COORDINATION IN *N*-PERSON GAMES

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ABSTRACT. International governance may be approached as a coordination in *n*-person games. Examining some key IGOs we find several different kinds of coordination mechanisms. The basic aspect of international coordination is unanimity and the deviations from unanimity that make the games interesting from a strategic point of view. Quantitative voting only makes sense if the requirement unanimity derived from state sovereignty is relaxed.

1. INTRODUCTION

The problem of coordination in a 2-person game is well-known, including the risk of coordination failures. In a *n*-person game coordination is approached as a market phenomenon on the basis of a Walrasian mechanism for the successive achievement of equilibrium. Such coordination concept is only possible where the game has a core. For more on such *n*-person games, see e.g. Lane and Mæland [7] and Owen [8]. Important and interesting interactions between a group of participants are made up of zero sum situations, which lack however cores. Thus, how can players in such choice situations coordinate?

Intergovernmental organisations such as the United Nations, the International Monetary Fund and the World Trade Organisation are typical organisations where coordination among actors can be modelled by *n*-person games. The actors in these organisations would be interested in finding the best solutions and at the same time secure the organisation against inefficiency in the form of indecisiveness or stalemate. Typically, international organisations or regional coordination mechanisms consist of *n* players (voters) who are interested in making common decisions. The logic of such *n*-person coordination may, however, be highly varied, reflecting the use of alternative institutions. We will first look at a few existing examples of coordination and then proceed to a general analysis of the problem of *n*-person coordination.

In the present systems of international/intergovernmental organisations we find a whole range of coordination mechanisms based on voting, which offers an interesting opportunity to analyze the variety of mechanism design. One finds both quantitative voting and qualitative voting as well as all kinds of aggregation rules from simple majority to unanimity. The implications of the use of alternative coordination mechanisms in a *n*-person game may be spelled out by using a voting power index, which states the form of the game.

2. FORM AND CONTENT OF VOTING IN *n*-PERSON GAMES

One coordination mechanism in *n*-person games is voting, which transform the problem of coordination to that of scoring a winner by means of a rule aggregating the preferences of

each choice participant. A voting game is basically a zero sum game in a *n*-person game - a simple game. The advantage of voting is the capacity to arrive at a conclusion - the probability of decisiveness as well as the possibility of creating an aggregation rule which makes the final outcome dependent upon the preferences of the players. The drawback of the voting mechanism is that some players may not accept the final outcome but keep demanding new rounds of voting until they *'win'*. Voting schemes are in general not strategy proof meaning that players have an incentive to vote insincerely in order to make the link between outcomes and preferences less transparent.

The basic components of coordination in voting are the rules and the preferences. The rules give the form of the game according to a probabilistic interpretation. When preferences are taken into account, then the game is strictly determined by the actual set up of preferences. However, this is purely accidental as the preferences of the players vary from issue to issue. Let us first concentrate on coordination in a *n*-person game which in the form of voting and subsequently take preferences into account.

Voting in a group of choice participants constitutes a simple game where the outcomes are binary, either winning or loosing. Each choice participant targets voting power, or the capacity to be decisive for outcomes. And voting power depends upon the number of votes cast, the rule of aggregating the votes and preferences of the participants. See [1], [9] and [5] for more on the two most common power indices: the Banzhaf index and the Shapley Shubik index.

Voting power results from coalition strategies where each player maximizes his/her capacity to be decisive. Formally, using Banzhaf [1] power indices, a voter's voting power (β_i) is the same as two times the capacity of the whole group (the assembly) to be decisive (δ) times the individual blocking power of the voter (θ_i).

$$\beta_i = \delta\theta i \tag{1}$$

This general solution of an *n*-person game fits political coordination well, as choice participants can always vote *yes* or *no* as the basic strategy.

The Banzhaf power index contains much information about coordination in n-person games. Thus, one may calculate:

(a) the decisiveness of the entire group, δ,
(b) the individual capacity to be decisive, β_i, and, finally,
(c) the individual capacity to block, θ_i.

