PERIODICA POLYTECHNICA SER. SOC. MAN. SCI. VOL. 6, NO. 2, PP. 105-128 (1998)

ESTIMATION OF DISTRIBUTION OF PARLIAMENT SEATS BASED ON POLL DATA*

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Received: Dec. 10, 1998

Abstract

Due to the multiple connections the Hungarian election system is unstable. Poll data cannot be applied directly in estimating parliament seats. In this publication we present an estimation method, which gives a relatively good estimation of distribution of parliament seats, based on the little experience and if several hypotheses are accepted. A part of the hypotheses which form the basis of our method were tested, while the other part can only be proved by time.

Keywords: election, forecast.

1. Introduction

We have been creating a political and social statistics geographic information system named Polis since 1990, in the Department of Sociology at the Technical University of Budapest. We intend to use it for rigorous analysis of election data. To achieve this, we had to incorporate the election data in a system broken down to voting wards. Just like to census data, we processed the data in the most detailed form, that is for each census ward. Generally we wanted to use the same solution, so that any new data group can be incorporated by aggregating at the smallest territorial unit. We have presented Polis in a publication titled *Hungarian Political Atlas*[1] and in several articles. The main frames of the system were complemented in 1996 with model simulating the election systems. The model surveys the effects of a modification of the present election system on the distribution of parliament seats. In creating our model, we tried to build in as much

*Sources of data used for the publication: KSH Census, BM Election Office, TÁRKI and GALLUP. The research was sponsored by OTKA, OKTK and the Konrad Adenauer Foundation.

[1] József MÉSZÁROS – István SZAKADÁT: Hungarian Political Atlas, Budapest, Konrad Adenauer Foundation, 1995.

as possible modifications.[2] After creating the above model the need arose to further develop Polis, which we did in 1996, we searched for methods, algorithms with which distribution of parliament seats could be estimated based on poll data. This part of our system will be presented in this study. Our student, Lajos Nagy, helped in creating the system and in doing the calculations.

1.1. Introduction of the Hungarian Election System

The Hungarian election system is regulated by Act CCCIX of 1989, Act II of 1990, Constitutional Court Decree No. 3/1990 (III.4.), Act XLV of 1990, Constitutional Court Decree No. 6/1991 (II.28.), Constitutional Court Decree No. 8/1991 (III.5.), Act XX of 1991, Act LXVI of 1992, and Act III of 1994.

The election system can be described in general as follows:

1.1.1.

The total number of Members of the Parliament: 386.

1.1.2.

176 MPs are elected in individual election districts (EVK), 152 are elected in county and municipal election districts (regional election districts) on party lists. On the basis of aggregate number of votes not qualifying for mandate and cast in individual and regional election districts, the parties received further 58 compensation mandates from the national list.

1.1.3.

In the Capital 32 and in the counties 144 individual mandates are distributed (Baranya 7, Bács-Kiskun 10, Békés 7, Borsod-Abaúj-Zemplén 13, Csongrád 7, Fejér 7, Győr-Moson-Sopron 7, Hajdú-Bihar 9, Heves 6, Jász-Nagykun-Szolnok 8, Komárom-Esztergom 5, Nógrád 4, Pest 16, Somogy 6, Szabolcs-Szatmár-Bereg 10, Tolna 5, Vas 5, Veszprém 7, Zala 5).

[2] József MÉSZÁROS – István SZAKADÁT: Election processes – election systems, BME Sociology Dept. Publications 2., Budapest, 1993.

1.1.4.

There are 28 mandates in the Capital and 124 mandates in the counties available on regional lists (Baranya 6, Bács-Kiskun 8, Békés 6, Borsod-Abaúj-Zemplén 11, Csongrád 6, Fejér 6, Győr-Moson-Sopron 6, Hajdú-Bihar 8, Heves 5, Jász-Nagykun-Szolnok 6, Komárom-Esztergom 5, Nógrád 4, Pest 14, Somogy 5, Szabolcs-Szatmár-Bereg 9, Tolna 4, Vas 4, Veszprém 6, Zala 5).

1.1.5.

The number of mandates available on the national list: 58.

1.2.1.

To be a candidate in an individual election district at least 750 citizens with voting rights are required to sign the nomination of the prospective candidate. A party which has a candidate in one quarter of individual election districts in a regional electoral district but in at least two individual election districts is entitled to set up a regional list. A national list can be set up by the party that has compiled a list in at least 7 election districts.

1.3.1.

In individual election districts the candidate receiving more than 50% of the valid votes in the first round of elections will be elected to the Parliament, on condition that more than 50% of the citizens with voting rights in the election district in question cast their votes.

1.3.2.

If in the first round of elections more than 50% of the citizens with voting rights cast their votes, but neither candidate received more than 50% of the votes cast (hereinafter unsuccessful election round), the second round of the election will include:

a) candidates receiving at least 15% of valid votes cast in the first round or if there are no such candidates the three candidates receiving the

highest number of votes in the first round. If anyone of the candidates withdraws from the elections in the meantime there shall be no substitute candidate, and

b) that candidate shall be elected to the Parliament, who receives the highest number of valid votes, on condition that more than 25% the citizens with voting rights of the election district in question cast their votes.

