

The problem of triple seaters still arises, but less so. Only three constituencies would have triple seats in 1998, and five in 2003. The overwhelming majority of constituencies would have 1 or 2 seats.

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<sup>17</sup> This Land resulted from the merger in 1952 of the Länder of Baden, Württemberg-Baden, and Württemberg-Hohenzollern, following a referendum in which most Baden voters came out against the proposed merger.

A new problem arises, however. When compensation is done within a small region (3 constituencies and 2 compensatory seats), a party may be entitled to 4 or even 5 seats, yet its three constituency candidates have already been elected. The party has no best loser to reward, simply because it has no loser at all! The phenomenon occurs in regions that tend to support massively the same party.

Who in this case will get the compensatory seat? In Baden-Württemberg, the seat is assigned to the constituency where the recipient party scored the highest within the region. Thus, the party receives not only a direct mandate but also a second mandate. The seat goes to a substitute designated before the election at the same time as the candidate. Since the introduction of this provision in 1956, such an outcome has occurred only five times, always in the region of Tübingen, which very strongly supports the CDU. Specifically, it occurred in the constituency of Biberach in three of the five cases.

The "Biberach problem" is marginal in Baden-Württemberg (fewer than half a dozen cases in 45 years). **In Québec, however, it would be endemic.** In 1998, it would have occurred in no fewer than 7 of the 26 regions and involved 8 MNAs (2 MNAs within the same region). These cases are in the regions of Ile-de-Montréal, Outaouais, and Saguenay—Lac-Saint-Jean. In 2003, this problem would have occurred in five regions and involved 6 seats.

While it may remain attractive for those who find party lists abhorrent, the "Best Losers" method produces anomalies, whatever the regional framework. If this approach is used with small and numerous regions, a "standby list" will clearly be needed for overcoming the "Biberach problem". Maybe this explains why this method is followed in very few jurisdictions (Baden-Württemberg and the Italian Senate appear to be the only ones) and has been abandoned by West Berlin.

## Conclusion

Our research confirmed most of the conventional wisdom about the political consequences of the various features of an MMP system. District magnitude plays a central role: near-perfect proportionality can be reached with provincewide compensation, provided there is no threshold. The smaller the regions become, the less proportional the outcomes. Techniques like D'Hondt, Ste-Laguë and largest remainder had the expected consequences, which increase with the number of regions.

Our research sheds much new light on the so-called overhang seats that bedevil the German electoral system. There had been no systematic study of the features that foster such seats. We showed that the driving force is of course the distortion between the share of the popular vote and the number of constituency seats won by the leading party (the higher the distortion, the higher the number of overhang seats), but that other factors play a role. Small regions tend to foster overhang seats, while D'Hondt tends to minimize them.

Our adaptation of the Scottish method to Ste-Laguë and the largest remainder was an worthwhile exercise of imagination, but the outcomes proved unfair and disappointing. It is unlikely that such combinations will ever be selected in the real world.

Provincial compensation followed by a redistribution among regions of seats won by each party offered at first sight an attractive compromise between the competing desires of securing proportionality and having smaller regions. However, we found disturbing consequences, like a region ending up with no list seat at all, or the uncertainty about how many seats each region will end with. Unless a country is willing to accept encroachments on Rep. by Pop., as Germans are, this is an option legislators should be wary of.

Finally, the best-loser method for filling compensatory seats will likely lead to odd situations. In view of these, it is not surprising that this method has been selected in so few jurisdictions so far.

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**Table 1. Outcome summary — German-style regional compensation — 1998 election**

Number of regions and technique	Total	QLP	PQ	ADQ	Overhang seats
26 regions					
D'Hondt	125	60 <i>48.00</i>	59 <i>47.20</i>	6 <i>4.80</i>	1 (PQ)
Sainte-Laguë	131	55 <i>41.98</i>	59 <i>45.04</i>	17 <i>12.98</i>	7 (QLP 1; PQ 6)
Largest Remainder	130	54 <i>41.54</i>	59 <i>45.38</i>	17 <i>13.08</i>	6 (QLP 1; PQ 5)
16 regions					
D'Hondt	125	58 <i>46.40</i>	59 <i>47.20</i>	8 <i>6.40</i>	1 (PQ)
Sainte-Laguë	131	57 <i>43.51</i>	58 <i>44.27</i>	16 <i>12.21</i>	7 (QLP 1; PQ 6)
Largest Remainder	131	56 <i>42.75</i>	58 <i>44.27</i>	17 <i>12.98</i>	7 (QLP 1; PQ 6)
13 regions					
D'Hondt	125	58 <i>46.40</i>	57 <i>45.60</i>	10 <i>8.00</i>	1 (PQ)
Sainte-Laguë	127	54 <i>42.52</i>	57 <i>44.88</i>	16 <i>12.60</i>	3 (PQ)
Largest Remainder	127	54 <i>42.52</i>	57 <i>44.88</i>	16 <i>12.60</i>	3 (PQ)
4 regions					
D'Hondt	125	56 <i>44.80</i>	55 <i>44.00</i>	14 <i>11.20</i>	1 (PQ)
Sainte-Laguë	125	56 <i>44.80</i>	55 <i>44.00</i>	14 <i>11.20</i>	1 (PQ)
Largest Remainder	125	56 <i>44.80</i>	55 <i>44.00</i>	14 <i>11.20</i>	1 (PQ)
Provincewide compensation					
D'Hondt	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>	0
Sainte-Laguë	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>	0
Largest Remainder	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>	0