Let us evaluate some existing coordination mechanism which display a variety of characteristics according to the properties (a) - (c) above, reflecting alternative framing of the votes cast and the aggregation rule. We concentrate upon the form of the game, i.e. we first assume that the players have an equal probability of voting *yes* or *no*. Later we will analyze how preferences matter for voting power.

3. Some Coordination Mechanisms

Interestingly, international organisations offer a menu of coordination mechanisms where all kinds of alternatives exist. Thus, there is the veto mechanism of the Security Council on the one hand and the simple majority mechanism in European Parliament on the other hand. In the WTO each player counts for one whereas in other international organisation such as the IMF and the EU there is quantitative voting. The ECB employs still another alternative where a subgroup of players - the experts - may prevail. Let us look at each mechanism before we do a comparative assessment. One may actually in the world of international organisations find examples of almost all the kinds of coordination mechanisms conceivable.

3.1. **One-man One-vote Integovernmental Organisations.** When an organisation employs unanimity, then it is well known that transaction costs will sooner or later start souring. The capacity to block will be 1 for each player meaning that any positive decision must bring all of them on board. But each player then has an incentive to withhold his/her support as long as possible in order to extract maximum benefits in the last round of negotiations leading up to all players saying *yes*. Thus, with a large group of players, the probability of decisiveness will be extremely low, as there will only be one winning coalition in the entire set of coalitions.

Table 1. One-Man One-Vote Intergovernmental Organisations

Intergovernmental Organization (IGO)	Members n	Decision Rule	Banzhaf Index	Capacity to Block	Probability of Decisiveness
World Trade	146	2/3	0.000015	0.35	0.000021
Organisation (WTO)	146	3/4	0.00000000034	0.51	0.00000000033
International Labor Organisation (ILO)	174	2/3	0.0000045	0.34	0.0000065
International Whaling Commission (IWC)	57	3/4	0.000081	0.52	0.000077

WTO: The World Trade Organisation. The World Trade Organisation generally makes its decisions by consensus, however, when consensus is not possible, WTO employs two different decision rules, 2/3rds and 3/4ths of votes. With an assembly size of 146, Table 1, a qualified majority of 2/3rds results in fairly high capacity to block, 35 percent chance, However, the Banzhaf power and decisiveness are both very low, efficiency is only 0.002 percent. With a qualified majority rule of 3/4ths the probability of decisiveness and individual Banzhaf power are extremely low while the blocking power of each player is quite large, 50 percent chance. How, then, does the WTO deliver its important coordination of world trade and its regulation and harmonisation? The answer is to be found with the preferences of the players, i.e. the content of the game. Although the content of the games varies with the particular constellations of preferences at one time or another, one may conclude that the players participating in the coordination of world trade issues have thus far has a rather strong consensus to deliver a body of rules common to all which each and everyone could accept. This may change though as the WTO takes on more controversial issues where the players have more divergent views.

ILO: The International Labor Organisation. ILO has 174 member states and its organisation consists of the General Conference of representatives of the Member States, the Governing Body , and the International Labor Office which is controlled by the Governing Body. The General Conference of representative is the decisive body of ILO and employs a decision rule of a qualitative majority of 2/3 of the votes cast by the delegates. The number of votes cast must be at least half of the delegates present at the conference.

Table 1 has the Banzhaf power index measured under the assumption of 100 percent attendance at the conference (n = 174), and we observe a low power index as well as an almost equally low probability of decisiveness. Consequently, we observe a relatively high capacity to block.

IWC: The International Whaling Commission. The International Whaling Commission (IWC) organizes the states which adheres to the International Convention for the Regulation of Whaling of 1946. Currently[1] IWC has 57 member nations, each represented by a commissioner. Decisions within IWC is normally done by annual meetings on a one-man one-vote basis and with decision rule of 3/4 qualified majority. Again in Table 1, we find that even in this rather small organisation, $n = 57$, the three-quarters majority results in low Banzhaf and low decisiveness measures while blocking capability is slightly more than 50 percent

Let us contrast these IGOs - WTO, ILO and IWC - with a mechanism which uses the simple majority scheme, the European Parliament.

3.2. **The European Parliament: Simple Majority.** The European Parliament has a coordination mechanism similar to most legislative assemblies. Like national assemblies it employs two classical rules in representation theory, namely

1. one-man one-vote, and,
2. simple majority voting.

