Chapter 7. A Cooperative Approach to Decision-Making in the European Union(*)

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1 Introduction

An essential ingredient of politics is winning. What counts in politics is the passing of a bill, the amendment of a proposal, getting a policy accepted, or the enforcement of a decision. However, in general, it is impossible to win by staying alone. In politics, including European politics, it is necessary to form winning coalitions in order to enforce decisions.

Surely, in any political system, individual preferences with respect to a decision-making problem will diverge. Consequently, conflict will be at the heart of politics. However, this does not mean that coalitions are not important. In order to resolve conflict in political decision-making processes, cooperation and hence coalition-formation is essential. Conflict and cooperation are different sides of the same coin. Indeed, even if conflict is so strong that no resolution is possible, coalition-formation is still essential: in the extreme, it is necessary in order to revolutionize the system itself.

Since cooperation is an essential ingredient of politics, it is evident that non-cooperative game theory, with its neglect of coalition-formation, can hardly be an adequate framework to describe and explain political processes. The cooperative approach seems to be more adequate in order to model political decision-making.[1] Hence, in this chapter, we will use cooperative game theory to analyze decision-making in European politics.

However, cooperative game theory has a serious drawback: it is mainly geared towards solving games in terms of payoff structures, not in terms of coalitions. For quite some time, political scientists have been aware of this fact (e.g. see Riker 1962)[2]. Due to this disadvantage, some authors have developed a number of coalition-formation theories, each of which is rooted in n-person cooperative game theory (for an overview, consider De Vries 1999 or Van Deemen 1997). In this chapter, we follow this theoretical line. The aim, therefore, is to model decision-making in the EU from a coalition-formation perspective.

In this chapter, we present two multi-dimensional models of coalition-formation which are closely related. Both models predict policy outcomes

[1]Noncooperative models of coalition formation are mainly focused on coalition bargaining by means of exogenous protocols (determined by some institutional rule, or randomly) and the role these protocols play to establish equilibrium coalitions and the division of coalitional payoff (Chatterjee *at al.* 1993 ; Bloch 1996; Ray and Vohra 1999). According to scholars within this branch of coalition formation theory, coalitions are the product of institutional rules and power and/or policy positions. This requires a clear picture of the structure of strategies (games in extensive form) or, in absence of the structure, only strategies (games in strategic form). The starting point of the cooperative approach is, however, that strategies are invisible and coalitions remain as the unit of analysis (Rapoport 1970). Our approach focuses in the first place on the rationale of coalition formation, *i.e.* handling conflict by proposing solution in terms of a coalition-policy combination. It hence does not aim at institutional (constitutional) analysis, which is, inter alia, the point of focus of the noncooperative perspective and of power index theories.

[2]Also see Van Deemen (1997).

and the winning coalitions that are associated with these outcomes. The basic idea of the two models is that distances between players' preferences contain information about the extent of conflict existing between them.

In the first model, the notion of the expected policy center of a winning coalition is essential. The expected policy center of a winning coalition is the convex combination of the policy preferences and the weights of its members. It is a kind of gravity center for the coalition which may be interpreted as the policy that coalition will implement when formed. Conflict in a winning coalition S is defined as the variance of the distances of the members of S to the expected policy center of S.

The second model takes another route. In this model, the notion of 'reference distance' is central. It posits that players in a decision-making committee have different, subjective notions about the level of conflict existing within a coalition. The extent of conflict depends on their interpretation of pairwise distances between their own policy position and the policy preferences of other players. This subjective conflict notion is based on two reference points for each player, namely one of absence of conflict and one of maximal conflict. This model is close to the original conflict of interest model as formulated by Axelrod(1970) [3].

The models in this chapter differ in at least two respects from more traditional theories of coalition-formation. First, coalition-formation so far mainly has been described in terms of solution concepts for spatial voting games. Among the more well-known concepts are the competitive solution, the ϵ-core, the Copeland set, the uncovered set, the yolk and the minimal response point (Owen 1995). Our models differ from these concepts in the sense that they are built on two parts, namely, a descriptive and a solution part. The descriptive part of the model focusses on the policy positions of the players, the formation of individual coalition preferences, and the rules that define winning (and hence also loosing). On the basis of the descriptive part of the model, the solution part then formulates predictions. The distinction between the solution and the description part it is due to Shubik (1982).

The second difference as compared to more traditional models of coalition-formation is that players' preferences for coalitions are taken into account. In almost any model of coalition-formation, the preferences of players for coalitions are either assumed to be exogenously given or simply neglected. In our models, by comparison, coalition preferences are treated endogenously. Both models explain the formation of individual coalition preferences in terms of their policy preferences and the expected policy positions of the coalitions that may form.

Both models are multi-dimensional elaborations and variations of the

[3] Axelrod's Conflict of Interest Theory (1970) uses a policy proximity constraint on the minimal winning coalition proposition of Von Neumann and Morgenstern (1947). Particularly, the set of permissible coalitions is restricted to those coalitions which are convex on a policy dimension. For a formal description of the theory, consider Van Deemen 1997

conflict of interest model as presented by Axelrod (1970). A discrete version of the models was developed by Van Deemen (1997). The aim of this chapter is to test the two multi-dimensional models of coalition-formation on the basis of data about decision-making and policy outcomes in EU politics.

The chapter is organized as follows. In Section 2, the basic concepts of spatial voting games and of conflict models of coalition-formation are presented. In Section 3, we discuss the research design for the application of the models to the data set. Section 4 illustrates the models on the basis of a concrete example of the decision-making process: reform of the subsidy regime for cotton producers in the European Union (EU). In section 5, the models are tested using data on EU decision-making. The final section evaluates the research results and discusses possible avenues for future research.

2 Conflict Models of Coalition-Formation

2.1 Voting Games

Our models are based on the theory of voting games. These games are discussed in more detail in, for example, Owen (1995) and Van Deemen (1997).

Consider a nonempty, but finite set N of players. Any subset $S \subseteq N$ is called a *coalition.*

Definition 1 *A* voting game *or* simple game *is an ordered pair*

$$G = (N, W)$$

where

1. *N is the set of players*
2. *W is a set of coalitions such that*
   - *$W \neq \emptyset$ and $\emptyset \notin W$*
   - *If $S \in W$ and $T \supset S$, then $T \in W$.*

Coalitions in W are called *winning*, coalitions not in W are *losing.* The set of losing coalitions is denoted by L. The first axiom implies that the game is not trivial. There is a winning coalition and the empty set is not winning. The second axiom is a monotonicity assumption. It says that adding players to a winning coalition cannot turn that coalition into a losing one.

Let S^c denote the complement of coalition S. A voting game G is

1. *proper* if $S \in W$ implies $S^c \in L$
2. *strong* if $S \in L$ implies $S^c \in W$

3. *decisive* if G is proper and strong.

A *minimal winning coalition* (MWC) is a coalition in which each member is necessary for the coalition in order to win. Formally, S is minimal winning if $S \in W$ and $S - \{i\} \in L$ for any $i \in S$. The set of MWCs is denoted by W^{min}.

In voting games, there can be a number of special players, such as veto players or dummies. A veto player forms part of every winning coalition. Formally, $i \in N$ is a *veto player* if $i \in \bigcap W^{min}$. Clearly, a veto player is necessary for a coalition to win. Any coalition without a veto player is losing. Although a veto player cannot win on its own, it can block a decision. An essential[4] game with a veto player is called weak, *i.e.* not strong, since the complement of any losing coalition with a veto player is itself losing. Several analyses applied to EU decision-making, and more specifically analyzes of a priori voting power in EU institutions, are dealing with weak games. In the Council of the EU for example, a winning coalition has to encompass 62 out of the total of 87 votes. Losing coalitions are coalitions with less than 62 votes. In most cases, their complements are not winning. For such analyzes, e.g. see Hosli (1993), Hosli (1995) or König and Bräuninger (1998).