**Table 2. Outcome summary — German-style regional compensation — 2003 election**

Number of regions and technique	Total	QLP	PQ	ADQ	Overhang seats
26 regions					
D'Hondt	133	69 <i>51.88</i>	46 <i>34.59</i>	18 <i>13.53</i>	9 (QLP 5; PQ 4)
Sainte-Laguë	135	66 <i>48.89</i>	46 <i>34.07</i>	23 <i>17.04</i>	11 (QLP 6; PQ 5)
Largest Remainder	135	63 <i>46.67</i>	46 <i>34.07</i>	26 <i>19.26</i>	11 (QLP 6; PQ 5)
16 regions					
D'Hondt	131	65 <i>49.62</i>	45 <i>34.35</i>	21 <i>16.03</i>	7 (QLP 4; PQ 3)
Sainte-Laguë	131	63 <i>48.09</i>	44 <i>33.59</i>	24 <i>18.32</i>	7 (QLP 4; PQ 3)
Largest Remainder	131	63 <i>48.09</i>	43 <i>32.82</i>	25 <i>19.08</i>	7 (QLP 4; PQ 3)
13 regions					
D'Hondt	128	66 <i>51.56</i>	44 <i>34.38</i>	18 <i>14.06</i>	4 (QLP 3; PQ 1)
Sainte-Laguë	129	62 <i>48.06</i>	44 <i>34.11</i>	23 <i>17.83</i>	5 (QLP 3; PQ 2)
Largest Remainder	129	62 <i>48.06</i>	44 <i>34.11</i>	23 <i>17.83</i>	5 (QLP 3; PQ 2)
4 regions					
D'Hondt	126	62 <i>49.21</i>	43 <i>34.13</i>	21 <i>16.67</i>	2 (QLP)
Sainte-Laguë	126	61 <i>48.41</i>	43 <i>34.13</i>	22 <i>17.46</i>	2 (QLP)
Largest Remainder	126	62 <i>49.21</i>	42 <i>33.33</i>	22 <i>17.46</i>	2 (QLP)
Provincewide compensation					
D'Hondt	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>	0
Sainte-Laguë	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>	0
Largest Remainder	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>	0

**Table 3. German-style regional compensation — Number of overhang seats produced by different regional boundary delimitations**

Number of regions	Mean number of overhang seats per election	Total number of seats		Rate of increase of parliamentary representation (%)
		Expected	Actual	
26	7.6	124	132	+ 6.5
16	6.0	124	130	+ 4.8
13	3.5	124	128	+ 2.8
4	1.5	124	126	+ 1.2
1	0.0	124	124	-

**Table 4. Outcome summary — Provincewide compensation with regional redistribution — 1998 election**

Number of regions and technique	Total	QLP	PQ	ADQ	Overhang seats
26 regions					
D'Hondt	127	55 <i>43.31</i>	57 <i>44.88</i>	15 <i>11.81</i>	3 (PQ)
Sainte-Laguë	127	55 <i>43.31</i>	57 <i>44.88</i>	15 <i>11.81</i>	3 (PQ)
Largest Remainder	127	55 <i>43.31</i>	57 <i>44.88</i>	15 <i>11.81</i>	3 (PQ)
16 regions					
D'Hondt	130	56 <i>43.08</i>	59 <i>45.38</i>	15 <i>11.54</i>	6 (QLP 1; PQ 5)
Sainte-Laguë	126	55 <i>43.65</i>	56 <i>44.44</i>	15 <i>11.90</i>	2 (PQ)
Largest Remainder	127	55 <i>43.31</i>	57 <i>44.88</i>	15 <i>11.81</i>	3 (PQ)
13 regions					
D'Hondt	126	55 <i>43.65</i>	56 <i>44.44</i>	15 <i>11.90</i>	2 (PQ)
Sainte-Laguë	126	55 <i>43.65</i>	56 <i>44.44</i>	15 <i>11.90</i>	2 (PQ)
Largest Remainder	126	55 <i>43.65</i>	56 <i>44.44</i>	15 <i>11.90</i>	2 (PQ)
4 regions					
D'Hondt	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>	0
Sainte-Laguë	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>	0
Largest Remainder	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>	0