The use of these two institutions guarantees a high probability of decisiveness in the Parliament. In an assembly of an odd number of voters, a simple majority voting will split the set of possible coalitions int two equal parts, the winning coalition and the blocking coalitions. Hence, the probability of decisiveness will be equal to 0.5, and, furthermore, by equation (1), individual Banzhaf power will be equal to individual blocking power. However, with an even

TABLE 2. Simple Majority: The European Parliament

Assembly	Members n	Decision Rule†	Banzhaf Index	Capacity to Block	Probability of Decisiveness
Current Parliament (2003)	626	314	0.0319	0.0329	0.4841
Enlarged Parliament (2004)	730	366	0.0295	0.0304	0.4852

†50 percent of votes plus one vote.

number of voters simple majority results in a actual decision rule of 50 percent of all votes plus one. Thus, proportion of blocking coalition will be higher larger than the proportion of

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winning coalitions which implies that decisiveness will be less than 0.5. The current European Parliament has an even number voters (members), 626, which, with simple majority rule, results in a prbability of decisiveness equal to 0.4841 with Bazhaf power and blocking capacity equal to 0.0319 and 0.0329 respectively, Table 2.

In the same table we see that the enlarged Parliament of 2004 with 730 members[2] implies, as expected, a reduction in the individual power measure. Decisiveness is close to constant since this change is only the effect of odd number versus even numbers of voters being diminished as these number grow larger. Hence, efficiency of an assembly with simple majority voting will be robust to enlargent, or any change in size, by decisiveness contant and equal to 0.5 in the odd members case or in even number case, approximately constant and equal to 0.5. decisiveness is constant and equal to 0.5 in the odd number case, and approximately constant and equal to 0.5 in the even number case. Furthermore, in Table 2, we observe rather minor changes in the power measures, hence, the importatnt information to draw from these results is the robustness of simple majority decision rule compared to the IGOs above who employ much stricter decision rules, Table 1. In this table, WTO and ILO have an equal decision rule of 2/3ds. Given this decision rule, augmenting an assembly's membership of 146 (WTO) to 174 (ILO) we observe a substantial decrease in Banzhaf power and decisiveness while capacity to block is close to constant. As we observed above, a shift of decision rule of 2/3ds to one of 3/4ths (WTO) implied large reductions in both Banzhaf power and decisiveness while capacity to block increased. Tripling an assembly's votes from 57 (IWC) to 146 (WTO) with this decisionrule (3/4) has an even more devastating effect on Banzhaf power and decisiveness while capacity to block is close to constant.

The formal organisation of the European Parliament is such that the members sit in political groups and not as national delegations. The current European Parliament has seven such groups as shown in Table 3.

The three largest groups should be well known from their national counterparts: the *European Peoples Party and European Democrats* (EPP-DE), the *Party of European Socialists* (PES), and the *European Liberal, Democrat and Reform Party* (ELDR). That is, the Christian Democrats with the British and Nordic Conservatives, the Socialists, and the Liberals.

To the left of the Socialists on the the political left-right scale we find two groups, first, the *Confederal Group of the European United Left/Nordic Green* which started out as in the early seventies as the Communist Group and later transformed into a collection of reformist leftist parties with member parties from a mojority of the member states. The second group on the left-wing is the *Greens/European Free Alliance* (Green/EFA) which consists of the Unions's green parties as well as a number of regionalist parties with regional autonomy on their agenda.

To the right of the Christian Democrats/Conservativers we find the *Union for Europe of the Nations Group* which consist far-right parties like the italian *Alleanza Nationale* and the Danish *Dansk Folkeparti* as well as more moderate parties like the Irish republican party *Fianna Fáil*.

[2]Presently there is some confusion about how many member got elected in 2004: 730 or 732. Compare www.europarl.eu.int with www.elections2004.eu.int.

