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National, Political and Institutional Influence in European Union Decision Making

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Abstract The distribution of decisional power among member states of the EU has remained a hot issue in recent discussions about the future design of European Union decision making and the Lisbon revision of the unsuccessful proposal of the Constitutional Treaty. Usually only the distribution of voting weights in the Council of Ministers under the qualified majority voting rule is taken into account. In contrast, in this paper we formulate simplified models of the consultation and co-decision procedures in the decision making of European Union institutions, reflecting the fact that together with the Council of Ministers the Commission and European Parliament are also important actors in EU decision making. The main conclusion of this paper is that the distribution of voting power in the Council of Ministers voting provides incomplete evidence about national influences in European Union decision making. With rare exceptions decision making is based on the consultation and co-decision procedures involving the Commission and/or European Parliament. Legislative procedures change the inter-institutional distribution of power (among the Council, Commission and European Parliament) reducing the power of the Council and at the same time they change intra-institutional power in the Council (the relative power of the Member States compared to the Council voting without taking into account the Commission and Parliament).

Keywords Co-decision procedure, committee system, consultation procedure, European Union decision making, Penrose-Banzhaf power indices, qualified majority, simple voting committee, weighted majority game
JEL classification C71, D72, H77

1. Introduction

In discussions about the distribution of decisional power among the Member States of the EU, only the distribution of voting weights in the Council of Ministers qualified majority voting is taken into account. In contrast, in this paper we analyze models of the consultation and co-decision procedures in the decision making of European Union institutions: the Commission, Council of Ministers and European Parliament. While the consultation procedure is a "game" between the Council and Commission, with an agenda-setting role of the Commission and the consultation role of the European Parliament, the co-decision procedure involves all three of the most important European institutions, providing each of them with unconditional veto rights. Table 1 illustrates

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the broad use of the consultation and co-decision procedures in legislative acts decided by European Union institutions during 2000-2006. Consultation and co-decision are the usual methods of European governance and the Council of Ministers is not an exclusive decision maker in the EU. In this paper, using the power indices methodology, a distribution of influence among the Commission, Council and the Parliament under different decision-making procedures is being evaluated, together with the voting power of Member States and European political parties.

Table 1. Legislative proposals under consultation and co-decision procedures 2000–2006

	2000	2001	2002	2003	2004	2005	2006
CNP	150	140	118	152	121	132	126
CDP	94	84	140	117	73	88	112

Source: PreLex database (http://ec.europa.eu/prelex/rech_simple.cfm?CL=en).
Note: CNP = consultation procedure, CDP = co-decision procedure.

The inter-institutional distribution of power (among the Commission, Council and European Parliament) in the decision-making procedures of the EU (consultation procedure, and co-decision procedure) has been analyzed in Widgrén (1996), Laruelle and Widgrén (1997) and Napel and Widgrén (2004). While in the first paper (Widgrén, 1996) the traditional committee model is developed for the consultation procedure (consultation procedure as a committee of *n* Member States plus the Commission with a composite voting rule), other models are formulated in terms of three unitary actors' (Commission, Council and Parliament) extensive form games, without the breakdown of the Council into Member States and the Parliament into party factions. European multi-cameral procedures were also studied by König and Bräuninger (2001) using the explicit analysis of winning coalitions in multi-cameral decision making, but without the formulation of the corresponding voting game model. The traditional power indices approach to the disaggregate modeling of the consultation and co-decision procedures, allowing the expression of both inter-institutional and intra-institutional influence was presented in Turnovec (2004). In this paper we extend this stream of models defining national influence as the influence of Member States in the Council of Ministers' voting and political influence as the influence of European political parties in basic legislative procedures.

In the second section we provide a short overview of the methodology used, introduce logical combinations of weighted majority games and apply the power indices methodology for the evaluation of voting power in committee systems. We selected the Penrose-Banzhaf concept of voting power, which is strongly recommended by some authors and frequently used in voting power evaluation in the EU (Felsenthal and Machover 2004a, 2004b, 2007). The third section formulates models of different versions of the qualified majority in the Council of Ministers voting: the Nice rule (status quo), the Lisbon Treaty rule and the proposal of "Jagiellonian compromise," based on the implementation of the "square root rule." Simplified models of consultation and co-decision procedures, developed on the basis of ideas from Widgrén (1996) and Turnovec (2004) are analyzed in the fourth section. The fifth section provides empirical evidence about the structural effects of legislative procedures based on the Penrose-Banzhaf power index (results calculated from data about the EU of 27). Conclusions are taken up in the sixth section.

2. Voting power in committee systems

In this part we define the logical combinations of weighted majority games and adjust the Penrose-Banzhaf power index for the evaluation of its members' influence.

Let n be a positive integer, $\mathbf{w} = (w_1, w_2, \ldots, w_n)$ be a nonnegative real valued vector and q be a real number such that:

$$\frac{1}{2}\sum_{i=1}^{n} w_i < q \leq \sum_{i=1}^{n} w_i$$

By a weighted majority game of n members (Owen 1982) we mean a triple $[N, q, \mathbf{w}]$ in which $N = \{1, 2, \ldots, n\}$. Number w_i is called a weight of member i, q is called a quota, any subset $S \subseteq N$ is called a coalition in $[N, q, \mathbf{w}]$. Coalition S is called a winning one if $\sum_{i \in S} w_i \geq q$ and a losing one otherwise. The weighted majority game provides a model of a simple voting committee (a single camera committee in which each member has one weight).

Let $C_1 = [N_1, q_1, \mathbf{w}_1]$ and $C_2 = [N_2, q_2, \mathbf{w}_2]$ be a pair of weighted majority games. Then w_{ij}, $j = 1, 2$ denotes the weight of member $i \in N_j$ in C_j, and q_j is the quota in committee C_j. Let $N = N_1 \cup N_2$. By $\overline{w_1}$ and $\overline{w_2}$ we denote the zero extension of weight vectors $\mathbf{w}_1$, $\mathbf{w}_2$ with respect to $N = N_1 \cup N_2$ such that $\overline{w_{ij}} = w_{ij}$ if $i \in N_j$ and $\overline{w_{ij}} = 0$ if $i \notin N_j$. Let $S_1 \subseteq N_1$ be a coalition in C_1 and $S_2 \subseteq N_2$ be a coalition in C_2, then $S = S_1 \cup S_2 \subseteq N$ is a joint coalition of the members of C_1 and C_2. We assume that the same members (if any) vote identically in both committees. The weighted majority game $\overline{C_j} = [N_1 \cup N_2, q_j, \overline{w_j}]$ we call a zero extension of C_j with respect to $N_1 \cup N_2$. Considering an interrelated system of two simple voting committees with different (possibly overlapping) sets of members in which the final outcome of voting depends on the results of voting in both committees, we have to substitute the corresponding weighted majority games by their zero extensions with the same sets of members.