1.3.3.

a) The party list candidates receive mandates in regional election districts in proportion to the votes cast (in such a way that by adding one to the available mandates in the election district the total number of valid votes is divided by this number, and the quotient received this way is the number of votes required for obtaining the mandate) in their order of appearance on the voting card, on condition that more than 50% of the citizens with voting rights cast their votes.

b) If the first round of elections in a regional election district is invalid, because less than half of the citizens with voting rights cast their votes, all party lists participating in the first round can take part in the second round. The method of calculation is the same as in point a), on condition that more than 25% of citizens with voting rights cast their votes.

1.3.4.

If there are unfilled mandates in the regional election district following calculations according to point 3, the list having insufficient number of votes for one mandate but more than two thirds of the limit shall also receive a mandate. In the case of more than one such list, the list receiving the highest number of votes shall receive the mandate. If there are unfilled mandates following the calculation, these mandates are added to the number of mandates available on the national list.

1.3.5.

If a mandate is obtained according to point 4, the difference between the number of votes required for obtaining the mandate and the number of votes actually received shall have to be subtracted from the national aggregate fragment vote number of the party presenting the candidate.

1.3.6.

However, the regional party list, which did not receive more than two thirds of the votes required in the given election district to obtain the mandate, and if the party's list did not receive more than 5% (in 1990 4%) of the national aggregate valid votes cast for regional party lists, no mandate shall be awarded.

1.3.7.

On national lists the candidates receive mandates in proportion to the national aggregate fragment votes, in the order of their appearance. The following shall be classified as fragment votes:

a) votes cast for party candidates in regional election districts in the first round of elections, which did not lead to the winning of a mandate in either round of the elections,
b) votes cast for lists in regional election districts in a valid round of elections, which did not lead to winning of a mandate, and also those which exceeded the number of votes used for obtaining the mandate.

1.4.1.

Citizens with voting rights cast their votes in election wards. The number and regional distribution of election wards is determined by the notary public, by including a minimum of 600 and a maximum of 1200 citizens with voting rights in each election ward. However, there shall be at least one election ward in each village.

Table 1. Relation of the territory levels and election wards

National level																								
Territory election district	County 1															County 2								
Individual election district	EVK1							EVK2							EVK3							EVK4							EVK5							EVK6						
Settlement	A				B				C					D				E				F							G										
Voting ward	1	2	3		4	5	6	7	8	9	10	11		12	13			14	15	16		17	18	19					20		21			22	23	24				

On the basis of *Tables 1* and *2* we can make a very important statement on the relationship between different territory level districts. Whereas between county (territory election district) and individual election districts,

Table 2. Number of districts at territory level and number of mandates assigned to the districts

Territory level	No. of mandates at territory level	No. of geographical districts attached to territory level
National level	58	1
Territory election district	152	20
Individual election district	176	176
Settlement	–	3200-3300
Voting ward	–	10-11 thousand

county and settlements, furthermore between individual election districts and voting wards there is a hierarchical relationship, there is no such relationship between settlements and individual election districts.

It could also happen that:

- an individual election district comprises several settlements (possibly part of settlement),
- a settlement is broken into several individual election districts,
- an individual election district is identical with a settlement.

The complication of our election system is due, apart from the multiple territory division, to the method of addition of votes, basically by its complexity.

During election every citizen may cast two types of votes: one for a party list and one for an individual candidate. Based on the two types of votes, mandates can be distributed to the individual candidate or to the territory election district, later the unused votes (the so-called fraction votes) are converted to more mandates at the national level.

The logic of the system is illustrated by the following Figure.

2. Instability of the Hungarian Election System

The Hungarian election system connects the individual voting modes and the result of the votes cast in the voting modes in several points. These connections can often result in surprising results, that means a little modification in the number of votes cast for the parties or individuals could lead to a very large change in the composition of the parliament. In mathematics