TABLE 3. The EU Parliament of 2003

Political Groups	National Political Parties	Votes	Banzhaf Index	Capacity to Block
EUL/NGL		49	0.1769	0.1777
Green/EFA		45	0.1481	0.1487
PES		175	0.2731	0.2743
EDD		18	0.0705	0.0709
ELDR		53	0.1981	0.1990
EPP-DE		232	0.7269	0.7303
UEN		23	0.1163	0.1169
Non-Attached:	EH (es)	1	0.0046	0.0046
	LEB (it)	7	0.0336	0.0337
	VLD (nl)	1	0.0046	0.0046
	MPF (fr)	5	0.0232	0.0233
	sans étiquette (fr)	1	0.0046	0.0046
	parteilos (a)	2	0.0092	0.0092
	DUP (uk)	1	0.0046	0.0046
	VB (nl)	2	0.0092	0.0092
	LN (it)	3	0.0138	0.0139
	FPÖ (a)	3	0.0138	0.0139
	FN (fr)	5	0.0232	0.0233
Sum		626		
Decisiveness				0.4977

The last group, the *Group for a Europe of Democracies and Diversities* (EDD) is a little more difficult to place on the standard political left-right scale since it consists of parties which opposes most of what the European Union represents in form of integration. However, within this group the restistence towards a deepening of the european integrations varies from members who oppose EU membership to those who accept the EU membership but oppose any further integration.

For a more detailed study of the political groups of the European Parliament consult [2].

In addition to these groups there is also a collection of national parties and some independents who do not share political affinities with any of these formal groups. These non-attached members (NA) spans a rather wide spectrum of political ideas. On the left-wing we find a member from the Basque nationalist coalition *Euskal Herritarro*, a coalition widely seen as ETA's political arm. On the far right-wing ther is four parties: *Vlaams Blok* (Belgium), Lega Nord (Italy), *Freiheitliche Partei Österreichs* and *Front National* (France). Even if these four parties could agree on some political agenda, they are, according to the European Parliament's Rules[3], too few to make up a formal political group. Between these extremes we find the largest single non-attached delegation *Lista Emma Bonino* of italian radicals and with apparently similar political inclination a member from the Belgian *Vlaamse liberalen en democrate*. One French and two Austrian non-party members should also be characterised as liberals as well as the french *Mouvement pour la France.* In this middle of the political spectre we also find the long time member of the Europena Parliament Ian Paisley's *Democratic Unionist Party* from Northern Ireland.

[3]If delegates come from two member states a minimum of 23 members is requires, if delegates come from three member states a minimum of 18 members is required, and finally, if delegates come from four or more member states a minimum of 14 members is required.

In Table 3 the political groups as well as the non-attached members are listet on a left-right order with power measures calculated under the assumtion that the group members vote as one and not as representing national interests.

It pays to enter a coalition, at least when players share the same preferences. We see that the main party families have very different voting power reflecting their size. A block will have more voting power than individual members, which is attractive from a strategic point of view, especially if the voters share the same preferences in the block.

Let us now move to the analysis of the special voting mechanism in the European Union, namely double qualified majority.

3.3. **The EU Council: Qualified Majority.** The evolution of coordination in the chief decision making body of the Union - the Council - is truly interesting from the point of view adopted here, namely the tension between group decisiveness and the individual capacity to block. Let us first look at how things stand before the enlargement in 2004. The EU employ a mechanism which combines quantitative voting with qualified majority.

TABLE 4. The EU Council of 1995

		Simple Majority	Qualified Majority		Double Qulaified Majority	
Members	Votes	Banzhaf Index/ Capacity to Block	Banzhaf Index	Capacity to Block	Banzhaf Index	Capacity to Block
Germany	10	0.3260	0.1129	0.7254	0.0982	0.6980
United Kingdom	10	0.3260	0.1129	0.7254	0.0982	0.6980
France	10	0.3260	0.1129	0.7254	0.0982	0.6980
Italy	10	0.3260	0.1129	0.7254	0.0982	0.6980
Spain	8	0.2543	0.0934	0.6006	0.0827	0.5879
Netherlands	5	0.1561	0.0594	0.3817	0.0590	0.4195
Greece	5	0.1561	0.0594	0.3817	0.0590	0.4195
Belgium	5	0.1561	0.0594	0.3817	0.0590	0.4195
Portugal	5	0.1561	0.0594	0.3817	0.0590	0.4195
Sweden	4	0.1302	0.0484	0.3111	0.0506	0.3597
Austria	4	0.1302	0.0484	0.3111	0.0506	0.3597
Denmark	3	0.0924	0.0363	0.2334	0.0418	0.2972
Finland	3	0.0924	0.0363	0.2334	0.0418	0.2972
Ireland	3	0.0924	0.0363	0.2334	0.0418	0.2972
Luxembourg	2	0.0612	0.0229	0.1471	0.0301	0.2139
Sum	87					
Decisiveness		0.5000		0.0778		0.0703

