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Abstract

In this paper game-theoretical concepts of power indices are applied to evaluation of power (or influence) distribution among different European Union member states in a decision making processes in the Council of Ministers, Commission and European Parliament. Dynamics of distribution of power during a sequence of extensions is analyzed and possible consequences of future East European and Mediterranean extensions anticipated. A new voting rule concept is suggested and evaluated: the so called double majority principle, based on two sets of weights in voting: one given by the number of votes in a decision making body and the second by the proportion of GDP or proportion of population. Models of Commission, Council, and European Union interactions are investigated from the point of view of power distribution among the member states and among the three most important European institutions.

Keywords

Coalition, commission, council of ministers, distribution of power, double majority, European parliament, power indices, voting procedures, voting weights

JEL-Classifications

D720, D790, F020

Comments

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Contents

1. Introduction

The decision making system of the European Union is based on interaction of the three super-national institutions: Commission, Council of Ministers and European Parliament. Since the European Union has created an entity that is "less" than federation, but more than a coalition of independent states, its institutions are different from traditional forms, such as the state institutions, or an international organisation institutions. It is the reason why the study of the operation of European institutions is significant for the understanding of the present and future of the European integration project.

Entry of new member states and enlargement of the European Union have become important political and policy issue. The fundamental question is how to organise a community with perhaps 27 members on the basis of democracy, transparency and efficiency.

This paper address some topical issues of decision making in the European Union from the point of view of distribution of the rents from cooperation among the member states (expressed in their share of decisional power), and at the same time from the point of view of distribution of the influence among the three most important institutions of the decision making process.

In the second part of the paper we shortly resume the system of European Union institutions and decision making procedures implemented in European Union (consultation procedure, cooperation procedure, co-decision procedure).

In the third part we analyze national distribution of votes (seats) in the most important European institutions (Council, Commission, and European Parliament), relating it to such objective indicators as population and GDP.

Since voting weight is a poor proxy for measuring the power, in the fourth part of the paper we are using the concept of power indices to evaluate a power (or influence) distribution among member states and European institutions under different decision making rules. Two well defined power indices are applied: the SHAPLEY-SHUBIK (1954) power index and the BANZHAF-COLEMAN (1965) power index. Dynamics of distribution of power during a sequence of extensions is analyzed and possible consequences of future East European and Mediterranean extensions anticipated. A new voting rule concept is suggested and evaluated: the so called double majority principle, based on two sets of weights in voting: one given by the number of votes in a decision making body and the second by the proportion of GDP or proportion of population. Simple game theoretical models of interactions in the Commission - Council - European Parliament decision making game, reflecting some features of cooperative, consultation and co-decision procedures, are introduced. Impact of changes in the rules (qualified majority versus simple majority, initiation monopoly versus broader right to initiate) on the relative influence of the Commission, Council and the Parliament, is evaluated.

Appendix presents an overview of the properties of the most frequently used power indices (Shapley-Shubik, Banzhaf-Coleman, Johnston, Deegan-Holler, and Deegan-Packel). It is shown that all these concepts can be derived outside of the framework of cooperative game theory.

Distribution of power in the EU Council of Ministers and European Parliament has been analyzed earlier in HOLLER and KELLERMANN (1977), JOHNSTON (1982), BRAMS and AFFUSO (1985), the present development associated with the 1995 enlargement of EU in WIDGRÉN (1993, 1994, 1995), BERG (1996), LANE (1996), NURMI (1996, 1997), TURNOVEC (1996), BINDSEIL and HANTKE (1997) and others, decision-making procedures and interactions between Commission, Council, and European Parliament in CROMBEZ (1996, 1997), MOSER (1996), LARUELLE and WIDGRÉN (1997).

2. Decision Making in European Union Institutions

The system of European institutions currently consists of the Council of Ministers, Commission, the European Parliament, the European Court of Justice, and several other institutions (the Court of Auditors and the Council of Regions). They represent different views in the sense that Commission is supposedly independent of any part of national views and thus represents the EU as a whole. The Council represents the view of national governments and the Parliament represents member countries citizens' views. The rules on which decisions are made, have been up to this point, based more or less on an extrapolation and extension of the original rules of the EEC with six members.

The Commission[1] can also be seen as an organ which promotes integration. The Commission has the agenda setting power: a monopoly of making proposals. The Council, in contrast, is the main decision maker since its positive view is always required to a decision. Until 1987, the European Parliament had only an advisory role in EU-decision making, but during the last ten years its influence has increased due to the Maastricht Treaty Reform.

The most important institution at present is without a doubt the Council of Ministers; this body is responsible for the creation of the general strategy of the Union and for making basic political and legislative decisions, and in some cases, it has a direct responsibility for executive decisions.[2] The members of the Council, representing individual member states, have different voting weights (numbers of votes allotted to member countries). The Council has two main decision making rules: qualified majority and unanimity. When qualified majority is applied, the sum of national weights (votes) in favour of a proposal has to represent roughly 70 % of the total sum of votes, while the decision can be blocked by a so-called "blocking minority" (about 30 % of votes against). A specific institution is a Council Presidency.[3]

European Parliament has 626 members (after the last extension in 1995) representing citizens of 15 member countries. It has developed from so called General Assembly, originally a group of 142 members composed of deputies delegated by national parliaments. In 1976 the Council of Ministers accepted an Act about direct election to the European Parliament and extended the number of members to 355. The first election to European Parliament took place in 1979 with average turnout of 61% of eligible voters. European Parliament approves the budget of European Union, votes the composition of Commission, can dissolve the Commission (non-confidence vote), and decides about international agreements. It has so called co-decision authority in legislative acts.

The European Union has three main decision making procedures.[4] They are the consultation procedure (defined in the Treaty of Rome in 1957), the cooperation procedure (defined in the Single European Act in 1986) and the co-decision procedure (defined in the Maastricht Treaty in 1992). In each of these procedures the Council has two ways of taking a decision: the qualified majority rule and unanimity. In some cases the simple majority of member states in the Council is used (very seldom for minor procedural questions) and the rule of a qualified majority of votes with the quota of 10 member states based on the principle one state - one vote.[5]

Consultation procedure was the only way to take decisions during 1958 - 1986. It totally disregarded European Parliament by giving only advisory role to it. The decision itself relies on a Commission proposal and a Council decision. Thus, as it is common to all procedures, in consultation procedure the Commission first make a proposal. Then on the basis of the Commission proposal the Council either accepts or rejects it. However, unanimous Council has the right to amend the proposal of the Commission and thus effectively has a limited right to propose.

Cooperation procedure was introduced by the Single European Act in 1986, that for the first time revised decision-making in EU. Compared to the consultation procedure, the cooperation procedure gives some powers to the European Parliament in the sense that the passage of a proposal depends on its vote. The EP also has the right to propose amendments to the Council's preliminary decision. It thus has some indirect agenda setting powers under certain circumstances.

The procedure can be summarized as follows. The Commission makes a draft proposal, which is commented by the EP, and thereafter initiated by the Commission. In its first reading, the Council either accepts (take a common position) or rejects the proposal. In the latter case, the proposal lapses and the Council thus has an unconditional right to veto. The EP has the right to propose a rejection, amendments or acceptance to the common position of the Council. If it does not act, its acceptance is presumed. An absolute majority is required for rejection and amendments. In the case of the former, the Council has the next move and unanimity is then required to overrule EP's rejection. Although EP has not the right to veto, it seems to have a quite effective tool in making things more complicated for the Council and the Commission. In practice, however, the EP has used this weapon very seldom.

In the case of amendments, the Commission has the next move. It examines the amendments and it can reject them fully or partially or it can accept them completely. Thus its basic choice is between accepting and rejecting but the original proposal can split into pieces.

After the Commission's examination the Council has next move. In the cases of the Commission's approval, the Council either accepts or rejects the new proposal by qualified majority or it can amend the proposal by a unanimous vote. In the case of the Commission's rejection, the Council need unanimity to make a decision on the basis of the Commission's new proposal or it has the right to amend proposal by a unanimous vote.

Basically, in cooperation procedure the EP can enforce the Council to decide unanimously on the original proposal. Therefore, it has certainly indirect influence on the Commission's proposal.

Co-decision procedure, introduced by the Maastricht treaty in 1992, increased the power of the European Parliament. The beginning of the procedure is similar to the cooperation procedure.The first main difference compared to the cooperation procedure comes when a common position of the Council is examined by the EP. In the co-decision procedure, a unanimous Council can not overrule the EP's veto.

In the case of EP's veto, a conciliation committee is formed between the Council and the EP. It consists of the same number of representatives from each, trying to find a compromise that must be approved by a qualified majority of the Council and absolute majority of the EP. If the Conciliation Committee does not agree on a joint position, the Council can confirm its common position, possibly as amended by the Parliament. The Parliament can reject the confirmed common position, and then the status quo prevails. If the Parliament accepts, the confirmed common position becomes EU policy. In the case of EP's amendments the main difference from cooperation procedure is that, on the one hand, a unanimous Council can not amend a proposal by itself in its second reading, and on the other hand, in the case of Council's rejection a conciliatory committee is formed and it works as it does in the case of the EP's veto. In regard to the shifts of power it seems that the Commission's role as an agenda setter has weakened in favour of the EP. The Council is also a likely loser since it has not the right to make decision by itself.

3. Weights and Votes in European Union

"Decision-making game" in European Union assumes an interaction of Commission, Council of Ministers and European Parliament. From the point of view of member states distribution of votes in Council of Ministers and in European Parliament (and in some extent in Commission, as well) is a very sensitive question, important for preserving a national influence in a community decision making. Let us have look, first, on development and properties of distribution of weights among member states in the Council of Ministers and European Parliament.

3.1 Distribution of votes in EU Council of Ministers

Table 3.1 presents the distribution of votes in the Council of Ministers in different stages of development of the European Union, starting with the EU of 6 up to the EU of 15.

Table 3.1
Votes in the Council of Ministers of EU

country	votes				
	EU-6	EU-9	EU-10	EU-12	EU-15
Belgium	2	5	5	5	5
Denmark		3	3	3	3
Germany	4	10	10	10	10
Greece			5	5	5
Spain				8	8
France	4	10	10	10	10
Ireland		3	3	3	3
Italy	4	10	10	10	10
Luxembourg	1	2	2	2	2
Netherlands	2	5	5	5	5
Austria					4
Portugal				5	5
Finland					3
Sweden					4
UK		10	10	10	10
total votes	17	58	63	76	87
QM	12	41	45	54	62
% QM	70.59	70.69	71.43	71.05	71.26
BM	6	18	19	23	26

In Table 3.2 we provide shares of votes of the different members of the EU in the Council of Ministers in different stages of development (weight of the votes of each country).

Table 3.2
Voting weights in the Council of Ministers

country	voting weights				
	% EU-6	% EU-9	% EU-10	% EU-12	% EU-15
Belgium	11.76	8.62	7.94	6.58	5.75
Denmark	0.00	5.17	4.76	3.95	3.45
Germany	23.53	17.24	15.87	13.16	11.49
Greece	0.00	0.00	7.94	6.58	5.75
Spain	0.00	0.00	0.00	10.53	9.20
France	23.53	17.24	15.87	13.16	11.49
Ireland	0.00	5.17	4.76	3.95	3.45
Italy	23.53	17.24	15.87	13.16	11.49
Luxembourg	5.88	3.45	3.17	2.63	2.30
Netherlands	11.76	8.62	7.94	6.58	5.75
Austria	0.00	0.00	0.00	0.00	4.60
Portugal	0.00	0.00	0.00	6.58	5.75
Finland	0.00	0.00	0.00	0.00	3.45
Sweden	0.00	0.00	0.00	0.00	4.60
UK	0.00	17.24	15.87	13.16	11.49
total	100	100	100	100	100

It is clear that the distribution of votes is not proportional to the distribution of population. It has been argued by WIDGRÉN[6] that the relationship between the votes and population is logarithmic. The relation between the voting weight v and population p can be described with a regression equation

$$\log v = 0.0063 (\log p)^{2.465}$$

with

$$R^2 = 0.972$$

In Table 3.3 we give the ratios of population and GDP to different members representation in the Council of Ministers of the present European Union of 15.

Table 3.3
Population and GDP per one vote

country	POPUL	GDP	votes	PR	P/V	GDP/V
Belgium	10.061	213.435	5	5.75	2.012	42.68
Denmark	5.191	137.61	3	3.45	1.730	45.87
Germany	80.769	1902.995	10	11.49	8.077	190.30
Greece	10.376	76.698	5	5.75	2.075	15.34
Spain	39.125	533.986	8	9.20	4.891	66.75
France	57.65	1289.235	10	11.49	5.765	128.92
Ireland	3.569	44.906	3	3.45	1.190	14.97
Italy	57.84	1134.98	10	11.49	5.784	113.49
Luxembourg	0.397	14.233	2	2.30	0.199	7.12
Netherlands	15.277	316.404	5	5.75	3.055	63.28
Austria	7.937	183.53	4	4.60	1.984	45.88
Portugal	9.848	77.749	5	5.75	1.970	15.55
Finland	5.072	96.22	3	3.45	1.691	32.07
Sweden	8.712	216.294	4	4.60	2.178	54.07
UK	58.04	1042.7	10	11.49	5.804	104.27
total	369.864	7280.975	87	100		

The data about GDP and population express the level of 1993 (OECD database, GDP in billions of USD, population in millions of inhabitants)

We can see that the representation of different members of the EU is highly disproportional with respect to population and GDP, e.g. one UK vote represents 5.804 millions of population and 104.27 billions of USD of GDP, while one vote of Luxembourg represents 199 thousand of population and 7.12 billions of GDP.

3.2 Minimum Population for Qualified Majority and Blocking Minority

To consider properties of decision making process in the Council of Ministers we can formulate the following minimization problem:[7]

Let v_i be the number of votes and p_i be the population of the country i. Let q be the minimal number of votes for qualified majority and m be the minimal number of votes for blocking minority. Let

$x_i = 1$ if the country i votes YES
$x_i = 0$ if the country i votes NO

Then the solution of the problem:

minimize

$$\sum_{i=1}^{n} p_i x_i$$

subject to

$$\sum_{i=1}^{n} v_i x_i \geq q$$

$$x_i \in \{0, 1\}$$

gives us the minimum of population necessary to obtain the qualified majority q in the Council of ministers.

The solution of the problem:
minimize

$$\sum_{i=1}^{n} p_i x_i$$

subject to

$$\sum_{i=1}^{n} v_i x_i \geq m$$

$$x_i \in \{0, 1\}$$

gives us the minimum of population necessary to obtain the blocking minority m in the Council of ministers.

Table 3.4 presents the results of solution of the minimal population problems.

Table 3.4
Minimal share of population for qualified majority and blocking minority

	EU-6	EU-9	EU-10	EU-12	EU-15
QM	70.59	70.69	71.43	71.05	71.9
BM	35.29	31.03	30.15	30.26	29.89
MPQM	67.81	70.49	70.13	63.21	58.73
MPBM	13.18	12.32	13.85	12.1	12.06

In Table 3.4 MPQM gives the minimal population (percentage share) necessary to obtain qualified majority and MPBM gives the minimal population necessary to obtain the blocking minority. We can see for example that in the present EU of 15 members the representation of 12,06% of population can obtain 32.2% of votes and block decision making process (Portugal, Finland, Austria, Denmark, Ireland, Netherlands, Finland and Luxembourg).

The same analysis can be applied with respect to GDP. We can look for minimal share of total GDP necessary to pass a decision under qualified majority and for minimal share of total GDP necessary to block decision under blocking majority. For example, in EU of 15 the minimal share of total GDP to pass a decision is 51.81% (Belgium, Spain, Ireland, Luxembourg, Portugal, Austria, Sweden, Denmark, Greece, Italy UK and Finland), while the minimal share of total GDP to block a decision is only 9.08% (Belgium, Ireland, Luxembourg, Portugal, Denmark, Greece and Finland).