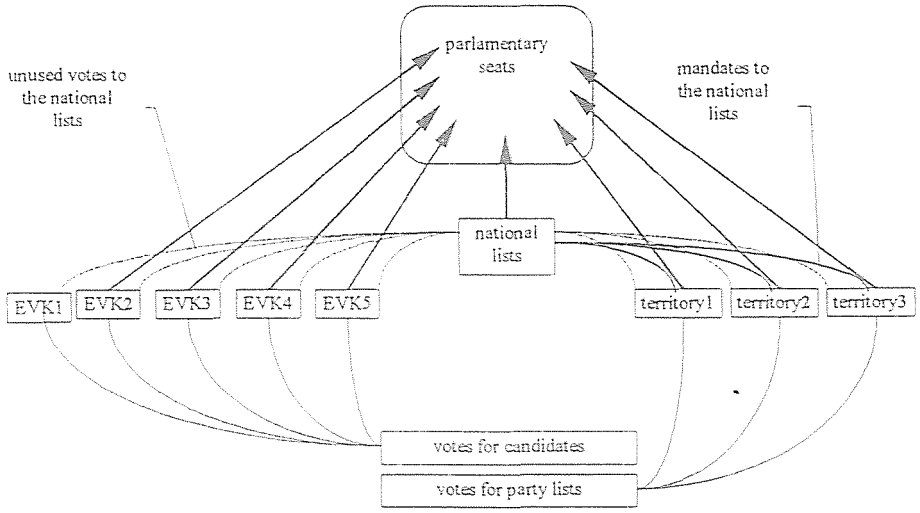

Fig. 1. Schematic diagram of the Hungarian election system

this phenomenon is termed instability: when a little change in the boundary conditions ('perturbation') leads to significant change in the result. This instability is demonstrated by doing some simple calculations based on the data of 1994 election.

Table 3 shows the distribution of parliament seats if the votes cast for the party list are the same as those won in the election into the parliament. In calculating the ratios, votes cast for parties that obtained less than 5% were not considered.

Table 3. Distribution of list mandates in 1994

Party	Territory list	National list	Sum	Percentage	Vote percentage
MSZP	58	16	74	19.2	37.92
SZDSZ	31	12	43	11.1	21.33
MDF	24	0	24	6.2	13.66
FKGP	15	8	23	6.0	11.06
KDNP	5	19	24	6.2	8.01
FIDESZ	7	15	22	5.7	8.01
Total	140	70	210		

If we modify the votes cast for party list by taking 5.6 % from SZDSZ and giving it to FIDESZ, the distribution of list mandates is not modified only between these two parties, but the number of mandates for all parties change. In fact the biggest party gains, its mandates will increase.

Table 4. Distribution of list mandates with modified number of votes.

Party	Territory list	National list	Sum	Percentage	Vote percentage
MSZP	59	18	77	19.9	37.92
SZDSZ	25	6	31	8.0	15.69
MDF	24	0	24	6.2	13.66
FKGP	15	10	25	6.5	11.06
KDNP	7	19	26	6.7	8.01
FIDESZ	21	6	27	7.0	13.66
Total	151	59	210		

3. Territorial Distribution of Parliament Election Data in 1990 and 1994

While incorporating the election data of 1994 into the system, we recognised that there were astonishing similarities in the territorial distribution of 1990 and 1994 election results: territorial distribution of votes of the individual political forces was surprisingly stable. For example, the Christian Democratic People's Party performed well above its national average in certain regions, while in other regions it was well below.

Based on the above fact we formulated a hypothesis that territorial distribution of the performance of the individual political parties is stable. As an indication, we attach the table containing the territorial distribution of votes calculated for the parties in parliament in 1990 and 1994 (the fields of the table show percentages and the individual columns should give 100%).

4. Introduction of the Method of Estimating the Distribution of Parliament Seats

Because of the complexity of the election system, direct conclusions cannot be drawn from poll data about distribution of parliament mandates among the parties.

To be able to give any estimation of possible distribution of the mandates several hypotheses have to be formulated, some of which can be tested, while others can only be proved by time. We shall now present the components of our method, the hypothesis formulated and the logic of the system.

Table 5. Territorial distribution of votes for parties in parliament (1990 and 1994)

	FIDESZ		FKGP		KDNP		MDF		MSZP		SZDSZ	
	1990	1994	1990	1994	1990	1994	1990	1994	1990	1994	1990	1994
Budapest	27.4	18.0	9.2	10.8	18.9	16.5	24.4	26.3	25.2	22.0	27.0	21.7
Baranya	3.8	3.8	5.7	3.9	3.4	3.7	3.4	3.8	3.5	4.0	4.3	4.5
Bács-Kiskun	4.1	4.5	8.2	6.7	3.6	5.2	4.7	5.2	3.6	3.9	4.6	4.4
Békés	2.6	3.4	7.4	5.6	–	2.2	3.8	3.3	3.7	3.8	3.3	3.9
Borsod-Abaúj-Zemplén	6.4	7.2	5.9	5.7	10.0	9.3	6.6	6.0	9.0	8.9	5.2	6.0
Csongrád	2.8	3.9	4.8	5.2	3.0	4.1	6.5	3.6	2.8	3.3	2.6	4.2
Fejér	3.7	5.7	4.1	4.7	–	3.2	3.8	3.3	3.6	4.0	4.6	3.9
Győr-Moson-Sopron	5.7	5.1	4.9	5.4	7.3	5.1	4.0	4.8	3.9	3.6	5.7	5.0
Hajdú-Bihar	3.3	5.5	6.4	5.4	–	3.3	3.9	4.3	5.7	5.2	4.1	4.3
Heves	2.9	2.7	2.1	2.8	6.8	4.2	3.1	2.8	3.1	3.5	3.1	3.5
Szabolcs-Szatmár-Bereg	3.5	4.3	5.6	4.7	–	2.9	3.2	3.3	3.9	4.3	2.9	4.0
Jász-Nagykun-Szolnok	2.8	2.8	2.1	2.9	3.4	2.8	2.7	2.3	2.3	3.6	3.5	3.6
Komárom-Esztergom	1.8	2.1	1.2	1.6	5.2	3.4	1.6	2.0	2.2	2.4	1.8	1.9
Nógrád	9.6	9.1	9.5	9.9	11.2	9.9	9.4	9.3	7.4	8.2	9.2	9.5
Pest	2.8	3.5	5.3	4.6	–	3.0	2.2	2.5	5.4	4.1	2.4	2.6
Somogy	4.1	5.2	5.4	4.8	6.5	5.4	4.0	4.9	4.3	4.8	3.0	4.0
Tolna	2.6	2.7	2.7	2.2	5.1	3.0	2.0	2.2	2.0	2.3	2.1	2.2
Vas	2.5	2.9	2.6	3.7	5.7	4.3	3.0	3.0	2.2	2.2	4.4	3.7
Veszprém	4.9	4.4	4.0	4.5	4.3	4.2	4.4	4.0	3.3	3.4	3.2	4.3
Zala	2.6	3.3	2.8	4.7	5.5	4.2	3.3	3.2	2.9	2.7	3.2	2.9
Total:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