**Table 5. Outcome summary — Provincewide compensation with regional redistribution — 2003 election**

Number of regions and technique	Total	QLP	PQ	ADQ	Overhang seats
26 regions					
D'Hondt	130	62 <i>47.69</i>	45 <i>34.62</i>	23 <i>17.69</i>	6 (QLP 3; PQ 3)
Sainte-Laguë	132	62 <i>46.97</i>	47 <i>35.61</i>	23 <i>17.42</i>	8 (QLP 3; PQ 5)
Largest Remainder	132	62 <i>46.97</i>	47 <i>35.61</i>	23 <i>17.42</i>	8 (QLP 3; PQ 5)
16 regions					
D'Hondt	130	63 <i>48.46</i>	44 <i>33.85</i>	23 <i>17.69</i>	6 (QLP 4; PQ 2)
Sainte-Laguë	130	62 <i>47.69</i>	45 <i>34.62</i>	23 <i>17.69</i>	6 (QLP 3; PQ 3)
Largest Remainder	130	62 <i>47.69</i>	45 <i>34.62</i>	23 <i>17.69</i>	6 (QLP 3; PQ 3)
13 regions					
D'Hondt	128	61 <i>47.66</i>	44 <i>34.38</i>	23 <i>17.97</i>	4 (QLP 2; PQ 2)
Sainte-Laguë	128	61 <i>47.66</i>	44 <i>34.38</i>	23 <i>17.97</i>	4 (QLP 2; PQ 2)
Largest Remainder	128	61 <i>47.66</i>	44 <i>34.38</i>	23 <i>17.97</i>	4 (QLP 2; PQ 2)
4 regions					
D'Hondt	126	60 <i>47.62</i>	43 <i>34.13</i>	23 <i>18.25</i>	2 (QLP 1; PQ 1)
Sainte-Laguë	126	60 <i>47.62</i>	43 <i>34.13</i>	23 <i>18.25</i>	2 (QLP 1; PQ 1)
Largest Remainder	126	60 <i>47.62</i>	43 <i>34.13</i>	23 <i>18.25</i>	2 (QLP 1; PQ 1)

**Table 6. Outcome summary — Scottish-style regional compensation — 1998 election**

Number of regions and technique	Total	QLP	PQ	ADQ
26 regions				
D'Hondt	124	60 <i>48.39</i>	59 <i>47.58</i>	5 <i>4.03</i>
Sainte-Laguë	124	50 <i>40.32</i>	59 <i>47.58</i>	15 <i>12.10</i>
Largest Remainder	124	50 <i>40.32</i>	59 <i>47.58</i>	15 <i>12.10</i>
16 regions				
D'Hondt	124	57 <i>45.97</i>	59 <i>47.58</i>	8 <i>6.45</i>
Sainte-Laguë	124	53 <i>42.74</i>	58 <i>46.77</i>	13 <i>10.48</i>
Largest Remainder	124	52 <i>41.94</i>	58 <i>46.77</i>	14 <i>11.29</i>
13 regions				
D'Hondt	124	57 <i>45.97</i>	57 <i>45.97</i>	10 <i>8.06</i>
Sainte-Laguë	124	53 <i>42.74</i>	57 <i>45.97</i>	14 <i>11.29</i>
Largest Remainder	124	53 <i>42.74</i>	57 <i>45.97</i>	14 <i>11.29</i>
4 regions				
D'Hondt	124	56 <i>45.16</i>	55 <i>44.35</i>	13 <i>10.48</i>
Sainte-Laguë	124	55 <i>44.35</i>	55 <i>44.35</i>	14 <i>11.29</i>
Largest Remainder	124	55 <i>44.35</i>	55 <i>44.35</i>	14 <i>11.29</i>
Provincewide compensation				
D'Hondt	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>
Sainte-Laguë	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>
Largest Remainder	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>

**Table 7. Outcome summary — Scottish-style regional compensation — 2003 election**

Number of regions and technique	Total	QLP	PQ	ADQ
26 regions				
D'Hondt	124	66 <i>53.23</i>	42 <i>33.87</i>	16 <i>12.90</i>
Sainte-Laguë	124	62 <i>50.00</i>	41 <i>33.06</i>	21 <i>16.94</i>
Largest Remainder	124	59 <i>47.58</i>	41 <i>33.06</i>	24 <i>19.35</i>
16 regions				
D'Hondt	124	63 <i>50.81</i>	42 <i>33.87</i>	19 <i>15.32</i>
Sainte-Laguë	124	61 <i>49.19</i>	41 <i>33.06</i>	22 <i>17.74</i>
Largest Remainder	124	61 <i>49.19</i>	40 <i>32.26</i>	23 <i>18.55</i>
13 regions				
D'Hondt	124	65 <i>52.42</i>	43 <i>34.68</i>	16 <i>12.90</i>
Sainte-Laguë	124	61 <i>49.19</i>	42 <i>33.87</i>	21 <i>16.94</i>
Largest Remainder	124	61 <i>49.19</i>	42 <i>33.87</i>	21 <i>16.94</i>
4 regions				
D'Hondt	124	62 <i>50.00</i>	42 <i>33.87</i>	20 <i>16.13</i>
Sainte-Laguë	124	61 <i>49.19</i>	42 <i>33.87</i>	21 <i>16.94</i>
Largest Remainder	124	62 <i>50.00</i>	41 <i>33.06</i>	21 <i>16.94</i>
Provincewide compensation				
D'Hondt	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>
Sainte-Laguë	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>
Largest Remainder	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>