Table 4 shows the distribution of votes onto the member states, which ranges from 10 for the largest members to 2 for the smallest members. The weight to be given each member has been a major issue in each reform of the structure of decision making, where each member state tries to get as much votes as possible, because it affects their voting power scores. The member states can maximise their general Banzhaf score or they can target their blocking power. If they opt for the first, then they would choose simple majority - Table 4.

The coordination mechanism outlined in Table 4 is not employed in the Union, however. The reason is that the individual blocking power is considered as too low, opening up for

too many possibilities of having too put up with a negative decision in the Council. Under simple majority rule, the Banzhaf voting power score is equal to the individual capacity block, as simple majority is neutral in relation to the status quo. The probability is the same that there will be a decision which changes the status quo as that it will confirm the status quo. The EU has never accepted this neutrality between the power to change and the power to block. Thus, it has favored various schemes that give the players more blocking power than Banzhaf voting power.

Table 4 shows one such coordination mechanism used by the EU once it moved away from unanimity. Qualified majority means in the Union 71 per cent of the votes in quantitative voting, which reduces Banzhaf voting power and group decisiveness but increases the individual power to block quite substantially.

TABLE 5. The EU Council of 2005

			Simple Majority	Qualified Majority		Double Qualified Majority	
Members	Population	Votes	Banzhaf Index/ Capacity to Block	Banzhaf Index	Capacity to Block	Banzhaf Index	Capacity to Block
Germany	82.2	29	0.2986	0.0551	0.7674	0.0317	0.7152
United Kingdom	59.8	29	0.2986	0.0551	0.7674	0.0317	0.7152
France	59.5	29	0.2986	0.0551	0.7674	0.0317	0.7152
Italy	57.8	29	0.2986	0.0551	0.7674	0.0317	0.7152
Spain	49.5	27	0.2761	0.0523	0.7281	0.0303	0.6834
Poland	38.6	27	0.2761	0.0523	0.7281	0.0303	0.6834
Netherlands	16.0	13	0.1293	0.0272	0.3790	0.0190	0.4290
Greece	10.6	12	0.1188	0.0252	0.3505	0.0184	0.4160
Czech Republic	10.3	12	0.1188	0.0252	0.3505	0.0184	0.4160
Belgium	10.3	12	0.1188	0.0252	0.3505	0.0184	0.4160
Hungary	10.2	12	0.1188	0.0252	0.3505	0.0184	0.4160
Portugal	10.0	12	0.1188	0.0252	0.3505	0.0184	0.4160
Sweden	8.9	10	0.0989	0.0210	0.2931	0.0170	0.3830
Austria	8.1	10	0.0989	0.0210	0.2931	0.0170	0.3830
Slovakia	5.4	7	0.0690	0.0148	0.2066	0.0149	0.3356
Denmark	5.3	7	0.0690	0.0148	0.2066	0.0149	0.3356
Finland	5.2	7	0.0690	0.0148	0.2066	0.0149	0.3356
Ireland	3.8	7	0.0690	0.0148	0.2066	0.0149	0.3356
Lithuania	3.7	7	0.0690	0.0148	0.2066	0.0149	0.3356
Latvia	2.4	4	0.0393	0.0085	0.1186	0.0128	0.2885
Slovenia	2.0	4	0.0393	0.0085	0.1186	0.0128	0.2885
Estonia	1.4	4	0.0393	0.0085	0.1186	0.0128	0.2885
Cyprus	0.8	4	0.0393	0.0085	0.1186	0.0128	0.2885
Luxembourg	0.5	4	0.0393	0.0085	0.1186	0.0128	0.2885
Malta	0.4	3	0.0296	0.0064	0.0885	0.0121	0.2723
Sum	462.7	321					
Decisiveness			0.5000		0.0359		0.0222

The EU also employs another decision rule, namely double qualified majority, which entails that in addition to receiving the 71 percent majority the winning coalition must also include 2/3rds of the member states. This additional clause is employed in relation certain decisions, and it strengthens the blocking power of the medium large or small member states. However, it also reduces group decisiveness further - see Table 4.

