Two-dimensional voting bodies: The case of European Parliament

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Abstract. By a two-dimensional voting body we mean the following: the body is elected in several regional voting districts by proportional system based on multi-party competition of national political parties. Then the members of the body exercise dual responsibility: responsibility following from the party membership and responsibility following from regional affiliation.

In this paper we formulate the following problem: Taking as decisional units national chapters of European political parties, is there a difference between a priori voting power of national groups in the case of "national" coordination of voting and in the case of "partisan" coordination of voting? By coordination of voting we mean two step process: in the first step there is an internal voting in the groups of units (national or partisan), in the second step there is a voting coordination of aggregated groups (European political parties or national representations). In the both cases the voting has an ideological dimension (elementary unit is a national party group), difference is only in dimension of aggregation. Power indices methodology is used to evaluate voting power of national party groups, European political parties and national representations in the cases of partisan and national coordination of voting behaviour.

Keywords: European Parliament, European political parties, ideological coordination, national coordination, Shapley-Shubik power index, two-dimensional voting bodies, voting power of national party groups

JEL Classification: D71, C71
AMS Classification: 91F10

1 Introduction

By a two-dimensional voting body we mean the following: the body is elected in several regional voting districts by proportional system based on multi-party competition of national political parties. Then the members of the body exercise dual responsibility: responsibility following from the party membership and responsibility following from regional affiliation.

There exist more examples of two-dimensional voting bodies (committees). Practically all national parliaments have in some sense two-dimensionality features, especially upper houses in bi-cameral systems. Their individual members represent citizens of the region they were elected in and on the other hand they are affiliated to some political party. One of the voting bodies clearly exhibiting two-dimensional face is the European Parliament.

Increasing number of studies are focusing attention to constitutional analysis of European Union institutions and distribution of intra-institutional and inter-institutional influence in the European Union decision making. Most of the studies are related to distribution of voting power in the EU Council of Ministers as reflecting the influence of member states (or, more precisely, member states governments). Significantly less attention is paid to the analysis of European Parliament. It is usually studied in one-dimensional (partisan) framework, taking as a basic decision making unit European political party.

In this paper we extend Nurmi [5] and Mercik, Turnovec, and Mazurkiewicz [4] analysis and formulate the following problem: Taking as decisional units national chapters of European political parties, is there a difference between a priori voting power of national groups in the case of "national" coordination of voting and in the case of "partisan" coordination of voting? By coordination of voting we mean two step process: in the first step there is an internal voting in the groups of units (national or partisan), in the second step there is a voting coordination of aggregated groups (European political parties or national representations). In the both cases the voting has an ideological dimension (elementary unit is a national party group), difference is only in dimension

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of aggregation. Power indices methodology (Shapley and Shubik [6]) is used to evaluate voting power of national party groups, European political parties and national representations in the cases of partisan and national coordination of voting behaviour.

EP is institutionally structured on ideological principle, the individual members (national party groups) work in factions of the European political parties. Hix, Nouri and Roland [1] demonstrated, using empirical data about voting acts in EP of the fifth term, that while ideological dimension in EP voting prevails (in almost 80% of cases EP members voted according European party affiliation), there were still more than 20% of voting driven by national dimension (voting by national affiliation). Consequently, to measure the influence in the EP, basic decision making unit is a national party groups and it makes sense to measure not only voting power of European political parties and/or voting power of national representations, but also the voting power of national party groups, both in ideologically driven voting and nationally driven voting. European political parties cohesion is lower than cohesion of their national chapters.

2 Two-level committee model of power decomposition

Let N = {1, 2, …, n} be a set of agents, $[\gamma, \boldsymbol{\omega}]$, be a committee with quota γ and weights ω_i, $i \in N$, and $\boldsymbol{\pi} = (\pi_1, \pi_2, \ldots, \pi_n)$ be the vector of Shaply-Shubik power indices of agents of the committee. Then π_i is a probability that agent $i \in N$ will be in a pivotal situation.

Each agent i can be understood as a group G_i with cardinality ω_i (individual members of the committee belonging to i). Clearly $card(G_i) = \omega_i, \sum_{i \in N} card(G_i) = \tau$. Let $G_{ij} \in G_i$ be a subgroup j of the group G_i and ω_{ij} = card (G_{ij}), number of members belonging to G_{ij}. Assume that each group (agent) i is partitioned into m(i) subgroups G_{ij}. Then we can consider the following two step procedure of decision making: first each agent G_i looks for joint position in a subcommittee $[\gamma_{i;}\ \omega_{i1}, \omega_{i2}, \ldots, \omega_{im(i)}]$, where γ_i is the quota for voting in subcommittee i (e.g. the simple majority). There is a vote inside the group first (micro-game) and then the group is voting jointly in the committee on the basis of results of internal voting (macro-game).

