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Voting Power and Coalition Formation: The Case of the Council of the EU

René Levínský, Peter Silárszky

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Abstract

In this paper we study the distribution of power in the Council of the European Union (EU). The goal of this paper is to evaluate the voting power of the member states after the entry of Central and Eastern European Countries (CEEC). The analysis is based on the Shapley-Shubik power index of simple cooperative games. Modified versions of the Shapley-Shubik index are used to analyse the influence of sub-systems of the EU on the distribution of power in the decision making process.

Keywords
EU enlargement, EU decision making, a priori unions, Shapley value

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Comments

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1 Introduction

Ever since Central and Eastern European countries began their political and economic transformation from a planned economy to a standard market one, they have considered the idea of European integration, making EU enlargement an important issue among policy makers. One of the major problems of European integration is the question of the decision making structure and institutional rules in the future EU. The most important European institution is the Council (usually known as the Council of Ministers). This body is responsible for creating the general strategy of the EU and for making basic political and legislative decisions.

As long as the political representatives of the member states have power in the European Union's decision making process, national aspects and the balance of national power play important roles in the decision making. We seek to measure the voting power of EU member states in the decision making which takes place in the Council of the EU and the structural change of this balance of power after Central and Eastern European enlargement. We consider three different expansions—one with three new member states: the Czech Republic, Hungary, Poland (the most developed countries of the region, which are assumed to be in the first wave of the NATO enlargement); one with six new member states: the Czech Republic, Hungary, Poland, Cyprus, Estonia, and Slovenia (the countries which were recommended by the Commission to start accession negotiations in document "Agenda 2000"); and one with eleven new member states: the Czech Republic, Hungary, Poland, Cyprus, Estonia, Slovenia, Bulgaria, Lithuania, Latvia, Romania, and Slovakia (all associated countries).

We pay particular attention to sub-systems within the EU which consist of two or more member states cooperating more closely than the others (see Aliboni (1990), Davy (1990), and de Schoutheete (1990)). Since this paper investigates the role of member states in decision making, it disregards the role of the European Parliament, although the cooperation procedure (defined in the Single European Act 1986) and the co-decision procedure (defined in the Maastricht Treaty 1992) both gave it a stronger role in decision making than it had before.

We measure voting power with the Shapley-Shubik power index (see Shapley and Shubik (1954)) because, among the power indices used in social choice analysis, it is the only one which satisfies the set of postulates (introduced in Felsenthal and Machover (1995) and Levínský and Silárszky (1996)) that any reasonable power index ought to satisfy. The theoretical basis of the power indices lies in the cooperative game theory, which does not model explicitly the coalition formation process but rather the possible pay-offs each alliance could obtain. The power indices measure power in the abstract sense. They do not concentrate on any particular question of voting, and it is often argued that the power indices analyse the voting body rather than the actual game played in it (see Straffin (1988)). However, since in the Council of the EU the voters (the governments of the member states) change and the issues to be voted on in the future are not known, the probabilistic approach offered by the power indices is rather effective. Although it does not model the players' behaviour, it does measure each player's individual potential to change the results. When there is information indicating that some unions are more likely to cooperate than others, it can be used to modify the power indices (see Owen (1977)).

Power indices have been applied to political institutions or elections, which can be modelled as weighted voting games, e.g. regarding parliaments (Holler (1982)), the U.S. Senate (Shapley and Shubik (1954)), the U.N. Security Council (Laakso (1977)) and the presidential elections in the U.S. (Owen (1982)). Widgren (1994) analysed the voting power of the EC member states and the structural change of power distribution after the EFTA enlargement. Leech (1988) analysed the voting power of shareholders in large companies in the U.K.

This paper is organized as follows. Section 2 describes the decision making process in the European Union. We direct our attention to the Council. The Shapley-Shubik power index and its modified versions for games with a priori unions are defined and presented in Section 3. Section 4 presents the results obtained for the present European union and for possible future European Unions comprising several different Central and Eastern European nations. Section 5 concludes the paper.

2 Decision Making Process in the EU

The decision making process of the EU rests on three main actors: the Council, the European Parliament and the Commission. They represent different views. The Council represents national interests. The European Parliament represents the views of citizens of member countries. The voting patterns of the members of the European Parliament are likely to be based on ideology rather than nationality. The Commission represents, at least theoretically, the supranational view. Since this paper is devoted to the distribution of power among the member states, we focus on the Council of the EU.

The Council doesn't have the right to initiate any proposal. The Commission has the power to set the agenda; i.e., it has a monopoly on making proposals. It consists of 20 Commissioners who are appointed by governments of member states.[1] Theoretically, the Commission is

[1]Two from each of the five largest countries (Germany, Italy, France, the U.K. and Spain) and one from each of the other member states.

independent of the governments of the member states. However, as noted in Lodge (1989), the member governments do have certain indirect powers over the Commissioners and legislative proposals.

The Council, in which the ministers of member countries represent national governments and interests, is the main decision making body in the EU. The Council has two main decision making rules:[2]

1. there must be a qualified majority; in this case the member states are endowed with given voting weights;

2. there must be unanimity; in this case the distribution of votes does not matter and each country has the same voting power.

When a qualified majority is applied, the number of votes each member country has is related to its population as follows: Germany, Italy, France and the U.K. have 10 votes each; Spain 8 votes; the Netherlands, Portugal, Greece and Belgium 5 votes each; Austria and Sweden 4 votes each; Denmark, Finland and Ireland 3 votes each and, finally, Luxembourg 2 votes. The qualified majority is made up of 62 out of 87 votes.

Although the reform of decision making in the Council of EU is widely discussed, we assume in our analysis that the number of votes of the current members of the EU will remain the same. The reform of the voting system in the Council was part of the agenda of the Intergovernmental Conference 1996–97. Several proposals were considered, one of which was: Germany, Italy, France and the U.K. would be endowed with 25 votes each; Spain with 20 votes; the Netherlands with 12 votes; Portugal, Greece and Belgium with 10 votes each; Austria and Sweden with 8 votes each; Denmark, Finland and Ireland with 6 votes each; Luxembourg with 3 votes; and the qualified majority would be 142 out of 199 votes. However, in June 1997 the Council of EU decided that reaching agreement in this area would be extremely difficult and the decision was postponed.

We assume that the number of votes given to current member states will not change in near future. Thus, we assume that Poland will have 8 votes; Romania 6 votes; the Czech Republic and Hungary 5 votes each; Bulgaria 4 votes; Latvia, Lithuania and Slovakia 3 votes each; and Cyprus, Estonia and Slovenia 2 votes each. This allocation of votes was mentioned in Turnovec (1996) and is based on the formula developed by Widgren (1994). When the

[2] In this paper we disregard the simple majority of member states in the Council, which is used only rarely for minor procedural questions. We also disregard the rule which requires a qualified majority of votes with a quota of 10 member states. This rule can be applied only if all countries agree with it.