4.1. Simple Bayes Estimation

The simple version of our method treats poll data as the national party list data average. Using the territorial distribution as a condition, we calculate the territorial party preference for the 20 territory lists. (This is usually called Bayes estimation or less elegantly – it is called weighting).

The method is summarized as follows:

Based on the number of votes for the territory list, the number of mandates won by the parties from the given territory list is calculated, and the number of mandates to be transferred to the national list. As with the previous method, in the individual election districts, we calculate the territory distribution as a condition arising from party preference, so for each of the 176 individual election districts we get support ratios for the candidates of each party. From these support ratios we calculate votes for each candidate, then we compute those candidates who qualify for the second round in accordance with the election regulation, that means the three best

candidates and those who have more than 15%. In the next step, using the second party preference we compute the final result of the second round, that is the votes of candidates who did not qualify for the second round are distributed according to second preference data obtained from poll, we multiply it by the so-called 'transfer-matrix'. Consequently we obtain the winners of the individual election districts, while the remaining first round votes cast for the other candidates are transferred to the national lists. The mandates on the national list are distributed according to the number of votes on the national list as stated in the election laws. This is how we get the distribution of parliament seats among the parties.

In the following we present the steps of the calculation and the individual assumptions.

In our election prognosis we use two types of data:

- 1990 and 1994 election data (real data), and
- current poll data (survey data).

The real data of 1990 and 1994 elections are available for each voting ward in a uniform structure.[3] Votes cast for each party and for each candidate can be aggregated as wished for larger territorial units: for settlements (3200), election districts (176), counties (20, Budapest is classified as a county) and the whole country.

Our expectations from current poll data are the following: we need the average level of support for the parties and the second preference of the voters. If we do not know the second preference we will not be able to estimate who those voters will vote for if their first choice candidate does not qualify for the second round. This preference is usually measured by questions similar to these:

If the elections were held today:

1. *For which party/party's candidate would you vote?*
2. *For which party's candidate would you vote if the candidate you supported does not qualify for the second round?*

Our election prognosis is based on the following:

Votes cast in voting wards are summed at the county level for party lists, and also at election district level for individual (party) candidates, then the territorial vote aggregates are used to calculate the distribution of the mandates (in accordance with the algorithm of the election system). The support of the different parties can then be computed with different ratios. Doing prognosis based on poll an opposite approach has to be used, because in this case it is the indexes that show the national support of the parties that is available. After setting some hypotheses the national data have to be broken down into counties and election districts.

[3]The data are processed in Oracle database filing software.

For the calculation – in both cases – two data tables are needed which contain total votes cast for individual candidates/parties (let us call this territory vote tables):

- at the level of individual election district this is related to individual mandates, while
- at the county level this is related to county list mandates.

The former is called the election district vote table, while the latter is called county vote table. Based on these, the election district and territory mandates can be computed, and these are further used to get the national mandate distribution.

The time the poll data is obtained is called the *surveyed year*. We want to give the mandate prognosis for the surveyed year. To get this we have to use the real data of the previous election. The *basis year*, for example, can be 1990 or 1994, although there is the possibility of calculating some sort of average from a combination of the results of both elections, so the basis year is not defined as a real election year.

In the first instance we have to prepare the territory vote tables.

4.1.1. Virtual vote generation for the parties at national level

From the poll data we obtain *vote ratios* for the parties. From this we have to determine the *virtual total vote quantity* that can be assigned to the parties. First we can compute the total (total gained at national level) votes, for this we have to formulate our first hypothesis:

Hypothesis 1: The same number of voters go out to vote in the surveyed year as in the basis year.

Practically this means the *national total votes* are assumed in our calculation to be the same in the surveyed and basis year. Naturally this is a rather weak hypothesis, however, it will not be fully utilised in the later stage. Our system can accommodate more significant deviations (errors) as regards this assumption. However, this step is necessary because this is the only way we can generate a national vote quantity required for a start.