Composition of European Parliament

The last general election to European Parliament took place in 1994. After 1995 extension the European Parliament was extended by representatives of Austria, Finland and Sweden. The elections of the Austrian, Finish and Swedish members of EU took place in September-October 1996. In Table 3.5 we provide the distribution of seats in the European parliament at the end of 1996, related to population and GDP.[8]

Table 3.5
Representation of member states in European Parliament

country	seats	% seats	GDP	% GDP	popul.	% popul.	abbr.
Belgium	25	3.99	213.44	2.93	10.06	2.72	BE
Denmark	16	2.56	137.61	1.89	5.19	1.40	DK
Germany	99	15.81	1903.00	26.14	80.77	21.84	D
Greece	25	3.99	76.70	1.05	10.38	2.81	GR
Spain	64	10.22	533.99	7.33	39.13	10.58	ES
France	87	13.90	1289.24	17.71	57.65	15.59	FR
Ireland	15	2.40	44.91	0.62	3.57	0.96	IR
Italy	87	13.90	1134.98	15.59	57.84	15.64	IT
Luxembourg	6	0.96	14.23	0.20	0.40	0.11	LU
Netherlands	31	4.95	316.40	4.35	15.28	4.13	NE
Austria	21	3.35	183.53	2.52	7.94	2.15	AU
Portugal	25	3.99	77.75	1.07	9.85	2.66	PT
Finland	16	2.56	96.22	1.32	5.07	1.37	FI
Sweden	22	3.51	216.29	2.97	8.71	2.36	SE
UK	87	13.90	1042.70	14.32	58.04	15.69	UK
	626	100.00	7280.98	100.00	369.86	100.00	

While the relative representation of member countries in European Parliament is closer to population shares than in the case of the Council of Ministers, we can still observe significant irregularities.

Graphical representation of Table 3.5 is given in Fig. 3.1, comparing shares of seats, shares of population and shares of GDP for different countries. In Fig. 1.1 we are using abbreviations of member countries names from the last column of the Table 1.5. It is easy to identify countries that are in some sense over-represented (e.g. Luxembourg) or under-represented (Germany).

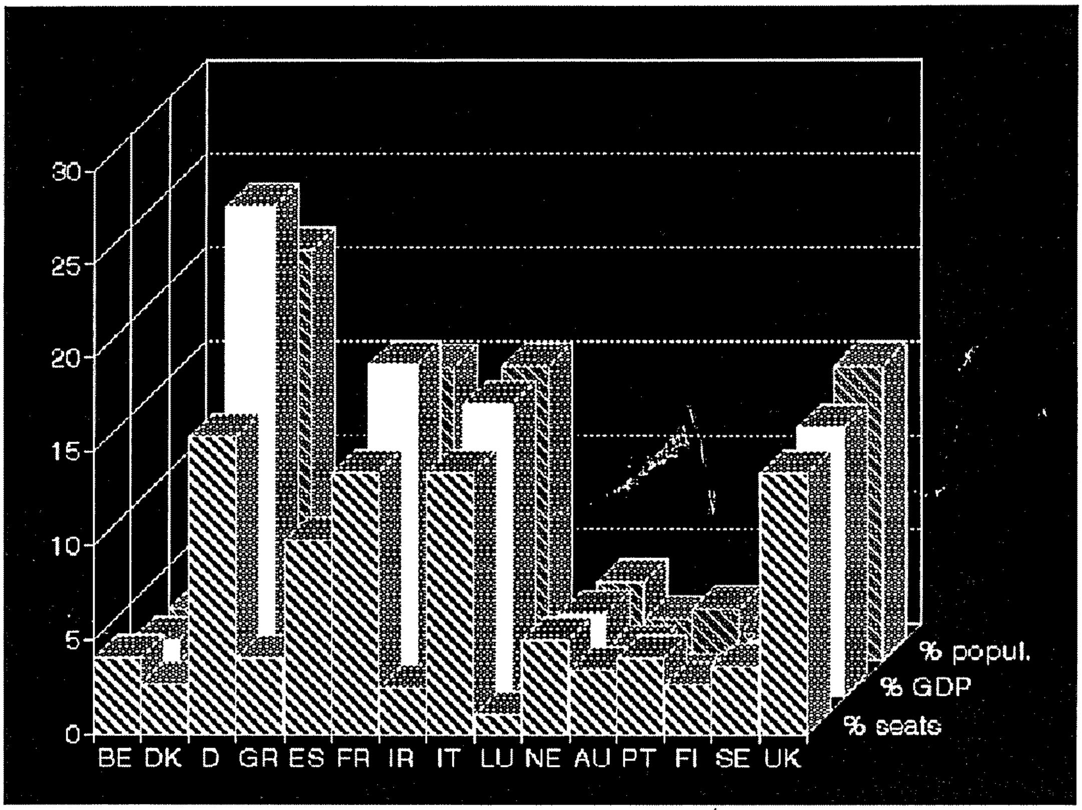

Fig. 3.1
Weights and votes in European Parliament (1996)

3.4 Extension makes things even more difficult

The decision making process in EU strongly favours small countries. The share of representation of small countries is higher than their share of population and GDP. Small countries can effectively block decision making by blocking minority. The influence of big countries is declining. This process will continue in future enlargements of EU (Central Europe, Baltic States etc.).

Table 3.6
Weights and votes in EU of 27 members

	votes	% votes	popul.	% popul.	GDP	% GDP
Belgium	5	3.79	10061	2.11	213435	2.84
Denmark	3	2.27	5191	1.09	137610	1.83
Germany	10	7.58	80769	16.95	1902995	25.33
Greece	5	3.79	10376	2.18	76698	1.02
Spain	8	6.06	39125	8.21	533986	7.11
France	10	7.58	57650	12.10	1289235	17.16
Ireland	3	2.27	3569	0.75	44906	0.60
Italy	10	7.58	57840	12.14	1134980	15.10
Luxembourg	2	1.52	397	0.08	14233	0.19
Netherlands	5	3.79	15277	3.21	316404	4.21
Portugal	5	3.79	9848	2.07	77749	1.03
UK	10	7.58	58040	12.18	1042700	13.88
Austria	4	3.03	7937	1.67	183530	2.44
Finland	3	2.27	5072	1.06	96220	1.28
Sweden	4	3.03	8712	1.83	216294	2.88
Poland	8	6.06	38446	8.07	87315	1.16
Czech R.	5	3.79	10323	2.17	28192	0.38
Slovakia	3	2.27	5345	1.12	10145	0.14
Hungary	5	3.79	10280	2.16	34254	0.46
Slovenia	2	1.52	1993	0.42	12566	0.17
Malta	2	1.52	362	0.08	3120	0.04
Cyprus	2	1.52	726	0.15	7539	0.10
Romania	6	4.55	22761	4.78	25427	0.34
Bulgaria	4	3.03	8459	1.78	9773	0.13
Estonia	2	1.52	1546	0.32	4703	0.06
Latvia	3	2.27	2588	0.54	5257	0.07
Lithuania	3	2.27	3747	0.79	4891	0.07
EU of 27	132	100	476440	100	7514157	100.00

In Table 3.6 we give a foreseen distribution of votes in a Union of 27 states.[9] Applying analysis from section 5 we can show that in this case the minimal population to obtain the qualified majority (95 votes from 135) would be 47.10% and the minimal population to obtain the blocking minority (41 out of 135) would be 11.39%. The minimal share of GDP to pass a decision by qualified majority would be 29.60% (all countries without Germany, France, Italy and United Kingdom), while the minimal share of GDP to obtain blocking minority would be only 2.69% (Ireland, Luxembourg, Slovakia, Slovenia, Cyprus, Bulgaria, Latvia, Czech Republic, Hungary, Malta, Rumania, Estonia and Lithuania). We can also see that the new states of Central and Eastern Europe (Poland, Czech Rep., Slovakia, Hungary, Romania, Bulgaria, Estonia, Latvia, Lithuania and Slovenia) acting as a group can block the Council decision.

3.5 Problems

With the growth in the number of members and deepening of integration, the issues of national representation, decision making procedures and efficiency in operation of European institutions become to be more and more sensitive, because national interests and national influence are affected. By a present pattern of allocation of national weights (votes) a relative influence of small countries is increasing, and the reduction of the influence of large countries representing decisive economic power and the majority of the population, can be observed. In the current EU, for example, the votes representing only 9.08% of the total GDP can block a decision of the Council. Criticism of the current institutional setup of the EU is very intense, and it stems from the perspective of further enlargement (the goal number being 27 members), which could lead to a totally muddled and inconclusive situation in decision-making.

The questions of reform of decision making rules are currently being discussed in a lively fashion, and various decisions are being proposed (the strengthening of the role of the European Parliament, the principle of the simple majority, the double majority principle, etc). It concerns a more general problem of redefining fair representation of member states in European Union institutions[10] and/or constructing decision-making rules in multinational, non-homogeneous groupings while preserving specific rules combining a non-zero influence of every member in accordance with its weight with respect to population and GDP; this problem is not trivial and is a part of the theory of public choice.

4. Distribution of National and Institutional Influence in European Union

We have established significant disproportionality of national representation in European Union institutions, both with respect to population and GDP. It is known, that distribution of power, or influence among the members of a committee can differ from the distribution of votes. Voting power, measured by so called power indices, is a function of distribution of votes, structure of the committee, and used voting rules.

We shall apply theory of power indices (see Appendix) to evaluate distribution of power among different members of European Union in decision making in Council of Ministers, European Parliament and Commission. Dynamics of distribution of power during a sequence of extensions is analyzed and possible implications of future East European and Mediterranean extension on distribution of power are considered.

4.1 Distribution of power in the Council of Ministers

The most important institution in European Union is without a doubt the Council of Ministers; this body is responsible for the creation of the general strategy of the Union and for making basic political and legislative decisions, and in some cases, it has a direct responsibility for executive decisions. The Council of Ministers is a typical weighted voting game. The members of the Council, representing individual member states, have different voting weights (numbers of votes allotted to member countries). The votes of one country are indivisible, all of them are casted either for YES or for NO. During decision-making, a so-called "qualified majority" (roughly 70 % of votes in favour) is required for the acceptance of the decision, while the decision can be blocked by a so-called "blocking minority" (about 30 % of votes against). In the game "Commission - Council - European Parliament" the Council always had the most important position. It is not surprising that analyses of distribution of national influence in European Union always use distribution of power in the Council of Ministers as a departure point.[11]

4.1.1 Dynamics of distribution of power during the past enlargements

Table 4.1 presents Shapley-Shubik power indices (calculated for the qualified majority on the basis of representation in the Council of Ministers) for different countries in different stages of development in the EU. In the Table SS-6, SS-9, SS-10, SS-12, and SS-15 stand for Shapley-Shubik power index for European Union of 6, 9, 10, 12, and 15 members respectively (qualified majority is assumed).

Table 4.1
Distribution of power in the Council of Ministers of EU (measured by Shapley-Shubik power indices)

country	SS-6	SS-9	SS-10	SS-12	SS-15
Belgium	15.00	8.10	7.46	6.40	5.50
Denmark		5.70	5.67	4.90	3.30
Germany	23.33	17.90	16.39	13.40	12.10
Greece			7.46	6.40	5.50
Spain				11.10	9.00
France	23.33	17.90	16.39	13.40	12.10
Ireland		5.70	5.67	4.20	3.30
Italy	23.33	17.90	16.39	13.40	12.10
Luxembourg	0.00	1.00	0.71	1.20	2.00
Netherlands	15.00	8.10	7.46	6.40	5.50
Austria					4.30
Portugal				6.40	5.50
Finland					3.30
Sweden					4.30
UK		17.90	16.39	13.40	12.10
total	99.99	100.2	99.99	100.6	99.9

When analysing the consequences of the enlargement of the EU in 80's and 90's, we can observe a stable decrease of influence of the big countries (Germany, France, Italy, UK). It is interesting that the influence of Luxembourg is increasing (from 0 to 2%), while its relative share in the Council of Ministers is decreasing. Expansion of the European Union leads to substantial changes in the balance of power.

In the last enlargement of the EU by Austria, Finland and Sweden, the loss of power for the original 12 members of the EU was almost 12%.

Increasing number of members naturally raises question of eventual coalitional considerations. Just to illustrate this possibility, let us consider the following hypothetical coalitional structure:

a) Hard core group (Germany, France, Belgium, Netherlands, Luxembourg, Austria),
b) Mediterranean group (Italy, Spain, Portugal, Greece),
c) Scandinavian group (Denmark, Sweden, Finland),
d) GB group (GB, Ireland).

In Table 4.2 we provide evaluation of distribution of power in the Council of Ministers for such a coalitional structure. Other coalitional structures can be considered.

Table 4.2
Evaluation of power of hypothetical regional coalitions in EU of 15

coalition	votes	% votes	SS QM	SS SM
G+F+B+NL+L+A	36	41,38	50	50
I+S+P+GR	28	32,18	50	16,67
D+SU+SW	10	11,49	0	16,67
GB+IR	13	14,94	0	16,67
total	87	99,99	100	100,01

4.1.2 Possible consequences of future extension

Considering possible consequences of future extension under unchanged decision making rules and rules for allocation of votes to the countries, we can observe another decline of influence of the big countries.[12] In Table 4.3 we give evaluation of power distribution in a hypothetical European Union of 27 (Shapley-Shubik and Banzhaf-Coleman indices for qualified majority). We assume independent voting (no coalitional structures forming voting blocs). Five small countries (Luxembourg, Slovenia, Malta, Cyprus and Estonia) would have, according to this scheme, the same joint influence as any of big countries. We can see, that in this case the distribution of power is very close to the distribution of votes.

Increasing number of members provides an extensive space for coalitional considerations.[13] Let us consider only a very simple case: a coalition of 10 Central and East European countries (CEEC), with all other 17 members acting independently. In Table 4.4 we give the corresponding distribution of power (Shapley-Shubik indices for qualified and simple majority) in the Council of Ministers. We can see, that under this assumption the power of CEEC would be 43.89% for qualified majority and 41.73% for simple majority, what is an alarming fact for other member countries.

We can identify plenty of other possible regional coalitions of countries with close interests. It makes the problem of distribution of power even much more complex than it can be anticipated from a simple model of independent voting in the Council of Ministers.

Table 4.3
Distribution of Votes and Power in EU of 27 Members - Independent Voting

	votes	%	SSQM	BCQM
Belgium	5	3.79	3.75	3.89
Denmark	3	2.27	2.21	2.37
Germany	10	7.58	7.81	7.15
Greece	5	3.79	3.75	3.89
Spain	8	6.06	6.14	5.97
France	10	7.58	7.81	7.15
Ireland	3	2.27	2.31	2.37
Italy	10	7.58	7.81	7.15
Luxembourg	2	1.52	1.47	1.58
Netherlands	5	3.79	3.75	3.89
Portugal	5	3.79	3.75	3.89
UK	10	7.58	7.81	7.15
Austria	4	3.03	2.97	3.13
Finland	3	2.27	2.21	2.37
Sweden	4	3.03	2.97	3.13
Poland	8	6.06	6.14	5.97
Czech R.	5	3.79	3.75	3.89
Slovakia	3	2.27	2.21	2.37
Hungary	5	3.79	3.75	3.89
Slovenia	2	1.52	1.47	1.58
Malta	2	1.52	1.47	1.58
Cyprus	2	1.52	1.47	1.58
Romania	6	4.55	4.51	4.61
Bulgaria	4	3.03	2.97	3.13
Estonia	2	1.52	1.47	1.58
Latvia	3	2.27	2.21	2.37
Lithuania	3	2.27	2.21	2.37
	132	100.00	100.15	100

Table 4.4
Distribution of Votes and Power in EU of 27 members with CEEC Coalition

	votes	%	SSQM	SSSM
Belgium	5	3.79	3.01	3.18
Denmark	3	2.27	1.78	1.92
Germany	10	7.58	6.43	6.46
Greece	5	3.79	3.01	3.18
Spain	8	6.06	5.03	5.17
France	10	7.58	6.43	6.46
Ireland	3	2.27	1.78	1.92
Italy	10	7.58	6.43	6.46
Luxembourg	2	1.52	1.14	1.26
Netherlands	5	3.79	3.01	3.18
Portugal	5	3.79	3.01	3.18
UK	10	7.58	6.43	6.46
Austria	4	3.03	2.28	2.51
Finland	3	2.27	1.78	1.92
Sweden	4	3.03	2.28	2.51
Malta	2	1.52	1.14	1.26
Cyprus	2	1.52	1.14	1.26
CEEC	41	31.43	43.89	41.73
	132	100.00	100.0	100.00

4.1.3 The double majority principle as a decision making rule in the Council of Ministers

We have mentioned some problems of decision making in European Union, related to disproportional national representation in European Union institutions (where disproportionality is considered not only with respect to population share, but also to economic power, the share of GDP).[14] With the prospect of Malta and Cyprus, plus up to ten associated countries from CEEC joining the Union in the coming years, the question of institutional reform of European Union can no longer be avoided.[15]

One of the options for reform of weighting of member countries votes is implementation of double majority principle in one way or another.