Council of EU reaches agreement on new distribution of votes, our analysis can simply be repeated using the same methodology.

Until the mid-eighties the decision making process was marked mainly by negotiations to amend Commission proposals in the Council until unanimity could be reached. Searching for unanimity was the rule rather than the exception. This was mainly due to the so-called Luxembourg Compromise, which was agreed on in 1966. The Single European Act of 1986, changed the mechanism and increased the importance of coalition formation. The role of a qualified majority was strengthened because the old consensus-based system did not work after the Greek and Iberian enlargement. Specifically, legislation of the single market program was submitted to the qualified majority rule.

Since 1987, when the Single European Act went into effect, coalitions have become central elements of the decision making process in the Council of the EU. As noted in Wallace (1990), what matters in the negotiations is not whether a vote is actually taken but the knowledge that a vote could be taken. This knowledge leads to active coalition formation during the preparatory work, which consists of both formal and informal negotiations between government representatives. All this preparatory work is done with the understanding that the Council makes the final decisions and that sums of voting weights of different coalitions are decisive when alliances are compared to each other.

There is an interesting dimension in the coalition formation process in the Council—permanent and predictable cooperation between two or more member states. Cooperation between countries which have more in common is deeper than between others. De Schoutheete (1990) defines and analyses the concept of sub-systems. He found that in the European Community of twelve, the sub-systems are the Franco-German axis, the Benelux countries (Belgium, the Netherlands and Luxembourg) and the Mediterranean countries (Spain, Portugal and Greece). The Franco-German axis and the Benelux countries form the "core" group of the EU. In this group the countries in sub-systems cooperate more closely with each other than with the countries from the second sub-system. For example, France cooperates more closely with Germany than Belgium, but more closely with Belgium than with the countries which are not included in the "core" group. Italy sometimes tends towards the "core" group, but it often finds itself in agreement with the southern members of the EU.

There is an additional sub-system in the EU of fifteen—the Scandinavian countries (Sweden, Denmark and Finland). After the expected entry of Central and Eastern European countries, there will be two possible new sub-systems—the sub-system of Central and Eastern European countries with 7 members (the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Bulgaria, and Romania), and the Baltic sub-system (Estonia, Lithuania, and Latvia). The Baltic group will probably cooperate alternatively with the Scandinavian group and with the Central and Eastern European countries. Cyprus will probably join the Mediterranean sub-system after its eventual entry. As noted in de Schoutheete (1990), this kind of close co-operation in the form of sub-systems within the Community is fully accepted by other member states, although it changes the conditions of coalition formation remarkably.

3 The Power Indices

3.1 The Shapley-Shubik power index

Let U denote the universe of players, and define a *cooperative game with transferable utility* (in characteristic function form) to be any superadditive set-function v from the subsets of U to real numbers; thus,

$$\begin{aligned} v(\emptyset) &= 0 \\ v(S) &\geq v(T) + v(S \setminus T) \qquad \forall\, T \subseteq S \subseteq U. \end{aligned} \tag{1}$$

We denote the space of all games by $\mathcal{G}$. $\mathcal{G}^n \subset \mathcal{G}$ is the set of n-person games, i.e., such games where the cardinality of the set of players is finite and equal to n. A non-zero game v is a game for which at least one coalition S exists, such that $v(S) \neq 0$. The *value* of the game $v \in \mathcal{G}$ is the function $f : \mathcal{G}^n \longrightarrow \mathbb{R}^n_{+0}$ defined $\forall n \in \mathbb{N}$. A *carrier* for a game v is a coalition N such that $\forall S : v(S) = v(S \cap N)$.

Shapley (1953) introduced a value Φ:

$$\Phi_i(v) = \sum_{i \notin S \subset N} \frac{s!(n-s-1)!}{n!}[v(S \cup \{i\}) - v(S)], \tag{2}$$

where $N \subset U$ is any finite carrier of v.

The superadditive game v, for which $v(S) \in \{0,1\}\ \forall S$, is called the *simple game*. We denote the space of all simple games by $\mathcal{G}_S$. $\mathcal{G}^n_S \subset \mathcal{G}^n$ is the set of n-person simple games. The *pivotal* player i of coalition $S \subset U$ is such a player that $v(S) = 1$ and $v(S \setminus \{i\}) = 0$. The coalition S such that $v(S) = 1$ is called the *winning* coalition; the coalition S such that $v(S) = 0$ is called the *losing* coalition. The coalition S is *blocking* if and only if $v(U \setminus S) = 0$. A particularly important class of simple games are weighted games. If for non-zero n-person simple game v, a $(n+1)$-dimensional, non-negative vector $r_v = (\rho_1, \ldots, \rho_n, q)$ exists such that

$$v(S) = 1 \Longleftrightarrow \sum_{i \in S} \rho_i \geq q\,, \tag{3}$$

then we call the simple game v a *weighted game*. Number ρ_i is called the *weight* of player i; number q is called the *quota*; vector r_v is called the *representation* of game v. The *index* of the game $v \in \mathcal{G}_S$ is the function $f : \mathcal{G}_S^n \longrightarrow \mathbb{R}_{+0}^n$ defined $\forall n \in \mathbb{N}$. The concept of the index is a reduction of the concept of value on the domain of simple games. In other words, each value generates an individual index. The Shapley value (2) gives the Shapley-Shubik index.

In the words of Shapley and Shubik (1954), the logic underlying their index is as follows:

> Let us consider the following scheme: There is a group of individuals all willing to vote for some bill. They vote in order. As soon as a majority has voted for it, it is declared passed, and the member who voted last is given credit for having passed it. Let us choose the voting order of the members randomly. Then we may compute the frequency with which an individual belongs to the group whose votes are used and, of more importance, we may compute how often he is pivotal. This latter number serves to give us our index. It measures the number of times that the action of the individual actually changes the state of affairs.

3.2 The Shapley value of games with a priori unions

In standard analysis there are no constraints on coalition formation. This means that the size of the coalition measured by the sum of votes matters but not particularly who belongs to the alliance. Player i is equally likely to cooperate with players j and k, $\forall j \neq k$. This assumption often serves as the first approximation when the additional information of players' cooperative behaviour is not used or is not available. If we take into account the possibility that some players may be more likely to cooperate than others, the idea of a priori unions, introduced by Owen (1977), is useful.

