

## ***When Simple Voting Doesn't Work: Multicameral Systems for the Representation and Aggregation of Interests in International Organizations***

THOMAS BRÄUNINGER\*

This article analyses the origins and consequences of multicameral representation and voting in international organizations. It is argued that the existence of visible and durable conflicts in an issue area can make standard procedures such as unicameral majority voting ineffective with respect to the functioning of the regime. Applying spatial models of strategic decision making, it is asserted that multicameralism is more likely to be effective than unicameralism if chambers consist of key groups with distinct interests. Empirical evidence is provided by studying the multicameral voting rule in the Council of the International Seabed Authority (ISA). I compare likely decision-making outcomes under unicameral and multicameral voting rules from 1996 to 2002 and find that multicameral outcomes are more likely to be stable and supported by those actors critical for the effective functioning of the regime.

### HOW STATE INTERESTS ARE REPRESENTED AND AGGREGATED

With the end of the Cold War, the question of how to achieve international co-operation in the face of divergent state interests has again attracted considerable attention. To make international institutions effective in environments where conflicting state interests abound, most regimes have formal and clear-cut rules for vesting authority in the actors involved, i.e. for agenda setting, deliberation, decision making and policy implementation. When creating or reforming international (non-)governmental organizations, the question of how to represent and aggregate divergent interests is often a serious problem.<sup>1</sup> Recent developments in international politics have witnessed the emergence of a range of constitutional arrangements for decision making in multilateral settings that reflect the depth of integration and the character of the decisions to be made.<sup>2</sup>

Regarding the representation of interests, a standard technique for providing the desired recognition of groups of states with particular, and above all economic, interests is seat allocation in executive organs. Prominent examples are the World Bank and the International Monetary Fund (IMF). Geographical representation, such as in the UN

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<sup>1</sup> For the European Union (EU), for example, see Matthias Sutter, 'Fair Allocation and Re-weighting of Votes and Voting Power in the EU Before and After the Next Enlargement', *Journal of Theoretical Politics*, 12 (2000), 433–50.

<sup>2</sup> For an overview, see Stephen Zamora, 'Voting in International Economic Organizations', *American Journal of International Law*, 74 (1980), 566–608.

Children's Fund, is often considered as a means to balance the power of industrial states and developing countries, and the UN Security Council recognizes permanent and non-permanent members. There are also various forms of aggregating interests. The IMF employs a weighted voting scheme in which donors are given more votes than receivers. In the contemporary European Union (EU), various legislative procedures define the interplay of the bureaucratic Commission, the executive Council of Ministers and the popularly elected Parliament as unicameral, bicameral or even tricameral systems.<sup>3</sup>

One obvious question in this context is why there are so many different patterns of voting and representation. Previous research on formal rules for decision making in international organizations has largely concentrated on the effects of particular, single characteristics of institutional arrangements. Studies have addressed the distribution of voting weights in the EU Council of Ministers and the European Parliament,<sup>4</sup> weighted voting in International Monetary Fund,<sup>5</sup> vetoing in the UN Security Council,<sup>6</sup> or voting by count and account rules.<sup>7</sup> The core interest of these studies is in detecting the relative influence of decision-making actors in shaping policy outcomes. However, few studies have examined the reasons that brought about these institutional settings. What drives the choice of specific arrangements to represent and aggregate state interests in international co-operation?

This article addresses these questions while focusing on a specific method of representing and aggregating divergent interests, namely multicameral decision making. Multicameral institutions combine the representation of diverse interests in groups or 'chambers' with the unanimous aggregation of chambers' majority votes.<sup>8</sup> Using spatial models of decision making, I argue that under certain conditions a committee with  $k$  groups of actors – organized in chambers – reduces high-dimensional conflicts to a  $(k - 1)$ -dimensional space of bargaining between the groups.<sup>9</sup> The theoretical findings suggest that in certain situations, multicameralism is more efficient and effective than unicameralism, i.e. it is more likely to produce outcomes that are stable and that will be implemented. The

<sup>3</sup> George Tsebelis, 'The Power of the European Parliament as a Conditional Agenda Setter', *American Political Science Review*, 88 (1994), 128–42; Christophe Crombez, 'Legislative Procedures in the European Community', *British Journal of Political Science*, 26 (1996), 199–228; Geoffrey Garrett and George Tsebelis, 'An Institutional Critique of Intergovernmentalism', *International Organization*, 50 (1996), 269–99; Anick Laruelle and Mika Widgrén, 'Is the Allocation of Power Among EU States Fair?' *Public Choice*, 94 (1998), 317–39.

<sup>4</sup> See Steven J. Brams and Paul J. Affuso, 'New Paradoxes of Voting Power on the EC Council of Ministers', *Electoral Studies*, 4 (1985), 135–9; Jan-Erik Lane and Reinert Mæland, 'Constitutional Analysis: The Power Index Approach', *European Journal for Political Research*, 37 (2000), 37–56.

<sup>5</sup> Jacob S. Dreyer and Andrew Schotter, 'Power Relationships in the International Monetary Fund: The Consequences of Quota Changes', *Review of Economics and Statistics*, 62 (1980), 97–106; Dennis Leech, *Power Relations in the International Monetary Fund* (Warwick: Warwick Economic Research Papers, 1997).

<sup>6</sup> Eyal Winter, 'Voting and Vetoing', *American Political Science Review*, 90 (1996), 813–23; Erik Voeten, 'Outside Options and the Logic of Security Council Action', *American Political Science Review*, 95 (2002), 845–58.

<sup>7</sup> Barry O'Neill and Bezalel Peleg, *Voting by Count and Account: Reconciling Power and Equality in International Organizations* (unpublished, University of Stanford, 2000).

<sup>8</sup> A straightforward definition in terms of simple games is given by Taylor and Zwicker (Alan D. Taylor and William S. Zwicker, *Simple Games: Desirability Relations, Trading, Pseudoweightings* (Princeton, NJ: Princeton University Press, 1999), p. 35). They show that any simple game can be represented by a vector-weighted game using tuples as weights and quotas. A game is said to be of dimension  $k$  (or  $k$ -cameral) if it can be represented as vector-weighted game using  $k$ -tuples, but cannot be represented as a game using  $(k - 1)$ -tuples.

<sup>9</sup> Essentially identical results were found independently by N. Macartan Humphreys, *Core Existence in Multigroup Spatial Games* (unpublished, Harvard University, 2001).

most important condition is that chambers consist of those groups of actors who are necessary for the functioning of the regime and have distinctly different interests.

Empirical evidence is provided by analysing the multicameral voting rule in the Council of the International Seabed Authority (ISA). Within the ISA, the divergent interests of the consumer, producer and investor states regarding the use of the mineral resources on the deep seabed, which are beyond national jurisdiction, have to be mediated. Using data on 150 states' preferences for the use of deep-sea resources, this article analyses the composition of the ISA Council between 1996 and 2002 and predicts the decision-making outcomes associated with four unicameral and multicameral voting procedures. The findings show that multicameral outcomes are more likely to be both stable and supported by those actors critical for the effective functioning of the regime.

#### THE ORIGINS AND CONSEQUENCES OF MULTICAMERALISM

Compared to a simple committee system, multicameralism subjects any social choice to the approval of at least one more (collective) actor. Most research on multicameralism stems from the comparative politics literature, as bicameral legislatures are frequently used at the domestic level of modern states. In all of the literature, bicameralism is compared to mere simple majority voting in unicameral parliaments, where rationales for two-chamber systems have been arranged along two main dimensions: the political rationale and the efficiency rationale.<sup>10</sup> According to the political rationale, bicameralism is a means of mediating the conflicting interests of key societal groups by granting them veto power. The Westminster bicameral system, for instance, is considered to have emerged in Britain when effective policy making required the protection of both the people and the aristocracy against any encroachment by the other side.<sup>11</sup>

According to the efficiency rationale, bicameralism makes societally preferable outcomes more likely than unicameral institutions by improving legislators' informational judgements and generating outcomes that are stable.<sup>12</sup> Buchanan and Tullock, for instance, argue that multicameralism minimizes the external costs of decision making when the representatives of the chambers are elected from diversely arranged jurisdictions.<sup>13</sup> Hammond and Miller find that bicameral legislatures are likely to reduce two-dimensional conflicts to ones that are one-dimensional.<sup>14</sup> Using the game-theoretical concept of the core to delineate the set of likely outcomes, they show that, if chambers have distinctly different preferences, outcomes are located on a segment of a straight line that connects the two chambers. Tsebelis and Money extend the argument of Hammond and Miller in two ways. First, they show that, if the core of an  $n$ -dimensional bicameral legislature exists at all, it

<sup>10</sup> George Tsebelis and Jeannette Money, *Bicameralism* (Cambridge: Cambridge University Press, 1997), pp. 35–42.

<sup>11</sup> Gerhard Loewenberg and Samuel C. Patterson, *Comparing Legislatures* (Boston, Mass.: Little, Brown, 1979), pp. 120–5; Lawrence D. Longley and David M. Olson, *Two Into One: The Politics and Process of National Legislative Cameral Change* (Boulder, Colo.: Westview Press, 1991), pp. 1–2; see also John C. Bradbury and W. Mark Crain, 'Bicameral Legislatures and Fiscal Policy', *Southern Economic Journal*, 68 (2002), 646–59.

<sup>12</sup> James R. Rogers, 'An Informational Rationale for Congruent Bicameralism', *Journal of Theoretical Politics*, 13 (2001), 123–51, pp. 123–4.

<sup>13</sup> James M. Buchanan and Gordon Tullock, *The Calculus of Consent: Logical Foundations of Constitutional Democracy* (Ann Arbor: University of Michigan Press, 1962), pp. 232–5.