A dummy is a player who is in no MWC. Formally, i is a *dummy* if $i \notin \bigcup W^{min}$. Hence, a dummy player can never render a losing coalition winning or vice versa. In this sense, it is a powerless player. An example in European decision-making is Luxembourg in the first constellation of membership in the EU: it held just one vote, whereas the other Benelux countries had 2 and Germany, France and Italy 4 votes. The qualified majority threshold being 12 out of 17 votes, Luxembourg could never turn a winning coalition into a losing one or vice versa. See, among others, Brams and Affuso (1985) and Hosli (1993).

An important class of voting games are *weighted voting games.* Let $w_i \geq 0$ denote the weight assigned to player $i \in N$. A *weighted voting game* is an $n+1$ tuple

$$(q; w_1, w_2, \ldots, w_n)$$

where q denotes a threshold. A coalition S is winning if the sum of the weights of its members is at least as large as the threshold q. Formally:

$$S \in W \Leftrightarrow \sum_{i \in S} w_i \geq q.$$

In some instances, different thresholds may apply simultaneously. This will be true, for example, for decision-making in the Council of the EU after

[4]In an essential game, players have an incentive to form coalitions. Its counterparts, an inessential or dictatorial game, contains a dictator, *i.e.* a player who does not need other actors to win. Thus, the solo-coalition of a dictator is the minimal element of W. Clearly, dictatorial games are strong.

ratification of the Treaty of Nice. E.g. see Hosli (2000), Hosli and Van Deemen (2002), Felsenthal and Machover (2001), or Leech (2003). Evidently, a weighted voting game belongs to the category of voting games.

2.2 Spatial Voting Games

An m-dimensional spatial voting game G is a voting game together with n points θ_i, $i \in N$, in an m-dimensional Euclidean space R^m. Formally,

Definition 2 *A spatial voting game G is an ordered triple*

$$G = (N, W, \{\theta_i\}_{i \in N})$$

where

1. *$G = (N, W)$ is a voting game*
2. *$\theta_i \in \mathbb{R}^m$ where $\mathbb{R}^m$ is an m-dimensional Euclidean vector space.*

Points in $\mathbb{R}^m$ are termed *policy points.* Point θ_i is the *ideal point* or *bliss point* of player i. Spatial voting theory is used frequently in both political science and economics. Helpful expositions of the theory are Enelow & Hinich (1984), Hinich & Munger (1994) and Owen (1995).

There are neither theoretical nor empirical reasons to use the Euclidean norm. However, currently, the Euclidean is the standard norm. We are not aware of literature in political science or in economics using alternative norms.[5]. Define

$$n(x, y) = \{i \in N : d(\theta_i, x) < d(\theta_i, y)\}$$

and

$$n(x \sim y) = \{i \in N : d(\theta_i, x) = d(\theta_i, y)\}$$

where d denotes Euclidean distance. A policy point x *dominates* policy point y if $n(x, y) \in W$. A point x is *undominated* if there is no other point y that dominates x. The *core* of a voting game G, denoted $Core(G)$, is the set of undominated points.

As is well-known, a necessary and sufficient condition for the existence of a nonempty core for a spatial voting game is the existence of a median hyperplane in all directions. That is, all median hyperplanes have to pass through one same point (Davis, DeGroot and Hinich 1972, Owen 1995) . Since this condition is very demanding, the core of a spatial voting game will, in general, be empty. In order to meet the problem of the emptiness of the core, a number of other solution concepts have been developed for spatial voting games. For an excellent review of these solution concepts, consider Owen (1995).

[5]'Distance' can also be measured in other terms, for example on the basis of Hamming distances. For an example, see Van Deemen and Hosli (1999).

2.3 Theory of Conflict

The conflict models of coalition-formation presented in this chapter will use the theory of spatial games as a point of departure. The assumption used in these models is that the larger the distance between two points in policy space, the larger is the extent of conflict among players advocating these points.

We assume that conflict occurs over a number of issues which can be represented as continua on which decision-makers have single-peaked preferences. Since conflicts are an important determinant of the coalitions to be formed, we will associate an issue space to the formation game. In this issue space, players report to each other their most preferred positions on the issues constituting the decision-making problem. We denote this set of issues within a decision-making situation by $M = \{1, 2, \ldots, m\}$, where $m \in M$ and with a, b as typical elements. In some collective decision-making situations, players must decide on only one issue ($m = 1$), whereas in other situations, they decide on a set of issues ($m > 1$). Each of these issues can be seen as a major controversial point among the players. In other words, issues are specific policy questions on which players take different positions and which consist of at least two policy alternatives placed on a one-dimensional policy scale. The status quo and the actual outcome of decision-making can also be located as points in an m-dimensional space with metric properties.

In spatial voting games, the set of alternatives corresponds to an m-dimensional subset of the Euclidean space and the committee's task is to choose a point in this subset (McKelvey et al. 1978). The idea is that we use a limited number of independent dimensions to describe objects (locations) that could serve as the outcome of the decision-making situation. If we denote the set of alternatives on an issue a by X_a, then the issue space is given by the Cartesian product

$$X^m = \prod_{a=1}^{m} X_a.$$

Defined in this way, X^m is a subset of $\mathbb{R}^m$.

This description is necessary in order to clarify the structure in which decision-making takes place. The basic idea of our models is that conflict among individual players, or among players and coalitions, is the degree of dissimilarity of their preferences. Hereby, dissimilarity will be defined in terms of policy distances. Situations of conflict, evidently, arise when two interacting players cannot simultaneously attain their most preferred policies (Axelrod, 1970). In order to find coalitions with the lowest conflict index, and hence to predict the occurrence of certain coalitions, a spatial conflict index has to be defined.

2.4 Conflict Indices

Consider a spatial voting game $G = (N, W, \{\theta_i\}_{i\in N})$. A conflict index assigns to each subset of $\{\theta_i\}_{i\in N}$ a real number indicating the extent of conflict among the players concerned. A conflict index must satisfy at least two conditions: first, it cannot be negative. Second, if a subset of players take identical positions, then there is no conflict within their coalition, that is, the conflict index for this coalition must be zero (see Van Deemen 1997, Chapter7).

Definition 3 *A conflict index C is a mapping from the power set of $\{\theta_i\}_{i\in N}$ into the set of real numbers such that for all $S \subseteq N$:*

1. $C(\{\theta_i\}_{i\in S}) \geq 0$,
2. $C(\{\theta_i\}_{i\in S}) = 0$ *if for every* $i, j \in S : \theta_i = \theta_j$.[6]

The real number $C(\{\theta_i\}_{i\in S})$ is called the conflict index of S. For convenience, we write $C(S)$ instead of $C(\{\theta_i\}_{i\in S})$.

Of course, other axioms can easily be added. Defined in this way, many conflict indices are possible in practice.

The two models we present here each elaborate conflict in their own particular way. The first model uses the concept of the expected policy center of a coalition, which is a convex combination of the policy positions and the weights of the players in that coalition. It is a kind of 'focal point' for the players. Clearly, the dispersion of the policy positions of the players in the coalition around its expected policy center can be interpreted as the extent of conflict existing within the coalition. Hence, a suitable measure for the extent of conflict is the variance of the policy positions with respect to the expected policy center of a coalition.