Let $\mathcal{J} = \{T_1, \ldots, T_m\}$ be a partition of N to an a priori coalition structure, i.e. a collection of alliances which have made a prior commitment to pool their endowments in the game v. For the union T_j the total power Φ_j can be easily calculated from the quotient game (u, P), where $P = \{1, \ldots, m\}$ denotes the set of unions and $u(S) = v(\cup_{j \in S} T_j)$, $\forall S \subset P$. There is no reason to assume that the union would lose the power it could obtain. Because of this efficiency requirement of sub-systems, it seems natural to set the sum of individual power indices in each union to the total power of that union. Thus, we have

$$\sum_{i \in T_j} \Phi_i^1[v; \mathcal{J}] = \Phi_j[u]. \tag{4}$$

To determine the distribution of power in coalition T_j, we have to define a subgame w_j among the members of union T_j, which reflects the possibilities of different sub-unions when members defect from the sub-system T_j. Let K be a sub-union of T_j. The characteristic function of the game w_j played in coalition T_j can now be defined as the power indices of sub-unions of T_j in the game $u_{T_j|K}$, where coalition T_j is replaced by sub-union K in the quotient game; i.e.,

$$u_{T_j|K}(S) = \begin{cases} v(\cup_{k\in S\setminus\{j\}}T_k \cup K) & \text{if } j \in S \\ v(\cup_{k\in S}T_k) & \text{if } j \notin S \end{cases} \tag{5}$$

and $w_j(K) = \Phi_j[u_{T_j|K}]$. Owen (1977) suggests that the value for individual players in the game with a priori unions should be calculated as a value in the game w_j. Thus, we have $\Phi_i^1[v; \mathcal{J}] = \Phi_i[w_j]$.

To obtain a formula for $\Phi_i^1[v; \mathcal{J}]$, we note that for $i \in T_j$, we have

$$\Phi_i[w_j] = \sum_{K\subset T_j, i\notin K} \frac{k!(t_j - k - 1)!}{t_j!}[w_j(K \cup \{i\}) - w_j(K)]. \tag{6}$$

At the same time, $w_j(K) = \Phi_j[u_{T_j|K}]$, or

$$w_j(K) = \sum_{S\subset P, j\notin S} \frac{s!(m - s - 1)!}{m!}[u_{T_j|K}(S \cup \{j\}) - u_{T_j|K}(S)], \tag{7}$$

and there is a similar sum for $K \cup \{i\}$. Then, setting $Q = \cup_{a\in S}T_a$, we see that, for $j \notin S$,

$$\begin{aligned} u_{T_j|K\cup\{i\}}(S) - u_{T_j|K}(S) &= 0 \\ u_{T_j|K\cup\{i\}}(S \cup \{j\}) - u_{T_j|K}(S \cup \{j\}) &= v(Q \cup K \cup \{i\}) - v(Q \cup K). \end{aligned} \tag{8}$$

Substitution of (7) and (8) into (6) gives us

$$\Phi_i^1[v; \mathcal{J}] = \sum_{S\subset P, j\notin S} \sum_{K\subset T_j, i\notin K} \frac{k!(t_j - k - 1)!s!(m - s - 1)!}{t_j!m!}[v(Q \cup K \cup \{i\}) - v(Q \cup K)], \tag{9}$$

where s, k, and t_j are the cardinalities of the sets S, K, and T_j respectively.

An interesting extension of the above concept deals with union structure hierarchies, i.e., the possibility that, inside each union, there may be some groups that are closer together than the remaining members of the union. For this case, generalization of the above approach seems to be rather straightforward. For example, suppose game v is given the union structure $\mathcal{J} = \{T_1, \ldots, T_m\}$. Suppose further that T_j is divided into "clans," $T_{j1}, T_{j2}, \ldots, T_{jm_j}$. Let us denote this structure by $\mathcal{J}'$. Our above analysis has allowed us to determine a subgame, w_j, with player set T_j. Our previous procedure was to obtain the usual Shapley value $\Phi[w_j]$, and to treat this as the modified value, $\Phi^1[v; \mathcal{J}]$. Instead of using this procedure, we can compute the modified value $\Phi^1[w_j; \{T_{j1}, T_{j2}, \ldots, T_{jm_j}\}]$ and treat this as a new (doubly modified value) for the game v, based not only on the union structure $\{T_1, \ldots, T_m\}$, but also on the clans T_{ji}

within one or more of the unions T_j. Thus, for $z \in T_{ji} \subset T_j \subset N$, the doubly modified value is $\Phi_z^2[v; \mathcal{J}'] = \Phi_z^1[w_j; \{T_{j1}, T_{j2}, \ldots, T_{jm_j}\}]$.

To obtain a closed formula for $\Phi_z^2[v; \mathcal{J}']$, we note that for $z \in T_{ji} \subset T_j$, we have

$$\Phi_z^1[w_j; \{T_{j1}, T_{j2}, \ldots, T_{jm_j}\}] = \sum_{K \subset P_j, i \notin K} \sum_{L \subset T_{ji}, z \notin L} \frac{k!(m_j-k-1)!l!(t_{ji}-l-1)!}{m_j!t_{ji}!} \times$$
$$\times \quad [w_j(Q_j \cup L \cup \{z\}) - w_j(Q_j \cup L)], \quad (10)$$

where $P_j = \{1, 2, \ldots, m_j\}$ and $Q_j = \cup_{b \in K} T_{jb}$. The expressions $w_j(Q_j \cup L \cup \{z\})$ and $w_j(Q_j \cup L)$ are defined by (7). We can see that for $j \notin S$,

$$u_{T_j|Q_j \cup L \cup \{z\}}(S) - u_{T_j|Q_j \cup L}(S) = 0$$
$$u_{T_j|Q_j \cup L \cup \{z\}}(S \cup \{j\}) - u_{T_j|Q_j \cup L}(S \cup \{j\}) = v(Q \cup Q_j \cup L \cup \{z\}) - v(Q \cup Q_j \cup L). \quad (11)$$

Substituting (7) and (11) into (10) gives us

$$\Phi_z^2[v; \mathcal{J}'] = \sum_{S \subset P, j \notin S} \sum_{K \subset P_j, i \notin K} \sum_{L \subset T_{ji}, z \notin L} \frac{s!(m-s-1)!k!(m_j-k-1)!l!(t_{ji}-l-1)!}{m!m_j!t_{ji}!} \times$$
$$\times \quad [v(Q \cup Q_j \cup L \cup \{z\}) - v(Q \cup Q_j \cup L)], \quad (12)$$

where s, k, t_{ji}, and l are the cardinalities of the sets S, K, T_{ji}, and L, respectively.

4 Results

Even if we cannot model the tremendous preparatory work done in working groups, in committees and in informal settings, we can model the decision making process in the Council of the EU using the concepts of cooperative game theory and weighted games defined in Section 3. Under the unanimity rule there is only one winning coalition (the grand coalition). In the current EU, the characteristic function of the game played in the Council under the qualified majority rule is

$$v(S) = \begin{cases} 1 & \text{if } \sum_{i \in S} \rho_i \geq q = 62\,, \\ 0 & \text{otherwise}\,, \end{cases} \quad (13)$$

where ρ_i denotes the number of votes of member i, and q is the number of votes which is needed for a qualified majority. The influence of member states on the decision making process is approximated by the voting power of a particular country in this game. In this paper the indices for the EU members are calculated using our original computer programmes, which are based on equations (2), (9), and (12).