In this context we suppose that each of n members ($i = 1, \ldots, n$) of a committee has two weights v_i and t_i (e.g. the votes in the Council and the share of population, or GDP). Let v^M be a qualified majority for weights v_i and t^M be a qualified majority for weights t_i. We shall refer to such a voting body as a two-weight committee (a natural generalization to a multi-weight committee is obvious).

A decision is approved by a two-weight committee if there exists a coalition S of the members such that

$$\sum_{i \in S}^{n} v_i \geq v^M$$

AND

$$\sum_{i \in S}^{n} t_i \geq t^M$$

We shall call this rule a double-majority rule. It is clear a blocking minority in this case is

$$v^m = \sum_{i=1}^{n} v_i - v^M + 1$$

OR

$$t^m = \sum_{i=1}^{n} t_i - t^M + 1$$

4.1.3.1 Double majority: votes and population, or votes and GDP

In Table 4.5 we applied the concept of double-majority on European Union of six, using as weights votes in the Council and population or GDP (by 1960) assuming simple majority voting for the both sets of weights.

Table 4.5
Double majority in the Council of Ministers of EU of 6

country	% votes	SS votes	% popul.	SS pop.	% GDP	SS GDP	SS V+P	SS V+GDP
Belgium	11.76	10.00	5.29	0.00	4.90	3.33	5.00	5.00
Germany	23.53	23.33	32.19	33.33	37.65	36.67	28.33	28.33
France	23.53	23.33	26.50	33.33	26.33	28.33	28.33	28.33
Italy	23.53	23.33	29.23	33.33	23.67	28.33	28.33	28.33
Luxembourg	5.88	10.00	0.17	0.00	0.27	0.00	5.00	5.00
Netherlands	11.76	10.00	6.62	0.00	7.18	3.33	5.00	5.00
total	99.99	99.99	100.00	99.99	100.00	99.99	99.99	99.99

We can see, that a distribution of power, based on double-majority principle (either votes and population, or votes and GDP), is closer to relative share of population and GDP than a distribution of power based on the votes only, and at the same time it is not eliminating an influence of small members.

A hypothetical double majority principle distribution of power in EU of 15 members, based on votes and population weights, and votes and GDP weights, is summarized in Table 4.6. Population is given in thousands of citizens (1993), GDP in mil. of USD (1993, 0ECD database). The Shapley-Shubik power index is used for simple majority.

Table 4.6
Double majority principle in the Council of Ministers of EU of 15 members

	votes	% votes	popul.	% popul.	GDP	% GDP	V SSSM	V+P SSSM	V+GDP SSSM
Belgium	5	5.75	10061	2.72	213435	2.93	5.56	3.86	4.18
Denmark	3	3.45	5191	1.40	137610	1.89	3.26	2.17	2.52
Germany	10	11.49	80769	21.84	1902995	26.14	11.83	17.74	20.83
Greece	5	5.75	10376	2.81	76698	1.05	5.56	3.87	3.29
Spain	8	9.20	39125	10.58	533986	7.33	9.17	10.64	8.31
France	10	11.49	57650	15.59	1289235	17.71	11.83	13.89	14.52
Ireland	3	3.45	3569	0.96	44906	0.62	3.26	1.99	1.85
Italy	10	11.49	57840	15.64	1134980	15.59	11.83	13.89	13.22
Luxembourg	2	2.30	397	0.11	14233	0.20	2.18	1.10	1.15
Netherlands	5	5.75	15277	4.13	316404	4.35	5.56	4.41	4.98
Portugal	5	5.75	9848	2.66	77749	1.07	5.56	3.85	3.29
UK	10	11.49	58040	15.69	1042700	14.32	11.83	13.90	12.31
Austria	4	4.60	7937	2.15	183530	2.52	4.64	3.26	3.56
Finland	3	3.45	5072	1.37	96220	1.32	3.26	2.16	2.26
Sweden	4	4.60	8712	2.36	216294	2.97	4.64	3.26	3.74
total EU	87	100.00	369864	100.00	7280975	100.00	99.97	99.99	100.01

We can see, that both combinations, of votes and population and votes and GDP, in voting weights and implementation of the double majority principle gives intuitively much more acceptable distribution of power than using just present distribution of votes. No country is dummy and voting power of different countries is closer to their relative weights in population and economic power. This result cannot be achieved by implementation of standard democratic principle: strictly proportional voting relative to the weights of population only. It would make many small countries dummy players in the game.

The similar situation we can observe for hypothetical European Union of 27 members (see Table 4.7). In the calculation we used the 1993 data about population and GDP.

Table 4.7
The double majority in the Council of Ministers of hypothetical EU of 27 members

	votes	% votes	popul.	% popul.	GDP	% GDP	V SSSM	V+P SSSM	V+GDP SSSM
Belgium	5	3.79	10061	2.11	213435	2.84	3.74	2.89	3.25
Denmark	3	2.27	5191	1.09	137610	1.83	2.21	1.63	1.97
Germany	10	7.58	80769	16.95	1902995	25.33	7.80	12.94	18.04
Greece	5	3.79	10376	2.18	76698	1.02	3.74	2.92	2.38
Spain	8	6.06	39125	8.21	533986	7.11	6.14	7.03	6.71
France	10	7.58	57650	12.10	1289235	17.16	7.80	10.00	12.19
Ireland	3	2.27	3569	0.75	44906	0.60	2.21	1.48	1.41
Italy	10	7.58	57840	12.14	1134980	15.10	7.80	10.02	10.91
Luxembourg	2	1.52	397	0.08	14233	0.19	1.46	0.80	0.83
Netherlands	5	3.79	15277	3.21	316404	4.21	3.74	3.40	3.96
Portugal	5	3.79	9848	2.07	77749	1.03	3.74	2.87	2.39
UK	10	7.58	58040	12.18	1042700	13.88	7.80	10.05	10.12
Austria	4	3.03	7937	1.67	183530	2.44	2.97	2.29	2.66
Finland	3	2.27	5072	1.06	96220	1.28	2.21	1.62	1.71
Sweden	4	3.03	8712	1.83	216294	2.88	2.97	2.36	2.87
Poland	8	6.06	38446	8.07	87315	1.16	6.14	6.95	3.67
Czech R.	5	3.79	10323	2.17	28192	0.38	3.74	2.91	2.09
Slovakia	3	2.27	5345	1.12	10145	0.14	2.21	1.65	1.19
Hungary	5	3.79	10280	2.16	34254	0.46	3.74	2.91	2.12
Slovenia	2	1.52	1993	0.42	12566	0.17	1.46	0.94	0.82
Malta	2	1.52	362	0.08	3120	0.04	1.46	0.80	0.77
Cyprus	2	1.52	726	0.15	7539	0.10	1.46	0.83	0.79
Romania	6	4.55	22761	4.78	25427	0.34	4.53	4.58	2.47
Bulgaria	4	3.03	8459	1.78	9773	0.13	2.97	2.34	1.58
Estonia	2	1.52	1546	0.32	4703	0.06	1.46	0.90	0.78
Latvia	3	2.27	2588	0.54	5257	0.07	2.21	1.39	1.16
Lithuania	3	2.27	3747	0.79	4891	0.07	2.21	1.50	1.16
EU of 27	132	100	476440	100	7514157	100.00	99.92	100.00	100.00

4.1.3.2 Double majority: population and GDP

We can consider also double majority voting based directly on objectively existing votes - population and GDP. In this case each member country has in Council of Ministers voting two weights - share of population and share of GDP, and we assume, that a proposal is accepted if it has simple majority in the both sets of votes. In Table 4.8 we give the distribution of power, following from this voting rule, in the Council of Ministers of European Union of 15.

Table 4.8
The Double majority principle distribution of power in EU of 15 members, population and GDP

country	popul	% pop.	GDP	% GDP	SSSM	BCSM
Luxembourg	397	0.11	14233	0.20	0.09	0.1
Ireland	3569	0.96	44906	0.62	0.59	0.66
Finland	5072	1.37	96220	1.32	1.15	1.28
Denmark	5191	1.40	137610	1.89	1.42	1.55
Austria	7937	2.15	182530	2.51	2.18	2.31
Sweden	8712	2.36	216294	2.97	2.37	2.51
Portugal	9848	2.66	77749	1.07	1.58	1.76
Belgium	10061	2.72	213435	2.93	2.48	2.65
Greece	10376	2.81	76698	1.05	1.59	1.78
Netherlands	15277	4.13	316404	4.35	3.83	4.14
Spain	39125	10.58	533986	7.33	9.78	9.62
France	57650	15.59	1289235	17.71	16.56	16.14
Italy	57840	15.64	1134980	15.59	15.26	15.03
UK	58040	15.69	1042700	14.32	14.38	14.15
Germany	80769	21.84	1902995	26.14	26.74	26.32
	369864	100.00	7279975	100.00	100	100

In Table 4.9 we give the hypothetical distribution of power in the Council of Ministers of European Union of 27, based on double majority principle of voting with population and GDP shares used as voting weights.

Table 4.9
The Double majority principle distribution of power in EU of 27 members, population and GDP

country	popul	% pop.	GDP	% GDP	SSSM	BCSM
Malta	362	0.08	3120	0.04	0.05	0.06
Luxembourg	397	0.08	14233	0.19	0.12	0.13
Cyprus	726	0.15	7539	0.10	0.12	0.13
Estonia	1546	0.32	4703	0.06	0.18	0.20
Slovenia	1993	0.42	12566	0.17	0.27	0.30
Latvia	2588	0.54	5275	0.07	0.28	0.32
Ireland	3569	0.75	44906	0.60	0.63	0.67
Lithuania	3747	0.79	4891	0.07	0.39	0.45
Finland	5072	1.06	96220	1.28	1.09	1.13
Denmark	5191	1.09	137610	1.83	1.36	1.40
Slovakia	5345	1.12	10145	0.14	0.58	0.66
Austria	7937	1.67	182530	2.43	1.94	1.97
Bulgaria	8459	1.78	9773	0.13	0.88	1.01
Sweden	8712	1.83	216294	2.88	2.23	2.26
Portugal	9848	2.07	77749	1.03	1.44	1.56
Belgium	10061	2.11	213435	2.84	2.34	2.39
Hungary	10280	2.16	34154	0.45	1.22	1.36
Czech R.	10323	2.17	28192	0.38	1.18	1.33
Greece	10376	2.18	76698	1.02	1.49	1.62
Netherlands	15277	3.21	316404	4.21	3.59	3.66
Romania	22761	4.78	25427	0.34	2.46	2.72
Poland	38446	8.07	87315	1.16	4.47	4.84
Spain	39125	8.21	533986	7.11	7.64	7.30
France	57650	12.10	1289235	17.16	14.56	13.95
Italy	57840	12.14	1134980	15.11	13.29	12.94
UK	58040	12.18	1042700	13.88	12.51	12.20
Germany	80769	16.95	1902995	25.33	23.68	23.42
	476440	100.00	7513075	100.00	99.99	99.98

4.1.3.3 Double majority: population and member states, GDP and member states

Another logical option is to consider the following voting rule: decisions are to be approved by majority of member states (by the principle "one country - one vote") and majority in some set of objectively existing weights (population, or GDP). In Table 4.10 we give the distribution of power, following from this voting rule, in the Council of Ministers of European Union of 15. We assume simple majority in the both sets of weights (at least

8 member states, that represent more than 50% of total population, or at least 8 member states, that represent more than 50% of total GDP).

Table 4.10
The Double majority principle distribution of power in EU of 15 members, population and member states, or GDP and member states

	votes	% votes	popul.	% popul.	GDP	% GDP	V SSSM	C+P SSSM	C+GDP SSSM
Belgium	5	5.75	10061	2.72	213435	2.93	5.56	4.41	4.73
Denmark	3	3.45	5191	1.40	137610	1.89	3.26	3.87	4.22
Germany	10	11.49	80769	21.84	1902995	26.14	11.83	15.16	18.25
Greece	5	5.75	10376	2.81	76698	1.05	5.56	4.42	3.83
Spain	8	9.20	39125	10.58	533986	7.33	9.17	9.38	7.06
France	10	11.49	57650	15.59	1289235	17.71	11.83	11.30	11.93
Ireland	3	3.45	3569	0.96	44906	0.62	3.26	3.70	3.56
Italy	10	11.49	57840	15.64	1134980	15.59	11.83	11.30	10.26
Luxembourg	2	2.30	397	0.11	14233	0.20	2.18	3.35	3.40
Netherlands	5	5.75	15277	4.13	316404	4.35	5.56	4.97	5.53
Portugal	5	5.75	9848	2.66	77749	1.07	5.56	4.40	3.84
UK	10	11.49	58040	15.69	1042700	14.32	11.83	11.32	9.73
Austria	4	4.60	7937	2.15	183530	2.52	4.64	4.28	4.57
Finland	3	3.45	5072	1.37	96220	1.32	3.26	3.86	3.96
Sweden	4	4.60	8712	2.36	216294	2.97	4.64	4.28	4.76
total EU	87	100	369864	100	7280975	100	99.97	100	99.63

In Table 4.11 we give the same characteristics for hypothetical European Union of 27. We can see, that distribution of power tends to be more balanced with respect to objective characteristics of the countries, than distribution by the votes in the Council and qualified majority.

Table 4.11
The Double majority principle distribution of power in EU of 27 members, population and member states, or GDP and member states

	votes	% votes	popul.	% popul.	GDP	% GDP	V	C+P	C+GDP
Belgium	5	3.79	10061	2.11	213435	2.84	3.74	2.83	3.21
Denmark	3	2.27	5191	1.09	137610	1.83	2.21	2.35	2.71
Germany	10	7.58	80769	16.95	1902995	25.33	7.80	11.12	16.26
Greece	5	3.79	10376	2.18	76698	1.02	3.74	2.86	2.33
Spain	8	6.06	39125	8.21	533986	7.11	6.14	5.86	5.49
France	10	7.58	57650	12.10	1289235	17.16	7.80	8.04	10.32
Ireland	3	2.27	3569	0.75	44906	0.60	2.21	2.20	2.13
Italy	10	7.58	57840	12.14	1134980	15.10	7.80	8.06	8.94
Luxembourg	2	1.52	397	0.08	14233	0.19	1.46	1.89	1.94
Netherlands	5	3.79	15277	3.21	316404	4.21	3.74	3.36	3.94
Portugal	5	3.79	9848	2.07	77749	1.03	3.74	2.81	2.33
UK	10	7.58	58040	12.18	1042700	13.88	7.80	8.08	8.13
Austria	4	3.03	7937	1.67	183530	2.44	2.97	2.62	3.02
Finland	3	2.27	5072	1.06	96220	1.28	2.21	2.34	2.45
Sweden	4	3.03	8712	1.83	216294	2.88	2.97	2.70	3.23
Poland	8	6.06	38446	8.07	87315	1.16	6.14	5.78	2.39
Czech R.	5	3.79	10323	2.17	28192	0.38	3.74	2.86	2.03
Slovakia	3	2.27	5345	1.12	10145	0.14	2.21	2.37	1.91
Hungary	5	3.79	10280	2.16	34254	0.46	3.74	2.86	2.07
Slovenia	2	1.52	1993	0.42	12566	0.17	1.46	2.04	1.93
Malta	2	1.52	362	0.08	3120	0.04	1.46	1.89	1.87
Cyprus	2	1.52	726	0.15	7539	0.10	1.46	1.92	1.90
Romania	6	4.55	22761	4.78	25427	0.34	4.53	4.15	2.01
Bulgaria	4	3.03	8459	1.78	9773	0.13	2.97	2.68	1.91
Estonia	2	1.52	1546	0.32	4703	0.06	1.46	2.00	1.88
Latvia	3	2.27	2588	0.54	5257	0.07	2.21	2.10	1.88
Lithuania	3	2.27	3747	0.79	4891	0.07	2.21	2.22	1.88
total EU	132	100	476440	100	7514157	100.00	99.92	99.99	100.09

4.2 Commission and the Council of Ministers

Commission has 20 members. Its national structure is given in Table 4.12. We give in the Table also corresponding values of power indices: Shapley-Shubik and Banzhaf-Coleman for simple majority (11 votes) and hypothetical qualified majority (14 votes). We have only two values of power indices: for the big and small countries.

At the same time we have to keep in mind that Commission, representing supernational interests, interests of EU as a whole, and is supposedly independent on national views. So probably it doesn't contribute directly to the distribution of national influence and its role in decision making game of European Union should be treated differently than the role of the Council of Ministers.