<sup>14</sup> Thomas H. Hammond and Gary J. Miller, 'The Core of the Constitution', *American Political Science Review*, 81 (1987), 1155–74, p. 1160.

is in, at most, one dimension. Secondly, even if there are no stable outcomes, a generalization of the core, the uncovered set, exists and is also in at most one dimension.<sup>15</sup>

In other words, bicameralism reduces conflicts that involve a multitude of issue dimensions, to a one-dimensional bargaining set, whilst aggregating preferences regarding all other conflicts by majority rule. These two effects parallel the ‘political’ and the ‘efficiency’ rationales of bicameralism in the literature. On the one hand, chambers have a common interest in producing outcomes that make a sufficiently large proportion of actors better off and that are achievable at least costs. Chambers’ common interests establish an efficiency problem as they do not divide chambers one from the other, but they induce conflict within each chamber: bicameralism does not protect minorities in these ‘minor conflicts’, they are aggregated and reduced by majority vote. On the other hand, chambers have conflicting interests in changing the status quo. Bicameral institutions protect chambers from the majority’s will by defining these divergent interests as a political or ‘major conflict’: decisions on these major conflicts have to be taken by intercameral bargaining and compromise.

This suggests that bicameralism is likely to emerge when societal actors are divided by one major conflict, but have several common interests.<sup>16</sup> It begs the question of what institutions are appropriate for effective policy making in settings with two or more major conflicts, and under what conditions higher-numbered cameralism would be more advantageous than decision making in bicameral or unicameral institutions. For this reason, I will now take a theoretical look at the effects of multicameral systems having more than two chambers. Extending the results of Hammond and Miller and Tsebelis and Money, I argue that in comparable situations, a  $k$ -cameral legislature reduces an  $n$ -dimensional conflict between the actors to a  $(k - 1)$ -dimensional policy space of intercameral bargaining. To explore the location of likely decision-making outcomes, the concept of the core is used. The core is the set of all undominated alternatives, i.e. policies that cannot be upset by any possible coalition of actors whom the rules empower to replace one policy with another policy.<sup>17</sup> It is a standard concept – one that has been experimentally verified – in the spatial analysis of legislative decision making.<sup>18</sup>

<sup>15</sup> Tsebelis and Money, *Bicameralism*, pp. 93, 96f. For the uncovered set, see Nicholas R. Miller, ‘A New “Solution Set” for Tournaments and Majority Voting’, *American Journal of Political Science*, 24 (1980), 68–96; Gary W. Cox, ‘The Uncovered Set and the Core’, *American Journal of Political Science*, 31 (1987), 408–22.

<sup>16</sup> This is obviously based on the assumption that rules are not introduced and enforced exogenously, nor do they emerge purely accidentally, rather they are part of the state co-operation in the issue area.

<sup>17</sup> Gary J. Miller and Thomas H. Hammond, ‘Committees and the Core of the Constitution’, *Public Choice*, 66 (1990), 202–27, p. 202. The core of a multi-cameral institution may not exist, meaning that the uncovered set (that collapses with the core if the core exists) would be the more general solution concept (see Nicholas R. Miller, Bernard Grofman and Scott L. Feld, ‘The Geometry of Majority Rule’, *Journal of Theoretical Politics*, 1 (1989), 379–406; for two chambers, see Tsebelis and Money, *Bicameralism*). However, the stronger core concept better clarifies the logic of multicameralism, even if it is restricted to specific configurations of actors’ preferences. To guarantee that the core exists, a third, symmetry condition on the location of chamber actors’ ideal points must be satisfied. For  $n > k$ , this condition is as restrictive as the conditions for the median in two and more dimensions (Otto A. Davis, Morris H. DeGroot and Melvin J. Hinich, ‘Social Preference Orderings and Majority Rule’, *Econometrica*, 40 (1972), 147–57). For  $n = k$ , however, the probability that the core exists is greater than zero.

<sup>18</sup> See Janet Beryl, Richard D. McKelvey, Peter C. Ordeshook *et al.*, ‘An Experimental Test of the Core in a Simple  $N$ -Person, Cooperative, Nonsidepayment Game’, *Journal of Conflict Resolution*, 20 (1976), 453–79; Morris Fiorina and Charles R. Plott, ‘Committee Decisions under Majority Rule’, *American Political Science Review*, 72 (1978), 575–98; Gary J. Miller, Thomas H. Hammond and Charles Kile, ‘Bicameralism and the Core: An Experimental Test’, *Legislative Studies Quarterly*, 21 (1996), 83–103; William P. Bottom, Cheryl L. Eavey,

In the model there is an  $n$ -dimensional policy space  $\mathbf{R}^n$  and a finite group of actors  $N = \{1, \dots, m\}$  involved in decision making within a committee. Actors are assumed to have Euclidean preferences over this space where ideal points are denoted by  $x_i$ . Hence, an alternative  $y \in \mathbf{R}^n$  is preferred by actor  $i$  to the alternative  $x \in \mathbf{R}^n$  ( $y \succ_i x$ ) if and only if  $\|y - x_i\| < \|x - x_i\|$ . The distribution of ideal points is assumed to have no linear 'pattern'. In particular, for any  $m < n$ , no more than  $m + 1$  actors lie on any  $(m - 1)$ -dimensional affine subspace of  $\mathbf{R}^n$ .

DEFINITION: A  $k$ -cameral legislature  $L$  is a committee with  $k$  disjoint chambers, where (i) each chamber  $j = 1, \dots, k$  has  $n_j$  actors, each having one vote; and (ii) decision making requires that a simple majority within each chamber approves the proposal (*joint majority*).

In order to show that the core of a  $k$ -cameral legislature is the highest in  $k - 1$  dimensions four results on so-called median hyperplanes will be used. Median hyperplanes are multi-dimensional equivalents to median points (in one) or median lines (in two dimensions). Theorem 1 applies a finding of Cox and McKelvey to  $n$ -dimensional policy spaces. It states that in an  $n$ -dimensional  $k$ -cameral legislature, at least one  $k$ -cameral median hyperplane exists, i.e. a hyperplane  $H$ , which is a median hyperplane for all  $k$  chambers.<sup>19</sup> Lemma 1 establishes that  $k$ -cameral median hyperplanes are essential for studying  $k$ -cameral majority voting: if all  $n_j$  are odd, then the number of ideal points to one of each side of  $H$  plus the number of ideal points lying on  $H$  constitute a joint majority. According to Lemma 2 the core of a  $k$ -cameral legislature is a subset of the intersection of all  $k$ -cameral median hyperplanes, and Lemma 3 establishes that the core may expand – but never shrinks – if the conflict between actors is 'reduced' by projecting actors' ideal points to a  $k$ -cameral median hyperplane. These lemmas are crucial to the proof of the following theorem:

THEOREM 2: In any  $n$ -dimensional  $k$ -cameral legislature  $L$ , where all  $n_j$  are odd:

$$\dim [\text{core} (L)] \leq \min \{k-1, n\}.$$

However, the multicameral core may be empty. In fact, Humphreys demonstrates that generically a core will not exist if the number of dimensions exceeds the number of chambers.<sup>20</sup> For the empirical analysis a corollary will thus be more useful which follows immediately from Theorem 2 and Lemma 1(i):

COROLLARY: In any  $n$ -dimensional  $k$ -cameral legislature, where  $n \geq k$  and all  $n_j$  are odd, the core, if it exists, is a subset of a  $(k - 1)$ -dimensional policy space that is spanned between at least  $k$  actors, one of each chamber.

(Footnote continued)

Gary J. Miller and Jennifer N. Victor, 'The Institutional Effect of Majority Rule Instability: Bicameralism in Spatial Policy Decisions', *American Journal of Political Science*, 44 (2000), 523–40.

<sup>19</sup> Gary W. Cox and Richard D. McKelvey, 'The Ham Sandwich Theorem for General Measures', *Social Choice and Welfare*, 1 (1984), 75–83. They adapt Ulam's ham sandwich theorem by generalizing the theorem to finite measures (Stanislaw M. Ulam, 'Zur Maßtheorie und der allgemeinen Mengenlehre', *Fundamenta Mathematicae*, 16 (1930), 140–50). For technical details relating to our model, please see the Appendix to the website version of this article.

<sup>20</sup> Humphreys, *Core Existence in Multigroup Spatial Games*, p. 13.

Intuitively, this suggests two basic hypotheses on the effects and causes of multicameral institutions which are empirically testable. On the one hand, one would expect that in  $k$ -cameral legislatures there are privileged dimensions of conflict and compromise. More specifically, outcomes are located in this  $(k - 1)$ -dimensional bargaining space that is spanned between the chambers. By contrast, conflicts on non-privileged dimensions are aggregated by a majority rule, so that policy change is favourable to all chambers (as collective actors). On the other hand, if constitutional designers understand these effects, one would expect multicameralism to be used as a means to transform major conflicts into privileged dimensions of bargaining and minor conflicts into non-privileged dimensions of seeking Pareto-improvements.<sup>21</sup> By contrast, if there are no visible and stable conflictual divisions between groups within the international regime, unicameral institutions may prove more useful. I will specify these conjectures in the following paragraphs using the concepts of *rule efficiency* and *rule effectiveness* to evaluate voting rules in terms of their decision-making outcomes.

Rule efficiency refers to the potential for policy change that enables a political regime to adapt to exogenous shocks and thereby promote its stability.<sup>22</sup> The ability to cope with upcoming problems is one requirement for regime effectiveness. The problem is that efficiency is often difficult to achieve. On the one hand, policy change is more likely with pure majoritarian rules than under unanimity. On the other hand, simple majority is likely to produce voting cycles resulting in either no policy change or outcomes that are unstable and can easily be upset again.<sup>23</sup> I therefore call a voting rule more efficient than another if the goal-directed change of an arbitrary status quo to any other policy is stable and more likely to occur under the first rule than under the second.