The Shapley-Shubik indices of all countries are equal under the unanimity rule. This case is rather trivial. Thus, we will focus on the qualified majority rule.

Country	p_i	Φ_i	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$
Gr. Britain	10	11.67	11.23	0.962	11.55	0.990	11.34	0.972	11.42	0.979	11.19	0.959
Ireland	3	3.53	3.39	0.960	3.29	0.932	3.28	0.929	3.78	1.071	1.67	0.473
Austria	4	4.54	4.38	0.965	4.60	1.013	4.33	0.954	5.06	1.115	4.52	0.996
Belgium	5	5.52	5.28	0.957	5.98	1.083	5.26	0.953	5.39	0.976	5.32	0.964
Netherlands	5	5.52	5.28	0.957	5.98	1.083	5.26	0.953	5.39	0.976	5.32	0.964
Luxembourg	2	2.07	2.12	1.024	2.39	1.155	1.96	0.947	2.67	1.290	2.46	1.188
France	10	11.67	13.13	1.125	11.55	0.990	11.34	0.972	11.42	0.979	12.02	1.030
Germany	10	11.67	13.13	1.125	11.55	0.990	11.34	0.972	11.42	0.979	12.02	1.030
Italy	10	11.67	11.23	0.962	11.55	0.990	11.34	0.972	11.42	0.979	11.19	0.959
Spain	8	9.55	9.12	0.955	9.18	0.961	10.84	1.135	9.81	1.027	10.40	1.089
Greece	5	5.52	5.28	0.957	5.61	1.016	6.43	1.165	5.39	0.976	6.35	1.150
Portugal	5	5.52	5.28	0.957	5.61	1.016	6.43	1.165	5.39	0.976	6.35	1.150
Sweden	4	4.54	4.38	0.965	4.60	1.013	4.33	0.954	4.46	0.982	4.44	0.978
Denmark	3	3.53	3.39	0.960	3.29	0.932	3.28	0.929	3.48	0.986	3.37	0.955
Finland	3	3.53	3.39	0.960	3.29	0.932	3.28	0.929	3.48	0.986	3.37	0.955

Table 1: The influence of four different unions on the power of EU members

Tables 1 and 2 summarize the results obtained for the recent EU.[3] The values of the Shapley-Shubik index Φ_i are presented in the third column. In the next columns of Table 1, it is assumed that certain a priori unions are formed: a Franco-German axis, Benelux, a Mediterranean and a Scandinavian block. The results reveal that the total gain for the Franco-German axis and the Mediterranean countries is approximately 3 percentage points, and the relative gain for each state joining such a block is between 12.5% (France and Germany) and 16.5% (Greece and Portugal). The relative gain for the Benelux countries is approximately the same (8.3% for Belgium and the Netherlands and 15.5% for Luxembourg). The total gain for Benelux countries is 1.24 percentage points.

A completely different situation is observed for the smallest block, which is a compound of the Scandinavian countries. The total gain of this block is negative (.18 percentage points). This is the case of the so-called "paradox of size" (see Brams (1975)).[4] Moreover, the relative gain of each particular Scandinavian country is negative as well. Sweden loses 1.8% of its power; Finland and Denmark each lose 1.4%.

The fact that the larger sub-systems gain more than the small ones is quite natural because they are closer to forming a blocking coalition. On the other hand, the above described difference is relatively high and the occurrence of the paradox of size is quite surprising.

The last column of Table 1 shows the situation in which all four blocks are formed. There is one distinct loser in this case–Ireland, which loses absolutely about 1.9 percentage points. This

[3] In all tables we use a statistical interpretation of values (Formally: we use 100Φ instead of Φ.)

[4] According to equation (4), the union can be considered as a single player with the weight equal to the sum of weights of members of the union. This approach will be employed several times throughout the paper.

Country	ρ_i	Φ_i	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^P	$\frac{\Phi_i^P}{\Phi_i}$
Gr. Britain	10	11.67	10.36	0.888	8.81	0.755	10.00	0.857	1.67	0.143	7.22	0.619
Ireland	3	3.53	2.58	0.731	2.14	0.606	1.67	0.473	1.67	0.473	1.67	0.473
Austria	4	4.54	3.54	0.780	2.14	0.471	1.67	0.368	1.67	0.368	1.67	0.368
Belgium	5	5.52	6.82	1.236	6.94	1.257	5.42	0.982	6.53	1.183	5.79	1.049
Netherlands	5	5.52	6.82	1.236	6.94	1.257	5.42	0.982	6.53	1.183	5.79	1.049
Luxembourg	2	2.07	3.68	1.778	4.21	2.034	2.78	1.343	4.44	2.145	3.33	1.610
France	10	11.67	14.75	1.264	14.52	1.244	14.72	1.261	14.58	1.249	14.67	1.257
Germany	10	11.67	14.75	1.264	14.52	1.244	14.72	1.261	14.58	1.249	14.67	1.257
Italy	10	11.67	10.36	0.888	8.81	0.755	11.94	1.023	16.67	1.428	13.52	1.158
Spain	8	9.55	8.02	0.840	10.24	1.072	10.00	1.047	13.61	1.425	11.20	1.173
Greece	5	5.52	4.81	0.871	5.95	1.078	5.83	1.056	8.19	1.484	6.62	1.199
Portugal	5	5.52	4.81	0.871	5.95	1.078	5.83	1.056	8.19	1.484	6.62	1.199
Sweden	4	4.54	3.54	0.780	3.25	0.716	3.89	0.857	0.56	0.123	2.78	0.612
Denmark	3	3.53	2.58	0.731	2.78	0.788	3.06	0.867	0.56	0.159	2.23	0.631
Finland	3	3.53	2.58	0.731	2.78	0.788	3.06	0.867	0.56	0.159	2.23	0.631

Table 2: The influence of structured unions on the power of EU members

represents more than half of its original power. Significant gains are made by Luxembourg, Greece and Portugal.

Table 2 employs our new concept dealing with union structure hierarchies. We focus mainly on the so-called "core" of the EU, which consists of the Benelux countries and the Franco-German axis. The first union structure considered in Table 2 supposes that this "core" is a structured coalition (the cooperation inside both groups is "deeper" than between the sub-groups) and no counter coalitions are formed. The influence of such a coalition on the power of its members is substantially higher than in the previous cases. The total gain of such a coalition is more than 10 percentage points and the "core" holds almost half of the decision power of the Council (exactly 46.8% compared to 36.4% in the case in which no sub-systems are assumed). It is a remarkable fact that Luxembourg, which has 2 votes, has more power than Sweden or Austria, which have 4 votes.

This inequality is even more notable in the next columns, where Mediterranean and Scandinavian counter coalitions are assumed. In such cases, "solitary" Austria, with four votes, has only 50.8% of the power of Luxembourg, which has just two votes.