If $\mathbf{p}(G_i) = (p_{i1}, p_{i2}, \ldots, p_{im(i)})$ is the power distribution in subcommittee G_i where p_{ij} be and internal power of subgroup G_{ij} in micro-game, then the voting power π_{ij} of the subgroup G_{ij} in macro-game is $\pi_{ij} = \pi_i p_{ij}$ expressing the probability of the subgroup G_{ij} being pivotal in the committee decision making. Using SS-power concepts it is easy to prove that

$$\sum_{j=1}^{m(i)} \pi_{ij} = \pi_i$$

so we obtained decomposition of the power of agent i among the subgroups G_{ij}.

3 Modeling distribution of power in European Parliament

To evaluate distribution of power of national party groups in European Parliament as basic decision making units we use the model of two-level committees from section 2. To reflect the double dimensionality in voting we use two dimensions of committee structure: the European party factions decomposed into national groups, and the national representations decomposed into the party groups. Basic unit remains the same in both cases: national party group. Then we obtain two schemes of decision making coordination: first based on European party factions and national party groups, second based on national representations and national party groups.

First (ideological) dimension leads to committee model A with European parties as agents voting together, $[\gamma, p_1, p_2, \ldots, p_n]$, the second (national) dimension leads to committee model B with national representations as agents voting together, $[\gamma, n_1, n_2, \ldots, n_m]$, where γ is the quota (the same for both models), p_i is the weight (number of seats) of European party i, n_k is the weight (number of seats) of member state k (n is the number of European parties, m is the number of member states).

Committee A generates n subcommittees A_j such that $[\gamma_j, p_{1j}, p_{2j}, \ldots, p_{mj}]$, where p_{kj} denotes number of members of party group j from country k, γ_j being a specific quota for subcommittee A_j. Each of these subcommittees consists of at most m national subgroups of the European political party j, where in each subcommittee the members of each party from the same member state k are voting together. We shall refer to the corresponding two-level model as the hierarchically structured committee $\{A/A_j\}$. Committee B generates m subcommittees B_k such that $[\delta_k, p_{k1}, p_{k2}, \ldots, p_{kn}]$, where p_{ki} denotes number of members of party group j from country k, δ_k being a specific quota for subcommittee B_k. Each of these subcommittees consists of at most n party subgroups of the national representation k, where in each subcommittee the members of from the same party j are voting together. We shall refer to the corresponding two-level model as the hierarchically structured committee $\{B/B_k\}$.

Let us denote by

α_j voting power of the European party *j* in the committee A (voting by ideological dimension), probability that party j will be pivotal in ideologically coordinated voting,

β_k voting power of the nation k in the committee B (voting by national dimension), probability that nation k will be pivotal in nationally coordinated voting,

α_{kj} voting power of the national segment k of party *j* in subcommittee A_j, probability that national segment k of party j will be pivotal in internal party voting,

βkj voting power of the national segment k of party *j* in subcommittee B_k, probability that party segment j of representation of country k will be pivotal in internal national voting,

π_{kj} voting power of the national segment k of party *j* in the committee $\{A/A_j\}$, probability that national segment k of party j will be pivotal in the grand committee voting based on ideological coordination,

φ_{kj} voting power of the national segment k of party *j* in the committee $\{B/B_k\}$, probability that party segment j of national representation k will be pivotal in the grand committee voting based on national coordination.

Using standard algorithms we can find SS-power indices α_j in committee A and α_{kj} in committees A_j (probabilities of being pivotal in corresponding committees) and then calculate $\pi_{kj} = \alpha_{kj}\alpha_j$ as conditional probability of two independent random events – pivotal position of j in grand committee A and pivotal position of k in subcommittee A_j. From probabilistic interpretation and properties of SS-power indices it follows that $\sum_{k=1}^{m} \pi_{kj} = \alpha_j \sum_{k=1}^{m} \alpha_{kj} = \alpha_j$. The sum of voting powers of national groups of European political party j in ideological voting is equal to the voting power of the European political party. The total power is decomposed among the national units of the party. In a more intuitive way: the national group k of political party j is in a pivotal position in compound committee $\{A/A_j\}$ if and only if it is in pivotal position in subcommittee A_j and the party j is in a pivotal position in committee A.