From the generated votes, using simple ratios we can calculate how many *virtual votes* the individual *parties win at the national level:* the national vote quantity is distributed among the parties according to the ratio of indexes from the poll.

4.1.2. Generation of virtual votes for the parties at the county level

When we have assigned national total votes quantity to each of the parties, these have to be broken down to the individual election districts for each party, and for each county. Here we have to formulate a new hypothesis.

Hypothesis 2: For each party the territorial distribution of the votes is the same in the surveyed year and in the base year

The hypothesis is true only for ratios and not for absolute numbers. So it is indifferent how a given party performed in the surveyed year in comparison to the others, we only have to assume for 'itself alone' that the territorial distribution of votes did not change (see *Table 5*). After this we can easily calculate the number of *virtual votes* each party received in each *county*: the total virtual votes of a given party are distributed among the territories in the territorial ratio of the basis year (in this case counties). This way we obtain a simulated county vote table, which can be used to distribute the territory list mandates.

4.1.3. Distribution of county list mandates

Several tasks can be accomplished by using the county vote table data:

- distribution of territory mandates among the parties,
- calculation of county fraction votes,
- determination of mandates transferred to the national list.

When the above calculations are done, the work on county list mandates is complete. It is more difficult to calculate the results of individual candidates.

4.1.4. Generation of virtual first round votes for the parties at the individual election district level

Polls do not contain information related to individual candidates, so these have to be obtained from other sources. So already at the beginning we have to formulate a hypothesis that may generate argument.

Hypothesis 3: The parties and their candidates are not differentiated from one another.

This hypothesis means practically that the same number of virtual votes is calculated for the candidates of the parties as was done for the parties based on the ratios for each party in the poll.

Naturally we know that several opposite examples can be raised against this hypothesis, (from 1990: Miklós Németh and the MSZP, from 1994: András Rabcsák and the KDNP are given examples) yet we still feel this hypothesis is not completely baseless. If we look at the deviations in each election district for the parliamentary party lists, and the ratio of the votes cast for candidates of the parties, it can be seen that deviations above 5% are not often (among 8–900 candidates it was experienced in 20–30 cases).

Though based on two events it is unreasonable to talk about trends, based on the data of 1990 and 1994 we can risk to state that in the next election the similar tables will have no more than 20 rows.

Naturally with the assumption of the hypothesis, differentiation between the candidate and the party makes no sense.

As a next step based on hypothesis 1 we calculate the national total vote quantity for the parties (i.e. candidate groups), later based on hypothesis 2 we generate the *first round election district vote table.*

4.1.5. Calculation of first round election district results

Based on the individual candidates' first round election district vote table, using the related election rules we can calculate:

- winners of the first round for each election district,
- those who qualify for the second round and the ranking for each election district,
- fraction votes of parties that did not qualify for the second round.

4.1.6. Generation of second round virtual votes for the parties at the election district level

To simulate the second round, further hypotheses have to be formulated.

Table 6. The election districts, where difference between the ratio of votes for the individual candidates of individual parties and the party lists exceeds 5%.

1990

Party	County	EVK	Deviation
MSZP	5	11	33.7
SZDSZ	1	31	14.1
MDF	6	2	13.7
MSZP	14	4	11.4
MDF	2	2	10.9
FIDESZ	19	3	10.8
SZDSZ	1	7	10.2
MSZP	9	6	9.6
SZDSZ	1	4	9.6
SZDSZ	1	18	9.6
MDF	1	4	8.9
SZDSZ	1	6	8.6
FIDESZ	8	7	8.6
SZDSZ	1	20	7.5
MDF	1	17	7.4
MDF	13	4	7.3
SZDSZ	13	12	7.1
MDF	3	1	6.8
SZDSZ	8	3	6.5
FIDESZ	1	13	6.3
SZDSZ	9	3	6.2
MSZP	8	7	6.0
MDF	15	7	6.0
SZDSZ	1	19	6.0
MDF	11	2	5.7
SZDSZ	1	1	5.7
SZDSZ	7	6	5.5
FIDESZ	1	15	5.4
SZDSZ	1	17	5.4
MSZP	9	8	5.3
SZDSZ	2	5	5.2
MDF	1	1	5.1

Party	County	EVK	Deviation
FKGP	2	6	−11.1
MDF	6	4	−10.8
MDF	10	1	−8.0
SZDSZ	13	5	−7.1
FKGP	4	5	−7.0
MDF	6	3	−6.9
MDF	5	11	−6.8
MDF	19	4	−6.8
MDF	5	5	−6.7
MDF	2	6	−6.4
SZDSZ	8	7	−6.2
MDF	15	2	−6.2
FKGP	13	7	−6.0
FIDESZ	13	5	−5.7
MDF	10	3	−5.7
MDF	6	7	−5.6
MSZP	5	8	−5.4
MDF	1	18	−5.3
MDF	15	1	−5.2
SZDSZ	20	3	−5.2
FKGP	6	4	−5.1
FKGP	5	11	−5.1

Hypothesis 4. For each party, the territorial distribution of the second party preference is of the same structure as the party list, and as assumed for the first round data.

