

COLLECTIVE DECISIONS BASIC APPROACHES

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Abstract

One of the most important human ability is a creative decision making approach. In modern world social-economic life is extremely valuable the representative democracy with its main part – election process and all respective attributes. The arrangement of the final elective results frequently confronted with a problem of the representative proportionality of the voted items. In conditions of high legislative diversity and particular social ambiance is required to apply specific techniques for solve the problem of results rounding to integer disproportionality. Many factors can influence the applied methods to solve this problem, but it is obstacle to be past – impossibility to choose necessary method through statistical experiments. In such conditions computer simulation of the elective results disproportionality problem can be used. Main modern approaches to collective decision optimization are analyzed in this paper.

Key words: *collective decisions, multi-optional decisions, proportional representation, electoral formula, index of disproportionality.*

JEL CLASSIFICATION: C-61

1. Introduction. People make decisions at every step. With the development of society, the role of effective decisions increases. Decisions are often complex, both by the number of factors that influence them and by the formalized or informal methods after which they are taken. In particular, these methods have to be seen in the context of the increasingly accelerated deployment of cybernetic systems with increased autonomy and more and more elements integrated by Artificial Intelligence (AI).

When involved in the decision-making process of several decision-makers, the decision can be taken by different methods, but it is usually taken by their vote. Of the voting systems used in practice, a peculiar interest is frequently represented by the multiple systems with **proportional representation** (PR). As an example of a multi-level PR system could serve to elect deputies in Parliament on party lists.

2. Systems with proportional representation. When it is taking the collective decisions by proportional representation, it is necessary to minimize the disproportion of the representation of decision makers' in the final option (decision) - a disproportion caused by the character of both the number of decision-makers and the alternative option. The estimation of such disproportion involves the special indices usage, many of which are described in [1], [3].

The most popular practices regarding the use of voting systems are probably those related to electoral polls. Therefore, the optimization aspects of such systems need to be analyzed, without diminishing from universality, through electoral ballots with proportional representation of elective unit lists (parties, coalitions, blocks). Proportional representation implies the distribution of mandates proportional to the number of votes accumulated by the parties.

A perfectly proportional election is one in which every party wins seats in exact proportion to its share of the votes. An elective unit with N per cent of the votes wins N per cent of the seats, an elective unit with 5 per cent of the votes wins 5 per cent of the seats, and so on. Disproportionality, then, refers to the degree to which the actual result deviates from this ideal. In order to compare levels of disproportionality across lots of elections, we need a way of measuring it. The difficulty is that there are many – indeed, in principle, infinitely many – ways such measuring.

The measurement of electoral disproportionality figures prominently in the agenda of different electoral systems research. The interest in disproportionality emanates both from a desire to quantify the performance of electoral systems against a normative benchmark of fair or proportional allocation, but also because of the influence of this phenomenon in shaping the party system. One of the established tenants of this research is that there is no unique, universally accepted way to measure disproportionality.

The aggregation of the voting results in order to obtain the collective decision (determining the number of mandates that each party has to vote) requires the application of certain rules, also called formulas, methods or algorithms, some of which are described in [1], [2], [4]; they will still be called "Voting-Decision rules" (VD rules).

The diversity of VD rules used, including *Hamilton*, *Jefferson*, *Webster*, *d'Hondt*, *Sainte-Laguë*, *modified Sainte-Laguë*, *Hamilton-Hill* and few others, is caused, first of all, by the diversity of polls. In similar cases in different countries, different methods of distributing mandates between parties apply. For example, in the elections, the *Hamilton* (Hare) method is applied in Germany, Russia, Ukraine, Rep. Korea, Mexico, Iceland and Slovenia, the *d'Hondt* method - in Sweden, Norway, Norway, Switzerland, Japan, the Netherlands, Israel, Poland, Peru, Portugal, Spain, Hungary, Thailand, Denmark and New Zealand.

According to many expert opinions, fortunately for democracy, many people that participate in elections tend to overestimate their own efficacy. One well-known study documenting this tendency comes from political scientist Terry Moe [3], who found that members of the economic organizations he surveyed tended to overestimate the extent to which their own dues and other contributions would help the organizations achieve their goals.

But, in the same time, the decision may vary, sometimes considerably, depending on the method used. This can lead to unwanted effects. For example, if the Hamilton method, which provides the slightest disproportionality and not the d'Hondt method that have more taught effect, can change the election result [2].

In many cases, it is recommended also to estimate the influence of the *electoral threshold*, that is an entry barrier that is intended to keep small parties out of parliament and is commonly found in countries that use proportional representation. Proportional systems are based on the principle that the legislative body should closely reflect preferences of the voters. None of the forms of the proportional system, however, guarantee full and perfect proportionality. First of all, perfection is mathematically impossible. Second, even those who support proportional representation acknowledge that it has weaknesses when carried too far, as it may cause a proliferation of parties and a fragmented parliament, which may lead to governmental instability. Consequently, all proportional systems have built-in mechanisms that change the conversion of votes into seats, to some extent or other. The electoral threshold is a classic example of such a mechanism within the proportional electoral system, which eschews pure proportionality in pursuit of other objectives.