Table 4.12
Distribution of national influence in the Commission of EU

country	number of commiss ioners	%	SSSM	SSQM	BCSM	BCQM
Belgium	1	5.0	4.87	4.87	4.912	5.061
Denmark	1	5.0	4.87	4.87	4.912	5.061
Germany	2	10.0	10.27	10.27	10.175	9.879
Greece	1	5.0	4.87	4.87	4.912	5.061
Spain	2	10.0	10.27	10.27	10.175	9.879
France	2	10.0	10.27	10.27	4.912	9.879
Ireland	1	5.0	4.87	4.87	4.912	5.061
Italy	2	10.0	10.27	10.27	10.175	9.879
Luxembourg	1	5.0	4.87	4.87	4.912	5.061
Netherlands	1	5.0	4.87	4.87	4.912	5.061
Austria	1	5.0	4.87	4.87	4.912	5.061
Portugal	1	5.0	4.87	4.87	4.912	5.061
Finland	1	5.0	4.87	4.87	4.912	5.061
Sweden	1	5.0	4.87	4.87	4.912	5.061
UK	2	10.0	10.87	10.27	10.175	9.879
total	20	100.0	100.00	100.00	100.00	100.00

4.2.1 Commission-Council Game, model without Commission's initiation monopoly

To evaluate in a more realistic way an influence of Commission on distribution of power among member states in European Union decision making, let us formulate the following simple model: Commission has the right to initiate, but in the case of unanimous vote of the Council of Ministers the Commission's proposal is not necessary for a decision. Let us assume, that to pass a Commission's proposal qualified majority in the Council is necessary. Hence, a proposal is accepted if

a) either, it is agreed by Commission and approved by qualified majority by the Council,

b) or, it is unanimously approved by the Council, even without approval of the Commission.

To be able to apply power indices methodology for weighted voting body on the "Council versus Commission game", we shall formulate the situation described above in terms of weighted voting games.

Let

v_i be the weight of the i-th country in the Council, $i = 1, 2, \ldots, n$,

q be the qualified majority quota in the Council voting,

then we have a model

$$[q, \mathbf{v}] = [q; v_1, v_2, \ldots, v_n]$$

of the Council as a weighted voting body. Now, let us define an auxiliary augmented weighted voting body with n+1 members

$$[\gamma, \boldsymbol{\omega}] = [\gamma; \omega_1, \ldots, \omega_n, \omega_{n+1}]$$

such that

$$\omega_i = v_i \quad \mathit{for}\ i = 1, 2, \ldots, n$$

$$\omega_{n+1} = \sum_{i=1}^{n} v_i - q$$

$$\gamma = \sum_{i=1}^{n} v_i$$

where the first n members represent Council and the member n+1 represents Commission. It can be easily seen than in this artificial committee the majority voting with quota γ will lead to required results: a decision is accepted if it is accepted by member n+1 (Commission) and qualified majority q of the first n members (Council), or if it is accepted by unanimous vote of the first n members (even against the last member).

Example 4.1

Let us consider a hypothetical Council of three members A, B, and C with the distribution of votes 50, 30, 20, with qualified majority 70 votes, and a Commission. Then the Council weighted voting committee is

$$[q, \mathbf{v}] = [70; 50, 30, 20]$$

and the Council-Commission auxiliary augmented weighted voting committee is

$$[\gamma, \boldsymbol{\omega}] = [100; 50, 30, 20, 30]$$

The distribution of power (Shapley-Shubik) in Council (without respect to the role of the Commission) is

$$\pi(q, v) = \left(\frac{2}{3}, \frac{1}{6}, \frac{1}{6}\right)$$

while the distribution of power in Council-Commission game is

$$\pi(\gamma, \omega) = \left(\frac{1}{2}, \frac{1}{6}, \frac{1}{6}, \frac{1}{6}\right)$$

We can see, that the Council keeps 83.33% of decisional power, while the Commission keeps 16.67% of decisional power. Including Commission into our considerations, we shall receive substantially different distribution of power among member states than taking into account the Council only.

In Table 4.13 we provide the distribution of power in the Council-Commission game (without Commission's monopoly to initiate) for the European Union of 15 member states.

Table 4.13
Distribution of power in the EU 15, based on Council-Commission game (without Commission's monopoly to initiate)

country	weights for QM	weights for SM	SSQM	BCQM	SSSM	BCSM
Belgium	5	5	4.18	5.09	3.20	4.13
Denmark	3	3	2.84	3.12	1.84	2.13
Germany	10	10	8.51	9.67	6.33	8.62
Greece	5	5	4.18	5.09	3.20	4.13
Spain	8	8	7.04	8.01	5.00	6.72
France	10	10	8.51	9.76	6.33	8.62
Ireland	3	3	2.84	3.12	2.05	2.44
Italy	10	10	8.51	9.67	6.33	8.62
Luxembourg	2	2	1.87	1.97	1.51	1.62
Netherlands	5	5	4.18	5.09	3.20	4.13
Austria	4	4	3.52	4.15	2.74	3.44
Portugal	5	5	4.18	5.09	3.20	4.13
Finland	3	3	2.84	4.13	2.05	2.44
Sweden	4	4	3.52	4.15	2.74	3.44
UK	10	10	8.51	9.67	6.33	8.62
Commission	25	43	24.78	13.32	43.75	26.43
total			100.00	100.00	100.00	100.00

Distribution of power between Council and Commission in this case is 24.78% for Commission and 75.22% for the Council under qualified majority voting in the Council, and 43.75% for Commission and 56.25% for the Council under simple majority voting in the Council.

In Table 4.14 we provide the distribution of power in the Council-Commission game (without Commission's monopoly to initiate) for the European Union of 27 member states.

Table 4.14
Distribution of power in the EU 27, based on Council-Commission game (without Commission's monopoly to initiate)

	weights for QM	weights for SM	SSQM	BCQM	SSSM	BCSM
Germany	10	10	5.57	6.51	4.06	6.11
France	10	10	5.57	6.51	4.06	6.11
Italy	10	10	5.57	6.51	4.06	6.11
UK	10	10	5.57	6.51	4.06	6.11
Spain	8	8	4.39	5.44	3.22	4.81
Poland	8	8	4.39	5.44	3.22	4.81
Romania	6	6	3.25	4.20	2.41	3.56
Belgium	5	5	2.71	3.54	2.02	2.96
Greece	5	5	2.71	3.54	2.02	2.96
Netherlands	5	5	2.71	3.54	2.02	2.96
Portugal	5	5	2.71	3.54	2.02	2.96
Czech Rep.	5	5	2.71	3.54	2.02	2.96
Hungary	5	5	2.71	3.54	2.02	2.96
Austria	4	4	2.17	2.85	1.63	2.36
Sweden	4	4	2.17	2.85	1.63	2.36
Bulgaria	4	4	2.17	2.85	1.63	2.36
Denmark	3	3	1.65	2.16	1.25	1.76
Ireland	3	3	1.65	2.16	1.25	1.76
Finland	3	3	1.65	2.16	1.25	1.76
Slovakia	3	3	1.65	2.16	1.25	1.76
Latvia	3	3	1.65	2.16	1.25	1.76
Lithuania	3	3	1.65	2.16	1.25	1.76
Luxembourg	2	2	1.14	1.44	0.87	1.17
Slovenia	2	2	1.14	1.44	0.87	1.17
Malta	2	2	1.14	1.44	0.87	1.17
Cyprus	2	2	1.14	1.44	0.87	1.17
Estonia	2	2	1.14	1.44	0.87	1.17
Commission	39	65	27.29	8.93	46.07	21.09
total	171	197	99.97	100	100.02	99.96

Distribution of power between Council and Commission in hypothetical EU of 27 would be in this case: 27.29% for Commission and 72.71% for the Council under qualified majority voting in the Council, and 46.07% for Commission and 53.93% for the Council under simple majority voting in the Council. Extension such would lead in this case to an increase of an influence of Commission and super-national interests.

4.2.2 Commission-Council Game, model with Commission's initiation monopoly

Let us adjust now our model of a "Council-Commission" game to implement different decision making rule: A proposal is accepted if it is approved by Commission **and** by a qualified majority of the Council. This rule expresses the monopoly of Commission to initiate a decision; in this case Council can either accept it, or reject it, without having possibility to change or amend it.

Let
v_i be the weight of the i-th country in the Council, i = 1, 2, ..., n,
q be the qualified majority quota in the Council voting,
then we have a model

$$[q, \mathbf{v}] = [q; v_1, v_2, \ldots, v_n]$$

of the Council as a weighted voting body. Now, let us define an auxiliary augmented weighted voting body with n+1 members

$$[\gamma, \boldsymbol{\omega}] = [\gamma; \omega_1, \ldots, \omega_n, \omega_{n+1}]$$

such that

$$\omega_i = v_i \quad for\ i = 1, 2, \ldots, n$$

$$\omega_{n+1} = \sum_{i=1}^{n} v_i - q + 1$$

$$\gamma = \sum_{i=1}^{n} v_i + 1$$

where the first n members represents Council and the member n+1 represents Commission. It can be easily seen than in this artificial committee the majority voting with quota γ will lead to required results: a decision is accepted if it is accepted by member n+1 (Commission) and qualified majority q of the first n members (Council), or if it is accepted by unanimous vote of the first n members (even against the last member).

Example 4.2

Let us consider a hypothetical Council of three members A, B, and C with the distribution of votes 50, 30, 20, with qualified majority 70 votes, and a Commission. Then the Council weighted voting committee is

$$[q, \boldsymbol{v}] = [70; 50, 30, 20]$$

and the Council-Commission auxiliary augmented weighted voting committee is

$$[\gamma, \boldsymbol{\omega}] = [101; 50, 30, 20, 31]$$

The distribution of power (Shapley-Shubik) in Council (without respect to the role of the Commission) is

$$\pi(q, \boldsymbol{v}) = (\frac{2}{3}, \frac{1}{6}, \frac{1}{6})$$

while the distribution of power in Council-Committee game is

$$\pi(\gamma, \boldsymbol{\omega}) = (0.4167, 0.0833, 0.0833, 0.4167)$$

We can see, that the Council keeps in this case 58.33% of decisional power, while the Commission keeps 41.67% of decisional power. Commission's monopoly to initiate increases power of the Commission and decreases power of member state.

Table 4.15
Distribution of power in the EU 15, based on Council-Commission game (with Commission's monopoly to initiate)

country	weights for QM	weights for SM	SSQM	BCQM	SSSM	BCSM
Belgium	5	5	3.77	5.09	2.78	4.13
Denmark	3	3	2.42	3.11	1.63	2.44
Germany	10	10	8.10	9.67	5.92	8.62
Greece	5	5	3.77	5.09	2.78	4.13
Spain	8	8	6.62	8.01	4.59	6.72
France	10	10	8.10	9.67	5.92	8.62
Ireland	3	3	2.42	3.11	1.63	2.44
Italy	10	10	8.10	9.67	5.92	8.62
Luxembourg	2	2	1.41	1.96	1.09	1.62
Netherlands	5	5	3.77	5.09	2.78	4.13
Austria	4	4	3.10	4.15	2.32	3.44
Portugal	5	5	3.77	5.09	2.78	4.13
Finland	3	3	2.42	3.11	1.63	2.44
Sweden	4	4	3.10	4.15	2.32	3.44
UK	10	10	8.10	9.67	5.92	8.62
Commission	26	44	31.03	13.34	50.00	26.44
total			100.00	100.00	100.00	100.00

In Table 4.15 we provide the distribution of power in the Council-Commission game (without Commission's monopoly to initiate) for the European Union of 15 member states, represented by Council.

Table 4.16
Distribution of power in the EU of 27, based on Council-Commission game (with Commission's monopoly to initiate)

	weights for QM	weights for SM	SSQM	BCQM	SSSM	BCSM
Germany	10	10	5.44	6.51	3.93	6.11
France	10	10	5.44	6.51	3.93	6.11
Italy	10	10	5.44	6.51	3.93	6.11
UK	10	10	5.44	6.51	3.93	6.11
Spain	8	8	4.26	5.44	3.09	4.81
Poland	8	8	4.26	5.44	3.09	4.81
Romania	6	6	3.11	4.20	2.28	3.56
Belgium	5	5	2.58	3.54	1.89	2.96
Greece	5	5	2.58	3.54	1.89	2.96
Netherlands	5	5	2.58	3.54	1.89	2.96
Portugal	5	5	2.58	3.54	1.89	2.96
Czech Rep.	5	5	2.58	3.54	1.89	2.96
Hungary	5	5	2.58	3.54	1.89	2.96
Austria	4	4	2.04	2.85	1.50	2.36
Sweden	4	4	2.04	2.85	1.50	2.36
Bulgaria	4	4	2.04	2.85	1.50	2.36
Denmark	3	3	1.52	2.16	1.11	1.76
Ireland	3	3	1.52	2.16	1.11	1.76
Finland	3	3	1.52	2.16	1.11	1.76
Slovakia	3	3	1.52	2.16	1.11	1.76
Latvia	3	3	1.52	2.16	1.11	1.76
Lithuania	3	3	1.52	2.16	1.11	1.76
Luxembourg	2	2	1.01	1.44	0.74	1.17
Slovenia	2	2	1.01	1.44	0.74	1.17
Malta	2	2	1.01	1.44	0.74	1.17
Cyprus	2	2	1.01	1.44	0.74	1.17
Estonia	2	2	1.01	1.44	0.74	1.17
Commission	40	66	30.86	8.93	49.64	21.09
total	172	198	100.02	100.00	100.02	99.96

In Table 4.16 we provide the distribution of power in the Council-Commission game (without Commission's monopoly to initiate) for the European Union of 27 member states, represented by the Council.

While in EU of 15 distribution of power between Commission and Council is 31.03% for Commission and 68.97% for Council under qualified majority voting in the Council, and 50% for Commission and 50% for Council under simple majority, Commission's monopoly to initiate doesn't lead to increase of Commission's influence in extended EU of 27 (30.86% for Commission under qualified majority, 49.64% for Commission under simple majority).

4.3 European Parliament entering the game

From 1986 European Parliament started to play a certain role in European Union decision making (cooperation, later co-decision procedure). Let us have a look now how European parliament involvement influences distribution of power in EU decision making.

Traditional analysis of distribution of national influence within the European Parliament under simple majority voting rule, is given in Table 4.17 (Shapley-Shubik and Banzhaf-Coleman for simple majority).

Table 4.17
Internal national distribution of power in European Parliament (1996)

country	seats	% seats	SSSM	BCSM
Germany	99	15.81	16.84	16.60
Italy	87	13.90	14.50	14.39
UK	87	13.90	14.50	14.39
France	87	13.90	14.50	14.39
Spain	64	10.22	10.08	10.62
Netherlands	31	4.95	4.49	4.43
Portugal	25	3.99	3.74	3.70
Greece	25	3.99	3.74	3.70
Belgium	25	3.99	3.74	3.70
Sweden	22	3.51	3.21	3.23
Austria	21	3.35	3.04	3.07
Denmark	16	2.56	2.34	2.37
Finland	16	2.56	2.34	2.37
Ireland	15	2.40	2.11	2.18
Luxembourg	6	0.96	0.82	0.86
total	626	100.00	99.99	100.00

Political dimension of distribution of power in European Parliament (European political formations) is given in Table 4.18. We use the following abbreviations: PES - Party of the European Socialists, EPP - European People's Party, ELDR - European Liberal, Democratic and Reform Party, UE - Union for Europe, EUL - European United Left, ERA - European Radical Alliance, ENS - Europe of National States, NA - Non-affiliated.

Table 4.18
Internal political distribution of power in European Parliament (1997)

party	seats	% seats	SSSM	BCSM
PES	214	34.19	34.84	32.66
EPP	181	28.91	22.58	19.27
UE	57	9.11	12.34	13.59
ELDR	43	6.87	8.06	8.72
EUL	33	5.27	5.74	6.69
greens	28	4.47	5.08	5.88
ERA	20	3.19	2.94	3.45
ENS	18	2.88	2.94	3.45
NA	32	5.11	5.44	6.29
	626	100.00	99.96	100.00

Source: European Parliament, February 1997

4.3.1 Commission-Council-Parliament Game without Commission's Initiation Monopoly

Let us extend model from section 4.2.1 by involving the European Parliament. We shall assume that a proposal is accepted if

a) either, it is agreed by Commission and approved by qualified majority by the Council and by simple majority of the Parliament,

b) or, it is unanimously approved by the Council, and by simple majority of the Parliament, even without approval of the Commission.