Definition 4 *The expected policy center θ_S of a coalition $S \subseteq N$ is the vector*

$$\frac{\sum_{i\in S} w_i \theta_i}{\sum_{i\in S} w_i}.$$

[6]The second condition of our conflict index is only a sufficient condition. In the conflict model based on the variance conflict index (see Definition 5 below), certain configurations of bliss points allow players with different ideal points to form coalitions with zero conflict. As an example, consider a 3–player simple majority game with $N = \{1, 2, 3\}$. Suppose that there is only issue, and players differ only with respect to their policy position: $\theta_i = 0$; $\theta_j = 100$. Then, according definition 4, $\theta_{\{i,j\}} = 50$. It is easy to observe that: $d(\theta_i, \theta_{\{i,j\}}) = 50$ and $d(\theta_j, \theta_{\{i,j\}}) = 50$. The average of these d's is 50, and therefore the variance of these d's is zero. The variance conflict index reflects the differences in the extent to which the several members had to "give in" with regard to their most preferred policy position in order to achieve the coalition's policy center.

Evidently, if players exert different degrees of influence on the various issues that shape the decision-making situation, w_i is no longer a scalar, but an m-vector $(w_{i1} \cdots w_{im})$ instead. In accordance with this, the policy center of a coalition S is the vector θ_S such that for all $a \in M$, $\theta_{Sa} = \frac{\sum_{i \in S} w_{ia}\theta_{ia}}{\sum_{i \in S} w_{ia}}$.

The expected policy center of a coalition, hence, is the balance point where the momentum (weights times distances from the center) is zero, *i.e.* where $\sum_{i \in S} w_i(\theta_i - \theta_S) = 0$. Certainly, the concept of the expected policy center is also applicable to one player ('solo coalition') or to two players. In the case of one player, the center simply is the policy position of this player. Furthermore, it can be proven that in the case of two players i and j, the center lies on the line segment connecting the policy positions θ_i and θ_j. In general, we have the following proposition:

Theorem 1 *The expected policy center θ_S of a coalition S in an $\mathbb{R}^m$ space is on the hyperplane spanned by the ideal points of the members of that coalition.*

As mentioned above, a conflict index can now be defined as the variance of the weighted Euclidean distances of all members of a coalition to the policy center of that coalition:

Definition 5 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial game. Let $S \subseteq N$ be a coalition and θ_S be the policy center of coalition S. Let $d(\theta_i, \theta_S)$ denote the Euclidean distance between player i and coalition S. The* variance conflict index *of S, $\sigma(S)$, is*

$$\sigma(S) = \frac{\sum_{i \in S}(d(\theta_i, \theta_S) - \sum_{i \in S} d(\theta_i, \theta_S)/|S|)^2}{|S|}$$

Here, $|S|$ denotes the number of players in S. It can be verified that this definition satisfies the conditions for a conflict index as defined above.

The second model we use in this chapter is closer to Axelrod's original model of conflict of interest (see Axelrod 1970, also cf. De Swaan 1973). It is based on the notion of 'conflict range'. In contrast to the first model outlined above, this model allows for conflict to be a non-symmetric measure. Players in this second model may have different perceptions about the extent of conflict existing between them.

In order to determine the extent of conflict between two players, we formulate two reference points. Each reference point visualizes an extreme situation, namely, one of maximal conflict and one of absence of conflict. Clearly, situations of conflict arise when two interacting players cannot attain their most preferred points simultaneously (Axelrod, 1970). Defined in this way, player i finds herself in a situation of maximal conflict with another player j if that player takes a policy position θ that is the most distant within the policy space. The line segment connecting the bliss points of i and j is the set of Pareto optimal agreement points. This is the region of the policy space where the interests of i and j are strictly opposed to each other. Assuming single-peaked preferences, utility losses will be smaller the closer players are to each other, that is, the smaller is the region of the conflict of interest.

Definition 6 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial game. Let $i, k \in N$ be players and θ_i and θ_k be their ideal points. Let $d(\theta_i, \theta_k)$ denote the distance between player i and player k. The* maximal conflict reference distance *(MaxCRD) for player i is defined as*

$$MaxCRD_i \equiv \max_{k \in N}\{d(\theta_i, \theta_k)\}$$

The other reference point is the policy position of the ideal coalition partner for player i. Being rational, player i wants to establish a policy outcome θ as close as possible to her own policy position θ_i. Then, i's ideal coalition partners would be the set of players with the exact same position in the policy space as player i herself has. In other words, it is expected that player i has no conflict with players that take the same position as player i does. The distance between a player's bliss point and the reference point MaxCRD can be interpreted as the range of possible conflict for a player in the game. Using this conflict range and the players' capabilities to influence decision outcomes, we can determine the extent of conflict between any two players in the game.

Definition 7 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial game. Let $i, j \in S \subseteq N$ be players and let θ_i and θ_j be their ideal points. Let $MaxCRD_i$ denote the maximal conflict reference distance for player i and let w_j denote the weight of player j. Then the extent of asymmetric* conflict *player i experiences with player j is defined as:*

$$\rho(i,j) = \begin{cases} 0 & \text{if } \max_{k \in N}\{d(\theta_i, \theta_k)\} = 0 \\ w_j \frac{d(\theta_i, \theta_j)}{MaxCRD_i} & \text{otherwise.} \end{cases}$$

Note that the definition of asymmetric conflict of player i with j weights the relative distance between i and j by the size of j. This takes account of the fact that a player i, who evaluates two equidistant players j and k, will experience more conflict with the more influential player of the two (defined in terms of capabilities), because this player will have a larger potential to shift the decision outcome towards his or her own bliss point.

As a consequence of the subjective evaluation of pairwise distances, players may have different evaluations regarding the extent of conflict in a coalition. This leads to the following definition of subjective coalition conflict — the extent of conflict a certain player experiences within a coalition.

Definition 8 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial game. Let $i, j \in S \subseteq N$ be players and let $\rho(i,j)$ be the asymmetric degree of conflict player i experiences with player j. Then,* subjective coalitional conflict *of player i with regard to S is defined as:*

$$\rho_i(S) \equiv \sum_{i \in S,\ i \neq j} \rho(i,j)$$

Regarding the extent of conflict among a set of players, we assume that conflicts with larger player are more important than those with smaller players (Axelrod, 1997). The total extent of conflict within a coalition is the weighted sum of the subjective extents of conflict experienced by its members. Formally,

Definition 9 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial game. Let $i \in S \subseteq N$ be a player and let be $\rho_i(S)$ be i's subjective coalitional conflict and let w_i denote the weight of player i. Then, the* maximum reference distance conflict index *of S is defined as:*

$$\rho(S) = \sum_{i \in S} w_i \ \rho_i(S)$$

The idea behind weighing the extent of conflict by the size of players is as follows. When members of a coalition have to reach a final decision, they all want to establish an outcome as close as possible to their own preferred positions. Clearly, the larger the weight of a player, the more power this player will have to shift the outcome into the direction of its most preferred outcome. An influential player will only be accepted as a coalition member if her position is not too far away from that of the other players; otherwise she could shift the outcome too strongly into the direction of her preferred position. By comparison, a less influential player with the same peripheral position in the issue space will be accepted more easily, because she does not possess the same leverage to shift the outcome in her favor.

2.5 Models of Conflict: Description

Subsequently, we elaborate the descriptive part of the conflict model. The model is based upon a number of assumptions: first, coalition-formation takes place in a setting that may be modelled by means of spatial games. Second, each actor has complete information about the policy positions, capabilities and salience of all actors involved in the decision-making process. Third, conflict in a coalition can be measured by means of a conflict index. Fourth, there is a behavioral rule stating that each actor strives to be a member of a minimal conflict coalition. Note that we formulate the descriptive part of the models generically in terms of C. The advantage of this general approach is that we do not need to specify the several models for each separate conflict index.

The coalition preferences of the players will be based on both perspectives for winning and the extent of conflict existing within the coalitions. Let $W_i = \{S \in W : i \in S\}$.