This does not guarantee that the decisions matter. To be effective, most (international) regimes require that actors comply with their rules and implement their policies – independently of any hegemonic force.<sup>24</sup> There are numerous potential mechanisms, such as reciprocity, transparency, accountability and regime-mindedness, that may facilitate compliance. With respect to decision-making rules, it is argued, for instance, that in the absence of overt coercion, only unanimity maximizes the likelihood of domestic implementation of international-level agreements. Granting veto power, however, entails the danger of a stalemate and thereby decreases rule efficiency. Thus, a second requirement is that of rule effectiveness. I call a voting rule more effective than a second voting rule if the implementation of decision-making outcomes is more likely under the first than under

<sup>21</sup> This argument may also pertain to the evolution of ‘informal’ multicameral settings in international politics such as bargaining between common interest groups in multilateral negotiations or between caucusing groups in the UN General Assembly. At the domestic level, the evolution of disciplined parties or party groups in parliaments may be traced back to privileged conflicts or basic lines of cleavages (Seymour M. Lipset and Stein Rokkan, ‘Cleavage Structures, Party Systems, and Voter Alignments: An Introduction’, in Seymour M. Lipset and Stein Rokkan, eds, *Party Systems and Voter Alignments* (New York: Free Press, 1967), pp. 1–64.

<sup>22</sup> George Tsebelis, ‘Veto Players and Law Production in Parliamentary Democracies: An Empirical Analysis’, *American Political Science Review*, 93 (1999), 591–606, p. 591.

<sup>23</sup> Charles R. Plott, ‘A Notion of Equilibrium and its Possibility Under Majority Rule’, *American Economic Review*, 57 (1967), 787–806; Norman J. Schofield, ‘Instability of Simple Dynamic Games’, *Review of Economic Studies*, 45 (1978), 575–94; Richard D. McKelvey, ‘Intransitivities in Multidimensional Voting Models and Some Implications for Agenda Control’, *Journal of Economic Theory*, 12 (1976), 472–82.

<sup>24</sup> Ronald B. Mitchell, ‘Regime Design Matters: International Oil Pollution and Treaty Compliance’, *International Organization*, 48 (1994), 425–58; James D. Fearon, ‘Bargaining, Enforcement, and International Cooperation’, *International Organization*, 52 (1998), 269–305.

the second.<sup>25</sup> In the following, unicameral and multicameral voting rules are compared in terms of their efficiency and effectiveness.

What makes one rule more efficient and/or effective than another? I will not explore the possible factors in great detail, but will instead distinguish between two ideal types of conflict, namely major and minor ones. Major conflicts are those where effective policy making *requires* the vote of all conflicting actors or groups of actors in order to reach outcomes that can be implemented. They are present when issues are redistributive in nature, trade-offs are not possible and enforcement mechanisms are weak. By contrast, effective policy making on minor conflicts does *not presuppose* the vote of all conflicting actors or groups. Differentiating between major and minor conflicts suggests three conjectures: first, in situations where – for whatever reason – there are only major conflicts, only unanimity can guarantee effective policy making. Secondly, in situations where there are only minor conflicts, effective policy making is also possible under majoritarian rules. Thirdly, if both major and minor conflicts exist, a multicameral voting rule may allow for effective policy making provided that minorities with respect to major conflicts have collective veto rights. This claim is supported by Humphreys' findings showing that certain separability conditions for the chambers establish a sufficient condition for core existence if  $k \geq n$ .<sup>26</sup> Given these considerations, a first – intuitive rather than theoretically proven – hypothesis on decision-making outcomes is:

**HYPOTHESIS 1 (Outcomes):** If there are less than  $k$  major conflicts and actors that are divided by these conflicts are assigned to different chambers, then a  $k$ -cameral majority rule is more effective and efficient than a unicameral majority rule.

Concluding that the type of voting rule accounts for the variance in the effectiveness of regimes, a relevant question concerns the institutional design of these rules. If state delegates present at the time of the regime formation understand the effects of multicameralism, one would expect multicameralism to be used as a means to solve specific and clear-cut problems, namely to transform major conflicts into privileged dimensions of intercameral bargaining and minor conflicts into non-privileged dimensions of intra-cameral voting. By contrast, if state delegates present at the time of rule design do not know what kinds of conflict will exist or what alliances will prevail, unicameral (majority) rules may be considered more efficient and equally effective. This suggests two final hypotheses on institutional design regarding the number of chambers and the assignment of actors to chambers:

<sup>25</sup> The question of institutional effectiveness is a core question in international politics (Robert O. Keohane, Peter M. Haas and Marc A. Levy, 'The Effectiveness of International Environmental Institutions', in Peter M. Haas, Robert O. Keohane and Marc A. Levy, eds, *Institutions for the Earth: Sources of Effective International Environmental Protection* (Cambridge, Mass.: MIT Press, 1993), pp. 3–24; Lisa L. Martin and Beth A. Simmons, 'Theories and Empirical Studies of International Institutions', *International Organization*, 52 (1998), 729–57; Carsten Helm and Detlef Sprinz, 'Measuring Effectiveness of Environmental Regimes', *Journal of Conflict Resolution*, 44 (2000), 630–52). One reason is that fundamental requirements like actor compliance, policy implementation or dispute resolution are possible but more difficult to accomplish in the 'anarchic' international system compared to political systems at the national level (Abram Chayes and Antonia H. Chayes, 'On Compliance', *International Organization*, 47 (1993), 175–305; Helen Milner, 'The Assumption of Anarchy in International Politics: A Critique', *Review of International Studies*, 17 (1991), 67–85). The question addressed in this article, however, has a much narrower focus as it asks for the causal connection between the operation of one regime element – formal rules for the representation and aggregation of state interests – and the effectiveness of the regime.

<sup>26</sup> Humphreys, *Core Existence in Multigroup Spatial Games*, pp. 10–11.

HYPOTHESIS 2 (Number of chambers): *Ceteris paribus*, if there are  $k - 1$  visible major conflicts, a system with no less than  $k$  chambers will evolve. If conflicts are minor or less clearly visible, a unicameral majority rule will evolve.

HYPOTHESIS 3 (Assignment of actors): *Ceteris paribus*, if there are  $k - 1$  visible major conflicts and no less than  $k$  chambers, actors that are divided by major conflicts are assigned to different chambers.

#### THE CASE OF DEEP-SEA MINING

Providing a single case study cannot be considered to be a profound empirical test of the above hypotheses concerning the reasons for and the effects of multicameralism. The analysis of the deep-sea mining regime, however, provides some evidence for them. In what follows, I first describe the quadricameral voting system of the seabed mining regime and review earlier studies to identify its major conflict dimensions. These studies argue that there are two or three major conflicts that sharply divide states, the resolution of which is critical for the functioning of the regime. These claims are consistent with Hypothesis 2, which proposes that a quadricameral system would in fact be a means for effective conflict resolution. The next major section will finally address Hypotheses 1 and 3.

#### *The Seabed Mining Regime*

The International Seabed Authority (ISA) is an autonomous international organization established in November 1994 when the 1982 UN Convention on the Law of the Sea entered into force. It became fully operational in 1996. The ISA is the intergovernmental body through which more than 150 state parties to the Convention organize, monitor and control activities on the deep-sea floor outside of nationally regulated ocean territories – an area covering more than half the globe. The ISA operates by contracting with private and public corporations authorizing them to explore, and eventually exploit, specified areas on the deep seabed for solid, liquid or gaseous mineral resources, in particular manganese nodules containing a number of important metals and minerals. ISA activities include reviewing working plans for seabed exploration and exploitation, monitoring compliance with regulations and procedures, promoting scientific research and the development of marine technology, and developing recommendations of mining standards for the protection and preservation of the marine environment.

The tasks and organizational structure of the ISA are defined by the 1982 Convention and a so-called Implementation Agreement adopted in 1994.<sup>27</sup> They establish three principal organs: an Assembly, consisting of all member states, a 36-member Council which is elected by the Assembly, and an administrative Secretariat. The Assembly, which is the supreme organ, meets only twice a year, so that the actual decision-making power is vested in the executive Council. A key feature of the ISA is the recognition of special interests that is embodied in both the representation and aggregation of state interests in the Council:

—Council members are elected on the basis of ‘group representation’: (a) four states are elected from among those states that are the largest consumers of the minerals in

<sup>27</sup> *United Nations Convention on the Law of the Sea*, U.N. Doc. A/CONF.62/122, 10 December 1982; *Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982*, U.N. Doc. A/RES/48/263, 28 July 1994.

question; (b) four states from among the eight states that have made the largest investments in deep-sea mining; (c) four states from among the states which are major net exporters (producers) of minerals; (d) six states from among the developing countries; and (e) eighteen states according to the principle of ensuring an equitable geographical distribution of seats in the Council as a whole.<sup>28</sup>

—Council decisions on most issues require a two-thirds majority of its members ‘provided that such decisions are not opposed by a majority in any one of the [four] chambers’.<sup>29</sup> The first three chambers respectively represent the groups of consumers, investors and producers, while the group of developing countries and the remaining eighteen members of the Council are treated as a single, fourth chamber.

This establishes a (pseudo) quadricameral voting rule which is different from the ideal type in so far as: first, the simple majority quota *within* the chambers is reduced to the blocking quota, and secondly, the unanimity provision *between* chambers is supplemented by an overall two-thirds quota. Yet the voting rule is a multicameral one. It cannot be changed to a weighted voting system by creatively assigning an appropriate scheme of voting weights to Council members. According to Taylor and Zwicker, *one-trade robustness* is a necessary condition for a simple voting game to be represented as a weighted voting game: any one-for-one exchange of actors between two winning coalitions renders at least one of them winning.<sup>30</sup> Naive checking shows that this is not the case for the ISA multicameral rule. Consider the two coalitions of Council members:

$$S = \{\text{Consumer 1, Consumer 2, Investor 1, Investor 2,} \\ \text{all members of chambers 3 and 4}\}, \text{ and}$$

$$T = \{\text{Consumer 3, Consumer 4, Investor 3, Investor 4,} \\ \text{all members of chambers 3 and 4}\}.$$

Both  $S$  and  $T$  form winning coalitions under the ISA multicameral rule but exchanging Consumer 1 for Investor 3 renders both losing as they lack the support of either the first or the second chamber. Thus, the ISA quadricameral qualified majority rule is non-weighted. Rather it grants collective veto rights to distinct groups of states and, therefore, provides prerogatives for states that are deemed to be crucial for the functioning of the regime: such a system prevents unfettered access to the seabed resources, which has previously been the case, because the deep seabed is beyond national jurisdiction.<sup>31</sup> However, the common view was that an uncontrolled use of the deep seabed would end up in a rapid, one-sided exploitation of the resources that is unfair from the global commons standpoint and has adverse economic effects on the long-term performance of the world metal markets.