The union $C_1 \cup C_2$ of two games $C_1 = [N_1, q_1, \mathbf{w}_1]$ and $C_2 = [N_2, q_2, \mathbf{w}_2]$ is the game $\overline{C_1} \cup \overline{C_2} = [N_1 \cup N_2, q_1 \wedge q_2, \overline{w_1}, \overline{w_2}]$ with the following composite voting rule: A proposal to be passed has to obtain votes representing at least a total weight q_1 in game C_1 **or** at least a total weight q_2 in game C_2. A coalition $S \subseteq N = N_1 \cup N_2$ is a winning coalition in $C_1 \cup C_2$ if S_1 is a winning coalition in C_1 or S_2 is winning coalition in C_2, The set of all winning coalitions in $C_1 \cup C_2$ is equal to the union of the sets of all winning coalitions in $\overline{C_1}$ and $\overline{C_2}$.

The intersection $C_1 \cap C_2$ of two games $C_1 = [N_1, q_1, \mathbf{w}_1]$ and $C_2 = [N_2, q_2, \mathbf{w}_2]$ is the game $\overline{C_1} \cap \overline{C_2} = [N_1 \cup N_2, q_1 \vee q_2, \overline{w_1}, \overline{w_2}]$ with the following composite voting rule: A proposal to be passed has to obtain votes representing at least a total weight q_1 in game C_1 **and** at least a total weight q_2 in game C_2. A coalition $S \subseteq N = N_1 \cup N_2$ is a winning coalition in $C_1 \cup C_2$ if S_1 is winning coalition in C_1 and S_2 is winning coalition in C_2. The set of all winning coalitions in $C_1 \cap C_2$ is equal to the intersection of the sets of all winning coalitions in $\overline{C_1}$ and $\overline{C_2}$.

Using union and intersection operations we can construct logical combinations of weighted majority games. For example, $[N_1 \cup N_2 \cup N_3,\ (q_1 \vee q_2) \wedge q_3,\ \overline{w_1},\ \overline{w_2},\ \overline{w_3}]$ is a logical combination of three weighted majority games $[N_1, q_1, \mathbf{w}_1]$, $[N_2, q_2, \mathbf{w}_2]$, $[N_3, q_3, \mathbf{w}_3]$ with the following composite voting rule: A proposal to be passed has to obtain either at least q_1 weights in a simple committee $[N_1, q_1, \mathbf{w}_1]$ and at least q_2 weights in a simple committee $[N_2, q_2, \mathbf{w}_2]$, or at least q_3 weights in a simple committee $[N_3, q_3, \mathbf{w}_3]$. Logical combinations of weighted majority games provide models of committee systems (committees in which each member has more weights or multi-camera committees consisting of several simple voting committees and complex voting rules).

Models of simple voting committees and committee systems are applicable to political science, as they provide instruments for the analysis of the a priori voting power of their members. Voting power analysis seeks an answer to the following question: Given a simple voting committee or a committee system, what is the influence of its members over the outcome of voting? Voting power of a member i is a probability that i will be decisive in the sense that such a situation appears in which she would be able to reverse the outcome of voting by reversing her vote. To define a particular power measure means to identify a qualitative property (decisiveness) whose presence or absence in the voting process can be established and quantified (e.g. Nurmi 1997). One of such properties related to committee members' positions in voting that is frequently used as a starting point for the quantification of voting power is the swing position of committee members.[1]

Let S be a winning coalition in a weighted majority game $[N, q, \mathbf{w}]$. A member $k \in S$ has a swing in coalition S if $\sum_{i \in S} w_i \geq q$ and $\sum_{i \in S \setminus \{k\}} w_i < q$. Assuming all coalitions are equally likely, it makes sense to evaluate the a priori voting power of each member of the committee by her probability to have a swing vote. This probability is measured by the absolute Penrose-Banzhaf (PB) power index (Penrose 1946, Banzhaf 1965):

$$\Phi_i^{PB}(N, q, \mathbf{w}) = \frac{\sigma_i}{2^{n-1}}$$

(where σ_i is the number of swing votes of member i and 2^{n-1} is the number of coalitions with i as a member). To compare the relative power of different members of the committee, the relative (normalized) form of the Penrose-Banzhaf power index is used:

$$\phi_i^{PB}(N, q, \mathbf{w}) = \frac{\sigma_i}{\sum\limits_{k \in N} \sigma_k}$$

Definitions of swing votes and PB power indices can be easily extended for logical combinations of weighted majority games.

Let $[N_1, q_1, \mathbf{w}_1]$ and $[N_2, q_2, \mathbf{w}_2]$ be two weighted majority games. If $S \subseteq N_1 \cup N_2$, then

[1] Another property, used in the definition of an alternative Shapley-Shubik power index (Shapley and Shubik, 1954) is the concept of the pivot. Relations between swing votes and pivots see in Turnovec (2007). The most comprehensive exposition of the power indices methodology is given by Felsenthal and Machover (1998).

a) $k \in S$ has a swing vote in the committee system $[N_1 \cup N_2,\ q_1 \wedge q_2,\ \overline{w_1},\ \overline{w_2}] = [N_1,\ q_1,\ \mathbf{w}_1] \cup [N_2,\ q_2,\ \mathbf{w}_2]$ in coalition S if and only if either $\sum_{i \in S} \overline{w_{i1}} \geq q_1$ and $\sum_{i \in S \setminus \{k\}} \overline{w_{i1}} < q_1$, or $\sum_{i \in S} \overline{w_{i2}} \geq q_2$ and $\sum_{i \in S \setminus \{k\}} \overline{w_{i2}} < q_2$ (or both),

b) $k \in S$ has a swing vote in the committee system $[N_1 \cup N_2,\ q_1 \vee q_2,\ \overline{w_1},\ \overline{w_2}] = [N_1,\ q_1,\ \mathbf{w}_1] \cap [N_2,\ q_2,\ \mathbf{w}_2]$ in coalition S if and only if $\sum_{i \in S} \overline{w}_{i1} \geq q_1$ and $\sum_{i \in S} \overline{w_{i2}} \geq q_2$, and either $\sum_{i \in S \setminus \{k\}} \overline{w_{i1}} < q_1$, or $\sum_{i \in S \setminus \{k\}} \overline{w_{i2}} < q_2$ (or both).