We can consider two cases:

(i) a correlated voting of the Council and the Parliament on national basis,

(ii) un-correlated voting of the Council and the Parliament (Council is voting on national bases and Parliament is voting on ideological basis, represented by political parties).

To be able to apply power indices methodology for weighted voting body on the "Council - Commission - Parliament game", we shall formulate the situation described above in terms of double majority weighted voting games.

4.3.1.1 Correlated Council - Parliament voting

Let

v_i be the weight of the i-th country in the Council, i = 1, 2, ..., n,

q be the required majority quota in the Council voting,

u_i be the weight of the i-th country in the Parliament,

s_j be the weight of the j-th European political party in the Parliament, j = 1, 2, ..., m

t be the required majority in the Parliament voting.

In the case of correlated voting we have a model

$$[q, \mathbf{w}] = [q; w_1, w_2, \ldots, w_n]$$

of the Council, and

$$[t, \mathbf{u}] = [t; u_1, u_2, \ldots, u_n]$$

of the Parliament as a weighted voting body.

Now, let us define an auxiliary augmented weighted voting body with n+1 members and two sets of weights

$$[\boldsymbol{\gamma}, \boldsymbol{\omega}] = \begin{Bmatrix} [\gamma_1; \omega_{11}, \ldots, \omega_{1n}, \omega_{1,n+1}] \\ \\ [\gamma_2; \omega_{21}, \ldots, \omega_{2n}, \omega_{2,n+1}] \end{Bmatrix}$$

such that

$$\omega_{1i} = v_i \quad for\ i = 1, 2, \ldots, n$$

$$\omega_{1,n+1} = \sum_{i=1}^{n} v_i - q$$

$$\gamma_1 = \sum_{i=1}^{n} v_i$$

$$\omega_{2i} = u_i \quad for\ i = 1, 2, \ldots, n$$

$$\omega_{2,n+1} = 0$$

$$\gamma_2 = t$$

where the first set of weights represents Council-Commission game and second set of weights represents Parliament game under the assumption of correlated Council and Parliament voting based on national principle. It can be easily seen than in this artificial committee the double majority voting with quotas γ_1 and γ_2 will lead to required results: a decision is accepted if it is accepted by member n+1 (Commission), majority q of the Council, and majority t of the Parliament, or if it is accepted by unanimous vote of the Council and simple majority of the Parliament (even against the Commission).

Let

$$\pi^{CC}(\gamma,\omega) = (\pi_1^{CC},\ldots,\pi_n^{CC},\pi_{n+1}^{CC})$$

be vector of power indices in Commission-Council game (see section 4.2.1) and

$$\pi^{CCP}(\gamma,\omega) = (\pi_1^{CCP},\ldots,\pi_n^{CCP},\pi_{n+1}^{CCP})$$

be vector of power indices in Commission-Council-Parliament game. Then we can measure distribution of power among the Commission, Council and Parliament as follows:

The power of the Commission in Commission-Council-Parliament game is given by

$$\pi^{commission} = \pi_{n+1}^{CCP}(\gamma,\omega)$$

The joint power of the Council and Parliament equals to

$$\pi^{C+P} = \sum_{i=1}^{n} \pi_i^{CCP}(\gamma,\omega)$$

while the power of the Parliament can be measured as a difference between the total power of the Council and the Parliament in the CCP game and the power of the Council in the CC game:

$$\pi^{P} = \sum_{i=1}^{n} \pi_i^{CCP}(\gamma,\omega) - \sum_{i=1}^{n} \pi_i^{CC}(\gamma,\omega)$$

and the power of the Council in the CCP game is

$$\pi^{council} = 1 - \pi^{commission} - \pi^{P}$$

In Table 4.19 we present results for the CCP game with correlated voting and without Commission's monopoly to initiate in EU of 15.

Comparing results from Table 4.19 to Table 4.13, we can see, that a distribution of power among the Commission, Council and the Parliament is the following:

Under qualified majority in the Council and simple majority in the Parliament the power of the Commission is 24.78%, the power of the Council 75.22% and the Parliament has zero power - is dummy. Combination of qualified majority in the Council and simple majority in the Parliament under assumption of correlated voting gives to the Parliament no influence. Slightly different result we shall get for the combination of simple majority voting in the Council and simple majority in the Parliament: in this case Commission has 42.26% of power, Council 56.25% and the Parliament 1.49%.

Table 4.19
Distribution of power in the EU 15, based on Council-Commission-Parliament game (with correlated voting, without Commission's monopoly to initiate)

	weights for QM	weights for SM	seats	SSQM	BCQM	SSSM	BCSM
Germany	10	10	99	8.51	9.67	7.99	10.36
France	10	10	87	8.51	9.67	7.29	9.59
Italy	10	10	87	8.51	9.67	7.29	9.59
UK	10	10	87	8.51	9.67	7.29	9.59
Spain	8	8	64	7.04	8.01	5.36	7.29
Netherlands	5	5	31	4.18	5.09	2.96	3.71
Portugal	5	5	25	4.18	5.09	2.76	3.46
Greece	5	5	25	4.18	5.09	2.76	3.46
Belgium	5	5	25	4.18	5.09	2.76	3.46
Sweden	4	4	22	3.52	4.15	2.40	2.96
Austria	4	4	21	3.52	4.15	2.32	2.87
Denmark	3	3	16	2.84	3.12	1.84	2.13
Finland	3	3	16	2.84	3.12	1.84	2.13
Ireland	3	3	15	2.84	3.12	1.76	2.03
Luxembourg	2	2	6	1.83	1.97	1.13	1.15
Commission	25	43	0	24.78	13.32	42.26	26.23
total	112	130	626	99.97	100.00	100.01	100.01

Analogical results for hypothetical EU of 27 are given in Table 4.20. We estimated distribution of seats in European Parliament of extended EU using the same principles of allocation of seats that are implemented in the present Parliament (clustering the countries by the population size and allocating the same or close number of seats to the countries from the same clusters).

Distribution of power:

a) Under combination of qualified majority voting for the Council and simple majority voting for the Parliament the Commission has 27.29% of power, the Parliament 0%, and the Council 72.71%.

b) Under simple majority voting rule both in the Council and in the Parliament the power of Commission is 44.99%, the power of the Council 53.93%, and the Power of the Parliament 1.08%.

Table 4.20
Distribution of power in the EU 27, based on Council-Commission-Parliament game (with correlated voting, without Commission's monopoly to initiate)

	weights for QM	weights for SM	seats	SSQM	BCQM	SSSM	BCSM
Germany	10	10	99	5.57	6.51	5.19	7.39
France	10	10	87	5.57	6.51	4.79	6.88
Italy	10	10	87	5.57	6.51	4.79	6.88
UK	10	10	87	5.57	6.51	4.79	6.88
Spain	8	8	64	4.39	5.44	3.60	5.18
Poland	8	8	63	4.39	5.44	3.57	5.15
Romania	6	6	41	3.25	4.20	2.47	3.59
Netherlands	5	5	31	2.71	3.54	1.97	2.86
Portugal	5	5	25	2.71	3.54	1.80	2.65
Greece	5	5	25	2.71	3.54	1.80	2.65
Czech Rep.	5	5	25	2.71	3.54	1.80	2.65
Hungary	5	5	25	2.71	3.54	1.80	2.65
Belgium	5	5	25	2.71	3.54	1.80	2.65
Sweden	4	4	22	2.17	2.85	1.51	2.18
Bulgaria	4	4	22	2.17	2.85	1.51	2.18
Austria	4	4	21	2.17	2.85	1.48	2.15
Denmark	3	3	16	1.65	2.16	1.15	1.61
Ireland	3	3	15	1.65	2.16	1.12	1.58
Finland	3	3	16	1.65	2.16	1.15	1.61
Slovakia	3	3	16	1.65	2.16	1.15	1.61
Latvia	3	3	12	1.65	2.16	1.03	1.47
Lithuania	3	3	15	1.65	2.16	1.12	1.58
Luxembourg	2	2	6	1.14	1.44	0.67	0.91
Slovenia	2	2	11	1.14	1.44	0.81	1.09
Malta	2	2	6	1.14	1.44	0.67	0.91
Cyprus	2	2	7	1.14	1.44	0.70	0.94
Estonia	2	2	10	1.14	1.44	0.79	1.05
Commission	39	65	0	27.29	8.93	44.99	21.06
total	171	197	879	99.97	100.00	100.02	99.99

4.3.1.2 Uncorrelated Council - Parliament voting

In the case of uncorrelated voting we have a model

$$[q, \mathbf{w}] = [q; w_1, w_2, \ldots, w_n]$$

of the Council, and

$$[t, \mathbf{s}] = [t; s_1, s_2, \ldots, s_m]$$

of the Parliament as a weighted voting body.

Now, let us define an auxiliary augmented weighted voting body with n+m+1 members and two sets of weights

$$[\boldsymbol{\gamma}, \boldsymbol{\omega}] = \left\{ \begin{matrix} [\gamma_1; \omega_{11}, \ldots, \omega_{1n}, 0, \ldots, 0, \omega_{1,n+1}] \\ \\ [\gamma_2; 0, \ldots, 0, \omega_{2,n+1}, \ldots, \omega_{2,n+m}, 0] \end{matrix} \right\}$$

such that

$$\omega_{1i} = v_i \quad for\ i = 1, 2, \ldots, n$$

$$\omega_{1,n+1} = \sum_{i=1}^{n} v_i - q$$

$$\gamma_1 = \sum_{i=1}^{n} v_i$$

$$\omega_{2,n+j} = s_i \quad for\ j = 1, 2, \ldots, m$$

$$\omega_{2,n+m+1} = 0$$

$$\gamma_2 = t$$

where the first set of weights represents Council-Commission game and second set of weights represents Parliament game under the assumption of uncorrelated Council and Parliament voting when Council voting is based on national principle and Parliament voting on political principle. It can be easily seen than in this artificial committee the double majority voting with quotas γ_1 and γ_2 will lead to required results: a decision is accepted if it is accepted by member n+m+1 (Commission), majority q of the Council, and majority t of the Parliament, or if it is accepted by unanimous vote of the Council and simple majority of the Parliament (even against the Commission).

Let

$$\boldsymbol{\pi}^{CCP}(\boldsymbol{\gamma}, \boldsymbol{\omega}) = (\pi_1^{CCP}, \ldots, \pi_n^{CCP}, \pi_{n+1}^{CCP}, \ldots, \pi_{n+m}^{CCP}, \pi_{n+m+1}^{CCP})$$

be vector of power indices in Commission-Council-Parliament game with uncorrelated voting. Then we can measure distribution of power among the Commission, Council and

Parliament as follows:

The power of the Commission in Commission-Council-Parliament game with uncorrelated voting is given by

$$\pi^{commission} = \pi_{n+m+1}^{CCP}(\gamma, \omega)$$

The power of the Council equals to

$$\pi^{C+P} = \sum_{i=1}^{n} \pi_{i}^{CCP}(\gamma, \omega)$$

and the power of the Parliament is

$$\pi^{P} = \sum_{j=1}^{m} \pi_{n+j}^{CCP}(\gamma, \omega)$$

Results for Commission-Council-Parliament game with uncorrelated Council-Parliament voting in EU of 15 see in Table 4.21.

In this case we have:

a) Under combination of qualified majority in the Council and simple majority in the Parliament the power of the Commission is 22.17%, the power of the Council is 62.69%, and the power of the Parliament 15.16%.

b) Under simple majority voting both in the Council and the Parliament un-correlated voting moves the balance of power in favour of the Parliament: the power of the Commission is in this case 34.32%, the power of the Council 34.06%, and the power of the Parliament 31.62%.

Table 4.21
Distribution of power in the EU 15, based on Council-Commission-Parliament game (with uncorrelated voting, without Commission's monopoly to initiate)

	weights for QM	weights for SM	seats	SSQM	BCQM	SSSM	BCSM
Germany	10	10	0	7.09	7.69	3.72	5.71
France	10	10	0	7.09	7.69	3.72	5.71
Italy	10	10	0	7.09	7.69	3.72	5.71
UK	10	10	0	7.09	7.69	3.72	5.71
Spain	8	8	0	5.87	6.37	2.97	4.45
Netherlands	5	5	0	3.47	4.05	1.96	2.73
Portugal	5	5	0	3.47	4.05	1.96	2.73
Greece	5	5	0	3.47	4.05	1.96	2.73
Belgium	5	5	0	3.47	4.05	1.96	2.73
Sweden	4	4	0	2.93	3.30	1.70	2.28
Austria	4	4	0	2.93	3.30	1.70	2.28
Denmark	3	3	0	2.39	2.48	1.32	1.62
Finland	3	3	0	2.39	2.48	1.32	1.62
Ireland	3	3	0	2.39	2.48	1.32	1.62
Luxembourg	2	2	0	1.55	1.56	1.01	1.07
PES	0	0	214	5.59	6.69	11.15	11.05
EPP	0	0	181	3.96	3.95	7.41	6.52
UE	0	0	57	1.67	2.78	3.81	4.60
ELDR	0	0	43	1.12	1.79	2.51	2.95
EUL	0	0	33	0.73	1.37	1.75	2.26
greens	0	0	28	0.64	1.21	1.54	1.99
ERA	0	0	20	0.37	0.71	0.89	1.17
ENS	0	0	18	0.37	0.71	0.89	1.17
NA	0	0	32	0.71	1.29	1.67	2.13
Commission	25	43	0	22.17	10.59	34.32	17.49
total	112	130	626	100.02	100.02	100.00	100.03
Council				62.69	68.93	34.06	48.70
Parliament				15.16	20.50	31.62	33.84

We cannot anticipate the impact of uncorrelated voting on hypothetical European Union of 27, not being able to estimate political structure of the Parliament.

In the same way the analysis can be extended on the Commission - Council - Parliament game with Commission's initiation monopoly.

4.3.2 Commission-Council-Parliament game with Commission's initiation monopoly

Let us adjust now our model of a "Council-Commission-Parliament" game to implement different decision making rule: A proposal is accepted if it is approved by Commission, by a qualified majority of the Council and by the simple majority in the Parliament. This rule expresses the monopoly of Commission to initiate a decision; in this case Council and Parliament can either accept it, or reject it, without having possibility to change or amend it. In our model the Parliament cannot overrule Council veto, but can veto Council positive decision.

As in section 4.3.1 we can consider two cases:

(i) a correlated voting of the Council and the Parliament on national basis,

(ii) uncorrelated voting of the Council and the Parliament (Council is voting on national bases and Parliament is voting on ideological basis, represented by political parties).

To be able to apply power indices methodology for weighted voting body on the "Council - Commission - Parliament game", we shall formulate the situation described above in terms of double majority weighted voting games. Only slight modification of the model from section 4.3.1.1 is required.

4.3.2.1 Correlated Council - Parliament voting

Let

v_i be the weight of the i-th country in the Council, i = 1, 2, ..., n,

q be the required majority quota in the Council voting,

u_i be the weight of the i-th country in the Parliament,

s_j be the weight of the j-th European political party in the Parliament, j = 1, 2, ..., m

t be the required majority in the Parliament voting.

In the case of correlated voting we have a model

$$[q, \mathbf{w}] = [q; w_1, w_2, \ldots, w_n]$$

of the Council, and

$$[t, \mathbf{u}] = [t; u_1, u_2, \ldots, u_n]$$

of the Parliament as a weighted voting body.

Now, let us define an auxiliary augmented weighted voting body with n+1 members and two sets of weights

$$[\boldsymbol{\gamma}, \boldsymbol{\omega}] = \left\{ \begin{matrix} [\gamma_1; \omega_{11}, \ldots, \omega_{1n}, \omega_{1,n+1}] \\ \\ [\gamma_2; \omega_{21}, \ldots, \omega_{2n}, \omega_{2,n+1}] \end{matrix} \right\}$$

such that

$$\omega_{1i} = v_i \quad for\ i = 1,2,\ldots,n$$

$$\omega_{1,n+1} = \sum_{i=1}^{n} v_i - q + 1$$

$$\gamma_1 = \sum_{i=1}^{n} v_i + 1$$

$$\omega_{2i} = u_i \quad for\ i = 1,2,\ldots,n$$

$$\omega_{2,n+1} = 0$$

$$\gamma_2 = t$$

where the first set of weights represents Council-Commission game and second set of weights represents Parliament game under the assumption of correlated Council and Parliament voting based on national principle. It can be easily seen than in this artificial committee the double majority voting with quotas γ_1 and γ_2 will lead to required results: a decision is accepted if and only if it is accepted by member n+1 (Commission), majority q of the Council, and majority t of the Parliament.