This hypothesis has to be formulated because poll data contain only national data, so we have no access to territory or election district level data.

Table 7. The election districts, where difference between the ratio of votes for the individual candidates of individual parties and the party lists exceeds 5%.

1994

Party	County	EVK	Deviation
KDNP	6	6	17.3
MDF	5	10	11.0
SZDSZ	1	22	9.4
MDF	1	10	7.7
SZDSZ	10	3	7.0
KDNP	5	6	6.3
FIDESZ	7	1	6.2
SZDSZ	13	12	5.9
MDF	9	4	5.7
SZDSZ	1	13	5.6

Party	County	EVK	Deviation
MSZP	5	11	−11.9
MSZP	5	5	−11.5
MSZP	5	10	−9.7
MSZP	13	14	−8.1
MSZP	10	2	−7.9
MSZP	1	24	−7.8
MSZP	5	8	−7.0
MSZP	5	9	−6.3
SZDSZ	5	11	−6.0
SZDSZ	1	24	−6.0
MSZP	6	6	−6.0
MSZP	10	3	−5.8
MSZP	5	13	−5.7
SZDSZ	20	3	−5.7
MSZP	4	7	−5.5
MSZP	10	6	−5.5

Hypothesis 5. The territorial distribution of support for the candidates of each party does not change in both rounds.

We have to assume the above so that we can use the second preferences to calculate the assumed support of candidates who qualify for the second round.

Hypothesis 6. The number of participants and their territorial ratios do not change.

To calculate the results of the second round we shall use the secondary support data of the parties – collected from poll – the values of the so-called transition matrix. The virtual votes of those candidates who do not qualify for the second round are distributed among those who qualify in accordance with the transition matrix. For the candidates who do not qualify for the second round, votes based on second preference are 'lost' (we cannot consider the votes of those whose first and second choice candidates do not qualify for the second round).

The above hypothesis, the real and survey data based calculation results will

give the second round election district vote table.

4.1.7. Calculation of second round results for election districts, distribution of the mandates

Based on the second round election district vote table we can calculate: votes for the parties for each election district, the list of winners in each election district in the second round, and using this, the quantity of fraction votes to go to the national list.

4.1.8. Calculation of votes for the national list, distribution of the mandates

The total final result can be calculated using the mandates from the county lists, from the individual election districts and the fraction votes in the algorithm of the election system related to the national list.

4.2. Test Results

We tested our method on the 1994 data in two ways. First we did ex-post estimation, using the 1994 territorial distribution as a condition. We used the April 1994 poll data of GALLUP. The following table shows the result of the estimation and the real data.

Table 8. Estimated and real data for 1994

	Individual		Territory list		National list		Total		Percentage (%)	
Party	fact	calculated	fact	calculated	fact	calculated	fact	calculated	fact	calculated
MSZP	149	156	53	53	7	4	209	213	54.1	52.2
SZDSZ	16	15	28	28	25	26	69	69	17.9	17.9
MDF	5	4	18	18	15	15	38	37	9.8	9.6
FKGP	1	0	14	14	11	12	26	26	6.7	6.7
FIDESZ	0	0	7	7	13	12	20	19	5.2	4.9
KDNP	3	1	5	5	14	14	22	20	5.7	5.1

Secondly we used ex-ante estimation, in estimating the 1994 election results we used the April 1994 poll data of GALLUP, and the 1990 territorial distribution was used in calculating the assumed distributions. The calculated data are as follows:

Table 9. Estimated and real data for 1994

	Individual		Territory list		National list		Total		Percentage (%)	
Party	fact	calculated	fact	calculated	fact	calculated	fact	calculated	fact	calculated
MSZP	149	162	53	53	7	6	209	221	54.1	57.3
SZDSZ	16	10	28	31	25	24	69	65	17.9	16.8
MDF	5	3	18	18	15	15	38	36	9.8	9.8
FKGP	1	0	14	14	11	12	26	26	6.7	6.7
FIDESZ	0	0	7	7	13	12	20	19	5.2	4.9
KDNP	3	1	5	5	14	13	22	19	5.7	4.9

4.3. Bayes Estimation Complemented by Deming–Stephan Algorithm

In historical perspective four years mean not a long time, but experience has shown that the composition of supporters could show tremendous change. So we modified our method so that when utilising the poll results, we use dimensions that concentrate on important macrosociological composition of party supporters (sex, age, education, occupation, etc.) in calculating. From the poll data file we calculate an n-dimension distribution whose boundary distributions are the given macrosociological dimensions and party preference. It is this n-dimension 'cube' obtained from public opinion poll that we use in calculating. In each county we calculate the boundaries from the statistical data which are obtained from Polis data, then using the DEMING–STEPHAN method[4] new margins are calculated for party preference. The result so obtained is accepted as poll data for the given territory, on which the Bayes estimation presented in chapter 4.1 is repeated, that is using the territorial distribution as a condition we calculate party preference for the given territory. We use a similar approach for the individual election districts: for all the 176 individual election districts, using the DEMING–STEPHAN algorithm and the macrosociological dimensions of each given territory we calculate the poll data, then for these data conditional probabilities are calculated using the territorial distribution as condition.