Lemma 1. *Let C_1 and C_2 be two weighted majority games (without the loss of generality we assume the same member set N in both games), $i \in N$, $\Phi_i^{PB}(C)$denotes an absolute PB power index and $\phi_i^{PB}(C)$denotes a relative PB power index of member i in a game C, then for any $i \in N$*

$$\Phi_i^{PB}(C_1 \cup C_2) + \Phi_i^{PB}(C_1 \cap C_2) = \Phi_i^{PB}(C_1) + \Phi_i^{PB}(C_2)$$

and

$$\phi_i^{PB}(C_1 \cup C_2) + \phi_i^{PB}(C_1 \cap C_2) = \phi_i^{PB}(C_1) + \phi_i^{PB}(C_2)$$

Proof. follows directly from the definition of swing votes in the union and intersection of games C_1 and C_2. Member k has a swing vote in coalition S in the union of games C_1 and C_2 if and only if he has a swing vote in S in game C_1, or in game C_2, or in both games C_1 and C_2. Member k has a swing vote in coalition S in the intersection of games C_1 and C_2 if and only if he has a swing vote in S in both games C_1 and C_2. Let $\sigma_i(C_1)$ be the number of swing votes of i in C_1 and $\sigma_i(C_2)$ is the number of swing votes of i in C_2, then the sum $\sigma_i(C_1) + \sigma_i(C_2)$ contains two times the swing votes of the intersection of games C_1 and C_2. Therefore, to obtain the number of swing votes in the union of games C_1 and C_2 from the sum of swing votes in C_1 and C_2, we have to subtract the number of swing votes in the intersection of C_1 and C_2. From here it follows that $\sigma_i(C_1 \cup C_2) = \sigma_i(C_1) + \sigma_i(C_2) - \sigma_i(C_1 \cap C_2)$. Applying the definition of the PB power indices we obtain the statement of the lemma. □

3. Council of Ministers: A qualified majority problem

Most of the analyses of EU decision making are focused on voting in the Council. The distribution of power in the EU Council of Ministers and European Parliament and the development associated with the 1995, 2004 and 2007 enlargement of the EU has been analyzed in Brams and Affuso (1985), Widgrén (1994, 1995), Turnovec (1996, 2001, 2002), Bindseil and Hantke (1997), Laruelle (1998), Steunenberg, Smidtchen and Koboldt (1999), Nurmi (2000), Nurmi, Meskanen and Pajala (2001), König and Brauninger (2001), Leech (2002), Felsenthal and Machover (2004a, 2004b), Hosli and Machover (2004), Plechanovová (2004), Baldwin and Widgrén (2004), Słomczyński and Życzkowski (2006, 2007), Hosli (2008), Leech and Azis (2008) and many others. Also, in political discussions the problem of influence in Council voting is presented as the crucial one, as a corner stone of national influence in EU decision making. Let us shortly resume models of qualified majority voting in terms of the unions and intersections of simple voting committees.

3.1 Status quo, the Nice Treaty

Through the Nice Treaty (2000), a qualified majority in Council voting in the recent EU is reached if the following three conditions are met:

a) A minimum of 255 votes of Member States is cast in favor of the proposal, out of a total of 345 votes,

b) a majority of Member States approve the proposal,[2]

c) the votes in favor represent at least 62% of the total population of the EU.

Each Member State has a fixed number of votes. The number of votes allocated to each country is roughly determined by its population, but progressively weighted in favor of less populated countries (see Table 2).

Let us consider three weighted majority games:

$$C_1 = [N,\ q,\ \mathbf{v}]$$
$$C_2 = [N,\ r,\ \mathbf{p}]$$
$$C_3 = [N,\ c,\ \mathbf{e}]$$

where N is the set of Member States ($n = card(N)$ is the number of Member States), q is the quota of votes, **v** is the vector of Member States votes, r is the population quota, **p** is the vector of Member States shares of the population (in %), $c = int(n/2)+1$ is the member states quota and **e** is a summation vector (one state = one vote). The Nice qualified majority rule can be modeled as a committee system generated by the intersection of C_1, C_2, and C_3:

$C_{QMN} = C_1 \cap C_2 \cap C_3 = [N,\ q \vee r \vee c,\ \mathbf{v},\ \mathbf{p},\ \mathbf{e}]$

In the EU-27, $n = 27$, $q = 255$, $r = 62\%$, $c = 14$ (Member States' weights and quotas are seen in Table 2).

3.2 Controversial future, Lisbon Treaty

If the Lisbon Treaty (2007) comes into force, the qualified majority rule will be simplified. In this case, for passing a proposal in the Council, a "double majority" of at least 55% of the Member States[3] that represent at least 65% of the population of the Union is required. In addition, a proposal backed by $n-3$ Member States is always adopted, even if they do not represent 65% of population.

Let us consider three weighted majority games:

$$C_1 = [N,\ r,\ \mathbf{p}]$$
$$C_2 = [N,\ c_1,\ \mathbf{e}]$$
$$C_3 = [N,\ c_2,\ \mathbf{e}]$$

[2] In some cases (when the Council is not acting on a proposal of the Commission) a two-thirds majority is required.

[3] When the Council is not acting on a proposal of the Commission, a majority of 72% of Member States is required.