**Table 8. Outcome summary — Moderate regional PR — 1998 election**

Number of regions and technique	Total	QLP	PQ	ADQ
26 regions				
D'Hondt	124	60 <i>48.39</i>	58 <i>46.77</i>	6 <i>4.84</i>
Sainte-Laguë	124	54 <i>43.55</i>	53 <i>42.74</i>	17 <i>13.71</i>
Largest Remainder	124	53 <i>42.74</i>	54 <i>43.55</i>	17 <i>13.71</i>
16 regions				
D'Hondt	124	58 <i>46.77</i>	58 <i>46.77</i>	8 <i>6.45</i>
Sainte-Laguë	124	56 <i>45.16</i>	52 <i>41.94</i>	16 <i>12.90</i>
Largest Remainder	124	55 <i>44.35</i>	52 <i>41.94</i>	17 <i>13.71</i>
13 regions				
D'Hondt	124	58 <i>46.77</i>	56 <i>45.16</i>	10 <i>8.06</i>
Sainte-Laguë	124	54 <i>43.55</i>	54 <i>43.55</i>	16 <i>12.90</i>
Largest Remainder	124	54 <i>43.55</i>	54 <i>43.55</i>	16 <i>12.90</i>
4 regions				
D'Hondt	124	56 <i>45.16</i>	54 <i>43.55</i>	14 <i>11.29</i>
Sainte-Laguë	124	56 <i>45.16</i>	54 <i>43.55</i>	14 <i>11.29</i>
Largest Remainder	124	56 <i>45.16</i>	54 <i>43.55</i>	14 <i>11.29</i>
Provincewide constituency				
D'Hondt	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>
Sainte-Laguë	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>
Largest Remainder	124	55 <i>44.35</i>	54 <i>43.55</i>	15 <i>12.10</i>

**Table 9. Outcome summary — Moderate regional PR — 2003 election**

Number of regions and technique	Total	QLP	PQ	ADQ
26 regions				
D'Hondt	124	64 <i>51.61</i>	42 <i>33.87</i>	18 <i>14.52</i>
Sainte-Laguë	124	60 <i>48.39</i>	41 <i>33.06</i>	23 <i>18.55</i>
Largest Remainder	124	57 <i>45.97</i>	41 <i>33.06</i>	26 <i>20.97</i>
16 regions				
D'Hondt	124	61 <i>49.19</i>	42 <i>33.87</i>	21 <i>16.94</i>
Sainte-Laguë	124	59 <i>47.58</i>	41 <i>33.06</i>	24 <i>19.35</i>
Largest Remainder	124	59 <i>47.58</i>	40 <i>32.26</i>	25 <i>20.16</i>
13 regions				
D'Hondt	124	63 <i>50.81</i>	43 <i>34.68</i>	18 <i>14.52</i>
Sainte-Laguë	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>
Largest Remainder	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>
4 regions				
D'Hondt	124	60 <i>48.39</i>	43 <i>34.68</i>	21 <i>16.94</i>
Sainte-Laguë	124	59 <i>47.58</i>	43 <i>34.68</i>	22 <i>17.74</i>
Largest Remainder	124	60 <i>48.39</i>	42 <i>33.87</i>	22 <i>17.74</i>
Provincewide constituency				
D'Hondt	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>
Sainte-Laguë	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>
Largest Remainder	124	59 <i>47.58</i>	42 <i>33.87</i>	23 <i>18.55</i>



**Table 10. Distortion level — Gallagher's index — German-style regional compensation — 1998 election**

Number of regions	D'Hondt technique	Sainte-Laguë technique	Largest Remainder technique
26	6.65	2.14	2.51
16	5.33	1.17	1.52
13	3.92	1.78	1.78
4	1.39	1.39	1.39
Provincewide compensation	0.95	0.95	0.95

**Table 11. Distortion level — Gallagher's index — German-style regional compensation — 2003 election**

Number of regions	D'Hondt technique	Sainte-Laguë technique	Largest Remainder technique
26	5.47	2.46	1.42
16	3.22	1.77	1.89
13	5.05	1.86	1.86
4	2.75	2.11	2.51
Provincewide compensation	1.55	1.55	1.55

**Table 12. Distortion level — Gallagher's index — Provincewide compensation with regional redistribution — 1998 election**

Number of regions	D'Hondt technique	Sainte-Laguë technique	Largest Remainder technique
26	1.54	1.54	1.54
16	1.90	1.25	1.54
13	1.25	1.25	1.25
4	0.95	0.95	0.95

**Table 13. Distortion level — Gallagher's index — Provincewide compensation with regional redistribution — 2003 election**

Number of regions	D'Hondt technique	Sainte-Laguë technique	Largest Remainder technique
26	1.84	2.11	2.11
16	2.06	1.84	1.84
13	1.71	1.71	1.71
4	1.61	1.61	1.61

**Table 14. Distortion level — Gallagher's index — Scottish-style regional compensation — 1998 election**

Number of regions	D'Hondt technique	Sainte-Laguë technique	Largest Remainder technique
26	7.31	4.08	4.08
16	5.36	3.02	3.06
13	3.69	2.36	2.36
4	1.89	1.37	1.37
Provincewide compensation	0.95	0.95	0.95

**Table 15. Distortion level — Gallagher's index — Scottish-style regional compensation — 2003 election**

Number of regions	D'Hondt technique	Sainte-Laguë technique	Largest Remainder technique
26	6.42	3.11	1.68
16	4.10	2.47	2.56
13	6.04	2.64	2.64
4	3.35	2.64	3.11
Provincewide compensation	1.55	1.55	1.55