Thus, on one hand, there were various motivations for creating an international institution: investors in mining technology were interested in legally secure rights,

<sup>28</sup> Para. 15, sec. 3, annex to the *Agreement*.

<sup>29</sup> Para. 5, sec. 3, annex to the *Agreement*.

<sup>30</sup> Taylor and Zwicker, *Simple Games*, p. 61.

<sup>31</sup> Rüdiger Wolfrum, ‘The Decision-Making Process According to Sec. 3 of the Annex to the Implementation Agreement: A Model to be Followed for Other International Economic Organisations?’ *Zeitschrift für ausländisches öffentliches Recht und Völkerrecht*, 55 (1995), 310–28, pp. 312–15.

consumers and producers in stable metal markets, and developing countries in restricting an intense and asymmetric exploitation of ocean resources by those industrialized states having the required technology.<sup>32</sup> On the other hand, rather than the participation of a large majority, it is the inclusion of distinct groups of states that is a necessary prerequisite for successful regime functioning. Without the industrial countries, the ISA would not be able to govern the seabed as these countries might feel free to invest in mining technology and exploit the seabed for their own gain regardless of ISA regulations. Without the land-based producers of the minerals in question, any attempt by the ISA to prevent adverse economic effects by establishing production ceilings and intervening on the metal markets would be impeded.

Previous studies of the Third United Nations Conference on the Law of the Sea (UNCLOS III) negotiations have accordingly identified a number of conflicts where the consent of opposing groups of states is necessary for the seabed mining regime to work effectively. In an analysis of the formation of negotiation groups at UNCLOS III, Wolf identifies three major groups of states with respect to common interests in seabed mining: developed countries that are potential mining states, land-producers/exporters of the minerals, and all other states that can benefit from the resources only by way of a distribution of ISA revenues.<sup>33</sup> Sebenius finds that ‘relevant divisions included developed and developing countries ... , Eastern bloc and Western nations ... , as well as nations that produce or export the minerals that will come from the seabed and those countries that consume or import them’.<sup>34</sup> In that respect, conflicts were more cross-cutting than over-lapping. Deriving state preferences from a content-analysis of official conference records, Friedheim concludes that essentially three substantial issues were subject to conflict in the negotiations: whether the ISA can limit states’ access to the resources or not, whether mining enterprises should pay substantial fees or be subject to the free market principle, and whether the resource use should benefit any state or developing states in particular.<sup>35</sup> Finally, analyses applying standard micro-economic models to metal markets suggest that the actual impact of deep-sea mining on state economies depends on three main parameters: the ceiling of seabed production, the system of taxes or fees and the system of revenue distribution.<sup>36</sup>

In sum, this suggests that the question of deep-sea mining encompasses two or three major dimensions of conflict that divide states into three or four different groups. This gives support to Hypothesis 2, which states that with two or three clearly visible and recognized major conflicts, a multicameral voting system with at least three chambers is likely to evolve. To analyse the actual compositions of the ISA Council in 1996–2002 and the effects of its multicameral voting rule, I next present data on states’ preferences for the three key issues.

<sup>32</sup> Christopher C. Joyner and Elizabeth A. Martell, ‘Looking Back to See Ahead: UNCLOS III and Lessons for Global Commons Law’, *Ocean Development & International Law*, 27 (1996), 73–95.

<sup>33</sup> Klaus D. Wolf, *Die Dritte Seerechtskonferenz der Vereinten Nationen. Beiträge zur Reform der internationalen Ordnung und Entwicklungstendenzen im Nord-Süd-Verhältnis* (Baden-Baden: Nomos, 1981), p. 105.

<sup>34</sup> James K. Sebenius, *Negotiating the Law of the Sea* (Cambridge, Mass.: Harvard University Press, 1984), pp. 16–18.

<sup>35</sup> Robert L. Friedheim, *Negotiating the New Ocean Regime* (Columbia: University of South Carolina Press, 1993), pp. 220–63.

<sup>36</sup> Federico Foders, ‘Who Gains from Deep-Sea Mining?’ in Juergen B. Donges, ed., *The Economics of Deep-Sea Mining* (Berlin: Springer, 1985), pp. 336–69; Thomas Bräuninger, *Internationale Institutionenpolitik. Die Wahl von Entscheidungsregeln für die Meeresbodenbehörde* (Frankfurt am Main: Campus, 2000), pp. 67–81.

*State Preferences and the Composition of the ISA Council in 1996–2002*

Conducting an analysis of the impact of formal voting rules on collective decision making presupposes the identification of actors' preferences at the time actors make their choices. Unfortunately, no information on the preferences of the ISA Council members for the period 1996–2002 is available for the present study. The official documents of the ISA report final Council decisions but not individual state positions on Council deliberations. I therefore re-analyse data from the above-mentioned thematic content analysis that was performed on official records of UNCLOS III issued between 1973 and 1975.<sup>37</sup> Although states' preferences may have changed over the twenty-five year period, it is reasonable to assume that the basic constellation of preferences has prevailed and states' positions on the three seabed mining issues at UNCLOS III are good proxies for their present positions.

State preferences with respect to substantial policies were conceptualized as single-peaked preferences and obtained in five steps. First, statements of preference by state delegates on single negotiating 'themes' were marked in the documents and coded. Secondly, themes representing different alternatives of one policy were grouped and scaled along a single dimension ranging from 1 to 10. Thirdly, country scores on each policy were calculated as means of a country's (different) statements on that policy. In a fourth step, country scores had to be estimated for states that did not speak on that policy. To obtain estimated country scores, linear regression was performed with known country scores as dependent variables and eleven political and economic characteristics as explanatory variables. Finally, a state's preferred position on a policy was calculated as a weighted average of its country score, if it exists, and its estimated country score. Hereby the number of statements upon which the country score is based served as a weight for the country score while the estimated score is given a weight of 1. Table 1 presents the distribution of the state preferred positions for the three issues of 150 states participating in UNCLOS III.<sup>38</sup>

The first issue, 'production size,' deals with the transfer of property rights. Policy alternatives vary between the options of an 'open access', where any state or enterprise has access to the seabed and can exploit its resources without any legal obligations, and a strict 'protection of resources', which would effectively prohibit deep-sea mining. A majority of states favoured a high level of protection of the resources (rank 8), but a substantial minority preferred open access with only few limitations (ranks 3–5). Most states were also interested in provisions that limit the impact of seabed mining on the economies of land-based producers and redistribute the surplus expected from seabed-resource use. Two further topics that attracted considerable attention among national delegates at the conference were price regulations and benefit redistribution. Correspondingly, two policies were debated: 'revenue sources', ranging between no and modest fees (rank 1) to a considerable ISA budget financed by production fees and royalties (rank 10); and 'revenue distribution', where advocates of a North–South redistribution (rank 10) were

<sup>37</sup> Primary data was collected and coded by the UN Law of the Sea project directed by Robert L. Friedheim, see Robert L. Friedheim, Karen W. Goudreau, William J. Durch *et al.*, *Forecasting Outcomes of Multilateral Negotiations: Methodology, Vol. I* (Arlington, Va: Center for Naval Analyses, 1977); Friedheim, *Negotiating the New Ocean Regime*; Thomas Bräuninger and Thomas König, 'Making Rules for Governing Global Commons: The Case of Deep-Sea Mining', *Journal of Conflict Resolution*, 44 (2000), 604–29.

<sup>38</sup> Data on the 1975 policy positions of Ukraine and Namibia are not available. Ideal positions for the two countries were approximated by the median position on each issue.

TABLE 1 *State Positions on Three Seabed Mining Issues in 1975*

	Ideal positions									
	(Not regulated)							(Highly regulated)		
	1	2	3	4	5	6	7	8	9	10
A. Production size <i>N</i> = 150; <i>m</i> = 7.42; SD = 1.58	0	1	4	6	17	5	11	87	19	0
B. Revenue sources <i>N</i> = 150; <i>m</i> = 9.17; SD = 1.48	0	2	0	2	1	1	16	7	8	113
C. Revenue distribution <i>N</i> = 150; <i>m</i> = 4.86; SD = 1.63	1	5	20	38	44	26	8	1	2	5

*Abbreviations:* *m* = mean, SD = standard deviation.

*Range:* A. open access (1) to protection of resources (10); B. encourage investment (1) to raise substantial production fees (10); C. strictly equal (1) to favour land-producing developing countries (10); positions are all rounded to integers.

*Source:* UN Law of the Sea project; own calculations.

opposed by states excluding benefit-sharing with respect to states' different social and economic conditions (rank 1). Whereas the first issue was dominated by a strong pro-international majority with small status quo groups, the question of revenue distribution did not produce any discernible pattern of distribution relative to positions.

In March 1996, more than twenty years after states' negotiations on the deep-sea mining regime, the Assembly of the newly established Authority elected the first Council. According to the Convention, the election term of one half of the members of each of the five groups is two years.<sup>39</sup> Upon the first election, however, member states agreed on an informal complex system of rotation and duration of terms that gives small states more opportunities to take part in the Council deliberations – at least for a limited period of time.<sup>40</sup> Table 2 lists the various compositions of the ISA Council from 1996 to 2002.<sup>41</sup>

The seats of group A, representing the largest consumers of the minerals in question, are occupied by Russia and four of the G7 states. In the past, those countries that have high needs for the metals in question, have few of their own mineral resources and are financially capable of investing, have notably engaged in deep-sea mining. Hence, in group B investor countries from both Western industrialized (Germany, France) and large developing states (India, China) have seats. Group C comprises land-based producers of minerals from both the developed (Australia, Canada) and the least developed (Zambia) state category. Group D consists of developing countries, but they also dominate group E, whose members are elected to ensure an equitable geographical distribution of seats. Because about two-thirds of all members of the ISA are developing countries, small industrial countries such as Austria and Belgium only have a modest chance of occupying a Council seat. This begs the question as to whether this composition, i.e. one according to the principle of a

<sup>39</sup> Art. 161, para. 3 of the *United Nations Convention on the Law of the Sea*.