In the next case presented in Table 2, it is supposed that Italy joins the "core." The power of the Benelux countries decreases, while the power of the Franco-German axis remains approximately the same. The total power of the "core" and Italy reaches 55%, the Mediterranean block has 21.7% and the countries outside these two blocks together receive 23.3%.

In the next case we suppose that Italy joins the Mediterranean coalition instead of the "core." Such an assumption leads to two strong blocks which have basically the same voting power. These blocks together represent more than 93% of the total power of the EU. The influence of Scandinavian countries, Britain, Ireland and Austria is negligible; e.g., Great Britain has almost three times less power than Luxembourg. On the other hand, this structure of alliances is extremely profitable for Italy, which becomes the most powerful member of the EU.

As noted in Owen (1977), another interpretation of the above described results is based on probabilistic union structures, i.e., cases where probabilities are given to the a priori union structures. We begin with a prior probabilities assigned to different union structures. The procedure for obtaining the power distribution is quite straightforward: we merely compute the modified Shapley value for each of the possible union structures and then obtain the expectation of this value, given the probabilities. The last column of Table 2 reports a simple illustration of this approach. Suppose that the "core," the Mediterranean and the Scandinavian block are formed, and that Italy cooperates with the "core" with probability $\frac{2}{3}$ and with the Mediterranean block with probability $\frac{1}{3}$. We obtain the expected Shapley value Φ_i^P as a weighted average of the modified Shapley values reported in the sixth and seventh column with weights $\frac{2}{3}$ and $\frac{1}{3}$. Using this method we could obtain the expected Shapley value for any reasonable probabilistic union structure. Since the computation is simple, we will not present it in this paper. If the reader considers a certain probabilistic union structure significant, she can compute the appropriate distribution of power using the described procedure.

Tables 3 and 4 summarize the results obtained for a hypothetical future EU enlarged by three new member states: Poland, the Czech Republic and Hungary. These states create a new block of Central European countries. Assuming the new members are allocated the numbers of votes suggested in Section 2, we find a block identical to the Mediterranean block (in the sense of the total weight and the structure of the block). The qualified majority is assumed to be 74 out of 105 votes.

The values of the Shapley-Shubik index Φ_i are presented in the third column of Table 3. The ratios of the Shapley-Shubik index for an EU with 18 members and 15 members are in the next column. They imply that this (hypothetical) enlargement of the EU leads to losses for all "old" members. Ireland, Finland and Denmark lose the highest share of power–more than 26%. On the other hand, Luxembourg loses less than 10% of its previous power.

In the next columns it is assumed that certain a priori unions are formed: Central European countries, Benelux, the Scandinavian block, the Franco-German axis and the Mediterranean

Country	ρ_i	Φ_i	$\frac{\Phi_i^{18}}{\Phi_i^{15}}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$
Gr. Britain	10	9.84	0.843	9.58	0.974	9.78	0.994	9.73	0.989	9.47	0.962	9.58	0.974
Ireland	3	2.60	0.737	2.48	0.954	2.61	1.004	2.58	0.992	2.57	0.988	2.48	0.954
Austria	4	3.94	0.868	3.89	0.987	3.83	0.972	4.13	1.048	3.83	0.972	3.89	0.987
Belgium	5	4.67	0.846	4.59	0.983	4.99	1.069	4.63	0.991	4.54	0.972	4.59	0.983
Netherlands	5	4.67	0.846	4.59	0.983	4.99	1.069	4.63	0.991	4.54	0.972	4.59	0.983
Luxembourg	2	1.88	0.908	1.82	0.968	2.06	1.096	1.83	0.973	1.85	0.984	1.82	0.968
France	10	9.84	0.843	9.58	0.974	9.78	0.994	9.73	0.989	10.94	1.112	9.58	0.974
Germany	10	9.84	0.843	9.58	0.974	9.78	0.994	9.73	0.989	10.94	1.112	9.58	0.974
Italy	10	9.84	0.843	9.58	0.974	9.78	0.994	9.73	0.989	9.47	0.962	9.58	0.974
Spain	8	7.55	0.791	7.31	0.968	7.47	0.989	7.54	0.999	7.37	0.976	8.33	1.103
Greece	5	4.67	0.846	4.59	0.983	4.61	0.987	4.63	0.991	4.54	0.972	5.30	1.135
Portugal	5	4.67	0.846	4.59	0.983	4.61	0.987	4.63	0.991	4.54	0.972	5.30	1.135
Sweden	4	3.94	0.868	3.89	0.987	3.83	0.972	4.18	1.061	3.83	0.972	3.89	0.987
Denmark	3	2.60	0.737	2.48	0.954	2.61	1.004	2.77	1.065	2.57	0.988	2.48	0.954
Finland	3	2.60	0.737	2.48	0.954	2.61	1.004	2.77	1.065	2.57	0.988	2.48	0.954
Poland	8	7.55	x	8.33	1.103	7.47	0.989	7.54	0.999	7.37	0.976	7.31	0.968
Czech Rep.	5	4.67	x	5.30	1.135	4.61	0.987	4.63	0.991	4.54	0.972	4.59	0.983
Hungary	5	4.67	x	5.30	1.135	4.61	0.987	4.63	0.991	4.54	0.972	4.59	0.983

Table 3: The influence of five different unions on the power of EU18 members

block. The results reveal a positive gain for all considered coalitions. The highest total gain is made by the Franco-German axis (2 percentage points), and the smallest by the Scandinavian block (.6 percentage points). The highest relative gain is made by the Czech Republic, Greece, Hungary and Portugal (13.5%), and the smallest by Sweden (6.1%). Another "paradox" occurs in the case of the Benelux coalition: the creation of this coalition is profitable for some of the countries which are not included in this block—countries which have three votes (Ireland, Finland and Denmark) gain 0.4% of their initial power. We can observe a similar situation for the Scandinavian block: Austria gains almost 5% compared to the case in which no sub-systems are considered. This "paradox" is also evident in Tables 1 and 5; e.g., Table 1 shows that Luxembourg gains 29% of its initial power when only the Scandinavian block is formed. Although the gains are in some cases negligible, all of them are interesting from the theoretical point of view.

In the case reported in the fourth column of Table 4, all five blocks (the Benelux countries, the Franco-German axis, the Mediterranean countries, the Scandinavian countries, and the Central European countries) are formed. It is surprising that this situation is extremely profitable for Austria (its relative gain is almost 46%), which is not a member of any of these coalitions. The Benelux group and the Franco-German axis gain but less than Austria. All other blocks lose.