In our calculation at this point we make the following assumption:

Hypothesis 7: Political preferences of individual voters are related to their societal position

This assumption can definitely be maintained, but the local literature has not presented a thorough test. In Hungarian literature such a hypothesis was formulated by KÖRÖSÉNYI in the relation between religiousness and prior

[4]Some people know it as IPF-iterative proportional fitting.

party membership[5]. This hypothesis was tested by Zoltán FÁBIÁN[6], but unfortunately we do not have detailed religiousness or MSZMP membership data (at least broken down to settlements).

Table 10. Preferences and transition matrix

Party	GALLUP 1998 February %	TÁRKI 1998 February %	Hypothesis 1 %	Hpothesis 2 %
FIDESZ	32.7	27.0	29.9	29.9
FKGP	14.6	15.0	15.0	15.0
KDNP	2.0	2.0	2.0	2.0
MDF	2.0	4.0	3.0	5.1
MSZP	32.7	39.0	35.9	35.9
SZDSZ	9.1	9.1	9.0	9.0
MDNP	1.0	1.0	1.0	1.0
MIÉP	2.0	2.0	2.0	2.0
MUNKÁSPÁRT	2.0	2.0	2.0	2.0

Table 11. Parties in Parliament based on public opinion research

Party	Territory list	National list	Total	Percentage	Vote Percentage
MSZP	53	17	154	39.9	33.42
SZDSZ	20	11	32	8.3	11.44
MDF	0	0	0	0.0	3.62
FKGP	30	21	62	16.1	19.59
KDNP	0	0	0	0.0	3.58
FIDESZ	42	16	138	35.8	28.35
Total	145	65	386		

The data shown in *Tables 11* and *12* indicate that the choice of the estimation method can have an influence on the result, that is taking the demographic and sociological composition (in this case: sex, age, education) into consideration could rearrange the result of the election. In the above example, age stratification of the voters results in gains for MSZP and FKGP to the disadvantage of FIDESZ.

[5]András KÖRÖSÉNYI: Nomenclature and Religiousness, Century end 1996/1.
[6]Zoltán FÁBIÁN: Division of the Voters, manuscript, 1996.

Table 12. Parliament mandates calculated by DEMING–STEPHAN method

Party	Territory list	National list	Total	Percentage	Vote Percentage
MSZP	57	13	185	47.9	36.21
SZDSZ	5	16	21	5.4	8.63
MDF	0	0	0	0.0	3.72
FKGP	42	22	112	29.0	26.55
KDNP	0	0	0	0.0	3.89
FIDESZ	32	23	68	17.6	21.0
Total	136	74	386		

4.4. Possibilities of Further Development

As an option our method allows modification of the previous hypothesis. There is a possibility of giving participation ratios for each county as an external parameter, that means:

Hypothesis 1/b.: Participation ratio of voters in territories follows a given distribution

In our calculation process so far we have exploited the fact that in the previous elections the participation ratio of voters has been appropriate for the next election. Our estimation method is capable of changing this hypothesis to have any distribution.

Table 13. Prognosis of 1994 elections using April 1994 GALLUP data, assuming a uniform territorial distribution of voters participation ratio

	Individual		Territory list		National list		Total		Percentage (%)	
Party	fact	calcu-lated	fact	calcu-lated	fact	calcu-lated	fact	calcu-lated	fact	calcu-lated
MSZP	149		53		7		209		54.1	
SZDSZ	16		28		25		69		17.9	
MDF	5		18		15		38		9.8	
FKGP	1		14		11		26		6.7	
FIDESZ	0		7		13		20		5.2	
KDNP	3		5		14		22		5.7	

4.5. Error of the Estimation Method

- *Error of poll data*
  In our calculation we use poll data as input parameter, so we inherit the error of the survey. We should note that precise error calculation methods for poll data have not yet been developed. It is not a coincidence that when poll data are presented, only sampling errors are mentioned. The calculation of Leslie Kish puts the error in a 1000-piece sample between 3–25 % in the case of a precise survey.
- *Error due to the instability of the election system*
  As analyzed previously, the Hungarian election system contains many elements and connections, consequently it is unstable. This instability could increase the error of the estimation method and render our results doubtful.
- *Error due to the dynamics of party preference of voters*
  Poll data have rather limited applicability in prognosis of party list votes, because for now we know rather little about the time stability and dynamics of election intentions, because our time series are rather short. The danger of using a cross-section measurement without dynamics was well demonstrated in the wrong prognosis of the last French election result.

Because of the above we cannot create a precise error calculation method for our simulation. We calculate the error of our method with the perturbation of our starting data, that is we modify our starting data slightly and calculate the related end result. After 10–15 calculations we get intervals for the possible end results. We are quite aware of the fact that the above method is very heuristical, but we could not formulate a precise estimation method.

