Economics Bulletin

Volume 31, Issue 1

Power in the European Union: an evaluation according to a priori relations between states

Sébastien Courtin
CREM, UMR CNRS 6211, Université de Caen Basse-Normandie

Abstract

We analyze and evaluate the power of each member state of the European Union according to the different relations between them. To do that, we use power indices introduced by Andjiga and Courtin (2010) for games in which the players are organized into a priori coalition configurations. As a difference of games with coalition structure as introduced by Owen (1977) in games with coalition configuration, it is supposed that players organize themselves into coalitions not necessarily disjoint. We suppose that different coalitions formed between the states for two reasons: an economic reason ("the GDP per capita"); and a political reason, their attitude towards the European Union ("Euro-enthusiastic" and "Euro-skeptic").

We are grateful to one anonymous referee for very valuable comments and suggestions. We thank Boniface Mbih and Joseph Siani for their comments and suggestions.

Citation: Sébastien Courtin, (2011) "Power in the European Union: an evaluation according to a priori relations between states", *Economics Bulletin*, Vol. 31 no.1 pp. 534-545.

Submitted: Oct 01 2010. **Published:** February 14, 2011.

1. Introduction

There is a vast and rich literature on States power in the European Union (EU). This is particularly due to the frequent enlargement of the EU, which implies new voting distributions to evaluate. There are three main institutions in Europe. The first one is the "Council of the EU" or the "Council of Ministers", which is the institution representing the governments of member States. The second one is the "European Parliament", which is the directly elected parliamentary institution of the EU. Together with the Council, they form the bicameral legislative branch of the EU. And finally, there is the executive body of the EU, the "European Commission", responsible for the general "day-to-day" running of the Union.

Most of the literature focuses on the rules of the voting games, by computing the standard Shapley (1954) or Banzhaf (1965) indices for each member of the EU referring to the Council or to the Parliament. These two indices can be seen as a measure of the a priori voting power of the members in a committee. The problem with these indices is that they do not take into consideration a priori relations between different players. For the EU, this means that the countries cannot be distinguished by their attitudes toward the EU[1]. Since some States are considered as "Euro-enthusiastic" (pro-European) and others as "Euro-skeptic" (opposed to Europe), ignoring the "policy positions" of the European governments is problematic. Indeed, we can imagine that some States are closer to one another, and this for their proximity with the European ideas. For example, if we consider two major European States, Germany and the United Kingdom (UK), it is known that the first one is rather "pro-European", while the UK is more "Euro-skeptic". So when it comes to deal with questions about the evolution of the EU and these institutions, there will be a problem to agree. On the contrary, France and Germany act together about this subject, since they agree about the evolution of the EU.

In order to represent these cooperation situations in a realistic way, Owen (1977, 1981) introduced games with a priori coalition structure[2]. In such a game, it is assumed that players organize themselves to defend their interests into a priori disjoint coalitions. Therefore, Owen (1977, 1981) proposed and characterized a modification of the Shapley and Banzhaf indices with respect to a coalition structure, the well-known Owen-Shapley and Owen-Banzhaf indices. Coalition structures implies that the European States, which act together, will form a priori coalitions, as French and Germans did to defend their point of view about the Europe's future. But notice that a State can be close to some States which are far from each other. For example, France is close to the UK since these two States have a lot of economic interests. Consequently, France can be close to Germany (for ideological reasons) and to the UK (for economic reasons), while Germany and the UK are far from each other.

One solution to model these more complex relations (which was not taken into consideration by Owen), is to suppose that a State can belong to different a priori coalitions. Rather than considering disjoint coalitions as in a coalition structure, Albizuri et al. (2006a, 2006b) introduced games with coalition configuration, where they consider the partition of the set of individuals into non necessarily disjoint coalitions (whose union is the grand coalition). In the previous example, France can then form a coalition with Germany (perhaps with more

[1]The literature about the EU rarely takes this into account (however, see Barr and Passarelli 2009).

[2]A coalition structure is a finite partition of the player set into disjoint coalitions.

States, not including the UK) and a coalition with the UK (perhaps with more States, not including Germany).