<sup>40</sup> ISBA/A/L.8 and Corr. 1.

<sup>41</sup> The composition of the Council did not change from 1998 to 1999.

TABLE 2 Composition of ISA Council, 1996–2002

1996	1997	1998/9	2000	2001	2002
GROUP A	(Chamber 1)				
Japan	Japan	Japan	Japan	Japan	Japan
Russia	Russia	Russia	Russia	Russia	Russia
UK	UK	UK	UK	UK	UK
USA	USA	USA	USA	Italy	Italy
GROUP B	(Chamber 2)				
China	China	China	China	China	China
France	France	France	France	India	India
Germany	Germany	Germany	Germany	Germany	Germany
India	India	Netherlands	Netherlands	Netherlands	Netherlands
GROUP C	(Chamber 3)				
Australia	Australia	Canada	Canada	Australia	Australia
Chile	Chile	Chile	Chile	Indonesia	Indonesia
Indonesia	Indonesia	Gabon	Gabon	South Africa	South Africa
Zambia	Zambia	Poland	Poland	Portugal	Portugal
GROUP D	(Chamber 4)				
Brazil	Brazil	Brazil	Brazil	Brazil	Brazil
Trinidad	Jamaica	Egypt	Egypt	Papua New G.	Papua New G.
Bangladesh	Bangladesh	Fiji	Fiji	Egypt	Egypt
Nigeria	Nigeria	Jamaica	Jamaica	Fiji	Fiji
Oman	Oman	Oman	Oman	Jamaica	Jamaica
Cameroon	Cameroon	Sudan	Sudan	Sudan	Sudan

TABLE 2—Continued.

	1996	1997	1998/9	2000	2001	2002
GROUP E		(Chamber 4)				
Egypt		Egypt	Nigeria	Nigeria	Nigeria	Nigeria
Sudan		Sudan	Cameroon	Cameroon	Cameroon	Cameroon
Tunisia		Tunisia	Tunisia	Tunisia	Tunisia	Tunisia
Kenya		Kenya	Kenya	Kenya	Algeria	Algeria
Namibia		Namibia	Namibia	Namibia	Namibia	Namibia
Senegal		Senegal	Senegal	Senegal	Senegal	Senegal
South Africa		South Africa	Philippines	Philippines	Gabon	Gabon
Malaysia		Malaysia	Pakistan	Pakistan	Pakistan	Pakistan
Philippines		Philippines	Saudi Arabia	Saudi Arabia	Saudi Arabia	Saudi Arabia
Korea Republic		Korea Republic	Korea Republic	Korea Republic	Korea Republic	Korea Republic
Paraguay		Paraguay	Indonesia	Indonesia	Paraguay	Paraguay
Cuba		Cuba	Argentina	Argentina	Chile	Chile
Argentina		Argentina	Costa Rica	Costa Rica	Argentina	Argentina
Netherlands		Trinidad	Trinidad	Trinidad	Trinidad	Trinidad
Italy		Italy	Paraguay	Paraguay	Czech Republic	Czech Republic
Ukraine		Ukraine	Ukraine	Ukraine	Poland	Poland
Poland		Poland	Belgium	Italy	Malta	Guyana
Austria		Belgium	Austria	Belgium	Spain	Spain

Source: ISBA/A/L.8, 21 March 1996 (years 1996–97); ISBA/4/A/6\*, 26 March 1998 (year 1998); Composition of the Council 1999–2002 (<http://www.isa.org>; downloaded 23 March 1999) (years 1999–2000); Composition of the Council 2001–04 (<http://www.isa.org>; downloaded 5 December 2000) (years 2001–02).

representation of special interests, can guarantee that all crucial interests and conflict dimensions are represented in the 36-member Council. I now turn to this question.

#### REPRESENTATION AND AGGREGATION OF INTERESTS IN THE ISA COUNCIL

Two points have to be addressed in order to assess the representation and aggregation of interests in the multicameral decision-making system of the ISA. The first, regarding representation, is that states have to be allocated to chambers in such a way that major conflicts divide chambers one from the other (Hypothesis 3). Otherwise multicameralism cannot guarantee that the interests of all groups of states with special interests are reflected in decision making. The second, regarding aggregation, is that the ISA quadricameral voting rule must prove to be more likely to produce outcomes that are stable and that will be implemented than a comparable unicameral voting rule (Hypothesis 1).

#### *Representation of State Interests*

Tables 3 and 4 provide an answer to the first question. Table 3 reports measures on the distribution of positions on the three issues. As the mean and standard deviations of state positions indicate, the first two chambers differ significantly from the third and the fourth with regard to questions of production size and revenue sources. Major consumers and investors apparently prefer significantly less regulation than other countries. Their interest in a regime that provides more or less open access to the seabed resources is represented in the first two chambers. Yet with respect to the first two issues, there is no noteworthy difference between the latter two chambers. The different preferences regarding the third issue of revenue distribution, however, justify the establishment of a further chamber. Here land-based producer countries in the third chamber favour more regulated policy options than all other Council members. The figures also suggest that these diversities are well reflected only in the first five years, whilst in 2001 and 2002 there is no clear cameral preference pattern regarding the third issue.

Table 4 provides the results of a multivariate analysis of variance (MANOVA) to test the hypothesis that the multicameral configuration represents states' locations in the three-dimensional issue space. MANOVA tests the differences in the centroid vector of means of the three dependent variables for the four categories of the independent variables. For all seven years the overall multivariate test statistic (Pillai's trace) is significant and 28 to 43 per cent ( $\eta^2$ ) of the variance in states' issue positions can be revealed by their cameral allocation.<sup>42</sup> However, the next question would of course be, which specific issue contributes to the significant overall effect?

The first rows of the table provide measures on the correspondence of a state's chamber membership to its position on each issue. The high values of  $\eta^2$  suggest that the composition of chambers (nearly perfectly) reflects states' positions on the first and second issue whilst the conflict concerning the distribution of revenues is mirrored worse in the chamber composition. Again, in the 2001 and 2002 Councils, states having dissimilar preferences regarding the distribution of revenues are not placed in different chambers. In sum, the

<sup>42</sup> Pillai's trace  $p$  is a function of the explained variances  $r_i$  in the canonical variables  $i$ :

$$p = \sum_{i=1}^s \frac{r_i}{1 + r_i}.$$

Thus  $p$  ranges between 0 and  $s$  where  $s$  is the number of canonical factors.

TABLE 3 State positions in the ISA Council Chambers in 1996–2002

	1996		1997		1998/99		2000		2001		2002	
	<i>m</i>	SD	<i>m</i>	SD	<i>m</i>	SD	<i>m</i>	SD	<i>m</i>	SD	<i>m</i>	SD
<b>A. Production size</b>												
Chamber 1	2.73	0.67	2.73	0.67	2.73	0.67	2.73	0.67	2.73	0.67	3.15	0.98
2	5.40	2.07	5.40	2.07	4.79	1.78	4.79	1.78	4.79	1.78	5.72	1.69
3	7.27	1.98	7.27	1.98	6.25	2.07	6.25	2.07	6.25	2.07	6.18	1.71
4	7.54	1.42	7.64	1.40	7.95	1.08	7.91	1.20	7.84	1.11	7.87	1.11
<b>B. Revenue sources</b>												
Chamber 1	3.30	1.43	3.30	1.43	3.30	1.43	3.30	1.43	3.30	1.43	4.46	1.99
2	6.56	2.06	6.56	2.06	6.16	1.72	6.16	1.72	6.16	1.72	7.30	0.96
3	9.15	1.54	9.15	1.54	9.01	1.44	9.01	1.44	9.01	1.44	8.25	1.30
4	9.36	1.06	9.48	0.89	9.54	0.81	9.53	0.84	9.66	0.43	9.70	0.39
<b>C. Revenue distribution</b>												
Chamber 1	3.61	1.82	3.61	1.82	3.61	1.82	3.61	1.82	3.61	1.82	4.22	2.06
2	4.88	1.76	4.88	1.76	4.24	1.04	4.24	1.04	4.24	1.04	5.12	1.56
3	7.41	3.05	7.41	3.05	7.64	2.84	7.64	2.84	7.64	2.84	4.35	1.78
4	4.56	0.82	4.63	0.93	4.65	0.97	4.66	0.98	5.00	2.14	4.94	2.12

Abbreviations: *m* = mean, SD = standard deviation.

TABLE 4 *Representation of Positions in the ISA Council Chambers in 1996–2002 (MANOVA)*

	1996	1997	1998/99	2000	2001	2002
Between-subject effects ( $\eta^2$ )*						
A. Production size	0.55	0.57	0.70	0.67	0.64	0.64
B. Revenue sources	0.73	0.77	0.81	0.81	0.81	0.82
C. Revenue distribution	0.36	0.33	0.40	0.40	0.03†	0.02†
Pillai's trace	1.10	1.12	1.30	1.28	0.85	0.86
$\eta^2$	0.37	0.37	0.43	0.43	0.28	0.29

\*Multivariate and between-subjects effects are all significant at the 0.01% level unless otherwise stated.

†Between-subjects effect is not significant at the 5% level (Council 2001:  $F = 0.28$ ; Council 2002:  $F = 0.25$ ).

findings support Hypothesis 3. In fact, the provisions for electing the members of the central decision-making body of the organization result in the representation of special interests, where minority positions on major conflicts are assembled in different chambers. Still, chamber composition does not reflect divergent interest on all major conflicts to the same extent.