In the following we present some simulation results related to error calculation.

Simulation related to February 1998 poll data.

The data are from the poll of GALLUP published in February 1998 and Omnibusz research of TÁRKI in February 1998, the transition matrix was calculated from TÁRKI data.

In the case of hypothesis 1, we assumed that the real support was between the data of the two polls, while for hypothesis 2 we increased the support of MDF above the 5% boundary, while accepting hypothesis 1.

In the calculation we used data in the election co-operation contract related to individual candidates signed by FIDESZ–Hungarian Christian Democratic People's Party and MDF, that is where only a FIDESZ candidate competes without MDF opponent, and vice-versa where only a MDF candidate competes without a FIDESZ opponent.

We also did calculations about second round co-operation of opposition parties (in merit FIDESZ and FGKP), that is what happens if FIDESZ and

Table 14. Starting data

Party	GALLUP 1998 February %	TÁRKI 1998 February %	Hypothesis 1 %	Hypothesis 2 %
FIDESZ	32.7	27.0	29.9	29.9
FKGP	14.6	15.0	15.0	15.0
KDNP	2.0	2.0	2.0	2.0
MDF	2.0	4.0	3.0	5.1
MSZP	32.7	39.0	35.9	35.9
SZDSZ	9.1	9.1	9.0	9.0
MDNP	1.0	1.0	1.0	1.0
MIÉP	2.0	2.0	2.0	2.0
LABOUR PARTY	2.0	2.0	2.0	2.0

Table 15. Expected distribution of parliament seats using GALLUP data

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	82	55	20	158	40.9	33.2
FIDESZ	80	55	14	149	38.6	33.0
FKGP	0	22	19	41	10.6	15.0
SZDSZ	1	12	13	26	6.5	9.1
MDF	13	0	0	0	3.4	2.1
Total:	176	146	66	386		

Table 16. Expected distribution of parliament seats using TÁRKI data

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	140	63	11	214	55.5	39.0
FIDESZ	28	41	26	95	24.6	27.0
FKGP	0	22	21	43	11.1	15.0
SZDSZ	1	11	15	27	7.0	9.0
MDF	7	0	0	0	1.8	4.0
Total	176	137	73	386		

FGKP eventually co-operate in the second round, so that the candidate with less votes steps down to the advantage of the one with higher votes and the voters follow the directives of the parties. The results of these calculations are presented in the following:

Table 17. Composition of parliament based on Hypothesis 1

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	117	58	16	191	49.5	36.0
FIDESZ	48	47	16	111	28.8	30.3
FKGP	0	22	24	46	11.9	15.0
SZDSZ	1.0	12	15	27	7.0	9.0
MDF	10	0	0	10	2.6	3.0
Total:	176	139	71	386		

Table 18. Composition of parliament based on Hypothesis 2

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	104	58	15	177	45.8	36.0
FIDESZ	58	47	17	122	31.6	30.0
FKGP	0	22	17	39	10.0	15.0
SZDSZ	1	12	11	24,0	6.2	9.0
MDF	13	3	8	24,0	6.2	5.0
Total:	176	142	68	386		

Table 19. Expected distribution of parliament seats using GALLUP data

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
FIDESZ	93	55	11	159	41.2	33.2
MSZP	68	55	23	146	37.8	33.0
FKGP	1	22	19	42	10.9	15.0
SZDSZ	1	12	13	26	6.0	9.1
MDF	13	0	0	13	3.4	2.1
Total:	176	144	66	386		

5. Conclusion

Due to the multiple connections the Hungarian election system is unstable. Poll data cannot be applied directly in estimating parliament seats. In this publication we present an estimation method, which gives a relatively good estimation of distribution of parliament seats, based on the little experience and if several hypotheses are accepted. A part of the hypotheses which form the basis of our method were tested, while the other part can only be proved by time.

Table 20. Expected distribution of parliament seats using TÁRKI data

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	132	63	13	208	54.0	39.0
FIDESZ	35	41	24	100	25.9	27.0
FKGP	1	22	21	44	11.4	15.0
SZDSZ	1	11	15	27	6.9	9.0
MDF	7	0	0	7	1.8	4.0
Total:	176	137	73	386		

Table 21. Distribution of parliament seats with acceptance of Hypothesis 1

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	117	58	16	191	49.4	35.9
FIDESZ	48	47	16	111	28.8	29.9
FKGP	0	22	24	46	11.9	15.0
SZDSZ	1	12	15	28	7.3	9.0
MDF	10	0	0	10	2.6	3.0
Total:	176	139	71	386		

Table 22. Distribution of parliament seats with acceptance of Hypothesis 2

Party	Individual	Territory list	National list	Total	Percentage of mandates %	Poll data%
MSZP	98	58	17	173	44.8	35.9
FIDESZ	65	47	15	127	32.9	29.9
FKGP	0	22	17	39	10.1	15.0
SZDSZ	1	12	11	24	6.3	9.0
MDF	12	3	8	23	6.0	5.1
Sum:	176	142	68	386		

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