The remaining part of Table 4 deals with the concept of structured blocks. In the fifth column the "core" is formed, in the sixth Italy joins the "core," and in the last case Italy joins

Country	ρ_i	Φ_i	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$
Gr. Britain	10	9.84	8.61	0.875	6.79	0.690	6.67	0.678	6.67	0.678
Ireland	3	2.60	2.18	0.838	0.36	0.138	0	0	0	0
Austria	4	3.94	5.75	1.459	6.07	1.541	6.67	1.693	6.67	1.693
Belgium	5	4.67	5.03	1.077	7.04	1.507	6.52	1.396	7.34	1.572
Netherlands	5	4.67	5.03	1.077	7.04	1.507	6.52	1.396	7.34	1.572
Luxembourg	2	1.88	2.12	1.128	4.01	2.133	3.86	2.053	4.01	2.133
France	10	9.84	10.20	1.037	13.15	1.336	12.38	1.258	13.15	1.336
Germany	10	9.84	10.20	1.037	13.15	1.336	12.38	1.258	13.15	1.336
Italy	10	9.84	8.61	0.875	6.79	0.690	8.33	0.847	8.69	0.883
Spain	8	7.55	7.46	0.988	6.07	0.804	6.11	0.809	7.10	0.940
Greece	5	4.67	4.68	1.002	4.17	0.893	4.44	0.951	4.60	0.985
Portugal	5	4.67	4.68	1.002	4.17	0.893	4.44	0.951	4.60	0.985
Sweden	4	3.94	3.66	0.929	3.29	0.835	3.33	0.845	3.57	0.906
Denmark	3	2.60	2.47	0.950	1.75	0.673	1.67	0.642	1.55	0.596
Finland	3	2.60	2.47	0.950	1.75	0.673	1.67	0.642	1.55	0.596
Poland	8	7.55	7.46	0.988	6.07	0.804	6.11	0.809	3.89	0.515
Czech Rep.	5	4.67	4.68	1.002	4.17	0.893	4.44	0.951	3.06	0.655
Hungary	5	4.67	4.68	1.002	4.17	0.893	4.44	0.951	3.06	0.550

Table 4: The influence of structured unions on the power of EU18 members

the Mediterranean block. All these cases are again very profitable for Austria, whose relative gain is between 54% and 69%. In the last two cases the power of Austria, which has 4 votes, is the same as the power of Great Britain, which has 10 votes. The other remarkable fact is that in these two cases Ireland has no power—it is a dummy player.

All cases very nicely illustrate the so-called "paradox of new members." This occurs if adding new players can improve the standing of an old player, even if it leads to a decrease in his relative weight at the same time (see Brams (1975)). In the case in which all coalitions are formed, the power of Austria increases from 4.52% (before enlargement—see the last columns of Table 1) to 5.75%. The other cases are even more revealing—when a "core" is formed, Austria's power is 6.07% (compared to 2.14%—see Table 2) and if Italy joins either the "core" or the Mediterranean block, Austria's power is 6.67% (compared to 1.67%—see Table 2).

Let us compare the results of the situations described in the last three columns of Table 4. The only difference between them is that Italy is either alone, a member of the "core" or part of the Mediterranean block. If Italy joins the "core," the power of all other countries in the "core" decreases compared to the situation in which Italy is alone. If Italy joins the Mediterranean block, the power of "core" countries remains the same or, in the cases of Belgium and Netherlands, increases compared to the situation in which Italy is alone. Comparing the last two columns of Table 4, we can see that if Italy stops cooperating with

Country	ρ_i	Φ_i	$\frac{\Phi_i^{21}}{\Phi_i^{15}}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$
Gr. Britain	10	9.30	0.797	9.21	0.990	9.03	0.971	8.99	0.967	9.22	0.991	8.99	0.967
Ireland	3	2.66	0.754	2.65	0.996	2.61	0.981	2.64	0.992	2.74	1.030	2.64	0.992
Austria	4	3.42	0.753	3.42	1.000	3.36	0.982	3.35	0.980	3.50	1.023	3.35	0.980
Belgium	5	4.43	0.803	4.69	1.059	4.33	0.977	4.30	0.971	4.40	0.993	4.30	0.971
Netherlands	5	4.43	0.803	4.69	1.059	4.33	0.977	4.30	0.971	4.40	0.993	4.30	0.971
Luxembourg	2	1.67	0.807	1.79	1.072	1.61	0.964	1.55	0.928	1.57	0.940	1.55	0.928
France	10	9.30	0.797	9.21	0.990	10.30	1.108	8.99	0.967	9.22	0.991	8.99	0.967
Germany	10	9.30	0.797	9.21	0.990	10.30	1.108	8.99	0.967	9.22	0.991	8.99	0.967
Italy	10	9.30	0.797	9.21	0.990	9.03	0.971	8.99	0.967	9.22	0.991	8.99	0.967
Spain	8	7.36	0.771	7.31	0.993	7.18	0.976	8.27	1.124	7.46	1.014	7.13	0.969
Greece	5	4.43	0.803	4.39	0.991	4.33	0.977	5.10	1.151	4.40	0.993	4.30	0.971
Portugal	5	4.43	0.803	4.39	0.991	4.33	0.977	5.10	1.151	4.40	0.993	4.30	0.971
Cyprus	2	1.67	x	1.67	1.000	1.61	0.964	1.96	1.174	1.57	0.940	1.55	0.928
Sweden	4	3.42	0.753	3.42	1.000	3.36	0.982	3.35	0.980	3.57	1.044	3.35	0.980
Denmark	3	2.66	0.754	2.65	0.996	2.61	0.981	2.64	0.992	2.83	1.064	2.64	0.992
Finland	3	2.66	0.754	2.65	0.996	2.61	0.981	2.64	0.992	2.83	1.064	2.64	0.992
Estonia	2	1.67	x	1.67	1.000	1.61	0.964	1.55	0.928	1.57	0.940	1.55	0.928
Poland	8	7.36	x	7.31	0.993	7.18	0.976	7.13	0.969	7.46	1.014	8.27	1.124
Czech Rep.	5	4.43	x	4.39	0.991	4.33	0.977	4.30	0.971	4.40	0.993	5.10	1.151
Hungary	5	4.43	x	4.39	0.991	4.33	0.977	4.30	0.971	4.40	0.993	5.10	1.151
Slovenia	2	1.67	x	1.67	1.000	1.61	0.964	1.55	0.928	1.57	0.940	1.96	1.174

Table 5: The influence of five different unions on the power of EU21 members

the "core" and joins the Mediterranean block, all countries in these two blocks and Italy gains. The only significant losers are the Central European countries. The power of Italy is maximized if it cooperates with the Mediterranean block.

Tables 5 and 6 summarize the results obtained for a hypothetical future EU enlarged by six new member states: Cyprus, Poland, the Czech Republic, Hungary, Estonia, and Slovenia. Cyprus joins the Mediterranean block. Poland, the Czech Republic, Hungary, and Slovenia create a block of Central European countries. Estonia cooperates alternatively with the Scandinavian group and with the Central European countries. We assume the number of votes for the new members given in Section 2. The qualified majority is assumed to be 79 out of 111 votes. We find the block of Central European countries again identical to the Mediterranean block (in the sense of the total weight and the structure of the block).