Coalition configurations offer interesting perspective, when we need to analyze the complex political games that take place between European States. We will then measure the power of each member State according to the different relations between them. We suppose that different coalitions are formed between States for two reasons: an economic reason ("the GDP per capita"), and a political reason, that is their attitude toward European Union ("Euro-enthusiastic" and "Euro-skeptic"). To do that, we will use three indices developed by Andjiga and Courtin (2010) for games with coalition configuration, namely Owen-Shapley-CCF share, Owen-Banzhaf-CCF share and Deegan-Packel-CCF share. Moreover we choose to carry out our study on the European Parliament, because it seems the most legitimate to represent the European situation, since its members are elected directly by the Europeans.

The rest of the paper is organized as follows. Section 2 discusses the theoretical measures of power. Then in Section 3 we present the results of our empirical analysis. And Section 4 concludes the paper.

2. The theory of voting power

A TU-game is a pair (N, v) defined by a finite set of players $N = \{1, 2, ..., |N|\}$, and a function $v : 2^N \to \mathbb{R}$, that assigns each coalition $S \subseteq N$ a real number $v(S)$ and satisfies $v(\varnothing) = 0$. A game v on N is simple if for all $S \subseteq N$, $v(S) = 0$ (losing coalition) or $v(S) = 1$ (winning coalition). A simple game on N is monotonic if $v(S) \leq v(T)$ for all $S \subseteq T \subseteq N$. The set of all monotonic simple games will be denoted $\mathcal{SG}$. A weighted voting game is denoted $[q;\ w_1, w_2, .., w_n]$, where $w_i \in \mathbb{N}$ is the number of votes of player $i \in N$, and the quota $q \in \mathbb{N}$ is the number of votes needed to win. The corresponding simple game (N, v) is given by $v(S) = 1$ if $\sum\limits_{i \in S} w_i \geq q$ and $v(S) = 0$ otherwise.

The two main solution concepts[3] on $\mathcal{SG}$, are Shapley φ^{Sh} and Banzhaf $\bar{\varphi}^B$ functions defined for all $i \in N$ by

$$\varphi_i^{Sh}(N, v) = \sum_{\substack{S \subseteq N \\ i \in S}} \frac{(|S| - 1)!(|N| - |S|)!}{|N|!} \left(v(S) - v(S/\{i\})\right);$$

and

$$\bar{\varphi}_i^B(N, v) = \sum_{\substack{S \subseteq N \\ i \in S}} \frac{1}{2^{|N|-1}} \left(v(S) - v(S/\{i\})\right).$$

Let us consider situations in which the players are organized in an a priori given coalition configuration. A coalition configuration of N is a finite collection $P = \{P_1, ..., P_m\}$, of m non-empty subsets of N, such that $\cup_{k=1}^m P_k = N$. The only assumption is that a player belongs to at least one coalition. In the following, the set of coalitions in the coalition configuration

[3]Both of them measure the relative frequency with which a player is in the position of "swinging" a losing coalition into a winning one.

is denoted by $M = \{1, ..., k, ..., m\}$, with $k \in M$ representing a coalition $P_k \in P$. For every $i \in N$, we write $P^i : \{P_r \in P : i \in P_r\}$ as the members of P, containing i. The set of all coalition configurations of N is denoted $\mathcal{P}^N$, a simple game with coalition configuration (N, v, P), and the set of all simple games with coalition configuration $SG\mathcal{P}^N = \mathcal{SG} * \mathcal{P}^{\mathcal{N}}$. For example, P can be seen as the distribution of European States in different coalitions, and that for economic, historical or geopolitical reasons. Nothing prevents a State from belonging to several coalitions, not including the same members.