Table 2. Weights and quotas in the EU-27

	Votes	Share (%)	Population (mil.)	Share (%)	Square root pop.	Share (%)	Country	Share (%)	Seats	Share (%)
Germany	29	8.41	82.10	16.71	9.06	9.45	1	3.70		
France	29	8.41	61.40	12.49	7.84	8.17	1	3.70		
UK	29	8.41	60.50	12.31	7.78	8.11	1	3.70		
Italy	29	8.41	58.00	11.80	7.62	7.95	1	3.70		
Spain	27	7.83	44.70	9.10	6.69	6.98	1	3.70		
Poland	27	7.83	38.10	7.75	6.17	6.44	1	3.70		
Romania	14	4.06	21.70	4.42	4.66	4.86	1	3.70		
Netherlands	13	3.77	16.50	3.36	4.06	4.24	1	3.70		
Greece	12	3.48	11.10	2.26	3.33	3.48	1	3.70		
Portugal	12	3.48	10.60	2.16	3.26	3.40	1	3.70		
Belgium	12	3.48	10.40	2.12	3.22	3.36	1	3.70		
Czech R.	12	3.48	10.30	2.10	3.21	3.35	1	3.70		
Hungary	12	3.48	10.00	2.04	3.16	3.30	1	3.70		
Sweden	10	2.90	9.10	1.85	3.02	3.15	1	3.70		
Austria	10	2.90	8.30	1.69	2.88	3.01	1	3.70		
Bulgaria	10	2.90	7.70	1.57	2.77	2.89	1	3.70		
Slovakia	7	2.03	5.40	1.10	2.32	2.42	1	3.70		
Denmark	7	2.03	5.40	1.10	2.32	2.42	1	3.70		
Finland	7	2.03	5.20	1.06	2.28	2.38	1	3.70		
Island	7	2.03	4.20	0.85	2.05	2.14	1	3.70		
Lithuania	7	2.03	3.40	0.69	1.84	1.92	1	3.70		
Latvia	4	1.16	2.30	0.47	1.52	1.58	1	3.70		
Slovenia	4	1.16	2.00	0.41	1.41	1.48	1	3.70		
Estonia	4	1.16	1.30	0.26	1.14	1.19	1	3.70		
Cyprus	4	1.16	0.80	0.16	0.89	0.93	1	3.70		
Luxembourg	4	1.16	0.50	0.10	0.71	0.74	1	3.70		
Malta	3	0.87	0.40	0.08	0.63	0.66	1	3.70		
EPP-ED									277	35.29
PES									218	27.77
ALDE									105	13.38
UEN									44	5.61
Greens-EFA									42	5.35
GUE-NGL									41	5.22
IND-DEM									23	2.93
ITS									21	2.68
NI									14	1.78
Total	345	100	491.40	100	95.85	100	27	100	785	100.00
quota Nice	255	73.91%	304.67	62%			14	50.01%	393	50.01
quota Lisbon			319.41	65%			15	55%	393	50.01
quota SR					58.85	61.40			393	50.01

Source: http://europa.eu/institutions/inst/index_en.htm.

where N is the set of Member States ($n = card(N)$ is the number of Member States), r is the population quota, $\mathbf{p}$ is the vector of Member States' shares of population (in %), $c_1 = int(55n/100) + 1$ is the Member States' quota, $c_2 = n - 3$ is alternative Member States' quota and $\mathbf{e}$ is a summation vector (one state = one vote). The Lisbon-qualified majority rule can be modeled as a committee system generated by the intersection of $C_1$and C_2, and the union of $(C_1 \cap C_2)$ and C_3:

$$C_{QML} = (C_1 \cap C_2) \cup C_3 = [N,\ (r \vee c_1) \wedge c_2,\ \mathbf{p},\ \mathbf{e},\ \mathbf{e}],\ c_2 > c_1$$

In the EU-27, $r = 65\%$, $c_1 = 15$, $c_2 = 24$ (for Member States' weights and quotas see Table 2).

3.3 Fairness and square-ness story

In the late spring of 2004 an open letter from European scientists to the governments of EU Member States was distributed throughout the European academic community. The open letter was originally signed by a group of nine distinguished scientists from six EU countries, calling themselves "Scientists for a democratic Europe," and was later cosigned by 38 colleagues, and then was submitted to the governments of Member States and to the Commission.[4]

The basic idea of the proposal supported by the open letter is the following concept of "fairness": *If the European Union is a union of citizens, then it is fair when each citizen (independently of her national affiliation) exercises the same influence over Union issues. It is achieved when the voting weight of each national representation in the Council of Ministers is proportional to the square root of the population*.

The so-called square root rule is attributed to the British statistician Lionel Penrose (1946) and is closely related to the indirect voting power measured by the Penrose-Banzhaf power index. Different aspects of the square root rule are analyzed in Felsenthal and Machover (1998, 2007), Laruelle and Widgrén (1998), Baldwin and Widgrén (2004), Słomczyński and Życzkowski (2006, 2007) and Leech and Aziz (2008).

The concept of indirect voting power is based on the following rather artificial construction: Assume n units (e.g. regions) with different sizes of population (voters), represented in a super-regional committee that decides different agendas relevant for the whole entity. Each unit representation in the committee has some voting weight (number of votes). The decision-making process is performed by a series of referenda in each unit and units' representations in the committee are voting according to the results of referenda. In each unit an individual citizen has the same voting weight (one vote) that provides her with a voting power (each citizen from one unit has the same voting power). Also, each super-regional representation has some voting power in the committee that follows from its voting weight in the committee. Then, the indirect voting power of a citizen from a particular unit is given by the product of her voting power in local referenda and the voting power of her representation in the committee.

[4] The letter (including added tables) and list of its signatories can be seen at the following Web site: http://www.esi2.us.es/∼mbilbao/pdffiles/letter.pdf

The representation of units in the committee is considered fair if each citizen has the same indirect voting power independently of the unit she belongs to.