The values of the Shapley-Shubik index Φ_i are presented in the third column of Table 5. The ratios of the Shapley-Shubik index for an EU with 21 members and 15 members, given in the next column, imply that this (hypothetical) enlargement of the EU leads to losses of all the "old" members. Austria and Sweden lose the highest share of power (almost 25%). Luxembourg again loses the lowest share, but in this case it loses more than 19% of its power in EU with 15 members. If we compare the Shapley-Shubik indices for an EU with 18 members, which are reported in the third column of Table 3, with those for an EU with 21

Country	ρ_i	Φ_i	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$
Gr. Britain	10	9.30	8.21	0.883	7.14	0.768	7.14	0.768	8.33	0.896	8.33	0.896
Ireland	3	2.66	4.96	1.865	3.81	1.432	3.81	1.432	6.67	2.508	6.67	2.508
Austria	4	3.42	4.96	1.450	3.81	1.114	3.81	1.114	6.67	1.950	6.67	1.950
Belgium	5	4.43	4.21	0.950	5.95	1.343	5.92	1.336	4.94	1.115	4.62	1.043
Netherlands	5	4.43	4.21	0.950	5.95	1.343	5.92	1.336	4.94	1.115	4.62	1.043
Luxembourg	2	1.67	1.18	0.707	1.03	0.617	1.02	0.611	1.19	0.713	1.11	0.665
France	10	9.30	9.11	0.980	11.23	1.208	10.95	1.177	8.63	0.928	8.99	0.967
Germany	10	9.30	9.11	0.980	11.23	1.208	10.95	1.177	8.63	0.928	8.99	0.967
Italy	10	9.30	8.21	0.883	11.75	1.263	12.38	1.331	9.88	1.062	9.88	1.062
Spain	8	7.36	7.71	1.048	5.95	0.808	6.55	0.890	7.22	0.981	7.38	1.003
Greece	5	4.43	4.43	1.000	3.73	0.842	3.81	0.860	4.37	0.986	4.54	1.025
Portugal	5	4.43	4.43	1.000	3.73	0.842	3.81	0.860	4.37	0.986	4.54	1.025
Cyprus	2	1.67	1.64	0.982	2.06	1.234	1.31	0.784	2.50	1.497	1.98	1.186
Sweden	4	3.42	3.12	0.912	2.94	0.860	2.94	0.860	3.33	0.974	2.66	0.778
Denmark	3	2.66	2.55	0.959	2.10	0.789	2.10	0.789	2.50	0.940	2.24	0.842
Finland	3	2.66	2.55	0.959	2.10	0.789	2.10	0.789	2.50	0.940	2.24	0.842
Estonia	2	1.67	1.19	0.713	0	0	0	0	1.19	0.713	1.19	0.713
Poland	8	7.36	7.71	1.048	6.43	0.874	6.55	0.890	4.33	0.588	4.64	0.630
Czech Rep.	5	4.43	4.43	1.000	3.83	0.865	3.81	0.860	3.19	0.720	3.65	0.824
Hungary	5	4.43	4.43	1.000	3.83	0.865	3.81	0.860	3.19	0.720	3.65	0.824
Slovenia	2	1.67	1.64	0.982	1.39	0.832	1.31	0.784	1.43	0.856	1.39	0.832

Table 6: The influence of a priori unions to the power of EU21 members

members, we can see that there are countries (Ireland, Denmark and Finland) which would gain by enlargement from 18 to 21 countries. This is again an example of the "paradox of new members."

In the next columns it is assumed that certain a priori unions are formed: Benelux, the Franco-German axis, the Mediterranean block, the Scandinavian block and Central European countries. All considered coalitions gain. The highest total gain is made by the block of Central European countries and the Mediterranean block (2.5 percentage points); the smallest by the Scandinavian block (.5 percentage points). The Central European and the Mediterranean countries uniformly gain the highest share of power (their relative gain is between 12.4% (Poland and Spain) and 17.4% (Slovenia and Cyprus)). The smallest relative gain is for Sweden (4.4%).

In the case which is reported in the fourth column of Table 6, all five blocks (the Benelux countries, the Franco-German axis, the Mediterranean countries, the Scandinavian countries, and the Central European countries) are formed. It is surprising that this situation is extremely profitable for Ireland (its relative gain is 86.5%) and Austria (its relative gain is 45%), which are not members of any of these blocks. There are no other winners in this situation except Spain and Poland. The Mediterranean block and the Central European block gain; all other blocks lose.

The remaining part of Table 6 deals with the concept of structured blocks. In the fifth and sixth column, Italy cooperates with the "core," in the seventh and eighth with the Mediterranean block. In the fifth and seventh column Estonia cooperates with the Central European countries, in the sixth and eighth with the Scandinavian block. The results are sensitive to changes in a priori coalition structure; e.g., Estonia is a dummy (without power) if Italy cooperates with the "core," and it is not a dummy if Italy cooperates with the Mediterranean block; the power of both Ireland and Austria almost doubles when Italy joins the Mediterranean block instead of the "core." Italy is the most powerful country of the EU in all investigated cases. The power of Italy is greater when it cooperates with the "core." The power of Estonia is independent of whether it cooperates with the Central European block or with the Baltic states.

Comparing the fourth column of Table 6 with the fourth column of Table 4, we can observe the so-called "paradox of redistribution." This "paradox" occurs if a decrease in the relative weight of any member can lead to an increase of its power (see Fischer and Schotter (1978)). The relative voting weight of Ireland decreased from $\frac{3}{105}$ to $\frac{3}{111}$, but its power increased from 2.18 to 4.96. The same paradox is observable again for Ireland if we compare the fifth or sixth column of Table 6 with the sixth column of Table 4 (or the seventh and eighth column of Table 6 with the seventh column of Table 4).

Table 7 summarizes the results obtained for a hypothetical future EU enlarged by eleven new member states: the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Bulgaria, Cyprus, Estonia, Lithuania, Latvia, and Romania. We assume the number of votes for the new members given in Section 2. The qualified majority is assumed to be 92 out of 130 votes. Cyprus joins the Mediterranean block. The Czech Republic, Hungary, Poland, Slovakia, Slovenia, Bulgaria, and Romania create a new block of Central European countries. Estonia, Lithuania, and Latvia create a new block of Baltic states. These blocks create a new structured block of Central and Eastern European countries. Alternatively, the Baltic and Scandinavian block create a new structured block of Nordic countries.

The values of the Shapley-Shubik index Φ_i are presented in the third column of Table 7. They imply that this (hypothetical) enlargement of the EU leads to losses for all the "old" members. This is also true if we compare these values with the Shapley-Shubik indices for an EU of 18 members, which are reported in the third column of Table 3, and with the indices for an EU of 21 members, which are reported in the third column of Table 5.