Albizuri et al. (2006a, 2006b) generalized Shapley (1953) and Banzhaf (1965) to games with coalition configuration, as Owen (1977, 1981) generalized them to games with coalition structure. Andjiga and Courtin (2010) redefined these coalition configuration indices by using the concept of share function as introduced by van der Laan and van den Brink (2002, 2005). A share function assigns to every player in a game (simple) his share in the worth to be distributed such that $\sum\limits_{i \in N} \rho_i = 1$ for all $(N, v) \in N$. The Shapley share function ρ^{Sh} and Banzhaf share function ρ^{B} , on $\mathcal{SG}$[4] are defined respectively by

$$\rho_i^{Sh}(N, v) = \frac{\varphi_i^{Sh}(N,v)}{v(N)},\ i \in N,$$

and

$$\rho^{B}(N, v) = \frac{\bar{\varphi}_i^{B}(N,v)}{\sum_{S \subseteq N}(2|S| - |N|)v(S)}\ ,\ i \in N.$$

We choose to apply the indices developed by Andjiga and Courtin (2010), instead of those of Albizuri et al. (2006a, 2006b) since these indices satisfy the "multiplication axiom", which seems to be a natural property when players are organized into a priori coalitions[5]. According to this property, the fraction in the total payment $v(N)$ received by a player i belonging to a coalition P_k, should be equal to the product of the fraction that the coalition P_k receives in a game between coalitions (*external game*), and the fraction that this player i receives in a game between the player inside coalition P_k (*internal game*), when the same index is applied to these two games. So, the arrangement of the players into an a priori coalition configuration implies to decompose the bargaining process into two games, namely the *internal* and the *external game*.

For a given game $(N, v, P) \in \mathcal{SGP}^N$, with $P = \{P_1, ..., P_m\}$ and $M = \{1, ..., m\}$, the *external game*[6] between coalitions denoted $(M, v^P) \in \mathcal{SG}$, is an m-player game defined by $v^P(L) = v(P(L)) = v(\cup_{j \in L} P_j)$, for all $L \subseteq M$. In this game induced by (N, v, P), coalitions of P are considered as players, and the worth of the grand coalition is distributed among the coalitions.

In the second game, the *internal game*, the payoff received by a coalition in the *external game* is distributed among the players within this coalition. The characteristic function of this game depends on the index which is applied. For Shapley, an *internal game* between the players in a coalition P_k is denoted (P_k, v^{P_k}) with $v^{P_k}(S) = \sum_{\substack{L \subseteq M \\ k \notin L}} \frac{|L|!(m-|L|-1)!}{m!} v^{P_k, L}(S), S \subseteq$

[4]Share functions are defined for non null games, that is $v(S) \neq 0$ for at least one $S \subseteq N$.
[5]E.g. van den Brink and van der Laan (2002, 2005) for a discussion about this property.
[6]Owen (1977) introduced this game under the name of "quotient game".

P_k, where for $L \subset M$, $k \notin L$, $v^{P_k,L}(S) = v(S \cup P(L)) - v(P(L))$, $S \subseteq P_k$. And for Banzhaf it is denoted $(P_k, \bar{v}^{P_k})$, with $\bar{v}^{P_k}(S) = \sum_{\substack{L \subseteq M \\ k \notin L}} 2^{-(m-1)} v^{P_k,L}(S)$, for all $S \subseteq P_k$.

Andjiga and Courtin (2010) showed that the outcomes of such a two-level interaction are reflected by the Owen-Shapley-CCF share function $\Pi^{OS}(N, v, P)$ and the Owen-Banzhaf-CCF share function $\Pi^{B}(N, v, P)$, defined respectively by:

$$\Pi_i^{OS}(N, v, P) = \sum_{P_r \in P^i} \left[\rho_i^{Sh}(P_r, v^{P_r}) . \rho_r^{Sh}(M, v^P) \right], i \in P_r \in P,$$

and

$$\Pi_i^{B}(N, v, P) = \sum_{Pr \in P^i} \left[\rho_i^{B}(P_r, \bar{v}^{P_r}) . \rho_r^{B}(M, v^P) \right], i \in P_r \in P.$$

The share of player i can be seen as the product of two shares; for each coalition this player i belongs to:

- a share of a coalition r in the *external game* (M, v^P) between coalitions;
- and a share of player i in the *internal game* (P_r, v^{P_r}).