#### *Aggregation of State Interests*

Given these results, the final question to be discussed involves the likely effects – in terms of policy outcomes – of special interest representation and subsequent voting in a multicameral system. For this purpose, likely outcomes under unicameral and multicameral arrangements are calculated. In order to make them comparable and construct a severe test of the effects of the ISA multicameral rule, I use voting quotas and a vote weighting scheme that are most similar to the actual ISA provisions. Four rules are considered:

- The actual ISA multicameral voting rule that subjects decisions to an overall two-thirds majority (twenty-four states) provided that there is no veto in one of the four chambers (i.e. there are two-state blocking minorities in the first three chambers and a twelve-state blocking minority in the fourth);
- A unicameral unweighted voting rule whereby states have one vote each and decision making is subject to a majority of twenty-five from the thirty-six states;<sup>43</sup>
- An ideal type multicameral voting rule that subjects decisions to an overall two-thirds majority (twenty-four states) provided that there is a simple majority within each of the four chambers (i.e. there are three-state majorities in the first three chambers and a thirteen-state majority in the fourth chamber);
- A unicameral weighted voting rule whereby actors in the first three chambers have six votes each, actors of the fourth chamber have one vote each, and the quota is set at sixty-eight out of ninety-six weighted votes. As a result, any of the four chambers is provided with twenty-four votes which is very similar to the ISA multicameral rule.

To predict likely decision-making outcomes, the core concept is applied to the three-dimensional space of policy alternatives that represents states' divergent interests in

<sup>43</sup> A two-thirds majority core of the unweighted and weighted voting rules (twenty-four or sixty-four votes) does not exist for all seven years. For this reason, results for slightly higher quotas are presented.

the major conflicts of the regime.<sup>44</sup> Figure 1 shows the location of the 1996 Council members in the issue space, and the cores of the unicameral and the multicameral voting rules. Let us first consider states' locations in the conflict space. States' positions differ widely, but they cluster on the upper right side of the three-dimensional cube. Ukraine (UA) and Namibia (NAM) may serve as points of orientation as they occupy issue-by-issue median positions in the Assembly of all 150 states.

On the one hand, most of the thirty-six Council members have positions that are close to those of Ukraine and Bangladesh. On the other hand, and without exception, all Council members with positions around the issue-by-issue median are developing countries. Also, but with the exception of Indonesia (RI), all of them are members of the fourth chamber. By contrast, members of the first three chambers are located on the lower left side of the cube. The major industrial countries – Russia, United States, Britain and Japan – make up the first chamber, located on the left, the investor states of the second chamber occupy a mediate position, and land-producing states of the third chamber are located on the upper right side. Figure 1 nicely portrays the results of Table 3, namely that the composition of chambers reflects the major conflicts within the regime and in particular the divergent interests regarding the first and second issue. What follows from this representation of special interests? Let us now consider the likely decision-making outcomes.

As Figure 1 points out, the cores under the four voting rules differ with respect to their location and shape. Applying the ISA multicameral provisions, we can expect outcomes that are centrally located in a small region (Figure 1a). Unicameral unweighted voting, by contrast, will produce outcomes that hardly reflect the interests of the actors of the first three chambers. The latter core is close to the issue-by-issue median and to the overwhelming majority of Council members who are all members of the fourth chamber (Figure 1b). Figure 1c suggests, however, that only the ideal type quadricameral rule can effectively protect the interests of minorities. It produces a core that is spanned between the preferred positions of Great Britain, Australia, India and the set of actors that make up the fourth chamber. We cannot foresee where the outcome will actually be, as states have to bargain. Yet, we know that the outcome of the bargaining process will be located inside the core, and the shape of the core indicates that outcomes *might* be next to any of the four chambers. The unicameral weighted voting scheme has effects that are similar to the ISA multicameral rule (Figure 1d). Again, outcomes are centrally located, but they are not spanned between the chambers.

Finally, these findings have to be investigated for the 1997 to 2002 Councils. To compare the location and shape of the core over these years, Table 5 lists three statistics. First, the central point indicates the core's location in the three-dimensional issue space. Assuming that decision-making outcomes are inside the core, and all these outcomes are equally likely, the central point can be interpreted as the 'expected outcome'. The core volume is thus a measure of the likelihood of policy change or the rule efficiency. The distance between the core and a chamber's Pareto set indicates how close to the outcome these groups' key actors will be; it is therefore a measure of the rule's effectiveness.

<sup>44</sup> Location and shape of the core are calculated using the programs *Limed* and *Qhull*. *Limed* (available at <http://www.tbraeuninger.de/download/download.html>) requires the commercial program *Gauss* and computes limiting median hyperplanes in two- and three-dimensional spaces for unicameral and multicameral legislatures with actors having weighted and/or unweighted votes. *Qhull* (C. Bradford Barber, David P. Dobkin and Hannu Huhdanpaa, 'The Quickhull Algorithm for Convex Hulls', in *ACM Transactions on Mathematical Software*, 22 (1996), 469–83; program available at <http://www.geom.umn.edu/software/qhull>) computes the core by intersecting halfspaces (defined by the limiting median hyperplanes of *Limed*) about a given core point.

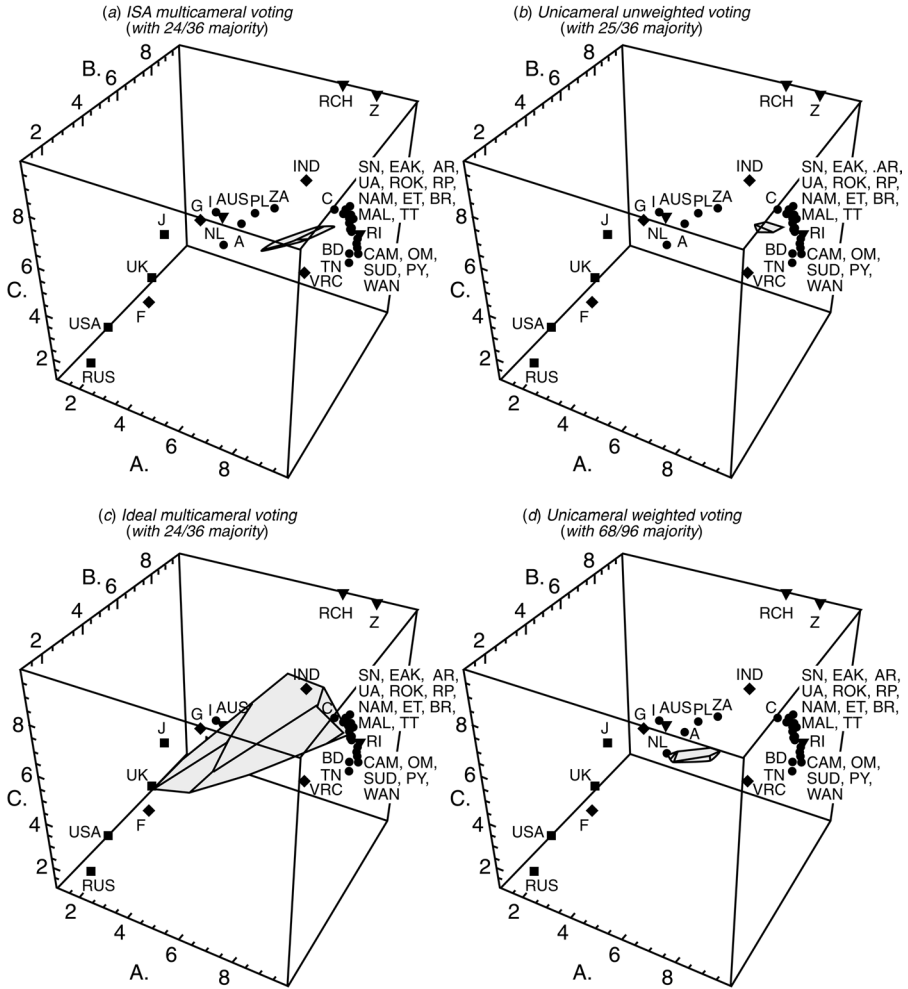


Fig. 1. Multicameral and unicameral cores of the 1996 ISA Council

Key: ■ Member of chamber 1 (4 consumers), ◆ Member of chamber 2 (4 investors), ▼ Member of chamber 3 (4 producers), ● Member of chamber 4 (6 developing countries and 18 others); Dimensions: A, Production size; B, Revenue sources; C, Revenue distribution.

ISA Council Members: A, Austria; AR, Argentina; AUS, Australia; BD, Bangladesh; BR, Brazil; C, Cuba; CAM, Cameroon; G, Germany; EAK, Kenya; ET, Egypt; F, France; I, Italy; IND, India; J, Japan; MAL, Malaysia; NAM, Namibia; NL, Netherlands; OM, Oman; PL, Poland; PY, Paraguay; RCH, Chile; RI, Indonesia; ROK, Korea Republic; RP, Philippines; RUS, Russia; SN, Senegal; SUD, Sudan; TN, Tunisia; TT, Trinidad and Tobago; UA, Ukraine; UK, United Kingdom; USA, United States; VRC, China (PR); WAN, Nigeria; Z, Zambia; ZA, South Africa.