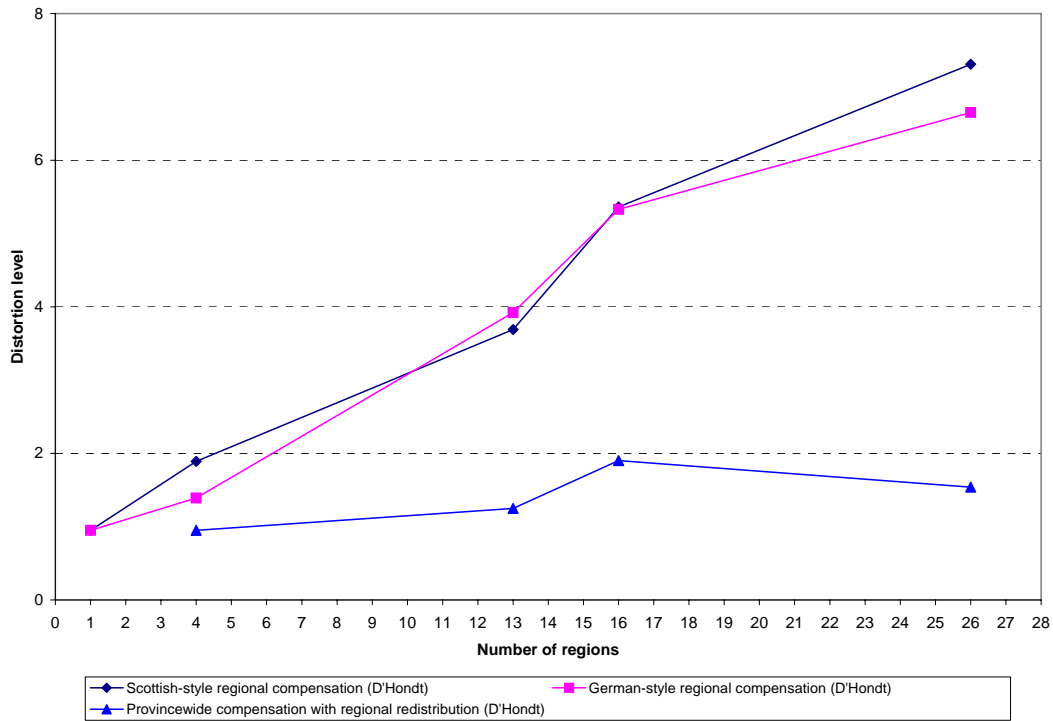
**Table 16. Average distortion levels in Québec, in other Canadian provinces, and in 36 sovereign democratic countries — Elections from 1945 to 1996**

Country	Average distortion level	Electoral system*
The Netherlands	1.30	PR
Israel	1.65	PR
Denmark	1.83	PR
Sweden	2.09	PR
Malta	2.36	STV
Austria	2.47	PR
Germany	2.52	CMS
Switzerland	2.53	PR
Finland	2.93	PR
Columbia	2.96	PR
Belgium	3.24	PR
Italy	3.25	PR
Luxembourg	3.26	PR
Ireland	3.45	STV
Portugal	4.04	PR
Costa Rica	4.13	PR
Iceland	4.25	PR
Venezuela	4.28	PR
France (1945-1956 and 1986 elections)	4.86	PR
United States	4.90	FPP
Norway	4.93	PR
Japan	5.03	SNTV
Greece	8.08	PR
Spain	8.15	PR
Australia	9.26	AV
Papua New Guinea	10.06	FPP
United Kingdom	10.33	FPP
New Zealand	11.11	FPP
India	11.38	FPP
Canada	11.72	FPP
Botswana	11.74	FPP
Manitoba	12.32	FPP-AV-STV
Trinidad	13.66	FPP
France (1958-1981 and 1988-1993 elections)	14.87	2-ballot run-off
Bahamas	15.47	FPP
Barbados	15.75	FPP
Mauritius	16.43	FPP
New Brunswick	16.58	FPP
Newfoundland	16.61	FPP
British Colombia	16.66	FPP-AV
Ontario	17.46	FPP
Jamaica	17.75	FPP
Québec	18.74	FPP
Nova Scotia	18.92	FPP
Saskatchewan	19.92	FPP
Prince Edward Island	20.47	FPP
Alberta	24.47	FPP-AV-STV