Less trivial is the following result: The country k is in a pivotal position in ideological coordination of voting if some party group from k is in pivotal position. Pivotal positions of national party groups of the same country in ideologically voting are mutually exclusive random events, hence the probability that some party group from state k is in a pivotal position is $\sum_{j=1}^{n} \pi_{kj} = \sum_{j=1}^{n} \alpha_j\alpha_{kj} = \theta_k$ (sum of power indices of all party groups from member state k). Then θ_k can be interpreted as a measure of country k influence in ideologically coordinated voting. From properties of SS-power it follows that $\sum_{k=1}^{m}\theta_k = \sum_{k=1}^{m}\sum_{j=1}^{n} \alpha_j\alpha_{kj} = \sum_{j=1}^{n} \alpha_j \sum_{k=1}^{m} \alpha_{kj} = \sum_{j=1}^{n} \alpha_j = 1$. There is no other direct way how to evaluate θ_k.

In the same way we can find β_k in committee B and β_{kj} in committees B_k and then calculate $\varphi_{kj} = \beta_{kj}\beta_k$ as conditional probability of two independent random events - pivotal position of k in grand committee B and pivotal position of j in subcommittee B_k). Measure of party j influence in nationally coordinated voting is $\sum_{k=1}^{m} \varphi_{kj} = \sum_{k=1}^{m} \beta_k\beta_{kj} = \vartheta_j$ (sum of power indices of party group j from all member states).

4 Illustrative example

To illustrate methodology introduced above we use a simple hypothetical example.[2] Let us consider a parliament consisting of representatives of three regions A, B, and C decomposed into three super-regional parties L, M, R (altogether 9 regional party chapters of 3 super-regional parties). Distribution of seats is provided in Table 1. Entries in last row provide total number of seats of each party in the parliament, entries in the last column total number of seats of each region in the parliament, and entries in the main body of the table provide number of seats of each regional party chapter.

Regions	parties (seats)			
	L	M	R	total
A	7	10	3	20
B	15	15	0	30
C	3	22	25	50
Total	25	47	28	100

Table 1 Distribution of seats

Let us start with evaluation of distribution of power of super-regional parties in the parliament under assumption that regional chapters of each party are voting together. To do that we have to calculate power indices in the committee [51; 25, 47, 28].Total influence of super-regional parties in ideologically coordinated voting measured by Shapley-Shubik power indices (assuming simple majority quota): (1/3, 1/3, 1/3). Total influence of regional representations in regionally coordinated voting measured by Shapley-Shubik power indices (assuming simple majority quota) we have to calculate power indices in the committee [51; 20, 30, 50], voting power (1/6, 1/6, 2/3).

Influence of regional party chapters in ideologically coordinated voting:

Party group L: committee [13; 7, 15, 3]; voting power of regional party chapters of party L: (0, 1, 0). Total voting power of L in the parliament ideological voting equal to 1/3 is decomposed among the regional party chapters: (0, 1/3, 0).

Party group M: committee [24; 10, 15, 22]; voting power of regional party chapters of party M: (1/3, 1/3, 1/3). Total voting power of M in the parliament ideological voting 1/3 is decomposed among the regional party chapters: (1/9, 1/9, 1/9)

Party group R: committee [15; 3, 0, 25]; voting power of regional party chapters of party R: (0, 0, 1). Total voting power of R in the parliament ideological voting 1/3 is decomposed among the regional party chapters (0, 0, 1/3).

Evaluation of voting power of regional party chapters in ideologically coordinated voting is provided in Table 2. Entries in last row provide total voting power of each party in the parliament, entries in the last column total voting power of each region in the parliament in the case of ideologically coordinated voting, and entries in the main body of the table provide voting power of each regional party chapter.

Regions	parties (voting power)			
	L	M	R	Total
A	0	1/9	0	1/9
B	3/9	1/9	0	4/9
C	0	1/9	3/9	4/9
Total	3/9	3/9	3/9	1

Table 2 Decomposition of power in ideologically coordinated voting

[2] European Parliament elected in 2009 has 8 party groups, and decomposition might consist of 216 national party chapters; it is difficult to handle such a structure on limited space of conference proceedings. The results of empirical analysis for the European Parliament elected in 2009 will be provided during the presentation. Results for European Parliament elected in 2004 see in Turnovec [7].