Let us have n countries, $i = 1, 2, \ldots, n$ with the population $p_1, p_2, \ldots, p_n$. Consider a randomly selected "yes/no" issue and suppose that member nations decide their approval or rejection by referendum. For simplicity assume the number of voters participating in the referendum is equal to the number of the population, and the quota (number of votes required to approve the proposal) is equal to $m_i < p_i$. We can assume a simple majority quota:

$$m_i = int\left(\frac{1}{2}p_i + 1\right) \approx \frac{1}{2}p_i$$

(the least integer greater than $\frac{p_i}{2}$). Then the number of cases in which the average citizen of country i will have a swing vote (the outcome of the national referendum will be identical with her vote) is:

$$\frac{m_i}{p_i}\begin{pmatrix} p_i \\ m_i \end{pmatrix} = \frac{m_i}{p_i}\frac{p_i!}{(p_i - m_i)!m_i!} \approx \frac{1}{2}\frac{p_i!}{\left(\left(\frac{p_i}{2}\right)!\right)^2}$$

and the probability to have a swing vote is:

$$P_i(p_i) = \frac{m_i}{2^{p_i-1}p_i}\frac{p_i!}{(p_i - m_i)!m_i!} \approx \frac{1}{2^{p_i}}\frac{p_i!}{\left(\left(\frac{p_i}{2}\right)!\right)^2}$$

(the power of a citizen of country i, the absolute Penrose-Banzhaf index). From the $P_i(p_i)$ formula it follows that the smaller the population, the higher the Penrose-Banzhaf power of an average citizen (assuming a simple majority quota). Using Stirling's formula:

$$n! \approx \frac{n^n}{e^n}\sqrt{2\pi n}$$

(Felsenthal and Machover, 1998), for a sufficiently large p_i we obtain the approximation:

$$P_i(p_i) \approx \sqrt{\frac{2}{\pi p_i}}$$

(for proof see Laruelle and Widgrén, 1998). The larger size of the population in the country i, the smaller is the individual citizen's Penrose-Banzhaf power in referendum-type country voting. If the countries' representations in the Council of Ministers that are voting on each issue according to the results of a national referenda and Φ_i is the Penrose-Banzhaf absolute power of the country i in the Council, then:

$$\Phi_i P_i(p_i) = \Pi_i\sqrt{\frac{2}{\pi p_i}}$$

is the i-th country-average citizen (indirect) power in the Council of Ministers' decision making. To guarantee the equal indirect power of citizens of different countries in the Council, it must hold that:

$$\Phi_i\sqrt{\frac{2}{\pi p_i}} = const$$

for all i. It holds if $\Pi_i = \alpha\sqrt{p_i}$, i.e. if the voting power of Member States is proportional to the square root of the population.

There is still one problem to be solved: What allocation of voting weights among Member States leads to the proportionality of power to the square root of the population? Supporters of the square root rule are proposing to allocate the weights in the Council proportionally to the square of the population, assuming that in committees with a large number of members the distribution of weights is a good proxy of voting power. However, a priori voting power seldom reflects the distribution of voting weights. If $[N, q, \mathbf{w}]$ is a simple weighted committee and $\Phi\,[N, q, \mathbf{w}]$ is a vector of the power indices of its members, then usually $\Phi\,[N, q, \mathbf{w}] \neq \alpha\mathbf{w}$.

Being aware of this problem, Słomczyński and Życzkowski (2006) formulated the following minimization problem:

Minimize the sum of square residuals between the normalized Penrose-Banzhaf power indices and voting weights defined as proportional to the square roots of the population according to the quota q:

$$\sigma^2(q) = \sum_{i \in N} \left(\phi_i^{PB}(N, q, \sqrt{\mathbf{p}}) - \frac{\sqrt{p_i}}{\sum_{k \in N} \sqrt{p_k}} \right)^2$$

for $q \in (0.5, 1]$. They used simulation and found the approximation of the optimal quota $q \approx 61.4\%$ for the EU of 27. So, the final proposal, known as "Jagiellonian Compromise," reads as follows: "*The voting weight of each Member State is allocated proportionally to the square of its population, the decision of the Council being taken if the sum of weights exceeds a (certain) quota*" (Słomczyński and Życzkowski, 2006), setting the quota equal to 61.4% of the sum of the square roots of the population in the Member States of the EU.

In our notations the square root qualified majority can be formalized as the weighted majority game:

$$C_{QMS} = [N,\ r,\ \sqrt{\mathbf{p}}],$$

where N is the set of Member States, r is a population square root quota and $\sqrt{\mathbf{p}}$ is the vector of the Member States' square roots of their populations (in %). In the EU-27, $r = 61.4$ and the square root of the population can be seen in Table 2.

4. The Commission, Council of Ministers and European Parliament: Consultation and co-decision procedures

Let

N be the set of Members States, $i = 1, 2, \ldots, n$,

$N \cup \{1\}$ be the set of actors in the consultation procedure (Member States plus the Commission),

M be the set of factions in the European Parliament (European political parties),

v_i be the number of votes assigned to Member State i,

s_j be the number of seats of European political party j,

$\mathbf{v}$ be the vector of Member States votes in the Council (vote weights, as defined in Nice),

$\mathbf{p}$ be the vector of shares of Member States' populations,

$\sqrt{\mathbf{p}}$ be the vector of the square roots of population shares,

$\mathbf{e}$ be the summation vector (one state – one vote weights),

$\mathbf{s}$ be the vector of the "weights" (numbers of seats) of political parties in the European Parliament,

q be the votes quota in the Council (the minimal number of votes required to pass a proposal),

c be the Member States quota in the Council (the minimal number of Member States required to pass a proposal),

r be a population quota in the Council (the countries supporting the proposal must represent at least r% of the total population of the Member States supporting the proposal),

t be a quota in the European Parliament (the minimal number of the members of the EP required to pass a proposal).

If $\mathbf{x} \in R_n$, then

$\mathbf{x}^{(-k)} \in R_{n+k}$ denotes the left zero extension of x (first k components equal 0),

$\mathbf{x}^{(+k)} \in R_{n+k}$ denotes the right zero extension of x (last k components equal 0),

$\mathbf{e}_{(n,j)} \in R_n$ denotes the n-dimensional unit vector with a j-th component equal to 1, all other components equal 0.

4.1 Consultation procedure

We assume that voting in the Commission is not influenced by the citizenship of Commissioners and by their ideological preferences;the Commission is making decisions as a collective body and the results of its voting are not known.