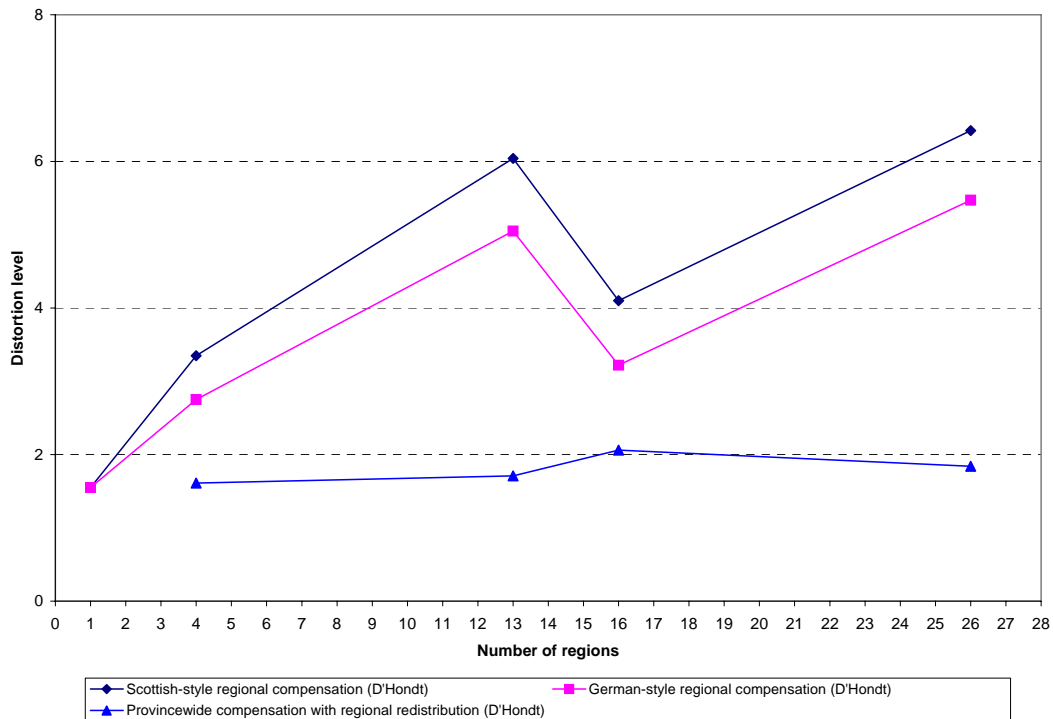
\* PR: proportional representation; STV: single transferable vote; SNTV: single non-transferable vote; AV: alternative vote; FPP: first-past-the post (single ballot plurality); 2-ballot run-off: double ballot run-off; CMS: compensatory mixed system.

Source: Arend LIJPHART, *Patterns of Democracy. Government Forms and Performance in Thirty-Six Countries*, New Haven and London, Yale University Press, 1999, pp. 160 and 162. Data for France have been broken down by electoral system: PR or double ballot run-off. For Québec and other Canadian provinces, computations were made by Angelo Elias, excluding elections held after 1996, to correspond to the period covered by the table.

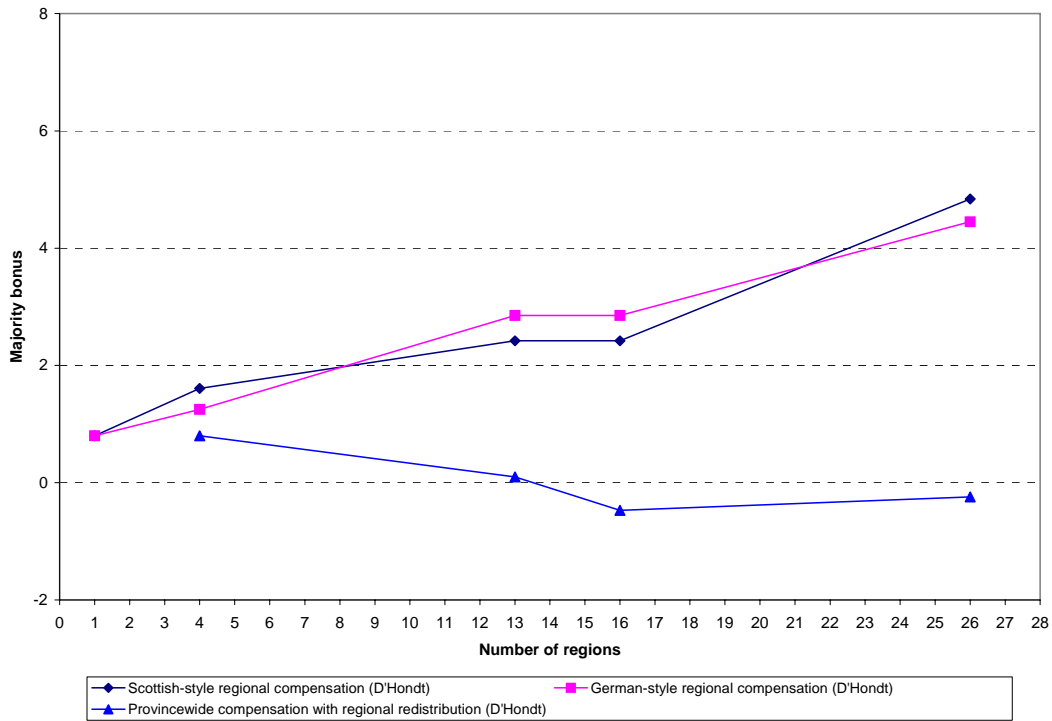
**Figure 1. Votes-seats distortion level (Gallagher index) produced by each scenario – Average level – 1998 Election**