Definition 10 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial voting game, $S, T \in W$, $i \in N$ and let C be a conflict index.*

1. *i* strictly prefers *S to T, notation $S \succ_i T$, if*
   (a) *$S, T \in W_i$ and $C(S) < C(T)$; or*
   (b) *$S \in W_i, T \notin W_i$*
2. *i is* indifferent *between S and T, notation $S \approx_i$, if*
   (a) *$S, T \notin W_i$; or*
   (b) *$S, T \in W_i$ and $C(S) = C(T)$.*
3. *i weakly prefers S to T, notation $S \succeq_i$, if $S \succ_i T$ or $S \approx_i T$.*

Part (1a) of the definition states that if a player is a member of two winning coalitions, she will prefer the winning coalition with the lower conflict index. Part (1b) states that a player prefers a winning coalition to any coalition T she does not belong to. Clearly, $\succeq_i$ is complete and transitive for every $i \in N$. Therefore, the set M_i of $\succeq_i$-maximal choices, that is, the set of all coalitions for which there are no better ones for player i, is not empty.

2.6 Models of Conflict: Solutions

In order to determine a solution for a spatial voting game in terms of coalitions and their policy positions, we have to determine a dominance relation among the coalitions. We do this by investigating the preferences of the members only in the intersection of two coalitions. The members of the intersection of two coalitions are called 'critical players'. Hence, we only analyze the coalition preferences of the critical players, an idea due to McKelvey et al.(1978). By the definition of individual coalition preferences we know that if S and T are both winning coalitions, then $\forall i \in (S-T) : S \succ_i T$ and $\forall i \in (T-S) : T \succ_i S$, hence the preferences of the critical players are decisive.

For the formation of coalition S, the non-critical players in $S-T$ (the non-critical players in S) are dependent on the critical players' choice of coalition. Coalition S is viable against T if there is at least one critical player that weakly prefers S to T. From this, it follows that coalition S is not viable against T if *all* critical players find coalition T strictly better than S. Or equivalently: coalition S is *viable* against T if it is *not* the case that *all* critical players have a strict preference for T. Two coalitions S and T are *mutually viable* if S is viable against T and vice versa. From this, it follows that one indifferent critical player is sufficient to make the two coalitions it belongs to viable against each other. Finally, we define *strict viability* of coalition S against T as a situation where coalition S is viable against T but not vice versa. In this case, all critical players have a strict preference for S. More formally, we define:

Definition 11 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a spatial game and let $S, T \in W$.*

1. *A coalition S is* viable against *a coalition T, notation $S \trianglerighteq T$, if there are players $i \in S \cap T$ such that $S \succeq_i T$.*
2. *A coalition S is* strictly viable against *a coalition T, notation $S \triangleright T$, if $S \trianglerighteq T$ but not $T \trianglerighteq S$.*
3. *Coalitions S and T are* viable with respect to each other, *notation $S \doteq T$, if $S \trianglerighteq T$ and $T \trianglerighteq S$.*

As usual, we take the set of $\trianglerighteq$−maximal elements as the prediction set.

Definition 12 *The* coalition core *of a spatial game $G = (N, W, \{\theta_i\}_{i \in N})$, notation $Core^{mc}(G)$, is the set of $\trianglerighteq$−maximal elements of W. That is,*

$$Core(G) = max(W, \trianglerighteq) = \{S \in W : \neg \exists T[T \trianglerighteq S]\}.$$

An element of core(G) is called a core coalition.

Clearly, no individual player or coalition of players can improve upon a core-coalition. It now remains to prove under which conditions a core-coalition as defined above exists for a spatial game. The next theorem states that if we are dealing with a proper spatial game, the coalition core will not be empty.

Theorem 2 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a proper spatial game. Then $Core^{mc}(G) \neq \emptyset$.*

The proof of this theorem is based on Van Deemen (1997, p.203).

Definition 13 *Let G be a spatial game and let C be a conflict index. A coalition is a* minimum conflict coalition *in G if $\forall T \in W : C(S) \leq C(T)$. The set of all minimum conflict coalitions in G is denoted by $W^{mc}(G)$.*

Theorem 3 *Let $G = (N, W, \{\theta_i\}_{i \in N})$ be a proper spatial game. Then*

$$Core^{mc}(G) = \quad W^{mc}(G)$$

Again, the proof of this theorem follows the proof given in Van Deemen(1997, p.202). According to this theorem, in order to compute the coalition core of a game, it suffices to calculate the conflict index for every coalition and subsequently, to determine the coalitions with the smallest index.

The core solution as presented here, however, is not the only applicable solution concept. Another possibility is, for example, to use the Nash Bargaining Solution (NBS). According to this approach, the solution is based on the maximum of the products of individual utilities for coalitions. However, in order to use this concept, we would need to be able to represent coalition preferences on an interval measurement level.

3 Research Strategies and Design

This section describes the research design for the application of the cooperative models used in this chapter. For most parts, the design is based on the general research design for this book, as described in Chapter 2 of the volume. Hence, we will subsequently mainly focus on a number of additional assumptions needed in order to apply the cooperative approach to the common DEU data set. First, we will define the set of winning coalitions under each of the legislative procedures and Council voting rules. We also discuss the capabilities of the actors to influence the outcome of decision-making, and how we will deal with indifferent actors.

3.1 Winning Coalitions in EU Decision-Making

The cooperative approach to EU decision making is strong, but simple: it takes into account the preferences of actors and their capabilities and salience, but it does not consider other bases of power, such as the capacity to set the agenda (*i.e.* to make suggestions on the basis of own preferences that make the realization of the preferences of others more difficult). Incorporation of such forces might make the picture more realistic, but also more difficult and messy to analyze.

In our cooperative approach to EU decision-making, we do not focus on procedural legislative aspects, but mainly on the question *whether it is numerically possible for some set of players to form a winning coalition.* The question *how to coordinate strategies* is beyond the scope of our approach as presented here. Expressed in simple terms, this means that we focus on the question 'whether a set of players is able to approve a legislative proposal, should its members wish to do so'. How and at which point in the legislative process they reach such an agreement (*i.e.* form a coalition), is beyond our concern here.

Each of the legislative proposals in the common data set is subject to one of the following procedures and requirements:

Consultation QMV: QMV in the Council in order to adopt a Commission proposal, unanimity in the Council in order to amend a Commission proposal.
Consultation Unanimity: unanimous vote in the Council in order to adopt or amend a Commission proposal.
Codecision QMV: proper coordination of the action of the EP and the Council may lead to the adoption of a legislative proposal. In this case, Council needs a qualified majority in support of the proposal, whereas EP needs a simple majority.
Codecision Unanimity: proper coordination of the action of the EP and Council may lead to the adoption of a legislative proposal. In this case, Council needs unanimity, whereas EP needs a simple majority.

In each one of these procedures, the Commission is a part of every minimal winning coalition, *i.e.* it is a veto player. In principle, this description allows us to define the set of winning coalitions for these four procedures. The following observations are important, however. If a legislative proposal is subject to the consultation procedure with QMV, the EP is always a dummy player, whereas under the co-decision procedure, both the EP and the Commission are veto players. In reality, the Treaties specify the conditions under which the EP can exercise its veto power, on the basis of simple majority votes. But unfortunately, we cannot model the subgame within the EP, because our data set does not contain information on the policy positions of the various party grouping in the EP: it only contains information on the position of the EP as an entity. Hence, accordingly, we will treat the EP as a unitary actor in our analysis.

3.2 Solutions to the Problem of Indifferent Actors

Another limitation of the DEU data set is that for some of the decision-making situations, the data set does not include specific information on the policy positions of the main actors (on this issue, also see the general research design chapter of this book). The importance of indifference regarding the outcome emerges from the fact that the combination of an actor's issue positions, and the importance she attaches to these issues, indicate her interest for the decision outcome. Moreover, the combination of the actor's capability to achieve her policy preference and the salience she attaches to an issue determine the effective influence she exercises on the outcome of this issue. That is, the more salient an issue is to an actor, the more she will employ her resources to influence the decision outcome. Therefore, an actor's weight in Definition 3 will be defined as the product of her capability and her salience.