Let

$$\pi^{CC}(\gamma, \omega) = (\pi_1^{CC}, \ldots, \pi_n^{CC}, \pi_{n+1}^{CC})$$

be vector of power indices in the corresponding Commission-Council game with Commission's initiating monopoly (see section 4.2.2) and

$$\pi^{CCP}(\gamma, \omega) = (\pi_1^{CCP}, \ldots, \pi_n^{CCP}, \pi_{n+1}^{CCP})$$

be vector of power indices in Commission-Council-Parliament game with Commission's initiating monopoly. Then we can measure distribution of power among the Commission, Council and Parliament as follows:

The power of the Commission in Commission-Council-Parliament game is given by

$$\pi^{commission} = \pi_{n+1}^{CCP}(\gamma, \omega)$$

The joint power of the Council and Parliament equals to

$$\pi^{C+P} = \sum_{i=1}^{n} \pi_i^{CCP}(\gamma, \omega)$$

while the power of the Parliament can be measured as a difference between the total power of the Council and the Parliament in the CCP game and the power of the Council in the CC game:

$$\pi^P = \sum_{i=1}^{n} \pi_i^{CCP}(\gamma, \omega) - \sum_{i=1}^{n} \pi_i^{CC}(\gamma, \omega)$$

and the power of the Council in the CCP game is

$$\pi^{council} = 1 - \pi^{commission} - \pi^P$$

In Table 4.22 we present results for the CCP game with correlated voting and with Commission's monopoly to initiate in EU of 15.

Table 4.22
Distribution of power in the EU 15, based on Council-Commission-Parliament game (with correlated voting and Commission's monopoly to initiate)

	weights for QM	weights for SM	seats	SSQM	BCQM	SSSM	BCSM
Germany	10	10	99	8.10	9.67	7.57	10.36
France	10	10	87	8.10	9.67	6.87	9.59
Italy	10	10	87	8.10	9.67	6.87	9.59
UK	10	10	87	8.10	9.67	6.87	9.59
Spain	8	8	64	6.62	8.01	4.94	7.29
Netherlands	5	5	31	3.77	5.09	2.55	3.71
Portugal	5	5	25	3.77	5.09	2.34	3.46
Greece	5	5	25	3.77	5.09	2.34	3.46
Belgium	5	5	25	3.77	5.09	2.34	3.46
Sweden	4	4	22	3.10	4.15	1.99	2.96
Austria	4	4	21	3.10	4.15	1.91	2.87
Denmark	3	3	16	2.42	3.12	1.42	2.13
Finland	3	3	16	2.42	3.12	1.42	2.13
Ireland	3	3	15	2.42	3.12	1.35	2.03
Luxembourg	2	2	6	1.41	1.97	0.72	1.15
Commission	26	44	0	31.03	13.32	48.50	26.23
total	113	131	626	100.00	100.00	100.00	100.01

Institutional distribution of power in EU of 15 under correlated voting hypothesis:

a) Qualified majority in the Council, simple majority in the Parliament gives zero power to the Parliament, 31.03% of power to the Commission and 68.97% of power to the Council.

b) Simple majority rule applied both in the Council and the Parliament gives 1.5% of power to the Parliament, 48.5% of power to the Commission and 50% of power to the Council.

Analogical results for hypothetical EU of 27 are given in Table 4.23.

Table 4.23
Distribution of power in the EU 27, based on Council-Commission-Parliament game (with correlated voting and Commission's monopoly to initiate)

	weights for QM	weights for SM	seats	SSQM	BCQM	SSSM	BCSM
Germany	10	10	99	5.44	6.51	5.06	7.39
France	10	10	87	5.44	6.51	4.66	6.88
Italy	10	10	87	5.44	6.51	4.66	6.88
UK	10	10	87	5.44	6.51	4.66	6.88
Spain	8	8	64	4.26	5.44	3.47	5.18
Poland	8	8	63	4.26	5.44	3.44	5.15
Romania	6	6	41	3.11	4.20	2.33	3.59
Netherlands	5	5	31	2.58	3.54	1.84	2.86
Portugal	5	5	25	2.58	3.54	1.66	2.65
Greece	5	5	25	2.58	3.54	1.66	2.65
Czech Rep.	5	5	25	2.58	3.54	1.66	2.65
Hungary	5	5	25	2.58	3.54	1.66	2.65
Belgium	5	5	25	2.58	3.54	1.66	2.65
Sweden	4	4	22	2.04	2.85	1.38	2.18
Bulgaria	4	4	22	2.04	2.85	1.38	2.18
Austria	4	4	21	2.04	2.85	1.35	2.15
Denmark	3	3	16	1.52	2.16	1.01	1.61
Ireland	3	3	15	1.52	2.16	0.99	1.58
Finland	3	3	16	1.52	2.16	1.01	1.61
Slovakia	3	3	16	1.52	2.16	1.01	1.61
Latvia	3	3	12	1.52	2.16	0.90	1.47
Lithuania	3	3	15	1.52	2.16	0.99	1.58
Luxembourg	2	2	6	1.01	1.44	0.54	0.91
Slovenia	2	2	11	1.01	1.44	0.68	1.09
Malta	2	2	6	1.01	1.44	0.54	0.91
Cyprus	2	2	7	1.01	1.44	0.57	0.94
Estonia	2	2	10	1.01	1.44	0.65	1.05
Commission	40	66	0	30.84	8.93	48.56	21.06
total	172	198	879	100.00	100.00	99.98	99.99

Institutional distribution of power (as measured by Shapley-Shubik) in hypothetical EU of 27 under correlated voting hypothesis:

a) Qualified majority in the Council, simple majority in the Parliament gives zero power to the Parliament, 30.84% of power to the Commission and 69.16% of power to the Council.

b) Simple majority rule applied both in the Council and the Parliament gives 1.08%

of power to the Parliament, 48.5% of power to the Commission and 50.42% of power to the Council.

4.3.2.2 Uncorrelated Council - Parliament voting

In the case of uncorrelated voting we have a model

$$[\gamma,\omega] = \begin{Bmatrix} [\gamma_1; \omega_{11}, \ldots, \omega_{1n}, 0, \ldots, 0, \omega_{1,n+1}] \\ \\ [\gamma_2; 0, \ldots, 0, \omega_{2,n+1}, \ldots, \omega_{2,n+m}, 0] \end{Bmatrix}$$

such that

$$\omega_{1i} = v_i \quad for\ i = 1,2,\ldots,n$$

$$\omega_{1,n+1} = \sum_{i=1}^{n} v_i - q + 1$$

$$\gamma_1 = \sum_{i=1}^{n} v_i + 1$$

$$\omega_{2,n+j} = s_i \quad for\ j = 1,2,\ldots,m$$

$$\omega_{2,n+m+1} = 0$$

$$\gamma_2 = t$$

where the first set of weights represents Council-Commission game and second set of weights represents Parliament game under the assumption of uncorrelated Council and Parliament voting when Council voting is based on national principle and Parliament voting on political principle. It can be easily seen than in this artificial committee the double majority voting with quotas γ_1 and γ_2 will lead to required results: a decision is accepted if it is accepted by member n+m+1 (Commission), majority q of the Council, and majority t of the Parliament.

Results for Commission-Council-Parliament game with uncorrelated Council-Parliament voting with Commission's initiation monopoly in EU of 15 see in Table 4.24.

In this case we have:

a) Under combination of qualified majority in the Council and simple majority in the Parliament the power of the Commission is 28.35%, the power of the Council is 56.61%, and the power of the Parliament 15.04%.

b) Under simple majority voting both in the Council and the Parliament uncorrelated voting moves the balance of power in favour of the Parliament: the power of the Commission is in this case 40.50%, the power of the Council 27.94%, and the power of the Parliament 31.52%.

Table 4.24
Distribution of power in the EU 15, based on Council-Commission-Parliament game (with uncorrelated voting and Commission's monopoly to initiate)

	weights for QM	weights for SM	seats	SSQM	BCQM	SSSM	BCSM
Germany	10	10	0	6.69	7.69	3.32	5.71
France	10	10	0	6.69	7.69	3.32	5.71
Italy	10	10	0	6.69	7.69	3.32	5.71
UK	10	10	0	6.69	7.69	3.32	5.71
Spain	8	8	0	5.46	6.37	2.57	4.45
Netherlands	5	5	0	3.06	4.05	1.55	2.73
Portugal	5	5	0	3.06	4.05	1.55	2.73
Greece	5	5	0	3.06	4.05	1.55	2.73
Belgium	5	5	0	3.06	4.05	1.55	2.73
Sweden	4	4	0	2.53	3.30	1.30	2.28
Austria	4	4	0	2.53	3.30	1.30	2.28
Denmark	3	3	0	1.98	2.48	0.91	1.62
Finland	3	3	0	1.98	2.48	0.91	1.62
Ireland	3	3	0	1.98	2.48	0.91	1.62
Luxembourg	2	2	0	1.15	1.56	0.61	1.07
PES	0	0	214	5.54	6.69	11.10	11.05
EPP	0	0	181	3.92	3.95	7.37	6.52
UE	0	0	57	1.66	2.78	3.81	4.60
ELDR	0	0	43	1.11	1.79	2.51	2.95
EUL	0	0	33	0.73	1.37	1.75	2.26
greens	0	0	28	0.64	1.21	1.54	1.99
ERA	0	0	20	0.37	0.70	0.89	1.17
ENS	0	0	18	0.37	0.70	0.89	1.17
NA	0	0	32	0.70	1.29	1.66	2.13
Commission	26	44	0	28.35	10.59	40.50	17.48
total	113	131	626	100.00	100.00	100.00	100.02
Council				56.61	68.93	27.98	48.70
Parliament				15.04	20.48	31.52	33.84

5. Conclusions

We have analyzed the process of decision making in the European Union with respect to the distribution of power among the member states and decomposition of power among the decision making institutions: Commission, Council and European Parliament. Simple model of committee systems, expressing some features of consultation and co-decision procedures were formulated that make possible to use methodology of power indices. East European and Mediterranean extension of European Union has been anticipated in the models. The following main results were obtained:

1. Extension will deepen disproportionality of national representation in European institutions (both with respect to population, and with respect to economic power of the member states).

2. Extension will further decrease a relative influence of large countries, representing decisive economic power and majority of population. Distribution of individual influence of the member states will go very close to the distribution of voting weights in the Council of Ministers. At the same time it is realistic to expect that extension will increase propensity of member states to coalitional considerations based on regional and other group interests in European Union decision making.

3. Certainly the most important actor in European Union decision making remains to be the Council of Ministers. Commission is the second most important body, while the European Parliament, even after implementation consultation and co-decision procedures, plays inferior role. The main reason is combination of qualified majority rule in the Council with simple majority rule in the Parliament.

4. To design in some sense more balanced distribution of national influence in European Union decision making, the following options are available:

a) Reform of weighting of votes in the Council and allocation of votes in the Parliament - politically very difficult change.

b) Reform of the threshold for qualified majority decision making and the voting rules in general.

c) Further refinement and cultivation of decision making procedures in the interactions among the Commission, Council, and the Parliament.

5. As follows from Table 5.1, change of the threshold from presently used qualified majority in the Council (70%) to simple majority, together with extension, would facilitate increase of the influence of the Commission and super-national interests on behalf of influence of member states: while the total influence of the Council and the Parliament in national dimension of decision making will decrease, the influence of the Parliament itself will slightly increase.

Table 5.1
Decomposition of power in CCP game with correlated voting (Shapley-Shubik)

	without Commission's monopoly to inititate		with Commission's monopoly to initiate	
	QM+SM	SM+SM	QM+SM	SM+SM
a) EU-15	100	100	100	100
Commission	24.78	42.26	31.03	48.50
Council	75.22	56.25	68.97	50.00
Parliament	0	1.49	0	1.50
b) EU-27	100	100	100	100
Commission	27.29	44.99	30.84	48.56
Council	72.71	53.93	69.16	50.36
Parliament	0	1.08	0	1.08

6. European Parliament has almost no significance in promoting national interests: in combination of qualified majority in the Council and simple majority in the Parliament the Parliament is dummy player in national dimension decision making game. Its influence is significant in political dimension of decision making (see Table 5.2), expressing ideological preferences of EU citizens. Un-correlated voting (Council on national principle, Parliament on political principal) increases the role of Parliament significantly.

Table 5.2
Decomposition of power in CCP game with uncorrelated voting (Shapley-Shubik)

	without Commission's monopoly to inititate		with Commission's monopoly to initiate	
	QM+SM	SM+SM	QM+SM	SM+SM
a) EU-15	100	100	100	100
Commission	22.17	34.32	28.35	40.50
Council	62.68	34.06	56.61	27.98
Parliament	15.15	31.62	15.04	31.52

7. Implementation of different variants of double majority voting rule (based on simple majority in the sets of weights) could make the relative influence of the member states more proportional to their population size and/or to their economic power.

Appendix

Power Indices and their Properties

Measuring of voting power in committee systems was introduced by Shapley and Shubik [1954] more than 50 years ago, as an application of the concept of Shapley value in cooperative simple games with side payments. Many other approaches to evaluation of power in voting bodies have been proposed since the first Shapley and Shubik paper (Banzhaf-Coleman, Johnston, Holler-Packel, Deegan-Pakel and many others). In this section we try to provide a general characterization of the problem, to overview most frequently used power indices and to investigate axiomatic properties of some of them.

A.1 Power in committees

Let $N = \{1, \ldots, n\}$ be the set of members (players, parties) and ω_{ij} ($i = 1, \ldots, n$, $j = 1, \ldots, m$) be the (real, non-negative) j-th weight of the i-th member such that

$$\sum_{i \in N} \omega_{ij} = 1, \ \omega_{ij} \geq 0$$

(e.g. the share of votes of party i, or the ownership of i as a proportion of the total number of shares, etc.). Let γ_j be a real number such that $0 \leq \gamma_j \leq 1$.

The matrix

$$[\gamma, \omega] = \begin{bmatrix} \gamma_1 & \omega_{11} & \omega_{21} & \cdots & \omega_{n1} \\ \gamma_2 & \omega_{12} & \omega_{22} & \cdots & \omega_{n2} \\ \cdot & & & & \\ \cdot & & & & \\ \cdot & & & & \\ \gamma_m & \omega_{1m} & \omega_{2m} & \cdots & \omega_{nm} \end{bmatrix}$$

such that

$$\sum_{i=1}^{n} \omega_{ij} = 1, \ \omega_{ij} \geq 0, \ 0 \leq \gamma_j \leq 1$$

we shall call a committee system of the size n = card N with quotas γ and allocations of weights

$$\omega^j = (\omega_{1j}, \omega_{2j}, \ldots, \omega_{nj})$$

(by *card* S we denote the cardinality of the finite set S, for empty set *card* $\varnothing = 0$)

Any non-empty subset $S \subset N$ we shall call a voting configuration. Given an allocation ω and a quota γ, we shall say that $S \subset N$ is a winning voting configuration, if

$$\sum_{i \in S} \omega_{ij} \geq \gamma_j$$

for all j, and a losing voting configuration, if

$$\sum_{i \in S} \omega_{ij} < \gamma_j$$

for at least one j (i.e. the configuration S is winning, if it has a required majority in all sets of weights, otherwise it is losing). We shall speak in this respect about the multi-majority voting rule. Usually a special case of a committee is considered with one set of the weights only and single majority voting is considered.

Let

$$\Gamma = \left\{(\gamma,\omega): \sum_{i=1}^{n} \omega_{ij} = 1,\ \omega_{ij} \geq 0,\ 0 \leq \gamma_j \leq 1\right\}$$

be the space of all committee systems of the size n and

$$E = \left\{ e \in \mathbb{R}_n: \sum_{i \in N} e_i = 1,\ e_i \geq 0\ (i=1,\ldots,n)\right\}$$

be the unit simplex.

A *power index* is a vector valued function

$$\pi : \Gamma \rightarrow E$$

that maps the space Γ of all committee systems into the unit simplex E. A power index represents a reasonable expectation of the share of decisional power among the various members of a committee, given by ability to contribute to formation of winning voting configurations. We shall denote by $\pi_i(\gamma, \omega)$ the share of power that the index π grants to the i-th member of a committee with weight allocation ω and quota γ. Such a share is called a *power index of the i-th member.*

Remark

Looking for some characteristic of influence of members of a voting body we can start with distribution of votes. It can be expected that Germany has more influence in the Council of Minsters than does Luxembourg, but the question is how much more.