Now let us calculate influence of regional party chapters in regionally coordinated voting, when all regional party chapters from the same region are voting together.

Region A: committee [11; 7, 10, 3]. Voting power of regional party chapters L, M, R in region A: (1/6, 4/6, 1/6). Total power of region A in the parliament regionally coordinated voting 1/6 is decomposed among the regional party chapters: (1/36, 4/36, 1/36)

Region B: committee [16; 15, 15, 0]. Voting power of regional party chapters L, M, R in region B: (1/2, 1/2, 0). Total power of region B in the parliament regionally coordinated voting 1/6 is decomposed among the regional party chapters: (3/36, 3/36, 0).

Region C: committee [26; 3, 22, 25]. Voting power of regional party chapters in region C: (1/6, 2/60, 3/6). Voting power of region C in the parliament regionally coordinated voting 4/6 is decomposed among the regional party chapters: (4/36, 8/36, 12/36)

Evaluation of voting power of regional party chapters in regionally coordinated voting is provided in Table 3. Entries in last column provide total voting power of each region in the parliament in the case of regionally coordinated voting, entries in the last row total voting power of each party in the parliament in the case of regionally coordinated voting, and entries in the main body of the table provide voting power of each regional party chapter.

regions	parties (voting power)			
	L	M	R	Total
A	1/36	4/36	1/36	6/36
B	3/36	3/36	0	6/36
C	4/36	8/36	12/36	24/36
total	8/36	15/36	13/36	1

Table 3 Decomposition of power in regionally coordinated voting

Let us assume that (based on empirical evidence) in average 3/4 of voting acts are ideologically coordinated and 1/4 of voting acts are regionally coordinated. Then, from the following matrix equation

$$\frac{3}{4}\begin{pmatrix} 0 & \frac{4}{36} & 0 \\ \frac{12}{36} & \frac{4}{36} & 0 \\ 0 & \frac{4}{36} & \frac{12}{36} \end{pmatrix} + \frac{1}{4}\begin{pmatrix} \frac{1}{36} & \frac{4}{36} & \frac{1}{36} \\ \frac{3}{36} & \frac{3}{36} & 0 \\ \frac{4}{36} & \frac{8}{36} & \frac{12}{36} \end{pmatrix} = \begin{pmatrix} \frac{1}{144} & \frac{16}{144} & \frac{1}{144} \\ \frac{39}{144} & \frac{15}{144} & 0 \\ \frac{4}{144} & \frac{20}{144} & \frac{48}{144} \end{pmatrix}$$

we obtain the mathematical expectation of voting power of regional party chapters, super-regional parties and regional representations under assumption that ideologically coordinated voting takes place with probability ¾ and regionally coordinated voting with probability 1/4 (see Table 4).[3]

Regions	parties (voting power)			
	L	M	R	Total
A	1/144	16/144	1/144	18/144
B	39/144	15/144	0	54/144
C	4/144	20/144	48/144	72/144
Total	44/144	51/144	49/144	1

Table 4 Mathematical expectation of voting power

[3] As was mentioned above, for the European Parliament these probabilities are estimated as 0.8 for ideologically coordinated voting and 0.2 for regionally coordinated voting, see Hix, Noury and Roland [1].

5 Concluding remarks

We tried to show that it is possible to evaluate not only the influence of European political parties as entities in ideologically driven voting and of national representations as entities in nationally driven voting, as it is usually done in analytical papers (Holler and Kellermann [2], Hosli [3], Nurmi [5]) but also the influence of national chapters of European political parties both in ideological and national voting and national influence in ideological voting, as well as the European political parties influence in national voting.

It was demonstrated that different dimensions of voting (ideological, national) lead to different levels of influence of the same national party group, European political party and national representation. The findings of our model analysis open the problem of strategic considerations, such as coalition formation, that can go across the existing structure, e.g. coalition of a country representation with some European political party, or preferring national coordination of different party groups of the same country to ideological coordination (this problem was opened with respect to Poland in Mercik, Turnovec, and Mazurkiewicz [4]). There is a broad area for extensions of presented model.

Acknowledgements

This research was supported by the Grant Agency of the Czech Republic, project No. 402/09/1066 “Political economy of voting behavior, rational voters’ theory and models of strategic voting”..

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