For an EU of 26 members, the eleven new members represent 22.3% of the population, but they get 33% of the votes. This is due to the apparent logarithmic relationship between

Country	ρ_i	Φ_i	Φ_i^1	$\frac{\Phi_i^1}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$	Φ_i^2	$\frac{\Phi_i^2}{\Phi_i}$
Gr. Britain	10	7.91	6.54	0.827	3.33	0.421	5.24	0.662	9.29	1.174	13.57	1.716
Ireland	3	2.25	1.77	0.787	0	0	1.90	0.844	0.95	0.422	1.90	0.844
Austria	4	3.03	2.53	0.835	0	0	1.90	0.627	0.95	0.314	1.90	0.627
Belgium	5	3.80	3.06	0.805	5.73	1.508	6.13	1.613	3.65	0.961	4.27	1.124
Netherlands	5	3.80	3.06	0.805	5.73	1.508	6.13	1.613	3.65	0.961	4.27	1.124
Luxembourg	2	1.49	1.22	0.819	1.43	0.960	1.94	1.302	1.15	0.772	1.94	1.302
France	10	7.91	6.54	0.827	10.26	1.297	9.90	1.252	5.42	0.685	6.55	0.828
Germany	10	7.91	6.54	0.827	10.26	1.297	9.90	1.252	5.42	0.685	6.55	0.828
Italy	10	7.91	6.54	0.827	11.59	1.465	12.90	1.631	7.14	0.903	9.17	1.159
Spain	8	6.22	5.03	0.809	1.23	0.198	4.29	0.690	3.83	0.616	5.19	0.834
Greece	5	3.80	3.06	0.805	0.83	0.218	2.50	0.658	2.60	0.684	3.09	0.813
Portugal	5	3.80	3.06	0.805	0.83	0.218	2.50	0.658	2.60	0.684	3.09	0.813
Cyprus	2	1.49	1.22	0.819	0.44	0.295	0.95	0.638	1.45	0.973	1.38	0.926
Sweden	4	3.03	2.53	0.835	1.11	0.366	2.14	0.706	4.21	1.389	3.21	1.059
Denmark	3	2.25	1.77	0.787	1.11	0.493	1.73	0.769	2.54	1.129	2.38	1.058
Finland	3	2.25	1.77	0.787	1.11	0.493	1.73	0.769	2.54	1.129	2.38	1.058
Latvia	3	2.25	3.42	1.520	5.48	2.436	1.96	0.871	5.87	2.609	2.30	1.022
Lithuania	3	2.25	3.42	1.520	5.48	2.436	1.96	0.871	5.87	2.609	2.30	1.022
Estonia	2	1.49	1.85	1.242	0.95	0.638	0.71	0.477	1.23	0.826	0.99	0.664
Poland	8	6.22	8.48	1.363	7.76	1.248	5.81	0.934	6.83	1.098	5.80	0.932
Romania	6	4.61	6.38	1.384	6.00	1.302	4.30	0.933	5.32	1.154	4.29	0.931
Czech Rep.	5	3.80	5.34	1.405	5.15	1.355	3.67	0.966	4.65	1.224	3.72	0.979
Hungary	5	3.80	5.34	1.405	5.15	1.355	3.67	0.966	4.65	1.224	3.72	0.979
Bulgaria	4	3.03	4.29	1.416	4.06	1.340	2.64	0.871	3.71	1.224	2.75	0.908
Slovakia	3	2.25	3.42	1.520	3.38	1.502	2.00	0.889	3.13	1.391	2.00	0.889
Slovenia	2	1.49	1.85	1.242	1.59	1.067	1.47	0.987	1.36	0.913	1.30	0.872

Table 7: The distribution of power in an EU of 26 members

the votes and population (see Widgren (1994)), which favours the smallest member states of the EU. The old members lose 32.7% of their power. We can observe similar situations for the enlargements considered before. For an EU of 18 members the new entrants represent 13.8% of the population; they get 17.1% of the votes and the old members lose 16.9% of the power. For an EU of 21 members the new entrants represent 14.6% of the population; they get 21.6% of the votes and the old members lose 21.2% of the power.

In the fourth column of Table 7 it is assumed that only the block of Central and Eastern European countries is formed. The total gain for this block, which represents 43.8% of total power, is 12.6 percentage points. The relative gain for each state joining this block is between 24% (Estonia and Slovenia) and 52% (Latvia, Lithuania and Slovakia). We do not report the results for the other possible unions (the Central European block, the Baltic block, the Scandinavian block, Benelux, the Nordic block, the Franco-German axis, and the Mediterranean block). All members of these blocks gain. All countries outside these blocks lose except in the case of the Scandinavian or Nordic block, when Austria and Bulgaria gain.

The remaining part of Table 7 deals with the concept of structured blocks. In the fifth and sixth column, Italy cooperates with the "core," in the seventh and eighth with the Mediterranean block. In the fifth and seventh column the Baltic states cooperate with the Central European countries, in the sixth and eighth with the Scandinavian block. The results are very sensitive to changes in a priori coalition structure; e.g., Ireland and Austria are dummies (without power) if the Baltic states cooperate with the Central European countries and Italy with the "core," and they are not dummies in other cases; the power of Great Britain almost triples when Italy joins the Mediterranean block instead of the "core" (in these cases the "solitary" Great Britain is the most powerful country); when Italy cooperates with the Mediterranean block, the power of Great Britain is equal to the sum of the power of three Scandinavian countries if the Baltic states cooperate with the Central European countries, and it is equal to the sum of the power of the six Nordic countries if the Baltic states cooperate with the Scandinavian block. The power of Italy is greater when it cooperates with the "core," and in these cases Italy is the most powerful country of the EU. The power of the Baltic states is greater if they cooperate with the block of Central European countries.

5 Conclusions

In this paper we have investigated the probable changes in the distribution of power in the Council of the European Union when it is expanded by several Central and Eastern European countries. Since it is likely that at least some of them will join the EU in the next decade, three different enlargements were analysed. Modified versions of the Shapley-Shubik index were used to analyse both deterministic and probabilistic sub-systems in the EU. Our analysis differs from previous attempts to evaluate the distribution of power in the Council of the EU in one important respect: we have introduced the concept of union structure hierarchies. Moreover, we have paid particular attention to cases when counter blocks are allowed.

There are four main results: 1. An enlargement of the EU implies that the power share of the old members will in general diminish. However, the "paradox of new members" may occur. 2. The additional power an alliance could obtain is generally positive and increases with respect to the voting weight of the block when it is assumed that no counter blocks are formed. However, the "paradox of size" may occur. 3. The gains and losses change remarkably when counter blocks are allowed. 4. Relatively small changes in coalition structure can produce large changes in the distribution of power.

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