Activeness and inactiveness — the formulation or not of a policy position — on the one hand, and interest or the lack of it on the other, lead to the following classification of actors: an actor who does not take a position on an issue and does not attach any salience to it may be described as a 'normal' indifferent actor. This actor does not care what the outcome is on the issue at hand. Moreover, she may not even recognize the issue as such. Instead, if the actor attaches some salience to an issue, she recognizes that it needs to be resolved, independent of *how* this will be done.

An actor taking a position, but not attaching salience to it, considers it to be unimportant that this issue be resolved. Regarding the outcome, the actor itself is not indifferent, but she does not care whether there is an outcome on the issue at all. However, this situation, although certainly possible in practice, does not occur in the common data set. The most common situation, generally, is one in which an actor takes a position and attaches some salience to it.

For the cooperative models we test in this chapter, indifferent actors need not constitute a problem, however. First, it is important to note that indifference of an actor is defined in relation to the outcome of a certain issue, and not with respect to a policy point (which constitutes a vector of issue positions). An actor is indifferent regarding a policy point when she is indifferent with respect to all issues that make up the respective decision-making situation. Formally, let M be the set of issues constituting a decision-making situation. Let $K_i \subseteq M$ be the set of issues player i is indifferent about (not precluding the possibility, of course, that $K_i = \emptyset$). Two different situations are then relevant:

situation 1: $K_i = M$: player i is indifferent on *all* issues, *i.e.* indifferent regarding the policy outcome;

situation 2: $K_i \subseteq M$ but $K_i \neq M$: player i is not indifferent on all the issues at stake.

How do the conflict models deal with these two situations in cases when there is some difference among them? In the case when a player is indifferent regarding *all* issues in the game, and therefore indifferent with respect to the policy outcome of the game, it is assumed that she will not have an incentive to block legislation (or give its support to any coalition of players). Nor will she exert any influence in an attempt to shift the policy outcome in any specific direction. Therefore, we will simply exclude such a player from the game[7].

[7]We will do this by reducing the winning threshold of the game by the sum of the weights of the players that are indifferent with regard to all issues, and by setting their formal voting weights to zero. This way, the indifferent players are transformed into 'dummy players'. They should not be conceived as powerless players, however, but rather as players who have no incentive to exert any power in the game. Consider a situation where 15 players have to come to an agreement on a decision-making problem by, for example, unanimity, and that one of them is indifferent regarding the outcome. The 14

Second, a player can be indifferent regarding some issues, but not regarding all of them. Analytically, this means that this player is interested in some parts of the decision outcome, *i.e.* the issues that are salient to her. We assume that indifferent actors do not exercise any influence on the establishment of a position on any of the issues (as part of the policy position) on which they are indifferent. For example, let $M = \{a, b, c\}$ and i,j,$k \subset N$, and $K_i = \{a\}$ and $K_j = K_k = \emptyset$. Then only the saliences, capabilities and positions of players j and k will be taken into consideration when we calculate the position on issue a (as part of the policy position) of $\{i,j,k\}$ in the *Variance of WEDs Model.*

Subsequently, the distances between the policy center of a coalition and the members' bliss points, which are key determinants for the measurement of conflict in the *Variance of WEDs Model*, are based on the issues that are salient for the respective players. In our example, this means that the distance between θ_i and $\theta_{\{i,j,k\}}$ is calculated on the basis of the positions of i and $\{i,j,k\}$ on issues b and c (evidently, in combination with the salience i attaches to these issues). In the *MaxCRD Model*, the conflict index of a coalition is based on the subjective coalitional conflict indices of its members. To compute the subjective indices, we need to calculate the maximal conflict reference distance. If we want to determine the maximum conflict index for an actor i who is indifferent with respect to some issues, we only take into account distances on issues that are salient for i and for each of the other players. (Note that this does not preclude the possibility of asymmetrical pairwise conflict indices). For example, let $M = \{a, b, c\}$ and i,j,$k \subset N$, and $K_i = a$, $K_j = b$, and $K_k = \emptyset$. In order to determine the maximal conflict reference distance for player i, we evaluate the distances between i and j on issue c (i is indifferent regarding issue a, whereas j is indifferent regarding b), and the distances between i and k on issue b and c (i is indifferent regarding issue a, whereas k is not indifferent regarding any of the issues at stake). If $K_i \cup K_j = M$, *i.e.* if there are no issues on which the distances between i and j may be calculated, then we assume that there is no conflict of interest between i and j.

players who are not indifferent assume that when it comes to a vote on the outcome during the last meeting of the decision-making committee, the indifferent player will go along with them (after all, this player was indifferent). Via backwards reasoning, the '14' know that they have to reach an agreement among themselves before the last meeting. Therefore, the weighted voting game could be modelled by a 15-tuple $[14; 1, 1, \cdots, 1]$ where each player holds equal voting weight. In the terminology of simple game theory, the 15^{th} player — the indifferent player — is not a powerless player, because he has the same formal voting weight as the other players, but he will never use this 'veto power' because of the very fact that he is indifferent.

3.3 The Measurement of Capabilities

With respect to the determination of a policy center of a coalition which could serve as the final policy outcome of the game, we assume that the capabilities of the stakeholders to influence the decision outcome depend on the membership composition of winning coalitions. In particular, we use the Shapley–Shubik indices of the stakeholders as an estimate of their capabilities. As regards the treatment of indifferent actors, we assume that stakeholders that are completely indifferent regarding the policy outcome have no capability to influence the decision outcome, since they are simply excluded from the game.

Besides exclusion from the game as a consequence of indifference regarding the policy outcome, players might also be excluded because they have no formal voting rights in some of the decision-making situations[8] In these cases, we have adjusted the structure of the games by setting the voting weight of the players without voting power to zero, and by reducing the winning threshold by the number of votes held by the excluded players. Subsequently, the capabilities of the stakeholders were estimated by calculating Shapley–Shubik indices within the structure of the adjusted voting game.

4 Case Study: Production Aid for Cotton

In this section, we will apply the conflict models to the legislative bargaining which occurred over a Commission proposal for a Council Regulation on production aid for cotton, introduced at the end of 1999. In the preceding years, the world price for cotton had fluctuated greatly and the price was low when the Commission proposal was introduced. In situations of low world prices, cotton producers have to receive relatively large subsidies in order to bring the price they receive up to the level of a guaranteed price. The general aim of the Commission proposal was to keep expenditures for the cotton regime under control, and to protect the environment by means of a number of measures designed to curb environmental damage and discourage the emergence of a mono-culture in some regions of the world.

The revision of the cotton aid regime the Commission envisaged was

[8]In our data set there are three decision-making situations where some of the stakeholders indeed do not possess voting power: in COM(2000)27 — Proposal for a Council Regulation listing the third countries whose nationals must be in possession of visas when crossing the external borders and those whose nationals are exempt from that requirement — *Denmark, UK*, and *Ireland* have no voting power, whereas in COM(2000)303 — Proposal for a Council Regulation listing the third countries whose nationals must be in possession of visas when crossing the external borders and those whose nationals are exempt from that requirement — and COM(1999)686 — Proposal for a Council Proposal Creating a European Refugee Fund — this is the case for *Denmark*. All three of these proposals were subject to consultation and unanimity.

based on increased penalties for exceeding the National Guaranteed Quantities (NGQs) allotted to producing countries, while the guide price level would be kept constant, as well as the level of NGQs. The penalty rate is the percentage of the guide price by which aid is reduced if the NGQs are exceeded by 1%. The Commission proposed to increase the penalty from 0.5% to 0.6%. This means that if NGQs were exceeded by 1%, the guide price would be reduced by 0.6%.[9]

Legislative bargaining on this proposal mainly focused on two aspects: *the level of the penalty rate*, which is the percentage of the guide price by which aid is reduced if NGQs are exceeded by at least 1%, and the *level of the NGQs*, which at the time of the introduction of the proposal were set at 782 K tonnes for Greece and 249 K tonnes for Spain. The underlying reasons for disagreement on these issues were that the decision outcomes would affect the amount of subsidies to be received by cotton producing countries (Spain, Greece, and to a more limited extent, Portugal). The environmental aspects of the proposal did not feature in the issues as specified by the interviewed experts, however.