According to Table 5, the location and shape of the cores in the subsequent years are fairly similar to those of the 1996 Council. ISA multicameral voting is a mixed type that combines elements of multicameralism with an overall (two-thirds) quota, which is characteristic for unicameralism. Accordingly, the central point and volume of the ISA cores range between those of the latter two. The same holds for the distance between the chambers' Pareto sets and the core. In this respect, ISA multicameral voting performs much

TABLE 5 *Location, Size and Shape of the Core\**

	Council					
	1996	1997	1998/99	2000	2001	2002
ISA multicameral voting (with 24/36 majority)						
C	(6.93, 8.39, 4.55)	(7.01, 8.44, 4.62)	(7.11, 8.55, 4.63)	(7.33, 8.81, 4.67)	(7.47, 9.05, 4.66)	(7.50, 9.08, 4.65)
V	0.03	0.03	0.09	0.09	0.07	0.07
D1	3.66	3.77	2.35	2.31	2.39	2.43
D2	1.25	1.26	1.42	0.67	1.38	1.38
D3	1.21	1.19	0.85	1.92	0.88	0.85
D4	0.65	0.62	0.11	0.11	0.26	0.25
Unicameral unweighted voting						
C	(7.38, 9.03, 4.71)	(7.95, 9.49, 4.71)	(8.01, 9.52, 4.69)	(8.01, 9.51, 4.69)	(7.80, 9.38, 4.55)	(7.80, 9.39, 4.55)
V	0.01	0.01	0.002	0.002	0.01	0.005
D1	5.49	6.08	6.33	6.33	4.20	4.23
D2	1.62	1.90	2.04	2.04	1.84	1.84
D3	1.00	0.80	3.22	3.22	0.82	0.82
D4	0.42	0.08	0.10	0.10	0.22	0.22
Ideal multicameral voting (with 24/36 majority)						
C	(6.68, 8.06, 4.82)	(6.87, 8.27, 4.88)	(5.96, 7.57, 5.38)	(5.83, 7.38, 5.15)	(6.59, 8.21, 4.73)	(6.79, 8.39, 4.69)
V	2.99	2.88	5.80	6.05	1.14	1.15
D1	0	0	0	0	0.34	0.34
D2	0.75	0.75	0.68	0.61	0.68	0.68
D3	0.86	0.81	0.60	0.61	0.53	0.54
D4	0.10	0.02	0.06	0.06	0.23	0.20
Unicameral weighted voting						
C	(5.78, 7.07, 4.53)	(5.97, 7.23, 4.46)	(5.12, 6.62, 4.88)	(5.10, 6.58, 4.77)	(5.70, 7.61, 4.96)	(5.71, 7.61, 4.96)
V	0.08	0.06	0.11	0.11	0.02	0.02
D1	2.06	2.09	1.41	1.41	1.22	1.22
D2	1.12	1.16	0.54	0.46	0.96	0.95
D3	1.03	1.08	1.17	1.17	0.81	0.82
D4	0.54	1.03	0.26	0.91	1.83	1.95

\*C = Core central point; V = Core volume; D1–D4 = Distance between core and each chamber.

†As the 24/36 core does not exist for all years, results are reported for the 25 quota.

‡The 68/96 core does not exist in 1998–2000. Results are reported for the 68 quota or the 69 quota.

better than unicameral unweighted voting, but the first chamber's distance to the core, for instance, is still much larger (3.66 in 1996) than the fourth chamber's distance (0.65 in 1996). In other words, even if the decision that results from intercameral bargaining is the one that is both feasible and most preferable to the consumer states, it is far from the consumer states' most preferred policy.

The ideal multicameral rule reverses these advantages and disadvantages. At the expense of a much larger core (and a lower rule efficiency) it offers a set of stable outcomes that are close to one of the four groups of states. In particular the intercameral bargaining space offers outcomes that are close to the Pareto sets of all chambers. Thus, in the case of the ISA the ideal multicameralism would make outcomes likely that are stable and can find the support of a number of actors that are relevant for effective regime function. This supports Hypothesis 1, but the findings also indicate that first, the ISA multicameral rule cannot guarantee effective decision making – although it performs better than the simple 'one-state-one-vote' rule. Secondly, the weighted voting rule produces effects similar to the actual ISA rule and could therefore have been an alternative setting. The fictitious weighted voting scheme discussed above, however, also presupposes that major conflict dimensions are recognized, that states are grouped along these conflicts, and that voting weights are allocated in such a way that any group has the same number of votes irrespective of its size. If votes were allocated differently, the results would differ in effect.

## CONCLUSIONS

This article has examined a specific arrangement for the representation and aggregation of interests in international organizations, namely multicameral voting. Applying a spatial model of strategic decision making, multicameralism was found in certain situations to be more efficient and effective than unicameralism, i.e. it is more likely to produce outcomes that are stable and that will be implemented. The most important condition, however, is that the assignment of states to chambers is based on their conflict of interests. Often the inclusion of distinct groups of states, more so than the participation of a large majority, is a prerequisite for regime functioning. In this case, chambers have to consist of those groups of states that are necessary for effective policy making. In the article this was operationalized using the ideal types of major and minor conflicts. Then, if the chambers' underlying policy dimensions constitute major conflicts between states,  $k$ -cameral voting produces a bargaining space of stable outcomes that is centrally located and spanned between key groups of states.

Formal voting schemes are not the only component of decision making in international organizations, but they are fixed hurdles around which actors' expectations converge. Even where informal understandings may be equally important, the possibility of resorting to formal voting rules may affect the decision taken. Most international organizations employ rules that create a trade-off between the 'one-state-one-vote' standard and a weighted votes principle based on population figures, economic wealth or budgetary contributions. This article has argued that appropriate mechanisms for the representation and aggregation of interests often have to be even more complex: if there are two or more key groups of states that guarantee the functioning of the organization, such as importers and exporters in a commodity regime, a bicameral or  $k$ -cameral voting rule will be more likely to produce outcomes that are stable and will be implemented. The ISA mediation of the interests of investors in deep-sea mining, consumers and land-based producers of the metals in a quadricameral Council, is one example. This is even more noteworthy as these results are

derived from empirical data that do not satisfy all of the restrictive conditions that guarantee multicameral efficiency and effectiveness in theory. The empirical analysis suggests that multicameral institutions may even have the above listed properties in more general situations.

If constitutional designers – at least intuitively – understand these effects, one would expect multicameralism to be used as a means of transforming major conflicts into privileged dimensions of bargaining and minor conflicts into non-privileged dimensions of seeking Pareto-improvements. By contrast, if there are no visible and stable conflictual divisions between groups within society or states within the international regime, unicameral institutions may prove more useful. The crucial question then is how we can identify major and minor conflicts empirically so that we can test the conjectures on the design of multicameral institutions. There are several causal factors that might be worth consideration:

- The payoff implications of the actual or expected decisions to be taken may be a key variable. Public choice studies differentiate between allocation and redistribution decisions: whenever autonomous states can refuse to comply or even exit fairly easily, only unanimity can secure effective decision making on apparently redistributive issues.<sup>45</sup>
- If there are central authorities or decentralized mechanisms capable of enforcing decisions, the allocative or redistributive nature of the issue in question no longer plays that role, as enforcing, by definition, refers to a situation where compliant behaviour is observed despite individual rejection of a (majoritarian) decision.
- If the long shadow of the future veils the long-run redistributive aspects of decisions, the actual nature of the conflict will similarly have a minor impact on the relationship between the voting rule and effectiveness.
- Finally, if international institutions deal with a broad range of subject-matter inducing a multitude of cross-cutting cleavages, issue-linkage may also generate net benefits even under majority rule. By contrast, if this is not the case, one would expect that the effectiveness of policy making is seriously linked to how decisions are made.

The question concerning the frequency of multicameral institutions may finally be discussed. In fact, multicameralism seems to be a rather unusual institutional arrangement.<sup>46</sup> Actually, international organizations tend to be very conservative with regard to the organizational structure and the voting rules applied. Moreover, future conflicts within a regime are seldom as obvious as they were in the seabed mining case. Finally, if major and minor conflicts can be separated, issue-by-issue decisions using different rules, such as the detailed procedural provisions for different issue areas in the EU, may also guarantee effective policy making.

However, if the problem of collective decision making is discussed in a broader sense, the theory of multicameralism has been applied to, for instance, the EU, where the Commission, the Council of Ministers and the European Parliament interact in a unicameral, bicameral or tricameral system. At the national level, the United States has been considered a tricameral system with one individual (President) and two collective

<sup>45</sup> Dennis C. Mueller, *Public Choice II* (Cambridge: Cambridge University Press, 1989), pp. 43–111; Bruno S. Frey, 'The Public Choice of International Organizations', in Dennis C. Mueller, ed., *Perspectives on Public Choice* (Cambridge: Cambridge University Press, 1997), pp. 106–23, at p. 111.

<sup>46</sup> At the national level, Yugoslavia and South Africa had genuine tricameral systems, Sweden had a quadricameral one (Rogers, 'An Informational Rationale for Congruent Bicameralism', p. 142).

actors (House and Senate) as chambers. More generally, both presidentialism, where the head of government has certain legislative powers, and parliamentarism, where the government acts as an agenda-setter within parliament, may be understood as multicameral systems. Similarly, the idea of partisan or institutional veto players is based on the logic of multicameralism: in a multi-party coalition government, a (no matter how large) majority of the relevant actors within each coalition party has to approve a government proposal; in corporatist countries certain governmental decisions are supposed to require the consent of (a majority of) labour and (a majority of) capital. Finally, judicial vetoes on legislation are considered to establish 'cheap' forms of multicameralism.<sup>47</sup>

<sup>47</sup> George Tsebelis, *Veto Players: How Political Institutions Work* (Princeton, NJ: Princeton University Press, 2002); George Tsebelis, 'Decision Making in Political Systems: Veto Players in Presidentialism, Parliamentarism, Multicameralism und Multipartyism', *British Journal of Political Science*, 25 (1995), 289–325, pp. 302–7; Rogers, 'An Informational Rationale for Congruent Bicameralism', p. 142.

APPENDIX

DEFINITION: (1) An  $n - 1$  dimensional hyperplane in  $\mathbf{R}^n$  (short: *hyperplane*) is an  $n - 1$  dimensional linear manifold in  $\mathbf{R}^n$  that is any set of the form:

$$H = \{x \in \mathbf{R}^n | x \cdot v = c\},$$

where  $v \in \mathbf{R}^n$ ,  $\|v\| = 1$  is the direction of  $H$  and  $c \in \mathbf{R}$ . The half spaces of  $\mathbf{R}^n$  are denoted by  $H^+$  and  $H^-$ :

$$H^+ = \{x \in \mathbf{R}^n | x \cdot v > c\} \quad \text{and} \quad H^- = \{x \in \mathbf{R}^n | x \cdot v < c\}.$$

(2) The atomic (finite) measure  $\mu_j$  is defined by

$$\mu_j(x_i) = \begin{cases} 1/n_j & i \text{ belongs to chamber } j \\ 0 & \text{else} \end{cases}.$$

If  $S$  is any set, then  $\mu_j(S)$  denotes the relative number of actors in  $S$  that belong to  $j$ .