Andjiga and Courtin (2010) obtained also a share function based on the work of Deegan-Packel (1979), denoted $\Pi_i^{DP}(N, v, P)$ and given by

$$\Pi_i^{DP}(N, v, P) = \sum_{P_r \in P^i} \left[\rho_i^{DP}(P_r, \hat{v}^{P_r}) . \rho_r^{DP}(M, v^P) \right], i \in P_r \in P.$$

Note that $\rho_i^{DP}(N, v) = \frac{\sum_{\substack{S \subseteq N \\ i \in N}} \hat{w}_{|S|}^{|N|} (v(S) - v(S/\{i\}))}{\sum_{S \subseteq N} v(S)}$ where

$\hat{w}_{|S|}^{|N|} = \left\{ \begin{array}{cc} \frac{1}{|N|} & if\ |S| = |N| \\ \frac{(1 + (|N| - |S|) \hat{w}_{|S|+1}^{|N|})}{t} & if\ |S| = |N| - 1, ..., 1 \end{array} \right|$, and $\hat{v}^{P_k}(S) = \sum_{\substack{L \subseteq M \\ k \notin L}} \hat{w}_{|k|}^{|M|} v^{P_k,L}(S)$, $S \subseteq P_k$.

We will apply these three functions to the European Parliament in order to measure the power of each member State according to their relationships.

3. The European political game

3.1 The European 27 members

The EU has recently enlarged to 27 countries. The 27 member States of the EU and their deputies (into brackets) are the following:

Table 1: Number of deputies of the EU States in the Parliament.		
1. Germany (99)	10. Greece (22)	19. Slovakia(13)
2. France (72)	11. Hungary (22)	20. Ireland (12)
3. Italie (72)	12. Portugal (22)	21. Lithuania (12)
4. United-Kingdom (72)	13. Czech Republic (22)	22. Latvia (8)
5. Spain (50)	14. Sweden (18)	23. Slovenia (7)
6. Poland (50)	15. Austria (17)	24. Cyprus (6)
7. Romania (33)	16. Bulgaria (17)	25. Estonia (6)
8. Netherlands (25)	17. Denmark (13)	26. Luxembourg (6)
9. Belgium (22)	18. Finland (13)	27. Malta (5)

Let us now measure the power of each State in the Parliament according to the relations between them. Each State will be represented by the above numbers, and we assume that all the deputies of the same State always vote in the same way[7].

Taking into account the number of deputies of each State, we can represent the game that takes place in the Parliament by a simple monotonic game v on $N = \{1, 2, ..., 27\}$ given by

$$v(S) = \left\{ \begin{array}{l} 1 \text{ if the sum of the deputies in } S \text{ is } >369 \\ 0 \text{ otherwise} \end{array} \right| .$$

Such a game is equivalent to the weighted voting game $[369;\ w_1 = 99, ..., w_i, .., w_{27} = 5]$, where $w_i \in \mathbb{N}$ is the number of deputies of State $i \in N$, and 369 the number of votes needed to pass a law (quota).

As noted in introduction, we suppose that different coalitions are formed between the States in such a way that a State can belong to one or more coalitions. Thus the number of possible coalitions is very large. Nevertheless, the question as to know which possible coalitions are more likely to occur should be explored. We then assume that coalitions will be formed for two main reasons.

The first one is the ideological position of States with regard to the EU, with "Euro-enthusiastic" States and "Euro-skeptic" States. Indeed, we think that closer States according to the European evolution will be encouraged to cooperate in order to defend their interests. The data set used to build the different a priori coalitions, according to the ideological position, comes from the Eurobarometer 70 (European Commission, 2008). The Eurobarometer polls European citizens on their position toward several policy issues, such as domestic issues (crime, poverty...), or international issues (foreign policy, defence). To model the relation space between States, the following question helped us: *"Generally speaking, do you think that (our country's) membership of the European Union is a good thing?"*. The results collected for all 27 countries are given in Appendix A. So, based on these results we assume that four different a priori coalitions will be formed, namely the coalitions $P_5 = \{6, 7, 8, 9, 20, 26\}$, which includes the most "Euro-enthusiastic" States with over 65% of favorable opinion, $P_6 = \{1, 5, 14, 17, 19, 23, 25\}$, with States between 55% and 65% of favorable opinion, $P_7 = \{2, 12, 13, 16, 18, 21, 27\}$, with States between 45% and 55%, and

[7] This assumption is quite strong, since some deputies of the same State can be opposed in some circumstances and agree in others. But this assumption is necessarily for the sake of simplicity.