On the first issue, four distinctive policy positions can be defined, ranging from the reference point of a 50% penalty to a 100% penalty in case NGQs would be exceeded. These positions were scored as 0 and 100 by the experts. In between, and closer to the reference point, experts scored the Commission proposal of a 60% penalty as lying at position 20 and a 70% penalty at position 40. Greece and Spain, supporting the reference point, certainly acted on the basis of domestic self-interest: Portugal supported this position largely in order to secure an eventual future development of domestic cotton production. Portugal only had one domestic cotton producer, who conducted its processing in Spain, however. During the stage of legislative bargaining, Portugal did not face penalties and therefore, regarded this issue as of low importance regarding its own priorities.

The Commission held the preference it did largely due to a desire to find a balance regarding the interests of the cotton-producing countries and its own concern to keep the EU's agriculture budget under control. In the stage before the proposal was introduced, the Commission provided calculations indicating that penalty rates lower than 70 per cent would lead to an increase in budgetary expenditure if the NGQs remained unchanged.

[9]As an illustration, consider the following computation example: according to the Commission proposal, if the national quantities are exceeded by 1%, aid will be reduced by 0.6% of the guide price (instead of 0.5% as in the past). The guide price for cotton is set at 1.063 per tonne. The NGQ for Greece, together with Spain, the only cotton producing member state in the EU, is 782.000 tonnes. Currently Greece overruns its NGQ, penalties are imposed. Now suppose Greece's actual production is 1.275.000 tonnes, which is an overrun of 493.000 ton or 63% percent of its NGQ. If a penalty of 0.5% is set, this means that under the regime, the Commission proposes that the guide price be reduced by 63% x 50% = 31,5%. The reduced guide price then becomes 1.063 - (31,5% x 1.063) = 1.063 - 335 = 728 euro per tonne.

Because Spanish and Greek DGs pressed the Commission to lower their initial penalty rate of 70%, emphasizing the economic and social importance of cotton production in the regions producing it, the Commission proposed a penalty rate of 60%. EU states who argued for an increase in the penalty rate — especially those located in the EU's North — did so because of the argument of budget neutrality.

The EP, however, did not agree to increase the co-responsibility levy by 20% — from 50% to 60% of the overshot — as it had been suggested by the Commission. Instead, the EP argued that the percentage reduction in the guide price applying at the time the proposal was introduced had proven to be an effective budget stabilizer and enabled Community cotton production to be maintained despite major fluctuations in world market prices for cotton fibre. In addition, an increase in penalties would force the smallest holdings to go out of business, thus causing social hardship, while, paradoxically, expenditure would rise due to the fact that prices paid increase when production decreases.[10]

The issue of NGQs was raised by Greece and Spain, who claimed that their current NGQs were set at a time when a particularly bad harvest for cotton had occurred, and that the NGQs did not reflect real production capacity. The Commission, however, stated that NGQs were assessed on the basis of three normal harvest years. The other EU states supported the position of the Commission on the issue.

The EP was opposed against maintaining the status quo. It argued that NGQs should be increased in order to bring them up to the level at which actual production stabilizes (1200 K tonnes in Greece and 300 K tonnes in Spain). According to the EP, the imbalance between those amounts and NGQs in effect was the key cause for the structural penalties [11].

As indicated above, cotton is produced in two EU countries only: Spain and Greece. These two countries were certainly not enthusiastic about the reforms envisaged for the cotton sector. Although other EU member states could easily have outvoted them, since the proposal was subject to the decision rule of QMV, the Council demonstrated its tendency to account for the concerns of individual member states and aimed at reaching a decision by consensus. All the experts interviewed for this proposal stated that this behavior of the Agriculture Council is rather common in situations in which some individual states hold pronounced interests. This is mainly due to the fact that other member states realize they may have to draw on the support of these states in future negotiations on agricultural production on issues in which they, in turn, may have special concerns ("log-rolling").

Until the end of the decision-making process, Spain still opposed the Commission proposal, despite the fact that a large majority of member

[10] Session document A5-0022/2001

[11] Session document A5-0022/2001, p.11

states favored the suggested reforms of the cotton sector. Hence, it tabled an alternative proposal: the proposal aimed at a 50% penalty rate for production between 1.031.000 tonnes and 1.600.000 tonnes, and an increase of 1% per amount of 20.000 tonnes above 1.600.000 tonnes. Basically, this proposal was equal to the status quo, as long as production would not exceed 1.600.000 tonnes.

Analyzing the configuration of policy positions on this issue, we can observe a large group of actors taking more or less the same positions regarding both of the issues: on the first issue, they either supported the 60% penalty as proposed by the Commission, or the suggestion of a somewhat larger penalty of 70%. Regarding the level of the NGQs, all of them supported the Commission proposal, which was equal to the reference point. The coalition of these ten actors (the Commission, Belgium, Germany, France, Ireland, Italy, Luxembourg, Austria, Finland, and the UK) did, however, not have the required legislative majority to get a common policy position accepted: the coalition includes nine member states with a total number of 57 votes. In order to be winning, this coalition needed support of a number of member states with a total weight of at least 5 votes.

One possible solution to achieve this aim would have been to include Portugal into this coalition. The inclusion of Spain or Greece was less likely, however, because of their rather extreme positions on both issues. Portugal, by comparison, only took a different position regarding the issue of the penalties. The same held for the Netherlands, Denmark and Sweden, who each strived for maximum penalties, while favoring maintenance of the status quo regarding the NGQs.

Let us illustrate the respective coalition-formation process and subsequent calculations on conflict indices. Inclusion of Portugal leads to a minimal winning coalition with a policy center of (24.09, 0). To illustrate how this policy position is obtained, the following information regarding the issue positions, saliences and capabilities of all actors is relevant:

According to Definition 3, the policy center of the above mentioned 10-member coalition plus Portugal, which we will denote by S, is a vector θ_S, such that

$$\theta_{S1} = \frac{w_{COM1}\,\theta_{COM1} + \cdots + w_{UK1}\,\theta_{UK1}}{w_{COM1} + \cdots + w_{UK1}}$$

and

$$\theta_{S2} = \frac{w_{COM2}\,\theta_{COM2} + \cdots + w_{UK2}\,\theta_{UK2}}{w_{COM2} + \cdots + w_{UK2}}.$$

The extent of influence the Commission exerts on the first issue, w_{COM1}, is estimated here by the product of its power in the game, approximated by its Shapley–Shubik index of 0.310299, and the salience it attaches to the first

Table 1: Positions, Saliences and Capabilities in an Illustrative Case

stakeholder	position issue 1	position issue 2	salience issue 1	salience issue 2	capabilities
Commission	20	0	90	80	0.310299
Belgium	40	0	90	80	0.037683
Denmark	100	0	90	80	0.024230
Germany	20	0	90	80	0.080979
Greece	0	100	50	70	0.037683
Spain	0	100	50	70	0.066210
France	20	0	90	80	0.080979
Ireland	20	0	90	80	0.024230
Italy	20	0	70	70	0.080979
Luxembourg	40	0	90	80	0.014107
Netherlands	100	0	90	80	0.037683
Austria	40	0	90	90	0.031023
Portugal	0	0	70	70	0.037683
Finland	40	0	90	80	0.024230
Sweden	100	0	90	80	0.031023
UK	40	0	90	80	0.080979
EP	0	100	90	50	0

issue, namely 90. Similarly, for the second issue, its influence is estimated by the product 0.310299×80.