(3) A hyperplane  $H$  with

$$\mu_j(H^+) \leq \frac{\mu_j(\mathbf{R}^n)}{2} \quad \text{and} \quad \mu_j(H^-) \leq \frac{\mu_j(\mathbf{R}^n)}{2}$$

is called a *one-chamber median hyperplane* of chamber  $j$ .

(4) A hyperplane  $H$  that is a one-chamber median hyperplane for all  $k$  chambers is called a *k-cameral median hyperplane*.

THEOREM 1: Given any  $n$ -dimensional  $k$ -cameral legislature,  $n \geq k$ , there exists at least one  $k$ -cameral median hyperplane.

PROOF: If  $k < n$ , define  $n - k$  measures  $\mu_j := \mu_k$  for any  $k < j \leq n$ . Then Theorem 2 of Cox and McKelvey applies.<sup>48</sup>

LEMMA 1:<sup>49</sup> If all  $n_j$  are odd, then for any  $k$ -cameral median hyperplane  $H$  in direction  $v$ :

- (i)  $\mu_j(H^+) \leq (n_j - 1)/2$ ,  $\mu_j(H^-) \leq (n_j - 1)/2$ , and  $\mu_j(H) \geq 1$  for any  $1 \leq j \leq k$ ;
- (ii) there is no other  $k$ -cameral median hyperplane  $G$  in direction  $w$  with  $w = v$ ;
- (iii)  $H$  is attractive in both directions.

PROOF: (i) For any  $j$ , if  $n_j$  is odd and  $\mu_j(H^\pm) \leq n_j/2$ , then  $\mu_j(H^\pm) \leq (n_j - 1)/2$  and  $\mu_j(H) \geq 1$ .

(i)  $\Rightarrow$  (ii): Let  $G$  be a hyperplane with  $w = v$  and  $d = c + \varepsilon$  ( $\varepsilon > 0$ ). Then  $H^- \cup H \subset G^-$  and  $\mu_j(G^-) \geq (n_j + 1)/2$ . Thus  $G$  is not a  $k$ -cameral median hyperplane.

(i)  $\Rightarrow$  (iii): For any point  $x$  on one side of  $H$ , its projection  $p_H(x)$  to  $H$  (the base of the perpendicular dropped to  $H$  through  $x$ ) is preferred by a joint majority of actors whose ideal points are located on  $H$  and on the other side of  $H$ . Thus  $H$  attracts all points on each side of  $H$ .

LEMMA 2: If all  $n_j$  are odd, then the core of an  $n$ -dimensional  $k$ -cameral legislature is a subset of the intersection of all  $k$ -cameral median hyperplanes.

PROOF:<sup>50</sup> Suppose, by way of contradiction, that a core alternative  $x$  and an arbitrary  $k$ -cameral median hyperplane  $H$  exist such that  $x \notin H$ . According to Lemma 1 (iii) the projection  $p_H(x)$  is preferred by a joint majority of actors to  $x$ . This contradicts the fact that  $x$  is a core point. Thus  $x$  is not an element of the core.

LEMMA 3: Let  $L$  be an  $n$ -dimensional  $k$ -cameral legislature in  $\mathbf{R}^n$  with odd numbers of actors,  $\{x_1, \dots, x_m\}$  actors' ideal points, and  $H$  a  $k$ -cameral median hyperplane. Let  $L'$  denote the 'reduced'  $(n - 1)$ -dimensional  $k$ -cameral legislature in  $H$  where actors have ideal points  $\{p_H(x_1), \dots, p_H(x_m)\}$ . Then:

$$\text{core}(L) \subseteq \text{core}(L').$$

<sup>48</sup> Cox and McKelvey, 'The Ham Sandwich Theorem for General Measures', p. 78.

<sup>49</sup> Cf. Theorem 2 of Davis, DeGroot and Hinich, 'Social Preference Orderings and Majority Rule'; and Thomas H. Hammond and Gary J. Miller, *The Core of the Constitution: Lemmas, Theorems, and Examples* (unpublished, Michigan State University, 1987), pp. 9–12.

<sup>50</sup> Cf. Lemma 3.A4 of Tsebelis and Money, *Bicameralism*.

PROOF: One has to show that  $x \notin \text{core}(L)$ , if  $x \notin \text{core}(L')$ . According to Lemma 2,  $\text{core}(L)$  is a subset of  $H$  as all  $n_j$  are odd. One can thus focus on points  $x \in H$ . Consider a  $x \in H \setminus \text{core}(L')$ . In the reduced legislature  $L'$  there is a  $y \in H$  and a joint majority  $S$  so that  $y \succ_i x$  for any  $i \in S$ . Otherwise  $x$  would be undominated and an element of  $\text{core}(L')$ . But it also holds that  $y \succ_i x$  for any  $i \in S$  where  $S$  is a joint majority in  $L$ . (To understand this, consider the following simple proposition: given any  $(n - 1)$ -dimensional hyperplane  $G$  in  $\mathbf{R}^n$  and any two actors  $a$  and  $b$  with ideal points  $x_a$  and  $x_b = p_G(x_a)$ , then for any two alternatives  $r, q \in G$ ,  $r \succ_a q$  if and only if  $r \succ_b q$ .) As a result,  $x \notin \text{core}(L)$ . Notice that in general,  $\text{core}(L) \neq \text{core}(L')$ : the core of the original legislature  $L$  is a real subset of  $\text{core}(L')$ .<sup>51</sup>

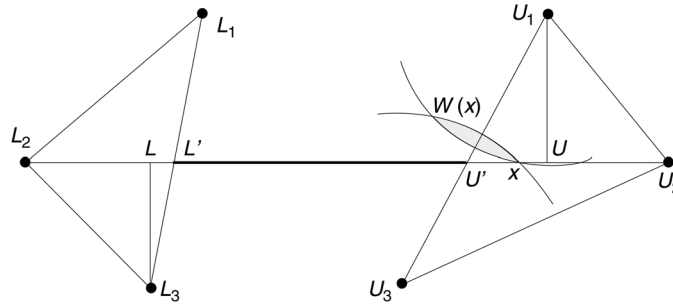


Fig. 2. The bounds of the core

PROOF OF THEOREM 2: Case  $n < k$ : by definition, the core cannot cover more than the entire policy space, or  $\dim[\text{core}(L)] \leq n$ . Case  $n \geq k$ : One has to show that  $\dim[\text{core}(L)] \leq k - 1$ . Let  $L^0$  be a  $k$ -cameral legislature and  $\{x^0_1, \dots, x^0_m\}$  actors' ideal points in  $\mathbf{R}^n$ . According to Theorem 1, there is a  $(n - 1)$ -dimensional  $k$ -cameral median hyperplane. Denote that hyperplane as  $H^1$  and define the reduced legislature  $L^1$  of  $L^0$  by  $x^1_j = p_{H^1}(x^0_j)$ . From Lemma 3 it follows that  $\text{core}(L^0) \subseteq \text{core}(L^1)$  and thus  $\dim[\text{core}(L^0)] \leq n - 1$ . As  $H^1$  is affine to an  $(n - 1)$ -dimensional subspace of  $\mathbf{R}^n$ ,  $H^1$  itself can be identified as  $\mathbf{R}^{n-1}$ . Using Theorem 1 yields a second  $k$ -cameral median hyperplane  $H^2$ , so that from applying Lemma 3 to the reduced legislature  $L^2$  with  $x^2_j = p_{H^2}(x^1_j) = p_{H^2}(p_{H^1}(x^0_j))$ , it follows that  $\text{core}(L^0) \subseteq \text{core}(L^1) \subseteq \text{core}(L^2)$ , and therefore  $\dim[\text{core}(L^0)] \leq n - 2$ . Applying this argument  $n - k$  number of times, one obtains that in  $H^{n-k}$ , which is a  $k$ -dimensional affine subspace of  $\mathbf{R}^n$ , a  $(k - 1)$ -dimensional  $k$ -cameral median hyperplane exists. Hence, the core  $(L^0)$  is indeed a subset of an affine subspace of  $\mathbf{R}^n$  on not more than  $k - 1$  dimensions.

Notice that zero and  $k - 1$  or  $n$  are indeed the greatest lower and smallest upper bounds of the core dimensionality. To understand this, consider a  $k$ -actor committee where decision-making requires unanimous consent. Interpreting each actor as a single chamber, the  $k$ -cameral legislature coincides with the  $k$ -actor committee applying unanimity, and the  $k$ -cameral core is in fact the convex hull ('Pareto set') of the  $k$  actors' ideal points. But the convex hull of  $k$  ideal points in  $\mathbf{R}^n$  is a set of at the most  $k - 1$  dimensions; if  $n < k$ , it extends in no more than  $n$  dimensions. On the one hand, these are indeed smallest upper bounds as long as actors' ideal points are not arranged somehow symmetrically. On the other hand, zero is the greatest lower bound as the Pareto set will collapse to a single point if the  $k$  actors have identical ideal points.

<sup>51</sup> The points where the  $k$ -cameral median hyperplane intersect the one-cameral median hyperplane determine the bounds of the core. In Figure 2, the core of the bicameral legislature is between  $L'$  and  $U'$  on the bicameral median line  $L_2U_2$ ; the core is *not* between  $L$  and  $U$ , the projections of  $L_3$  and  $U_3$ , as Figure 3.2 in Tsebelis and Money (*Bicameralism*, p. 83) suggests. For any point  $x$  in the segments  $LL'$  and  $U'U$ , there is a set of alternatives  $W(x)$  that beat the point with a joint majority (see also Figure 2 of Miller and Hammond, 'Committees and the Core of the Constitution'). In Lemma 3.A3 Tsebelis and Money (*Bicameralism*, p. 92) claim that the core of a bicameral legislature in  $n$  dimensions coincides with the core of its projection on a bicameral median hyperplane. This assertion is false. Instead, the weaker inclusion from Lemma 3 above holds.