$P_8 = \{3, 4, 10, 11, 15, 22, 24\}$, with the most "Euro-skeptic" with less than 45% of positive opinion. Obviously, other partitions would have been possible, but for technical reasons we choose four coalitions of the same size.

In addition to the above coalitions, other coalitions can also be formed. The second criterion that we take into account is a purely economic criterion, the gross domestic product (GDP). It is obvious that the richest countries in the EU will tend to cooperate in order to defend their economic interests. If we take into account the GDP per capita for 2008 expressed in terms of purchasing power standards (see Appendix B), we can group the States into four coalitions, $P_1 = \{4, 8, 14, 15, 17, 20, 26\}$ for States with the highest GDP per capita (≥ 116), $P_2 = \{1, 2, 3, 5, 9, 10, 18\}$ for States with a GDP between 95 and 116, $P_3 = \{12, 13, 19, 23, 24, 25, 27\}$ for States with a GDP between 67 and 95, and finally $P_4 = \{6, 7, 11, 16, 21, 22\}$ for the poorest States.

Therefore we have the game with coalition configuration (N, v, P), with $N = \{1, 2, ..., 27\}$ and $P = \{P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8\}$.

3.2 Measure of power

If we compute Owen-Shapley-CCF share, Owen-Banzhaf-CCF share and Deegan-Packel-CCF share[8] for all members of (N, v, P), we obtain the following results:

Table 2: CFF-share

	Shapley	Banzhaf	Deegan
1. Germany (99)	0.10446	0.10533	0.11929
2. France (72)	0.08760	0.09863	0.09239
3. Italie (72)	0.09354	0.09050	0.09857
4. United-Kingdom (72)	0.08585	0.10701	0.09871
5. Spain (50)	0.06423	0.06885	0.06290
6. Poland (50)	0.04859	0.06445	0.04819
7. Romania (33)	0.03431	0.03827	0.03309
8. Netherlands (25)	0.03897	0.03455	0.03965
9. Belgium (22)	0.02766	0.02641	0.03316
10. Greece (22)	0.03104	0.02310	0.03284
11. Hungary (22)	0.03241	0.02547	0.03068
12. Portugal (22)	0.04439	0.04025	0.04629
13. Czech Republic (22)	0.04439	0.04025	0.04629
14. Sweden (18)	0.03113	0.02527	0.02586
15. Austria (17)	0.03011	0.02353	0.02338
16. Bulgaria (17)	0.02472	0.02427	0.02183
17. Denmark (13)	0.02495	0.01897	0.02199
18. Finland (13)	0.01993	0.01850	0.01934
19. Slovakia (13)	0.02513	0.02588	0.02250
20. Ireland (12)	0.01687	0.01741	0.01428

[8]To simplify the reading, afterward we will use the term of Shapley, Banzhaf and Deegan instead of Owen-Shapley-CCF, Owen-Banzhaf-CCF and Deegan-Packel-CCF share.

	Shapley	Banzhaf	Deegan
21. Lithuania (12)	0.01696	0.01797	0.01537
22. Latvia (8)	0.01059	0.01236	0.00925
23. Slovenia (7)	0.01552	0.01253	0.01088
24. Cyprus (6)	0.00961	0.01193	0.00824
25. Estonia (6)	0.01451	0.01098	0.01045
26. Luxembourg (6)	0.01139	0.00716	0.00707
27. Malta (5)	0.01111	0.01025	0.00780

What do we learn from these results?

Firstly, the values according to Shapley, Banzhaf or Deegan are very close. Obviously there are some differences, but in general the power is substantially the same. We can however point out that Germany (player 1), which has the largest number of deputies, is the most powerful according to Shapley and Deegan, but is only second for Banzhaf. And Luxembourg (player 26), the last according to Banzhaf and Deegan, is more powerful than Malta (player 27) and Cyprus (player 24) according to Shapley. Consequently, for this game there is no major difference as well from a cardinal or an ordinal point of view.