This allows us to derive the policy center of the above-mentioned coalition, which is (24.09, 0). For each actor in S, we can subsequently compute the Euclidean distance to the policy center, and obtain both the average weighted distance to the policy center and the variance of this distance, which can serve as an estimate of the conflict level of a coalition (see the section on conflict indices above). For this decision-making situation, the coalition mentioned above is the coalition with minimal conflict in the sense that the variance of the distances to the policy center are minimal. According to Theorem 3, a core coalition is a minimum conflict coalition. Since {*Commission, Belgium, Germany, France, Ireland, Italy, Luxembourg, Austria, Portugal Finland, UK*} is the coalition with the lowest conflict, this coalition forms the core. We will now focus on the reference distance conflict model.

The maximal conflict reference distance of the Commission — and in fact that of almost all EU states — is its distance to Greece and Spain (see Table 2). Spain and Greece have maximal conflict of interest with Denmark, the Netherlands and Sweden in terms of the political distance between their bliss points on both issues. The EP, a dummy player under the consultation procedure, supports Spain and Greece on both issues, but the distances to players with no capabilities are not taken into account when reference distances are determined. From Table 2, it can be seen that distance and conflict between two players are asymmetric measures. Consider, for example, the distance between France and Greece. This distance is given by:

$$d(F,E) = \sqrt{\left[\begin{array}{cc} (20-0) & (0-100) \end{array}\right] \left[\begin{array}{cc} 90 & 0 \\ 0 & 80 \end{array}\right] \left[\begin{array}{c} (20-0) \\ (0-100) \end{array}\right]} = 914.3$$

whereas for Spain, the respective distance is given by

$$d(E,F) = \sqrt{\left[\begin{array}{cc} (0-20) & (100-0) \end{array}\right] \left[\begin{array}{cc} 50 & 0 \\ 0 & 70 \end{array}\right] \left[\begin{array}{c} (0-20) \\ (100-0) \end{array}\right]} = 848.5$$

Table 2: PAIRWISE DISTANCES BETWEEN ACTORS

	COM	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EP
COM	0.0	189.7	758.9	0.0	914.3	914.3	0.0	0.0	0.0	189.7	758.9	189.7	189.7	189.7	758.9	189.7	914.3
B	189.7	0.0	569.2	189.7	971.6	971.6	189.7	189.7	189.7	0.0	569.2	0.0	379.5	0.0	569.2	0.0	971.6
DK	758.9	569.2	0.0	758.9	1304	1304	758.9	758.9	758.9	569.2	0.0	569.2	948.7	569.2	0.0	569.2	1304.0
D	0.0	189.7	758.9	0.0	914.3	914.3	0.0	0	0.0	189.7	758.9	189.7	189.7	189.7	758.9	189.7	914.3
EL	848.5	883.2	1095	848.5	0.0	0	848.5	848.5	848.5	883.2	1095	883.2	836.7	883.2	1095	883.2	0.0
E	848.5	883.2	1095	848.5	0.0	0	848.5	848.5	848.5	883.2	1095	883.2	836.7	883.2	1095	883.2	0.0
F	0.0	189.7	758.9	0.0	914.3	914.3	0.0	0	0.0	189.7	758.9	189.7	189.7	189.7	758.9	189.7	914.3
IRL	0.0	189.7	758.9	0.0	914.3	914.3	0.0	0	0.0	189.7	758.9	189.7	189.7	189.7	758.9	189.7	914.3
I	0.0	167.3	669.3	0.0	853.2	853.2	0.0	0	0.0	167.3	669.3	167.3	167.3	167.3	669.3	167.3	853.2
L	189.7	0.0	569.2	189.7	971.6	971.6	189.7	189.7	189.7	0.0	569.2	0.0	379.5	0.0	569.2	0.0	971.6
NL	758.9	569.2	0.0	758.9	1304	1304	758.9	758.9	758.9	569.2	0.0	569.2	948.7	569.2	0.0	569.2	1304.0
A	189.7	0.0	569.2	189.7	1022	1022	189.7	189.7	189.7	0.0	569.2	0.0	379.5	0.0	569.2	0.0	1022.0
P	167.3	334.7	836.7	167.3	836.7	836.7	167.3	167.3	167.3	334.7	836.7	334.7	0.0	334.7	836.7	334.7	836.7
FIN	189.7	0.0	569.2	189.7	971.6	971.6	189.7	189.7	189.7	0.0	569.2	0.0	379.5	0.0	569.2	0.0	971.6
S	758.9	569.2	0.0	758.9	1304	1304	758.9	758.9	758.9	569.2	0.0	569.2	948.7	569.2	0.0	569.2	1304.0
UK	189.7	0.0	569.2	189.7	971.6	971.6	189.7	189.7	189.7	0.0	569.2	0.0	379.5	0.0	569.2	0.0	971.6
EP	732.1	802.5	1183	732.1	0.0	0	732.1	732.1	732.1	802.5	1183	802.5	707.1	802.5	1183	802.5	0.0

In this decision-making situation, France can be seen to have maximal conflict of interest with Spain and Greece, whereas, as indicated above, Spain has maximal conflict with Denmark, the Netherlands and Sweden. In order to compute the extent of conflict within this coalition, based on reference distances, we take the weighted sum of the subjective coalitional conflict levels of the members. For France, for example, this subjective coalitional conflict level is given by:

$$\rho_F(S) = \rho(F, COM) + \rho(F, B) + \rho(F, D) + \rho(F, IRL) + \rho(F, L) + \rho(F, A)\rho(F, P) +$$

$\rho(F, FIN) + \rho(F, UK)$.

The first element of this sum — the level of conflict with the Commission — is given by: $w_{COM}\frac{d(\theta_F,\theta_{COM})}{d(\theta_F,\theta_E)}$, which is 0, because France and the Commission take the same position on both issues. Hence, the relation between the Commission and France does not contribute to the level of conflict within this coalition. With regard to the levels of conflict with two member states that are equidistant from France, e.g. Belgium and Luxembourg, we can observe that France has more conflict with Belgium than with Luxembourg, because Belgium has more capabilities to influence the decision outcome than Luxembourg does. France and Belgium attach the same level of importance to the issues, but France is much stronger than Belgium in terms of its Shapley–Shubik index [12].

The level of conflict for all coalitions can be calculated in a similar way. It turns out that the coalition mentioned above was a minimal conflict coalition for this decision-making situation, and therefore a core coalition.

The example in this section only had one core coalition as a solution for each of the models. This is not necessarily the case in all decision-making situations, however. In particular, situations where we encounter identical players, *i.e.* players with the same policy positions, salience and voting weights, can easily give rise to more than one core coalition. Consider a decision-making situation where a coalition needs a qualified majority in order to pass a proposal. If a given coalition T, of which player i is a member, is in the core, and there is an identical player j in the complement of T in N, then player i can be exchanged for j, so that the resulting coalition T' will be in the core as well. Note that is common for many game theoretical solution concepts, for transferable utility games, to provide a set of outcomes as a solution rather than a single outcome.

5 Predictive Accuracy of the Models

The data set to which the conflict models described in this chapter have been applied consists of information on 66 Commission proposals containing a total of 162 issues. No proposals or issues were excluded from the analysis as presented here: in contrast to other models, the conflict models do not require reference points and in addition, they can deal quite easily with the issue of indifferent actors.