Distribution of votes among the parties in a committee is not a sufficient characteristic of power or influence distribution. This can be clearly seen from a simple example of the committee with 3 members and 100 votes distributed among them (see the Table). With respect to simple majority voting rule (50% plus one vote) all three members have the same position in the voting process (any two-member coalition is a winning one, no single member can win). In fact, under certain circumstances (if the two large members 1 and 3 have strictly opposite interests) the role of the member 2 could be essential. Quite a different situation can be observed for a qualified majority, say, 70%. In this case the

members	weights
1	49
2	2
3	49

member 2 has no influence on the outcomes of voting and a cooperation of members 1 and 3 is needed for approving any decision.

We can see that it makes sense to look for some measures that express the actual distribution of power among the members of a committee better than the data about proportional representation. Such measures exist and are called "power indices" in the literature on public choice.

A.2 Marginality

We shall term a member i of a committee $[\gamma, \omega]$ to be **marginal** (essential, critical, decisive) with respect to a configuration $S \subseteq N$, $i \in S$, if

$$\sum_{k \in S} \omega_{kj} \geq \gamma_j$$

$$\textit{for all } j = 1,2,\ldots,m \quad \textit{and}$$

$$\sum_{k \in S \setminus \{i\}} \omega_{kj} < \gamma_j$$

$$\textit{for at least one } j$$

A voting configuration $S \subseteq N$ such that at least one member of the committee is marginal with respect to S we shall call a critical winning configuration (CWC).

Let us denote by $C(\gamma, \omega)$ the set of all CWC in the committee with the quotas γ and allocation ω. By $C_i(\gamma, \omega)$ we shall denote the set of all CWC the member $i \in N$ is marginal with respect to, and by $C_{is}(\gamma, \omega)$ the set of all CWC of the size s (by size we mean cardinality of CWC, $1 \leq s \leq n$) the member $i \in N$ is marginal with respect to. By $P_{is}(\gamma, \omega)$ we shall denote the set of all CWC having exactly s marginal members ($1 \leq s \leq n$). Then

$$C_i(\gamma,\omega) = \bigcup_{s=1}^{n} C_{is}(\gamma,\omega) = \bigcup_{s=1}^{n} P_{is}(\gamma,\omega)$$

$$C(\gamma,\omega) = \bigcup_{i \in N} C_i(\gamma,\omega)$$

A voting configuration $S \subset N$ is said to be a minimal critical winning configuration (MCWC), if

$$\sum_{i \in S} \omega_{ij} \geq \gamma_j \quad \textit{for all } j, \textit{ and}$$

$$\sum_{k \in T} \omega_{kj} < \gamma_j \quad \textit{for at least one } j \textit{ for any } T \subsetneq S$$

Let us denote by $M(\gamma, \omega)$ the set of all MCWC in the committee $[\gamma, \omega]$. By $M_{is}(\gamma, \omega)$ we shall denote the set of all minimal critical winning configurations S of the size s such that $i \in S$, and by $M_i(\gamma, \omega)$ the set of all minimal winning configurations containing member i.

Different concepts of marginality and marginal sets provide possibility to cardinalise some measures of voting power. It is intuitively clear that the number of potential memberships in marginal coalitions in the position of marginal actor says something about the ability of the actor to influence the voting outcomes.

A.3 Most frequently used power indices

The five most widely known power indices were proposed by Shapley and Shubik (1954), Banzhaf and Coleman (1965, 1971), Johnston (1978), Holler and Packel (1978, 1983), and Deegan and Packel (1978). All of them measure the power of each member of a committee as a weighted average of the number of his marginalities in CWC or MCWC.

The Shapley-Shubik (SS) power index assigns to each member of a committee the share of power proportional to the number of permutations of members in which he is pivotal. A permutation is an ordered list of all members. A member is in a pivotal position in a permutation if in the process of forming this permutation by equiprobable additions of single members he provides the critical weight to convert the losing configuration of the preceding members to the winning one. It is assumed that all winning configurations are possible and all permutations are equally likely. Thus SS power index assigns to the i-th member of a committee with quota γ and weight allocation ω the value of his share of power

$$\pi_i^{SS}(\gamma,\omega) = \sum_{S\subseteq N} \frac{(\mathrm{card}\,S-1)!(\mathrm{card}\,N-\mathrm{card}\,S)!}{(\mathrm{card}\,N)!} \qquad \text{(A.1)}$$

where the sum is extended to all winning configurations S for which the i-th player is marginal. We can use an alternative formula as an explicit function of marginalities

$$\pi_i^{SS}(\gamma,\omega) = \sum_{s=1}^{n} \frac{(s-1)!(n-s)!}{n!}\,\mathrm{card}\,C_{is}(\gamma,\omega) \qquad \text{(A.2)}$$

Let us denote by $C_{is}(\gamma,\omega)$ the set of all s-member configurations the member $i \in N$ is marginal with respect to. Then we can write

$$\pi_i^{SS}(\gamma,\omega) = \sum_{s\in N} \sigma(s,n)\,card[C_{is}(\gamma,\omega)] \qquad \text{(A.3)}$$

where

$$\sigma(1,n) = \frac{1}{n}$$

$$\sigma(s+1,n) = \sigma(s,n)\frac{s}{n-s} \quad \mathit{for}\ s=1,\dots,n-1 \qquad \text{(A.4)}$$

(the last expression can save some computational effort by computing the coefficients weighting the "marginalities" recursively).

Example 1

Consider a single weight committee $[\gamma, \omega] = [7/13; 5/13, 3/13, 2/13, 2/13, 1/13]$. *We shall list all WC and CWC:*

a) of the size $s = 1$:
No one single member can create a winning configuration.

b) of the size $s = 2$:

$$\{1^*,2^*\}, \{1^*,3^*\}, \{1^*,4^*\}$$

c) of the size $s = 3$:

$$\{1^*,2,3\}, \{1^*,2,4\}, \{1^*,2^*,5\}, \{1^*,3,4\}, \{1^*,3^*,5\}, \{1^*,4^*,5\}, \{2^*,3^*,4^*\}$$

d) of the size $s = 4$:

$$\{1,2,3,4\}, \{1^*,2,3,5\}, \{1^*,2,4,5\}, \{1^*,3,4,5\}, \{2^*,3^*,4^*,5\}$$

e) of the size $s = 5$:

$$\{1,2,3,4,5\}$$

In Table A.1 rows correspond to the size of configurations and columns to the members of the committee. In the last column we give the values of $\sigma(s, n)$. *The entries of the table give the numbers of marginalities of each member in configurations of the size s.*

Table A.1

	1	2	3	4	5	σ
1	0	0	0	0	0	1/5
2	3	1	1	1	0	1/20
3	6	2	2	2	0	1/30
4	3	1	1	1	0	1/20
5	0	0	0	0	0	1/5

Now, using (A.3) and (A.4), from Table A.1 we can calculate the values of SS-power index for different members:

$$\pi_1^{SS}(\gamma,\omega) = 0\frac{1}{5} + 3\frac{1}{20} + 6\frac{1}{30} + 3\frac{1}{20} + 0\frac{1}{5} = \frac{30}{60} = \frac{1}{2}$$

$$\pi_2^{SS}(\gamma,\omega) = 0\frac{1}{5} + 1\frac{1}{20} + 2\frac{1}{30} + 3\frac{1}{20} + 0\frac{1}{5} = \frac{10}{60} = \frac{1}{6}$$

$$\pi_3^{SS}(\gamma,\omega) = \frac{1}{6}$$

$$\pi_4^{SS}(\gamma,\omega) = \frac{1}{6}$$

$$\pi_5^{SS}(\gamma,\omega) = 0$$

Remark

To illustrate the reasoning behind Shapley and Shubik's voting power measure (SS-power index) consider a four-member committee characterized by the Table. The committee is faced with a series of motions or "bills" on each of which the members will vote "Yes" or "No". Shapley and Shubik consider the process of building coalitional support for a particular bill. Let us suppose that simple majority is required to pass the bill (51 votes in our case). The bill may be most enthusiastically supported by, say, member 2, second most enthusiastically by 4, next most by 1, and least by 3. Thus 2 would be the first member to join a coalition in support of the bill, followed by 4. At this point the bill would still lose, and in fact it will be able to win only if the coalition can gain the support of the next most enthusiastic member 1. Gaining 1's support may require considerate modifications of the original bill, so that member 1 has considerable say over the form in which the bill will pass, if it passes. The member 1 has crucial power in this situation.

In an abstract setting, we would not have a priori knowledge about possible orders of coalition formation. Shapley and Shubik hence propose that to measure abstract voting power, we should consider all orders equally likely. For each order, one member will be pivotal in the sense as the member 1 above: the losing coalition will become winning precisely when the pivotal member joins it. The pivotal member holds the power. Hence, as our measure of a member's voting power we use the probability that the member will be pivotal, assuming that all orders of coalition formation are equally likely. (For a discussion of different aspects of the Shapley-Shubik power index see ROTH (ed.) [1988], for applications to various voting situations and interpretation see STRAFFIN [1980]).

members	weights
1	20
2	25
3	38
4	17

For our four member committee from the table above with simple majority rule, there are 4! = 24 possible orders of forming the winning coalitions (see the second Table). We stared the pivotal member in each order. The member 3 is pivotal in 12 of the 24 orders, while each of the other members is pivotal only in 4 of the orders. The Shapley-Shubik power indices of the members are thus 4 out of 24 for the party 1, 4 out of the 24 for the party 2, 12 out of the 24 for the party 3 and 4 out of the 24 for party 4, so we can write

$$\pi = (\pi_1, \pi_2, \pi_3, \pi_4) = \left(\frac{1}{6}, \frac{1}{6}, \frac{1}{2}, \frac{1}{6} \right)$$

123*4	213*4	31*24	412*3
124*3	214*3	31*42	413*2
13*24	23*14	32*14	421*3
13*42	23*41	32*41	423*1
142*3	241*3	34*12	43*12
143*2	243*1	34*21	43*21

The Banzhaf-Coleman (BC) power index assigns to each member of a committee the share of power proportional to the number of critical winning configurations for which the member is marginal. It is assumed that all critical winning configurations are possible and equally likely. Banzhaf suggested the following measure of power distribution in a committee:

$$\pi_i^{BC}(\gamma,\omega) = \frac{\operatorname{card} C_i(\gamma,\omega)}{\sum_{k\in N} card C_k(\gamma,\omega)} = \frac{\sum_{s=1}^{n} \operatorname{card} C_{is}(\gamma,\omega)}{\sum_{s=1}^{n}\sum_{k\in N} \operatorname{card} C_{ks}(\gamma,\omega)} \quad \text{(A.5)}$$

(so called normalized BC-power index).

Example 2

To calculate BC-power index in the same committee as in Example 2.4 we can use data from Table A.1.

Table A.2

	1	2	3	4	5	Σ
1	0	0	0	0	0	0
2	3	1	1	1	0	6
3	6	2	2	2	0	12
4	3	1	1	1	0	6
5	0	0	0	0	0	0
Σ	12	4	4	4	0	24

Now, using (A.5), from Table A.2 we can obtain values of BC-power index for different members:

$$\pi_1^{BC}(\gamma,\omega) = \frac{12}{24} = \frac{1}{2}$$

$$\pi_2^{BC}(\gamma,\omega) = \frac{4}{24} = \frac{1}{6}$$

$$\pi_3^{BC}(\gamma,\omega) = \frac{6}{24} = \frac{1}{6}$$

$$\pi_4^{BC}(\gamma,\omega) = \frac{4}{24} = \frac{1}{6}$$

$$\pi_5^{BC}(\gamma,\omega) = \frac{0}{24} = 0$$

Remark

The Banzhaf-Coleman power index (BC power index) follows a bit different intuition then Shapley-Shubik one. To calculate it we have to write down all the winning coalitions and in each of them to note the "swing" voters (if such exist), those who by changing their vote could change the coalition from winning to losing. For our committee from the previous remark we enumerated all possible coalitions (see Table). Since in each voting situation the committee splits into two parts: those who vote "yes" and those who votes "no" or abstain, we denote the "yes" coalitions by + and "not yes" coalitions by −. There exist exactly 2^n coalitions, 16 in our case.

1	2	3	4		
20	25	38	17	51	
+	+	+	+	100	W
+	+	+*	−	83	W
+*	+*	−	+*	62	W
+	+	−	−	45	L
+	−	+*	+	75	W
+*	−	+*	−	58	W
+	−	−	+	37	L
+	−	−	−	20	L
−	+	+*	+	80	W
−	+*	+*	−	63	W
−	+	−	+	42	L
−	+	−	−	25	L
−	−	+*	+*	55	W
−	−	+	−	38	L
−	−	−	+	17	L
−	−	−	−	0	L
2	2	6	2	12	

By asterisk we denoted "swing" members in winning coalitions. We can see, that for simple majority voting rule we have 8 possible winning coalitions. The member 1 is two times in position of the "swing" member, the member 2 also two times, the member 3 six times and the member 4 two times. There are exactly 12 possible "swings" in the committee. Supposing that in a large number of voting situations all possible coalitions are equally probable, we can evaluate the power of the members as a ratio of the number of swings the member can make to the total number of possible swings. Thus the Banzhaf-Coleman power indices of the members in our committee are

$$\pi = \left(\frac{1}{6}, \frac{1}{6}, \frac{1}{2}, \frac{1}{6} \right)$$

(in our example the same as Shapley-Shubik indices).

The *Holler-Packel* (HP) power index assigns to each member of a committee the share of power proportional to the number of minimal critical winning configurations he is a member of. It is assumed that all winning configurations are possible but only minimal critical winning configurations are being formed to exclude free-riding of the members that cannot influence the bargaining process. "Public good" interpretation of the power of MCWC (the power of each member is identical with the power of the MCWC as a whole, power is indivisible) is used to justify HP index. Holler [1978] suggested and Holler and Packel [1983] axiomatized the following measure of power distribution in a committee:

$$\pi_i^{HP}(\gamma,\omega) = \frac{\text{card}M_i(\gamma,\omega)}{\sum_{k\in N}\text{card}M_k(\gamma,\omega)} = \frac{\sum_{s=1}^{n}\text{card}M_{is}(\gamma,\omega)}{\sum_{k=1}^{n}\sum_{s=1}^{n}\text{card}M_{ks}(\gamma,\omega)} \qquad \text{(A.6)}$$

Example 3

Let us calculate HP-power indices in the committee from Example 1. In Table A.3 rows correspond to the size of configurations and columns to the members of the committee. The entries of the table give the number of MCWC of the size s containing corresponding member. In our case

$$M_{12}(\gamma,\omega) = \{\{1,2\},\{1,3\},\{1,4\}\}$$
$$M_{22}(\gamma,\omega) = \{\{1,2\}\}$$
$$M_{23}(\gamma,\omega) = \{\{2,3,4\}\}$$
$$M_{32}(\gamma,\omega) = \{\{1,3\}\}$$
$$M_{33}(\gamma,\omega) = \{\{2,3,4\}\}$$
$$M_{42}(\gamma,\omega) = \{\{1,4\}\}$$
$$M_{43}(\gamma,\omega) = \{\{2,3,4\}\}$$

(all other sets M_{is} empty).