The European Commission sends its proposals to both the Council of Ministers and European Parliament, but it is the Council that officially consults Parliament and other bodies. However, the Council is not bound by the Parliament's position, so the Parliament cannot change the proposal or prevent its adoption. Then the Council either approves the proposal by a qualified majority or rejects it by a blocking minority, or amends it by unanimity. Depending on the version of the qualified majority in the Council we have three models of the consultation procedure.

a) The Nice version of the consultation procedure. From the committee system for a qualified majority $C_{QMN} = [N, q \vee r \vee c, \mathbf{v}, \mathbf{p}, \mathbf{e}]$ we obtain the following model of the consultation procedure:

$$C_{CNPN} = [N \cup \{1\}, ((q \vee r \vee c) \vee 1) \wedge n, \mathbf{v}^{(+1)}, \mathbf{p}^{(+1)}, \mathbf{e}^{(+1)}, \mathbf{e}_{(n+1,n+1)}, \mathbf{e}^{(+1)}]$$

The proposal is accepted if it is supported by the Commission and approved by a Nice-qualified majority in the Council (no less than $q = 255$ votes, at least $r = 62\%$ of the population and at least $c = 14$ Member States), or changed if it has the unanimous support of all n Member States in the Council, even if the change is not supported by the Commission.

b) The Lisbon version of the consultation procedure:

$$C_{CNPL} = [N \cup \{1\}, ((r \vee c_1) \wedge c_2) \vee 1) \wedge n, \mathbf{p}^{(+1)}, \mathbf{e}^{(+1)}, \mathbf{e}^{(+1)}, \mathbf{e}_{(n+1,n+1)}, \mathbf{e}^{(+1)}]$$

The proposal is accepted if it is supported by the Commission and approved by a Lisbon qualified majority in the Council (at least $r = 65\%$ of the population and at least $c_1 = 55\%$ of Member States, or at least $c_2 = 24$ Member States even without a population quota, or changed if it has unanimous support, even if the change is not supported by the Commission).

c) The square root version of the consultation procedure:

$$C_{CNPS} = [N \cup \{1\}, (r \vee 1) \wedge n, \sqrt{\mathbf{p}^{(+1)}}, \mathbf{e}_{(n+1,n+1)}, \mathbf{e}^{(+1)}]$$

The proposal is accepted if it is supported by the Commission and approved by a square root qualified majority in the Council (at least $r = 61.4\%$ of square root population weights), or changed if it has unanimous support, even if the change is not supported by the Commission).

4.2 Co-decision procedure

Co-decision procedure was introduced in 1992 (Maastricht) and modified in 1997 (Amsterdam).

A new legislative proposal is drafted by the Commission and is submitted to the Council and the Parliament. During the first reading the Council adopts the “common position,” by a qualified majority including its amendments, and the EP approves it by a simple majority including its amendments. If the two institutions have agreed on the same amendments after the first reading the proposal becomes law. Otherwise there is a second reading in each institution where each considers the others’ amendments. If the institutions are unable to reach agreement after the second reading, a conciliation committee is set up with an equal number of members of the Parliament and the Council. The committee attempts to negotiate a compromise text that must be approved by both institutions. Both the Parliament and Council have the power to reject a proposal either in its second reading or following conciliation, causing the proposal to fail. The Commission may also withdraw its proposal at any time.

The European Parliament of the EU of 27 has 785 members in 8 political groups (European political parties): European People’s Party-European Democrats (EPP-ED), Group of the Party of European Socialists (PES), Alliance of Liberals and Democrats for Europe (ALDE), Union for Europe of the Nations (UEN), European Greens – European Free Alliance (Greens-EFA), European United Left – Nordic Green Left (GUE-NGL), Independence and Democracy (IND-DEM), Identity, Tradition, Sovereignty (ITS), Non Attached (NI). The distribution of seats among political groups can be seen in Table 1, the national representation in the EP is roughly proportional to the population. The voting quota in the EP is 393 votes (simple majority).

We assume that the European Parliament represents the interests of citizens and acts on the basis of ideological principles expressed by European political parties, hence voting in the Parliament does not necessarily correlate to voting in the Council.

a) Nice version of the co-decision procedure. From the committee system for a qualified majority $C_{QMN} = [N, q \vee r \vee c, \mathbf{v}, \mathbf{p}, \mathbf{e}]$ we obtain the following model of the co-decision procedure:

$C_{CDPN} = [N \cup \{1\} \cup M, ((q \vee r \vee c) \vee 1) \vee t, \mathbf{v}^{(m+1)}, \mathbf{p}^{(m+1)}, \mathbf{e}^{(m+1)}, \mathbf{e}_{(n+m+1,n+1)}, \mathbf{s}^{(-n-1)}]$

The proposal is accepted if it is supported by the Commission, approved by a Nice-qualified majority in the Council (at least $q = 255$ votes, at least $r = 62\%$ of the population and at least $c = 14$ Member States), and by the required majority in the European Parliament ($t = 393$).

b) Lisbon version of the co-decision procedure:

$C_{CDPL} = [N \cup \{1\} \cup M, ((r \vee c_1) \wedge c_2) \vee 1) \vee t, \mathbf{p}^{(m+1)}, \mathbf{e}^{(m+1)}, \mathbf{e}^{(m+1)}, \mathbf{e}_{(n+m+1,n+1)}, \mathbf{s}^{(-n-1)}]$

The proposal is accepted if it is supported by the Commission and approved by a Lisbon-qualified majority in the Council (at least $r = 65\%$ of population and at least $c_1 = 55\%$ of Member States, or at least $c_2 = 24$ Member States even without the population quota), and by the required majority in the European Parliament ($t = 393$).

c) The square root version of the co-decision procedure:

$C_{CDPS} = [N \cup \{1\} \cup M, (r \vee 1) \vee t, \sqrt{\mathbf{p}^{(m+1)}}, \mathbf{e}_{(n+m+1,n+1)}, \mathbf{s}^{(-n-1)}]$

The proposal is accepted if it is supported by the Commission and approved by a square root qualified majority in the Council (at least $r = 61.4\%$ of square root population weights), and by the required majority in the European Parliament ($t = 393$).