Secondly, it is possible to establish a "natural" relation between weight and power: the power of a State generally decreases when his number of deputies decreases. This observation seems relevant even though we know that weight does not mean power. However, one must make some distinctions. Let us compare two States with the same number of deputies. Take for example Spain (player 5) and Poland (player 6) with 50 deputies each. We note that the power of Spain is higher than the power of Poland, no matter the indices. For Shapley, Spain obtains 0.06423 against 0.04859 for Poland, that is 30% larger. How can we explain this? This is due to the fact that Spain belongs to coalitions P_6 and P_2, which have a greater weight than coalitions P_4 and P_5 to which Poland belongs. Indeed, the sum of the weights of the players in P_6 is equal to 206 and to 350 in P_2, while the total weight is only equal to 142 in P_4 and 148 in P_5. One way of observing more formally this phenomenon, is to evaluate the power of each coalition in the *external game* (M, v^P) between the coalitions.

Table 3: *External game* (1)

	$\rho^{\mu}_{P_1}(M, v^P)$	$\rho^{\mu}_{P_2}(M, v^P)$	$\rho^{\mu}_{P_3}(M, v^P)$	$\rho^{\mu}_{P_4}(M, v^P)$
Shapley: $\mu = Sh$	0.1250	0.2202	0.0774	0.0774
Banzhaf: $\mu = B$	0.1250	0.1917	0.0917	0.0917
Deegan: $\mu = DP$	0.1250	0.2239	0.0755	0.0755

Table 4: *External game* (2)

	$\rho^{\mu}_{P_5}(M, v^P)$	$\rho^{\mu}_{P_6}(M, v^P)$	$\rho^{\mu}_{P_7}(M, v^P)$	$\rho^{\mu}_{P_8}(M, v^P)$
Shapley: $\mu = Sh$	0.0774	0.1488	0.1250	0.1488
Banzhaf: $\mu = B$	0.0917	0.1417	0.1250	0.1417
Deegan: $\mu = DP$	0.0755	0.1497	0.1250	0.1497

Whatever the index used, $\rho^{\mu}_{P_2}(M, v^P)$ and $\rho^{\mu}_{P_6}(M, v^P)$ are greater than $\rho^{\mu}_{P_4}(M, v^P)$ and $\rho^{\mu}_{P_5}(M, v^P)$. This means that, the shares received in the *external game* by P_2 and P_6 are higher than the shares received by P_4 and P_5 . Consequently, Spain is more powerful than Poland, even if they are represented by the same number of deputies. This is also true for other States, like Lithuania (player 21) and Ireland (player 20), each with 12 deputies. Lithuania (belongs to P_4 and P_7) is slightly more powerful than Ireland (belongs to P_1 and P_5), since in the *external game*, P_7 is stronger than P_1 (P_4 and P_5 receive the same share).

Another example illustrating the fact that the more weight a State has, the more power it has, is the case of Portugal (player 12) and Czech Republic (player 13). They each have 22 deputies and belong to the same a priori coalitions and therefore have the same power. Both States have more power than States like the Netherlands (player 8) and Romania (player 7), which have more deputies, respectively 33 and 25. If we consider the Netherlands which belong to coalitions P_5 and P_1 and compare them to Portugal which belongs to coalitions P_3 and P_7, we see that the previous explanation which says that a State is more powerful because it belongs to a stronger coalition is not true. Indeed, these two States belong to coalitions which have the same power in the *external game* ($\rho^{\mu}_{P_3}(M, v^P) = \rho^{\mu}_{P_5}(M, v^P)$ and $\rho^{\mu}_{P_1}(M, v^P) = \rho^{\mu}_{P_7}(M, v^P)$). So, why is Portugal more powerful? To answer this question, we must not focus on the game between coalitions, but on the games within each coalition. Portugal is in fact in strong position in both coalitions it belongs to. In P_7, only France has more deputies than it, whereas in P_3, Portugal has the most number of deputies with Czech Republic. This is not the case of the Netherlands, since the UK in P_1, Romania and Poland in P_5 , have more deputies than them. Therefore, Portugal has a power of negotiation in the coalitions it belongs to, generally greater than the Netherlands. We can see this in the following tables, representing the power obtained in the *internal games*, respectively by Portugal and the Netherlands.[9]