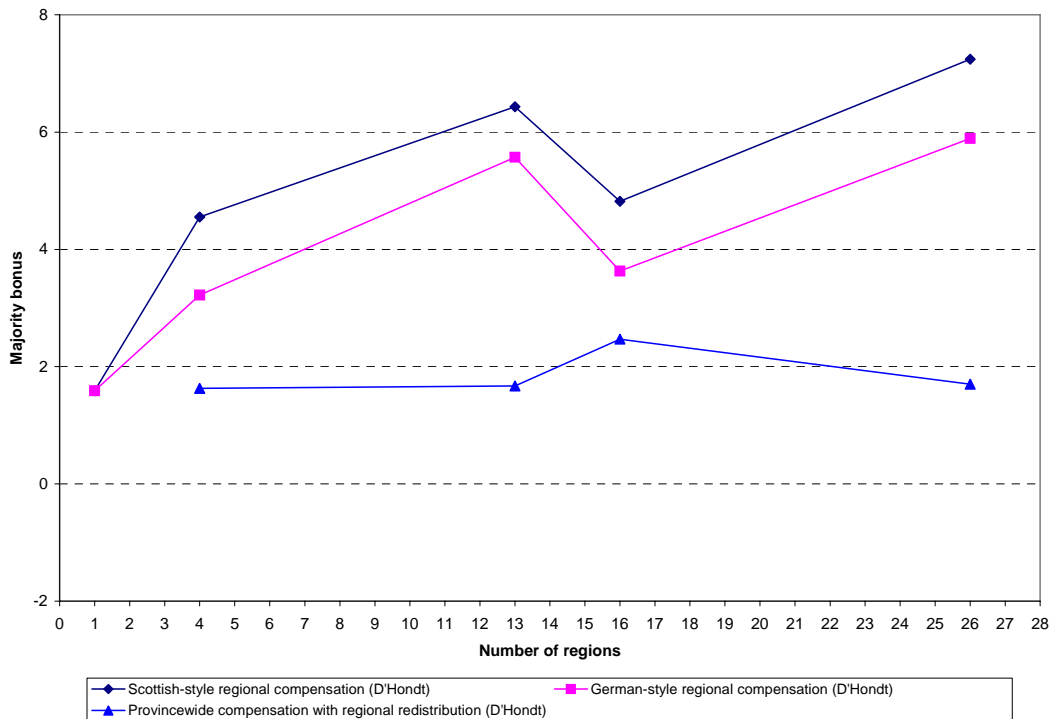
**Figure 2. Votes-seats distortion level (Gallagher index) produced by each scenario – Average level – 2003 Election**



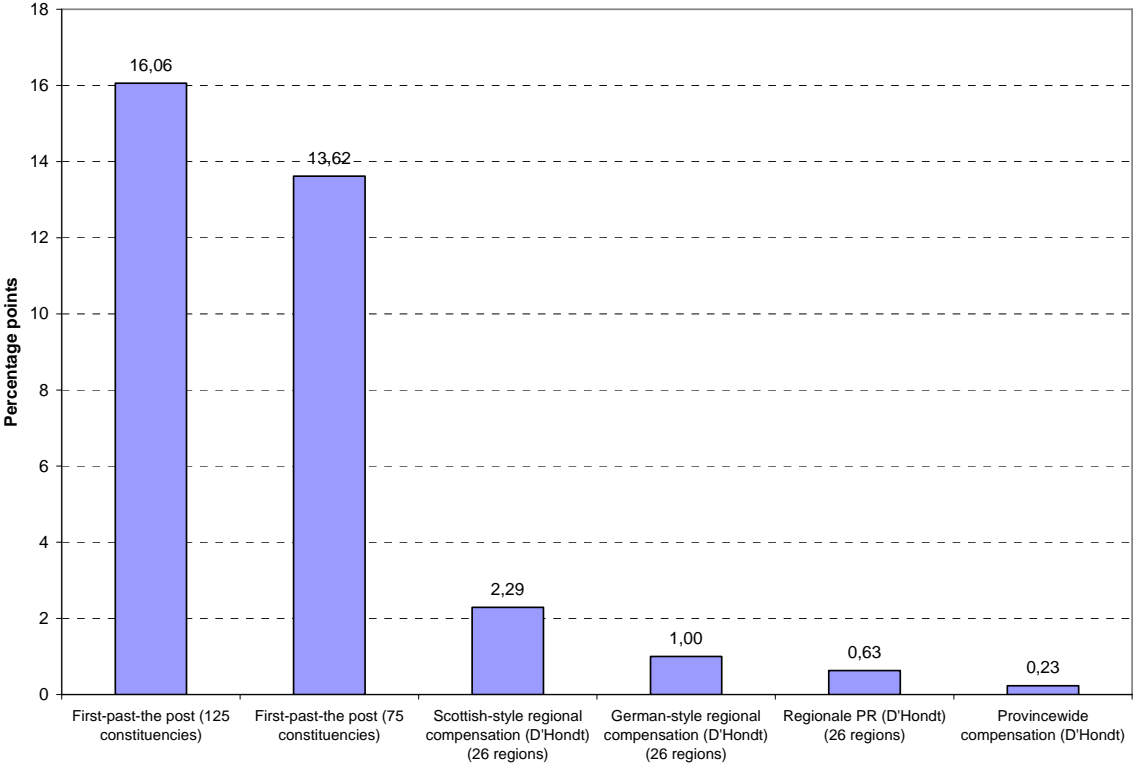
**Figure 3. Bonus for the strongest party (in percentage of vote) produced by each scenario – Average level – 1998 Election**