Table A.3

	1	2	3	4	5	Σ
1	0	0	0	0	0	0
2	3	1	1	1	0	6
3	0	1	1	1	0	3
4	0	0	0	0	0	0
5	0	0	0	0	0	0
Σ	3	2	2	2	0	9

Now, using (A.6), from Table A.3 we can obtain values of HP-power index for different members:

$$\pi_1^{HP}(\gamma,\omega) = \frac{3}{9} = \frac{1}{3}$$

$$\pi_2^{HP}(\gamma,\omega) = \frac{2}{9}$$

$$\pi_3^{HP}(\gamma,\omega) = \frac{2}{9}$$

$$\pi_4^{HP}(\gamma,\omega) = \frac{2}{9}$$

$$\pi_5^{HP}(\gamma,\omega) = \frac{0}{9} = 0$$

The Johnston (J) power index measures the power of a member of a committee as a normalized weighted average of the number of cases when he is marginal with respect to a critical winning configuration, using as weights the reciprocals of the number of marginalities in each CWC:

$$\pi_i^J(\gamma,\omega) = \frac{\sum_{s=1}^{n} \frac{1}{s} \mathrm{card}\, P_{is}(\gamma,\omega)}{\sum_{s=1}^{n} \frac{1}{s} \sum_{k\in N} \mathrm{card}\, P_{ks}(\gamma,\omega)} \tag{A.7}$$

Example 4

Let us calculate J-power indices in the committee from Example 1. In Table A.4 rows correspond to the size of configurations and columns to the members of the committee. The entries of the table give the number of CWC containing s marginal members the member i is marginal with respect to. In our case

$$P_{11}(\gamma,\omega) = \{\{1,2,3\},\{1,2,4\},\{1,3,4\},\{1,2,3,5\},\{1,2,4,5\},\{1,3,4,5\}\}$$

$$P_{12}(\gamma,\omega) = \{\{1,2\},\{1,3\},\{1,4\},\{1,2,5\},\{1,3,5\},\{1,4,5\}\}$$

$$P_{22}(\gamma,\omega) = \{\{1,2\},\{1,2,5\}\}$$

$$M_{23}(\gamma,\omega) = \{\{2,3,4\},\{2,3,4,5\}\}$$

$$P_{32}(\gamma,\omega) = \{\{1,3\},\{1,3,5\}\}$$

$$P_{33}(\gamma,\omega) = \{\{2,3,4\},\{2,3,4,5\}\}$$

$$P_{42}(\gamma,\omega) = \{\{1,4\},\{1,4,5\}\}$$

$$P_{43}(\gamma,\omega) = \{\{2,3,4\},\{2,3,4,5\}\}$$

(all other sets P_{is} empty).

Table A.4

	1	*2*	*3*	*4*	*5*	Σ	*1/s*
1	*6*	*0*	*0*	*0*	*0*	*6*	*1*
2	*6*	*2*	*2*	*2*	*0*	*12*	*1/2*
3	*0*	*2*	*2*	*2*	*0*	*6*	*1/3*
4	*0*	*0*	*0*	*0*	*0*	*0*	*1/4*
5	*0*	*0*	*0*	*0*	*0*	*0*	*1/5*
	9	*10/6*	*10/6*	*10/6*	*0*		*14*

Now, using (A.7), from Table A.4 we can obtain values of HP-power index for different members:

$$\pi_1^J(\gamma,\omega) = \frac{9}{14} = \frac{27}{42}$$

$$\pi_2^J(\gamma,\omega) = \frac{\frac{10}{6}}{14} = \frac{5}{42}$$

$$\pi_3^J(\gamma,\omega) = \frac{\frac{10}{6}}{14} = \frac{5}{42}$$

$$\pi_4^J(\gamma,\omega) = \frac{\frac{10}{6}}{14} = \frac{5}{42}$$

$$\pi_5^J(\gamma,\omega) = \frac{0}{14} = 0$$

The Deegan-Packel (DP) power index measures the power of a member of a committee as a normalized weighted average of the number of minimal critical winning coalitions he is a member of, using as weights the reciprocals of the size of each MCWC:

$$\pi_i^{DP}(\gamma,\omega) = \frac{\sum_{s=1}^{n} \frac{1}{s} \operatorname{card} M_{is}(\gamma,\omega)}{\sum_{s=1}^{n} \frac{1}{s} \sum_{k \in N} \operatorname{card} M_{ks}(\gamma,\omega)} \qquad (A.8)$$

Example 5

Let us calculate DP-power indices in the committee from Example 1. In Table A.5 rows correspond to the size of configurations and columns to the members of the committee. The entries of the table give the number of MCWC of the size s containing corresponding member.

Table A.5

	1	2	3	4	5	Σ	1/s
1	0	0	0	0	0	0	1
2	3	1	1	1	0	6	1/2
3	0	1	1	1	0	3	1/3
4	0	0	0	0	0	0	1/4
5	0	0	0	0	0	0	1/5
	3/2	5/6	5/6	5/6	0		4

Now, using (A.8), from Table A.5 we can obtain values of HP-power index for different members:

$$\pi_1^{DP}(\gamma,\omega) = \frac{\frac{3}{2}}{4} = \frac{3}{8} = \frac{9}{24}$$

$$\pi_2^{DP}(\gamma,\omega) = \frac{\frac{5}{6}}{4} = \frac{5}{24}$$

$$\pi_3^{DP}(\gamma,\omega) = \frac{\frac{5}{6}}{4} = \frac{5}{24}$$

$$\pi_4^{DP}(\gamma,\omega) = \frac{\frac{5}{6}}{4} = \frac{5}{24}$$

$$\pi_5^{DP}(\gamma,\omega) = \frac{0}{4} = 0$$

A.4 The double majority principle

We used single-majority examples to illustrate different concepts of power indices. Let us suppose now that each of n members ($i = 1, \ldots, n$) of a committee has two weights v_i and t_i (e.g. the votes in the Council and the share of population, or GDP). Let v^M be a qualified majority for weights v_i and t^M be a qualified majority for weights t_i. We shall refer to such a voting body as a two-weight committee (a natural generalization to a multi-weight committee is obvious).

A decision is approved by a two-weight committee if there exists a coalition S of the members such that

$$\sum_{i \in S}^{n} v_i \geq v^M$$

AND

$$\sum_{i \in S}^{n} t_i \geq t^M$$

We shall call this rule a double-majority rule. It is clear a blocking minority in this case is

$$v^m = \sum_{i=1}^{n} v_i - v^M + 1$$

OR

$$t^m = \sum_{i=1}^{n} t_i - t^M + 1$$

Remark

To show how to evaluate Shapley-Shubik type of power for this voting rule we shall use the same intuitive scheme as in the case of one-weight committee. In Table A.6 we provide two sets of weights in a four-member committee. Let us suppose that a simple majority is required to pass a bill (31 votes for the weights **v** and 58 votes for the weights **t**.

Table A.6

country	v_i	t_i
A	10	50
B	25	30
C	20	20
D	5	15
total	60	115

Let us suppose that a bill is most enthusiastically supported by member A, second most enthusiastically by member C, third most enthusiastically by member D and least enthusiastically by member B. Thus member A would be the first to join the coalition to support the bill, but having no majority by the both weights it will look for the support of another member. Then member C will join the coalition. This coalition has majority in the weights **t**, but the bill would still lose because of not having majority in the weights **v**. It will be able to win the majority in the both weights if the coalition can gain support of the member D. So the member D is pivotal in this case.

To derive an extension of the Shapley-Shubik power index we should consider all the orders of coalition formation and to look for pivotal members in the sense mentioned above. The Shapley-Shubik power index of a member of the committee is given by the probability that the member will be pivotal, providing that all the orders of a coalition formation are equally probable.

There are 4! = 24 possible orders of forming the winning coalitions (see Table 3.9). We denote by prime pivotal members for simple majority taking into account the fact that the pivotal member must convert a losing coalition into the winning one with respect to the both weights. In each row of Table 3.9 we give one order of forming a winning coalition, the sum of weights v_i and the sum of weights t_i necessary to win double-majority. We can see that member A is pivotal in 8 of 24 orders, member B is pivotal and 8 of 24 orders, member C is pivotal in 4 of 24 orders and member D is pivotal in 4 of 24 orders, so we can evaluate the power of members by the Shapley-Shubik power indices

$$\pi = \left(\frac{2}{6}, \frac{2}{6}, \frac{1}{6}, \frac{1}{6}\right)$$

In Table A.8 we compare this result with Shapley-Shubik power indices for simple majority calculated on the single-weight committee basis for weights **v** and **t**.

Table A.7

	v	t
AB'CD	35	80
AB'DC	35	80
ACB'D	55	100
ACD'B	35	85
ADB'C	40	95
ADC'B	35	85
BA'CD	35	80
BA'DC	35	80
BCA'D	55	100
BCD'A	50	65
BDC'A	50	65
BDA'C	40	95
CAB'D	55	100
CAD'B	35	85
CBA'D	55	100
CBD'A	50	65
CDA'B	35	85
CDB'A	50	65
DAB'C	40	95
DAC'B	35	85
DBA'C	40	95
DBC'A	50	65
DCA'B	35	85
DCB'A	50	65

Table A.8

member	v	t	π(v)	π(t)	π(v AND t)
A	10	50	25.00	50.00	33.33
B	25	30	41.67	16.67	33.33
C	20	20	25.00	16.67	16.67
D	5	15	16.67	16.67	16.67

The same approach can be applied on decision making process done by two voting bodies. In this case each set of weights corresponds to distribution of votes in one of the voting bodies and decision is approved, if it has corresponding majority in the both voting bodies.

A.5 Properties of power indices

A member $i \in N$ of the committee $[\gamma, \omega]$ is said to be **dummy** if he cannot benefit any voting configuration by joining it, i.e. the player i is dummy if

$$\sum_{k \in S} \omega_{kj} \geq \gamma_j \Rightarrow \sum_{k \in S-\{i\}} \omega_{kj} \geq \gamma_j$$

for any winning configuration $S \subseteq N$ such that $i \in S$, and for all j.

Two distinct members s and r of a committee $[\gamma, \omega]$ are called **symmetric** if their benefit to any voting configuration is the same, that is, for any S such that $s, r \notin S$

$$\sum_{k \in S \cup \{s\}} \omega_{kj} \geq \gamma_j \Leftrightarrow \sum_{k \in S \cup \{r\}} \omega_{kj} \geq \gamma_j$$

for all j.

Obviously, if for two members s and r of a committee $[\gamma, \omega]$ holds $\omega_s = \omega_r$, then r and s are symmetric.

Let $[\gamma, \omega]$ be a committee with the set of members N and

$$\sigma : N \rightarrow N$$

be a permutation mapping. Then the committee

$$[\gamma, \sigma\omega]$$

we shall call a **permutation** of the committee $[\gamma, \omega]$ and $\sigma(i)$ is the new number of the member with original number i.

Let $\pi_i(\gamma, \omega)$ be a measure of power of a member i in a committee with a quota vector γ and allocation matrix ω, then (assuming no additional information about the structure of the committee and specific voting rules) it is natural to expect that some minimal intuitively acceptable properties should be satisfied by a reasonable π. The following axiomatic characterization of power indices (in slightly different form) was introduced by Allingham [1975]:

Axiom D (dummy)
Let $[\gamma; \omega]$ is a committee and i is dummy, then

$$\pi_i(\gamma;\omega) = 0$$

Dummy member has no power.

Axiom A (anonymity)
Let $[\gamma; \omega]$ is a committee and $[\gamma; \sigma\omega]$ its permutation, then

$$\pi_{\sigma(i)}(\gamma,\sigma\omega) = \pi_i(\gamma,\omega)$$

The power is a property of committee and not of players names and numbers.

Axiom S (symmetry)
Let $[\gamma; \omega]$ is a committee and s and r ($s \neq r$) are symmetric, then

$$\pi_s(\gamma,\omega) = \pi_r(\gamma,\omega)$$

The power of symmetric players is the same.

Axiom LM (local monotonicity)
Let $[\gamma; \omega]$ be a committee and $\omega_{sj} > \omega_{rj}$, then

$$\pi_s(\gamma,\omega) \geq \pi_r(\gamma,\omega)$$

The player with greater weights cannot have less power than the player with smaller weights.

Turnovec [1994] suggested the additional fifth axiom:

Axiom GM (global monotonicity)
Let $[\gamma, \alpha]$ and $[\gamma, \beta]$ be two different committees of the same size such that $\alpha_{kj} > \beta_{kj}$ for one $k \in N$ and all j, and $\alpha_{ij} \leq \beta_{ij}$ for all $i \neq k$ and all j, then

$$\pi_k(\gamma,\alpha) \geq \pi_k(\gamma,\beta)$$

If the weights of one member are increasing and the weights of all other members are decreasing or staying the same, then the power of the "growing weight" member will at least not decrease.

Which index is right? This is an issue for a rather extensive discussion that can lead to refinement of the original model. Each of the indices apparently answers a slightly different question and the problem is to formulate explicitly the relevant question as a part of the model of a committee. In this paper we are not going to follow this direction. The purpose of the paper is to confront the indices with the five axioms of power.

Turnovec [1997] proved the following:

a) Shapley-Shubik power index satisfies axioms D, A, S, LM, and GM.

b) Banzhaf-Coleman and Johnston indices satisfy axioms D, A, S, LM, but not GM.

c) Holler-Packel and Deegan-Packel indices satisfy axioms D, A, S, but not LM and GM.

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Notes

1. The Commission has 20 members - the commissioners, responsible for different agendas. There is one commissioner from each member state and the five big countries (Germany, United Kingdom, France, Italy and Spain) have two commissioners each.

2. Three types of Councils of Ministers can be distinguished: a) The General Affairs Council, consisting of foreign ministers, which meets nearly every month and deals with major political issues. b) The Economic and Financial Council and the Agricultural Council, that meet nearly every month. c) Ad hoc Councils (like budget, internal market, environment, research and development, social affairs, education etc.). Some of them meets ten times a year, some only twice.

3. The Council Presidency rotates in alphabetical order every six months among the member states. The original powers of Council Presidency, defined in 1958, were: the chairmanship of the Council, agenda setting of the Council meetings, signing documents and notifying of decisions, and representation of the Council in European Parliament. But as the Union deepens and widens, the importance of the role of Presidency is increasing. See also *Kirchner, E. J. (1992)*. The sequence of rotation until the end of 2000 is: Netherlands, Luxembourg (1997), United Kingdom, Austria (1998), Germany, Finland (1999), Portugal, France (2000).

4. Our description of European Union decision making procedures is based on the unpublished paper: *Laruelle, A. and M. Widgren (1997), The Development of the Division of Power between EU Commission, EU Council and European Parliament.* See also: *Kirchner, E. (1992).*

5. This applies to the common foreign and security policy and justice and home affairs. The issues where this rule is applied require a unanimous acceptance of the Council before the rule can be applied.

6. The relation between the voting weight and population was studied by *Widgrén, M. (1994).*

7. It is a variant of a well known standard problem of integer linear programming, so called *knapsack problem.* This application with respect to the extreme possibilities that can emerge in EU voting was proposed in *Turnovec, F. (1996).*

8. Distribution of votes in European Parliament has not only national dimension, but also a political dimension. Political parties in member countries are taking part in the elections and they create international factions based on ideological basis, European political formations in EP: Party of European Socialist (PES) with 214 members of EP, European Peoples Party (EPP) with 173 members, Union for Europe (UE) with 56 members, European Liberal, Democrat and Reform Party (EDLR) with 52 members, European Unitary Left (EUL) with 33 members, Greens in the European Parliament (GREEN) with 28 members, European Radical Alliance (ARE) with 19 members, Europe of National States (ENS) with 19 members, Nonaffiliated (NI) with 32 members.

9. We use extrapolation provided in *Ludlow, P. and N. Ersbol (1994).*

10. It is for example clear that the principle of at least one Commissioner per member state can't be preserved ad infinity. The same is true for voting rules in the Council of Ministers, where the blocking power of smaller and underdeveloped states might create a permanent dead-lock in decision making.

11. First studies on distribution of power in the Council of Ministers, using power indices methodology, see in: Johnston, R. J. (1982), Brams, S. and P. Affuso (1985). The present development associated with the 1995 enlargement of EU, has been analyzed in: Widgrén, M. (1993, 1994, 1995), Berg, S. (1996).

12. Possible implications of future extension of European Union for distribution of power are addressed in: Turnovec, F. (1996), Nurmi, H., T. Meskanen and A. Pajala (1996).

13. All together $2^n - n - 1$ possible non-trivial coalitions exist in a body of n members, that is, in the case of $n = 27$, about 1.3×10^8 different coalitions, an astronomic number.

14. It is, of course, not the only problem in European Union decision making. For example, with respect to the Council, we can mention also procedural problems, the manner in which the Council transacts business (a tour de table with 27 states, with each speaking for just five minutes, would take over two hours, linguistic regimes and costs of interpretation etc.).

15. There were attempts to secure institutional reform in the past but they have never succeeded. As a result of a dispute on institutional matters (the threshold for qualified majority voting) before the EFTA enlargement negotiations were completed, the European Council in 1995 made a direct linkage between enlargement and the 1996 Intergovernmental Conference, when it stated that "the institutional conditions of ensuring the proper functioning of the Union must be created at the 1996 Intergovernmental Conference, which for that reason must take place before accession negotiations begin with countries of Central and Eastern Europe". [Quoted by the paper of Fraser Cameron from Directorate-General of International Affairs, *The European Union and the Challenge of Enlargement*, presented at the CEPS Chapter meeting in Prague, March 27, 1996].

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