Table 5: *Internal games*

	Netherlands		Portugal	
	$\rho^{\mu}_{8}(P_1, v^{P_1}_{\mu})$	$\rho^{\mu}_{8}(P_5, v^{P_5}_{\mu})$	$\rho^{\mu}_{12}(P_3, v^{P_3}_{\mu})$	$\rho^{\mu^w}_{12}(P_7, v^{P_7}_{\mu})$
Shapley: $\mu = Sh$	0.17834	0.20796	0.29251	0.16939
Banzhaf: $\mu = B$	0.14130	0.17994	0.26246	0.12637
Deegan: $\mu = DP$	0.18766	0.20863	0.31426	0.17700

Clearly, the power obtained by Portugal in coalition P_3 (0.29251) explains why Portugal is more powerful than the Netherlands, although less important in terms of deputies.

To sum up, power of a States depends on the power of each coalition in the *external game* and on its power in each *internal game*. In other words, a State that belongs to powerful coalitions and with an important power of negotiation inside these coalitions, has a lot of power. Thus both effects are important. But we cannot say if it is better to belong to powerful coalitions with a weak power of negotiation, or to belong to weak coalitions but with a high power of negotiation. This question obviously depends on each person and on the attitude toward power. Some will prefer to have power in a small group rather than to

[9]Note that when $\mu = Sh, B, DP$, then $v^{P_r}_{\mu}$=$v^{P_k}, \bar{v}^{Pr}, \hat{v}^{P_k}$, respectively.

belong to a big group but with not enough personal visibility, while others will prefer the opposite situation.

4. Conclusion

In this study, we examined, by measuring the power of each State in the European Parliament, the political game which takes place in the EU. We observed that whatever the indices, power decreases when the number of deputies decreases. However, there are some important exceptions, since the power of a State depends on two games, an *external game* between coalitions and an *internal game* within coalitions. This is the most important contribution of this paper. Indeed, unlike classical studies about power in Europe, we consider that States can organize themselves into a priori coalitions in order to obtain a better position in the bargaining process (see Holler and Owen, 2001 and Barr and Passarelli, 2009). In addition to the fact that States can form a priori coalitions, we assume that these States can be in relation with States that are not necessarily in relation with each other.

The coalition configuration framework then offers a more interesting perspective than the coalition structure framework. Although the specified coalition configuration consists of two coalition partitions, it is not the same thing to consider each game with coalition partition separately or to consider one game with coalition configuration. The problem is not the same since the external games are different. If we consider each game separately, we have two different external games which do not take into consideration the relation between a coalition formed according to economic criteria and a coalition formed according to political criteria. And it is not because two coalitions have almost the same members, that they necessarily always agree. For example consider the EU and NATO, it is well known that they are often in conflict. Then, if we divide the game with coalition configuration into two games with coalition structure, we lose information and the results are different.

Finally we may note that these new indices, recently developed by Andjiga and Courtin (2010), could be useful for other studies on the EU and its institutions.

References

Andjiga, N., Courtin, S. (2010). Coalition configuration and share functions. Working paper, CREM.

Albizuri, M.J., Aurrekoetxea, J. (2006). Coalition configurations and the Banzhaf index. *Social Choice and Welfare*, 26, 571-596.

Albizuri, M.J., Aurrekoetxea, J., Zarzuelo, J.M. (2006). Configuration values: Extensions of the coaltional Owen value. *Games and Economics Behavior,* 57, 1-17.

Banzhaf, J.F. (1965). Weighted voting doesn't work: A mathematical analysis. *Rutgers Law Review*, 19, 317-343.

Barr, J., Passarelli, F. (2009). Who has the power in the EU? *Mathematical Social Sciences,* 57, 339–366.

Deegan, J., Packel, E.W. (1979). A new index of power for simple n-person games. *International Journal of Game Theory*, 7, 113-123.

Holler, M.J., Owen, G. (2001). *Power Indices and Coalition Formation.* In Holler, M.J and Owen, G. (Eds.). Boston, Kluwer Academic Publisher.

Owen, G. (1977). Values of games with a priori unions. In Hernn, R., Moschlin, O. (Eds.), *Lecture Notes in Economics and Mathematical Systems: Essays in Honor of Oskar Morgenstern.* New York, Springer-Verlag, pp. 76-88.