5. Empirical findings

In Table 3 we provide the Penrose-Banzhaf power indices (in relative form) calculated for three different procedures (qualified majority, consultation procedure and co-decision procedure) in three alternative settings (Nice, Lisbon, square root). We apply the Lemma from Section 1 to nine corresponding committee systems.

Table 3. Inter-institutional and intra-institutional relative power in EU-27 legislative procedures (Penrose-Banzhaf index)

	Qualified majority			Consultation procedure			Co-decision procedure		
	Nice	Lisbon	SR	Nice	Lisbon	SR	Nice	Lisbon	SR
Germany	7.78	11.67	9.47	7.02	10.15	8.21	6.08	7.66	6.49
France	7.78	8.87	8.18	7.02	7.71	7.09	6.08	5.72	5.6
UK	7.78	8.75	8.12	7.02	7.61	7.03	6.08	5.65	5.55
Italy	7.78	8.43	7.95	7.02	7.33	6.89	6.08	5.46	5.44
Spain	7.42	6.69	6.97	6.7	5.82	6.04	5.8	4.39	4.76
Poland	7.42	5.71	6.44	6.7	4.97	5.58	5.8	4.01	4.38
Romania	4.26	4.19	4.86	3.86	3.65	4.21	3.34	2.78	3.3
Netherlands	3.97	3.53	4.23	3.61	3.07	3.67	3.12	2.42	2.87
Greece	3.68	2.87	3.54	3.34	2.5	3.07	2.89	2.05	2.35
Portugal	3.68	2.81	3.4	3.34	2.54	2.94	2.89	2.01	2.3
Belgium	3.68	2.79	3.35	3.34	2.43	2.91	2.89	2	2.27
Czech R.	3.68	2.78	3.34	3.34	2.42	2.9	2.89	1.99	2.26
Hungary	3.68	2.74	3.29	3.34	2.38	2.85	2.89	1.97	2.23
Sweden	3.09	2.63	3.15	2.81	2.29	2.73	2.43	1.9	2.13
Austria	3.09	2.53	3	2.81	2.21	2.6	2.43	1.85	2.03
Bulgaria	3.09	2.46	2.88	2.81	2.14	2.5	2.43	1.81	1.95
Slovakia	2.18	2.18	2.42	1.98	1.9	2.09	1.71	1.64	1.63
Denmark	2.18	2.18	2.42	1.98	1.9	2.09	1.71	1.64	1.63
Finland	2.18	2.16	2.37	1.98	1.88	2.06	1.71	1.63	1.61
Ireland	2.18	2.04	2.13	1.98	1.77	1.85	1.71	1.56	1.44
Lithuania	2.18	1.94	1.92	1.98	1.69	1.66	1.71	1.5	1.3
Latvia	1.26	1.81	1.58	1.98	1.57	1.37	1.71	1.42	1.07
Slovenia	1.26	1.77	1.47	1.13	1.54	1.27	0.98	1.4	0.99
Estonia	1.26	1.69	1.19	1.13	1.46	1.03	0.98	1.35	0.8
Cyprus	1.26	1.63	0.93	1.13	1.41	0.8	0.98	1.32	0.63
Luxembourg	1.26	1.58	0.74	1.13	1.38	0.64	0.98	1.29	0.5
Malta	0.94	1.57	0.66	0.86	1.27	0.57	0.74	1.29	0.44
EPP-ED							4.87	6.74	7.13
PES							2.63	4.05	4.27
ALDE							2.5	3.38	3.56
UEN							0.75	1.35	1.43
Greens-EFA							0.75	1.35	1.43
GUE-NGL							0.75	1.35	1.43
IND-DEM							0.41	0.43	0.47
ITS							0.41	0.43	0.47
NI							0.41	0.43	0.47
Council	100	100	100	91.34	86.99	86.65	79.04	69.71	67.95
Commission				8.66	13.01	13.35	7.48	10.78	11.39
Parliament							13.48	19.51	20.66
Council + Commission				100	100	100			
Council + Commission + Parliament							100	100	100

Source: Author's own calculations

The results demonstrate changes in the inter-institutional influence of the three most important EU institutions – the Council, Commission and Parliament. In the case of the consultation procedure, the Lisbon-qualified majority rule increases the power of the Commission compared to the Nice rule, and the square root rule increases its power compared to Lisbon (and the power of the Council as an aggregate power of Member States declines). In the co-decision procedure, where we have three institutional actors – the Council, Commission and Parliament – we can observe the same tendency: Lisbon increases power of the Commission and Parliament and decreases the power of the Council compared to the Nice rule and the square root increases the power of the Commission and Parliament and decreases the power of the Council compared to Lisbon. Moreover, in the co-decision procedure the influence of big European political parties can be compared to the influence of big Member States, so the political or ideological dimension of European Union decision making becomes measurably more important than in earlier stages of EU development. The influence of Member States is procedurally dependent and differs from their internal influence in the Council of Ministers internal voting not only by size, but also by structure.

In Table 4 we provide a structural comparison of the distribution of power in the Council in internal Council qualified majority voting, consultation procedure voting and co-decision procedure voting. The entries of Table 3 express the share of voting power of each Member State in the total inter-institutional power of the considered procedures (e.g. if the relative power of Germany in the co-decision procedure under Lisbon voting rules is 7.66% and the relative power of the Council in the co-decision procedure is 69.71%, then the share of the relative power of Germany in the co-decision relative power of the Council is 10.99%).

The relative intra-institutional power of Member States in the Council of Ministers in different legislative procedures is defined as a ratio of the number of swing votes the Member State has in a given procedure to the total number of swing votes of all Member States in the procedure. In block Nice we provide the relative power of individual Member States in Council voting under the recent voting rules of the Treaty of Nice: QM stands only for qualified majority voting in the Council (without interaction with other institutions), CNP stands for qualified majority Council voting in the consultation procedure, and CDP stands for qualified majority Council voting in the co-decision procedure. The same information for Lisbon voting rules can be found in block Lisbon and in block Square root for square root rule.