3. Measures of disproportionality. A formulation of the general problem of minimizing disproportionality and the solution for use as a criterion for optimizing the average relative deviation index is very important and it was analyzed in many researches. In the way to minimize disproportionality in decision-making systems such as Hamilton, Sainte-Laguë, d'Hondt, Huntington-Hill, mixed, and so on, and to simulate their efficiency, probably will be easier to use an unique optimization index of Average Relative Deviation (ARD).

Such indexes, in their specific ambiances, were widely applied in different analyses and approaches. *Michael Gallagher*, who created the index, included "other" parties as a whole category, and *Arend Lijphart* modified it, excluding those parties. Unlike the well-known *Loosemore-Hanby* index, the *Gallagher* index is less sensitive to small discrepancies. The index weighs the deviations by their own value, creating a responsive index, ranging from 0 to 100. The larger the differences between the percentage of the vote and the percentage of seats summed over

all parties, the larger the Gallagher index. The larger the index value the larger the disproportionality and vice versa [3].

The *Gallagher* index responds to the intuition that a few big deviations matter more than many small ones by giving bigger deviations greater weight. It measures an electoral system’s relative disproportionality between votes received and seats allotted in a legislature. As such, it measures the difference between the percentage of votes each party gets, and the percentage of seats each party gets in the resulting legislature—and it measures this dis-proportionality from all parties collectively in any one given election. This collective dis-proportionality from this one election is given a precise score, which can then be used in comparing various levels of proportionality among various elections from various electoral systems.

Specifically, it starts, like the *Loosemore-Hanby* index, with the difference between each party’s vote share and its seat share, but then it squares each of these differences before summing them. It then divides the sum by two and takes the square root in order to leave us on roughly the scale that we started with. The *Sainte-Laguë* index simply takes the square of the vote-seat deviation for each party, divides it by that party’s vote share, and then sums these values across all the parties.

The issue of whether absolute or relative measures of proportionality should be preferred, and he concluded in favor of the former. The relative measure that he tested was yet another index – the d’*Hondt* index – which does indeed produce some very counter-intuitive results.

It is important to mention the *World Election Indexes Report* that represents pure statistical report [4]. The countries included in this report include the standard set that tend to feature in comparative politics analyses and, relatedly of course, are covered in the sources listed above. As many other countries as possible are also included for particular elections, dependent on the availability of reliable and adequately disaggregated results. A complication that affects the calculation of *Eff N_s* in a few cases is that groups of parties may contest an election as a coalition in order to reap the benefits of size and then disaggregate after the election.

In [4] are presented the values of three indexes for Moldova’s case:

- 1) the *least squares index* (LSq), which measures disproportionality between the vote distribution and the seat distribution;
- 2) the *effective number of parties at the electoral level* (*Eff N_v*, also termed ENEP);
- 3) the *effective number of parties at the parliamentary or legislative level* (*Eff N_s*, also termed ENPP).

Table 1. Republic of Moldova - election indexes for Parliamentary [4]

Year	LSq	Eff N _v	Eff N _s	N seats
1994	9.49	3.95	2.62	104
1998	10.28	5.78	3.43	101
2001	16.34	3.52	1.85	101
2005	9.13	3.27	2.31	101
2009 Apr	8.64	3.43	2.45	101
2009 Jul	2.94	3.70	3.32	101
2010	3.65	3.73	3.23	101
2014	7.06	6.58	4.80	101

CONCLUSIONS

Essentially, measures of electoral disproportionality arise from the estimation of the parameters of some postulated low-dimensional representation of a generically multidimensional process. The significant gains on the empirical fit of this representation are achieved if at least two parameters are included in this approximation: one to assess severe disproportionality in the form of electoral thresholds, and another to represent weak (dis)proportionality or responsiveness. Through the use of simulation techniques it will be possible to simultaneously estimate these two quantities

from actual electoral returns. The resultant two-dimensional summary of the electoral system is in many respects superior for the purposes of comparative empirical work.

It might be that lots of small deviations matter less than a few large ones. Equally, however, it might not. If, say, all the under-represented parties belong to one likely coalition while all the over-represented parties belong to another, then the multiple small disproportionalities could add up to make a big difference to the overall result.

In general case, it is necessary to measure disproportionality using what is sometimes called the Proportionality Deviation Score (PDS). In order to differentiate it clear from other measures, it is necessary to follow standard practice among political scientists and refer to it as the Loosemore-Hanby index, named after the two authors who originally proposed it (Loosemore and Hanby 1971) [5]. This index looks at the deviation between each elective unit's (party's) vote share and its seat share: if an elective unit obtains, say 25 per cent of the votes and 20 per cent of the seats, the deviation is 5. The index adds up the absolute values of these deviations across all parties running in the election and divides the total by two.

This index became the standard measure of disproportionality. It represents the percentage of parliamentary seats that all of the over-represented parties combined hold above their proportional share (or, equivalently the deficit experienced by all the under-represented parties). As an example of such deviation, frequently is given an example of the UK general election of 2015, in which the value of the Loosemore-Hanby index was 24.0. That means that the parties whose seat shares exceed their vote shares (all parties in UK Parliament) collectively hold 24 per cent of the seats in the House of Commons more than they would if they were represented in exact proportion to their votes – that is, about 156 seats more. Conversely, the under-represented parties collectively hold about 156 seats fewer than they would in the case of perfect proportionality.

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