**Figure 4. Bonus for the strongest party (in percentage of vote) produced by each scenario – Average level – 2003 Election**

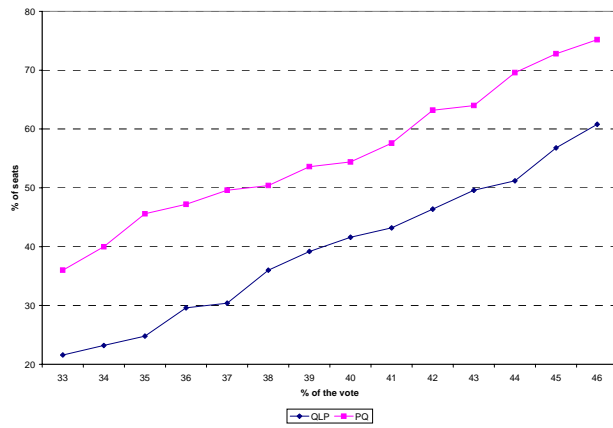


**Figure 5. Degree of asymmetry produced by each scenario – Average spread between the two parties in their seat standings, with an equal percentage of vote**

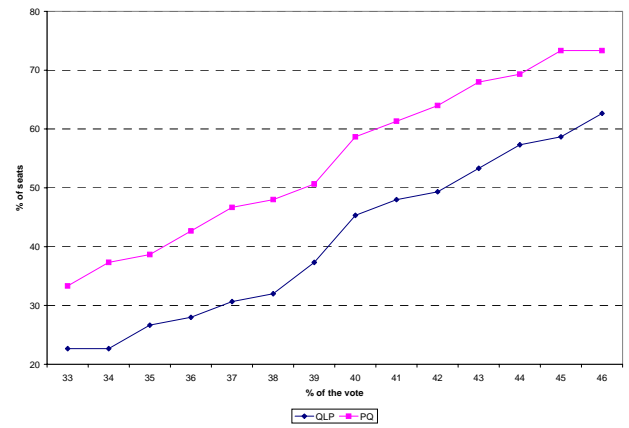


**Figure 6. Percentage of seats won by the two main parties with same percentage of the vote – 2003 election**

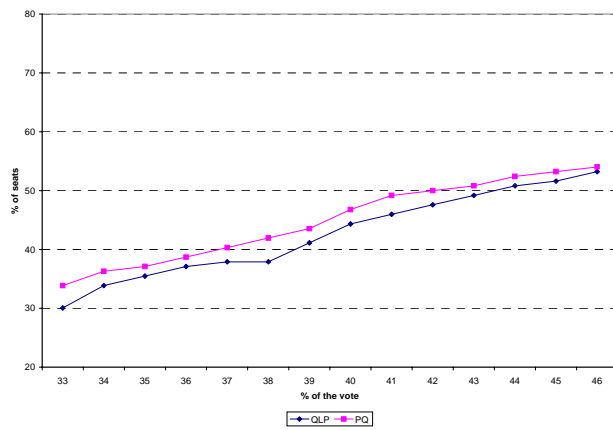
a) First-past-the-post – 125 constituencies



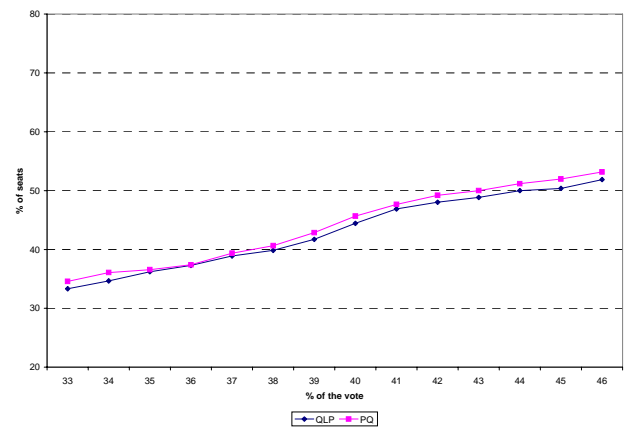
b) First-past-the-post – 75 constituencies



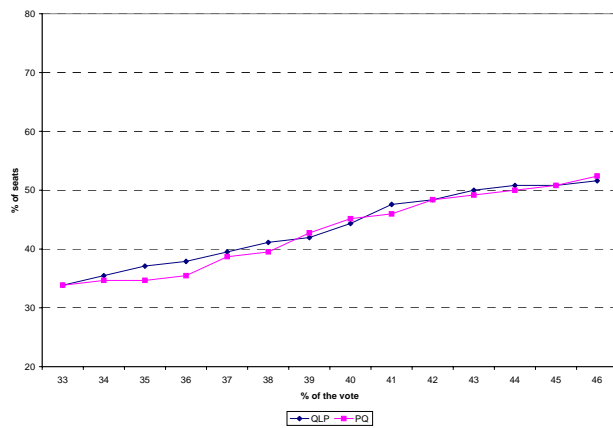
c) Scottish regional compensation (D'Hondt) – 26 regions



d) German regional compensation (D'Hondt) – 26 regions



e) Regional PR (D'Hondt) – 26 regions



f) Provincewide compensation (D'Hondt)