The first question that will be answered here is which of the models provides the most accurate predictions for outcomes of the EU decision- making process: the conflict models or the unweighed median base-line model. The accuracy of the models can be assessed by comparing the predicted outcome of the models and the information on the outcome as described by the

[12] $w_B\frac{d(\theta_F,\theta_B)}{d(\theta_F,\theta_E)} = 0.037683 \times \frac{189.7}{914.3}$ and $w_L\frac{d(\theta_F,\theta_L)}{d(\theta_F,\theta_E)} = 0.014107 \times \frac{189.7}{914.3}$

experts. Table 3 presents the average error at issue level for each of the models under each combination of legislative procedure (consultation (CNS) and codecision (COD) and voting rule in the Council (qualified majority (QMV) and unanimity (U))). The model that performs best is the conflict model in which conflicts within coalitions are based on the variance of the distances of the members to the policy center of the coalition. The performance of the conflict models is quite similar, but all clearly do better than the median model.

Table 3: AVERAGE ABSOLUTE ERROR ACROSS ISSUES

	All issues (n=162)	CNS QMV (n=55)	CNS Unan. (n=39)	COD QMV (n=56)	COD Unan. (n=12)
Unw. Median	28.4012	30.6182	21.0256	30.6429	31.7500
Reference Distance	26.2571	28.6415	18.8662	30.5910	17.6192
Variance WED	24.6874	25.3829	18.9435	29.5191	17.6192

Under all combinations of legislative procedures and Council voting rules, the conflict models hence perform better than the unweighed median model which relies on the policy positions of the players only.

The differences in the predictive accuracy between the different procedures, however, are striking. All models yield better predictions for the procedures where a unanimous Council is required in order to pass legislation. Under these procedures, the preferences of all players having a voting weight are taken into account, whereas in the QMV procedures, a winning coalition can easily neglect the preferences of players on the losing side.

Under unanimity voting procedures, the set of winning coalitions is quite small compared to the set of winning coalitions under QMV. When the legislative procedure is consultation, the set of minimal winning coalitions consists of a unanimous Council in addition to the Commission. Addition of the EP would expand the size of this minimal winning coalition. The EP, however, has no capacity to influence the policy center[13]; but it could choose to join a coalition, and thereby possibly affect the level of conflict within the coalition. Note that in the reference distance model, players with no capabilities do not affect the extent of conflict in a coalition.

Under the codecision procedure with QMV in the Council, minimal winning coalitions consist of the Commission, together with a qualified majority in the Council, and the EP. Adding more member states could expand the size of minimal winning coalitions, and affect the level of conflict within a

[13]The same holds for member states without voting weights. There are three Commission proposals in the data set which are subject to consultation and unanimity and where some member states have no voting weights.

coalition. In the reference distance model, adding more members necessarily leads to more conflict, because conflict is defined as the sum of subjective interpretations of the level of conflict within a coalition. In the average WED and the variance model, adding a player could lead to either a reduction or increase in conflict. In the average WED model, adding a player with few capabilities will normally lead to a decrease in the level of conflict: the policy center of the coalition this extra player has joined will only slightly differ from the policy center in case she would not have joined, but now conflict is spread out over more members.

On the other hand, peripheral players which are powerful are able to generate larger shifts of the policy center, which in turn could result in a substantial increase in the sum of the distances between the bliss points of the other members and the new policy center. If this increase outweighs the positive effect of adding an extra member to a coalition, *i.e.* the conflict is spread out over more members, conflict is higher within the coalition. For the variance model, the effect of adding an extra member is clearly dependent on the configuration of the policy positions of the players the additional member is about to join. Note that the variance model in essence describes the balance in terms of dissatisfaction with a policy outcome among a set of players who form a winning coalition, and that the model clearly differs in this respect from the model envisaged by Axelrod (1970), who advocates taking into account the dispersion of policy positions when the level of conflict in a coalition is to be measured. The policy outcome will only coincide with the preference of each individual player if all players have identical policy positions and the game reduces to a partnership game, otherwise it still has the property of being a balance point where the momentum is zero. Basically, this means that all coalition members have to give in to reach a compromise outcome, but that some players have to accept greater losses than others, which are dependent on their preferences and their potential to influence decision-outcomes. This leads to the observation that the more inequalities there are in terms of losses, the more conflict there will be in a coalition. If the differences in the distances to the policy center among the players are smaller due to enlargement, the level of conflict will decrease. By comparison, if the differences increase, conflict will be higher.

Since the compromise model appears to make better predictions than the conflict models, one may ask, however, whether conflict as defined in our models is indeed such an important determinant of the outcome of the EU decision-making process. One could for example raise the question whether excluding some of the players with peripherical policy positions in order to derive a predicted coalition with even less conflict might be a sensible strategy to embark upon. Alternatively, one might focus on the level of conflict within the total player set, rather than the level of conflict within a specific coalition. Generally, it appears that the compromise model more or less predicts the policy centers of core coalitions for decisions taken under unanimity (identical to the solutions proposed in this chapter), whereas it seems to provide more accurate forecasts in the case of decisions under QMV.

The basic assumption of voting game theory is that the winner takes all, and therefore any player wants to be on the winning side. However, by neglecting the preferences of players on the losing side, in order to minimize internal conflict, members of the winning coalition could easily burn their fingers in a next game with the same player set, but with a different configuration of policy preferences. That is, players may realize that they might have to draw on the support of other players during future negotiations in which they hold a peripherical policy position. Therefore, a tendency to give in to the concerns of individual players and aim to reach a decision by consensus, may be characterized as rational behavior in the framework of repeated games.

Table 4: AVERAGE ABSOLUTE ERROR ACROSS ISSUES BY POLICY AREA

	Agriculture (n=40)	Internal market (n=34)	Other policy areas (n=88)
Unweighted Median Model	33.2875	39.6029	21.8523
Reference Distance Model	31.7065	34.8496	20.4603
Variance WED model	28.4527	33.2985	19.6488

Table 5: AVERAGE ABSOLUTE ERROR BY TYPE OF ISSUE

	Dichotomous (n=33)	Rank Order (n=109)	Scale (n=20)
Unweighted Median Model	30.3030	29.4220	19.7
Reference Distance Model	35.6819	23.9750	23.1439
Variance WED model	33.9738	24.2324	22.6635

6 Conclusion

This chapter posits that as in many other real-world situations, coalition-formation is at the core of the decision-making process in the EU. We claim that the relevant institutional actors — which, according to this volume, are assumed to be the European Commission, the European Parliament and the members of the Council of the EU — do not affect policy outcomes individually, but that cooperation and the formation of (winning) coalitions among them is central to the determination of respective decisions.

In order to demonstrate our claim, we apply two spatial models of coalition-formation to the data collection forming the empirical basis to this volume. Our theoretical approach builds upon earlier work by DeSwaan (1973), McKelvey et al. (1978) and Axelrod (1970, 1997) in particular. We use two models in this chapter which both are based on a notion of possible conflict within a coalition. Both models constitute a multi-dimensional elaboration of the conflict of interest model as presented by Axelrod (1997). The models follow mainstream research by measuring 'distance' as Euclidean distance (although other approaches might be justified). Both are based on the behavioral assumption that actors strive to form coalitions with minimal conflict. However, both models measure conflict in a different way. The models predict coalitions and their respective policy outcomes.

In the empirical application of the models, we consider the weights of the players as the product of capability and salience. We use Shapley–Shubik indices as capability scores. For the Council, we distinguish between qualified majority and unanimity as voting rules. These rules, together with the consent of the Commission, determine the set of winning coalitions under the consultation procedure, whereas for decision-making subject to co-decision, the consent of the EP is also required. The policy outcomes predicted by our models are simply the balance points of the winning coalitions with minimal conflict.

Applying our two major models to the data collection DEU, we find that both conflict models provide relatively accurate forecasts of EU policy outcomes indeed.

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