Owen, G. (1981). Modification of the Banzhaf-Coleman index for games with a priori unions. In Holler, M.J. (Ed.), *Power, voting and voting power.* Wurzburg, Physica-Verlag, pp 232-238.

Owen, G., Shapley, L.S. (1989). Optimal location of candidates in ideological space. *International Journal of Game Theory*, 18, 339-356.

Shapley, L.S. (1953). A value for n-person games. In Kuhn, H.W., Tucker, A.W. (Eds.), *Contributions to the Theory of Games II.* In Annals of Mathematics Studies, vol. 28. Princeton Univ. Press, 307-317.

van der Laan, G., van den Brink, R. (2002). A Banzhaf share function for cooperative games with coalition structure. *Theory and Decision,* 53, 61-86.

van der Laan, G., van den Brink, R. (2005). A class of consistent share functions for games with coalition structure. *Games and Economics Behavior,* 51, 193-212.

Appendix A: Eurobarometer 70

The Eurobarometer survey covers the population of the EU member States. The basic sample design consists of a number of sampling points for each country that are proportional to the population size and density. This survey is composed of two parts, the first part takes the same questions in each period and the second part raises different issues in each period based on current events. We use in our study the data collected from the Eurobarometer 70, and particularly the results of question 9*A "Generally speaking, do you think that (OUR COUNTRY's) membership of the European Union is/would be a good things?*"

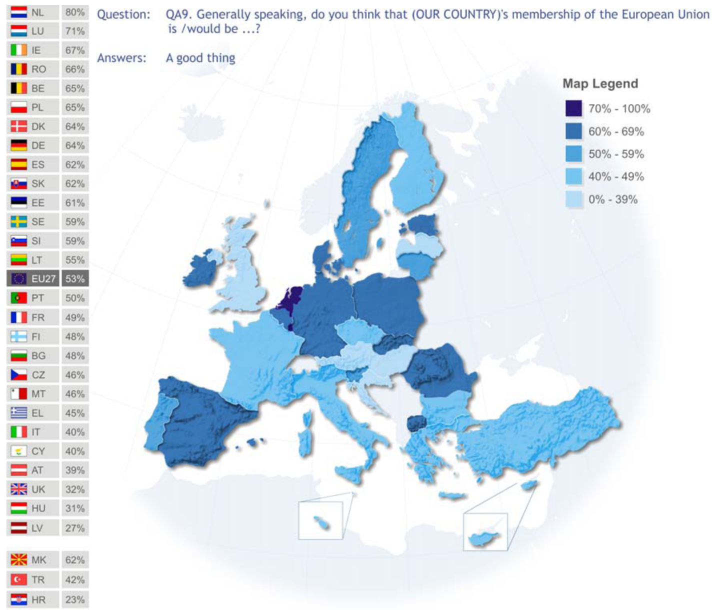

Figure 1: Eurobarometer 70

The answers for the 27 States permit us to build up the different a priori coalitions according to the ideological position. This method of building the relation space between States is based on the assumption that the way the deputies represent the preferences of the citizens is the same for each country and is not affected by differences in the national electoral systems. Moreover, we assume that there is no conflict of interest between citizens and their deputies.

Appendix B: GDP per capita 2008

To build the different a priori coalitions, we also use the GDP per capita for 2008 expressed in terms of purchasing power standards (PPS), that is expressed in a common currency that eliminates price level differences between countries.

Table 6: GDP (2008) in PPS (EU-27=100)		
1. Germany = 115	10. Greece = 93	19. Slovakia = 72
2. France = 108	11. Hungary = 64	20. Ireland = 135
3. Italie = 102	12. Portugal = 79	21. Lithuania = 62
4. United-Kingdom = 116	13. Czech Republic = 80	22. Latvia = 57
5. Spain =103	14. Sweden = 122	23. Slovenia = 91
6. Poland = 56	15. Austria = 124	24. Cyprus = 96
7. Romania = 42	16. Bulgaria = 40	25. Estonia = 68
8. Netherlands = 134	17. Denmark = 120	26. Luxembourg = 277
9. Belgium = 115	18. Finland = 117	27. Malta =77
Eurostat 2008.		