We can see that legislative procedures influence the structure of Member States' relative power in Council voting. Under Nice rules the consultation and co-decision procedures have a negligible effect on the internal distribution of national power with only one exception (the significant increase of Latvia's relative power). In the Lisbon case we can observe the negligible effect of the consultation procedure, but the quite significant impact of the co-decision procedure, generating a decrease of the relative power of the five biggest Member States, a slight increase of Poland's power , a decrease of Romania and the Netherlands' relative power and increases of the relative power of all other medium-sized and small countries. The square root rule leads to an increase of the relative power of the five biggest states, does not change the relative power of Romania, and decreases or leaves unchanged the relative power of medium-sized and small member states.

Table 4. Relative power of member states in EU-27 legislative procedures (Penrose-Banzhaf index)

	Nice			Lisbon			Square root		
	QM	CNP	CDP	QM	CNP	CDP	QM	CNP	CDP
Germany	7.78	7.68	7.69	11.67	11.67	10.99	9.47	9.47	9.55
France	7.78	7.68	7.69	8.87	8.86	8.21	8.18	8.18	8.24
UK	7.78	7.68	7.69	8.75	8.75	8.11	8.12	8.11	8.17
Italy	7.78	7.68	7.69	8.43	8.43	7.83	7.95	7.95	8.01
Spain	7.42	7.33	7.34	6.69	6.69	6.3	6.97	6.97	7.01
Poland	7.42	7.33	7.34	5.71	5.71	5.75	6.44	6.44	6.45
Romania	4.26	4.23	4.23	4.19	4.2	3.98	4.86	4.86	4.86
Netherlands	3.97	3.93	3.95	3.53	3.53	3.47	4.23	4.24	4.22
Greece	3.68	3.66	3.66	2.87	2.87	2.94	3.54	3.54	3.46
Portugal	3.68	3.66	3.66	2.81	2.92	2.88	3.4	3.39	3.38
Belgium	3.68	3.66	3.66	2.79	2.79	2.87	3.35	3.36	3.34
Czech R.	3.68	3.66	3.66	2.78	2.78	2.85	3.34	3.35	3.33
Hungary	3.68	3.66	3.66	2.74	2.74	2.83	3.29	3.29	3.28
Sweden	3.09	3.08	3.07	2.63	2.63	2.73	3.15	3.15	3.13
Austria	3.09	3.08	3.07	2.53	2.54	2.65	3	3	2.99
Bulgaria	3.09	3.08	3.07	2.46	2.46	2.6	2.88	2.89	2.87
Slovakia	2.18	2.17	2.16	2.18	2.18	2.35	2.42	2.41	2.39
Denmark	2.18	2.17	2.16	2.18	2.18	2.35	2.42	2.41	2.39
Finland	2.18	2.17	2.16	2.16	2.16	2.34	2.37	2.38	2.37
Ireland	2.18	2.17	2.16	2.04	2.03	2.24	2.13	2.14	2.12
Lithuania	2.18	2.17	2.16	1.94	1.94	2.15	1.92	1.92	1.91
Latvia	1.26	2.17	2.16	1.81	1.8	2.04	1.58	1.58	1.57
Slovenia	1.26	1.24	1.24	1.77	1.77	2.01	1.47	1.47	1.46
Estonia	1.26	1.24	1.24	1.69	1.68	1.94	1.19	1.19	1.18
Cyprus	1.26	1.24	1.24	1.63	1.62	1.89	0.93	0.92	0.93
Luxembourg	1.26	1.24	1.24	1.58	1.6	1.85	0.74	0.74	0.74
Malta	0.94	0.94	0.95	1.57	1.47	1.85	0.66	0.65	0.65
Total	100	100	100	100	100	100	100	100	100

Source: Author's own calculations

6. Conclusions

The author is aware of the fact that the models of consultation and co-decision procedures that have been utilized are highly simplified (i.e. the assumption of the equal probability of all possible coalitions, they do not reflect the multi-stage character of the games and the complex amendment process). However, under the hypothesis that the models reflect the basic features of the legislative procedures, they lead to interesting conclusions.

The influence of Member States in European Union decision making cannot be reduced to relative voting power in qualified majority voting in the Council independently of legislative procedures used involving the Commission and European Parliament. The consultation procedure (with the explicit interaction of the Commission and Council, where the Commission has agenda-setting authority), and the co-decision procedure involving the Commission, Council and European Parliament (with the de facto unconditional veto right of all three institutions) affects the distribution of the inter-institutional voting power of EU institutions and the intra-institutional voting power of decision-making actors (Member States and European political parties). With rare exceptions, decision making is based on the consultation and co-decision procedures involving the Commission and/or European Parliament.

Qualified majority, consultation and co-decision procedures can be modeled as the logical combinations of weighted majority games and the power indices methodology can be used. If one wants to measure national influence on the basis of its influence in the Council, then inter-institutional influence has to be taken into account. In consultation procedures the Council shares the power with the Commission. In co-decision procedures the Council shares the power with the Commission and the Parliament. Consultation procedures reduce the power of the Council in favor of the Commission, and co-decision procedures reduce the power of the Council and Commission in favor of the European Parliament. In both procedures this implies not only a reduction of the power of Member States in the Council, but also changes the structure of their power in the Council. On the other hand, in co-decision procedures, European political parties become important actors in EU decision making. To evaluate the different proposals of qualified majority rules from the standpoint of "fairness" of a Member States' share of power, one has to consider their effects on Member States' power in the legislative procedures. National influence in EU decision making should be measured as the weighted average of power in legislative procedures with weights given by the frequency of use of these procedures.

The power indices methodology has its critics. What exactly power indices are measuring is controversial, see e.g. the arguments of Garrett and Tsebelis (1999) about ignoring preferences, and the response of Holler and Widgrén (1999), but they are of general interest to political science because they can measure players' abilities to get what they want. Admittedly, a significant share of decisions under EU decision-making procedures are adopted without recourse to a formal vote. But it may well be the case that the outcome of a negotiation is conditioned by the possibility that a vote could be taken, and that an a priori evaluation of voting power does indeed matter. Moreover, analyses of the institutional design of decision making could benefit from the power indices methodology (Holler and Owen, 2001; Lane and Berg, 1999). Continued research and a deepening understanding of the power indices methodology reflect an actual demand for the amendment of the traditional legal and political analysis of institutional problems by quantitative approaches and arguments.

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