Actually, the double qualified majority rule does not favor the large member states. It hinders them from making a coalition and thus dominating the Union, since 10 states must approve a positive decision. Under qualified majority the biggest 8 states could prevail with one more member state coming in. But with qualified qualified majority there must be 10 states for.

At the Nice meeting, where the new decision rules for the Union were discussed, a new rule was introduced which augmented the qualified majority principle with a population requirement. Thus, it was required that a positive decision be supported by 62 per cent of the EU population. Recalculated for the new Union after 2004 this requirement entails a qualified decision rule of 72.27 of the votes. Table 5 shows the new Union with simple majority, qualified majority and double qualified majority.

It should be pointed out that the EU does nor use the simple majority mechanism outlined in Table 5. In procedural matters the Union votes according to simple majority with one state - one vote. and double qualified rule. The new population rule which demands support of 62 percent of total population has the effect that no decision can be made without support from at least two of the four large states, Germany, Britain, France and Italy. Without this rule, support is needed from one of these large states. The effect on the power measures is however negligible since only 46 out of total 1204448 winning coalitions disappear. Germany with the largest population has an minor increase in the Banzhaf index of 0.000003 while most other states have at most an equal decrease in their power indices. Capacity to block will increase 0.00007 for Germany and 0.00002 for five next largest states with an equal decrease for following 19 smaller states. Hence, with all rounding effect considered, the qualified majority values in Table 5 will be valid for double qualified majority with population constraint added. However, one should keep in mind that with this rule no decision can be made without the consent of at least two of the four largest member states.

Table 5 shows that the probability of decisiveness will be sharply down in the new Union, and how restrictive the double qualified majority rule will be upon the future Union, as the probability of decisiveness is even lower.

With so few winning coalitions in the future EU, positive decision making will have to be based upon common preferences. Only 2.2 percent of the possible coalitions would be winning, meaning that commonalities in the preferences would have to lead the players toward the making of any of these few winning coalitions.

The EU employs quantitative voting on a minor scale. Let us look at the unanimity voting in the Security Council of the United Nations as well as the IMF which employs quantitative voting on a major scale.

3.4. **The UN Security Council: The Veto Principle.** Coordination in one and the same international organisation can be done in different ways, as an international body may change its decision rule depending upon the matters to be decided upon. The basic principle when linking voting rule with issues is that coordination in *n*-person games require more of qualified majority the more sensitive the issues tend to be - the Wicksellian idea.

TABLE 6. The UN Security Council.

	Procedural		Substantive	
Members	Banzhaf Index	Capacity to Block	Banzhaf Index	Capacity to Block
China, France, Russian Federation, United Kingdom, United States	0.183	0.302	0.052	1.000
Angola, Bulgaria, Cameroon, Chile, Germany, Guinea, Mexico, Pakistan, Spain, Syria	0.183	0.302	0.005	0.099
Decisiveness		0.304		0.026

Table 6 exemplifies the Wicksellian idea applied on the 15 members Security Council. In the not so important procedural matter the Council employs qualitative voting with a qualified majority decision rule. However, in the issues concerning war and peace in the world the Council operates its well-known *veto* rule under which the five permanent members can block any action or decision. Introducing *veto* rule in this assembly reduces the probability of decisiveness to less than a tenth of its original value, as Table 6 shows.

TABLE 7. The IMF Executive Board.

		70% Majority		85% Majority	
Members	Country Votes	Banzhaf Index	Capacity to Block	Banzhaf Index	Capacity to Block
United States	371743	0.1064	0.9899	0.001371	1.0000
Japan	133378	0.0616	0.5729	0.001237	0.9023
Germany	130332	0.0602	0.5604	0.001227	0.8953
France	107635	0.0502	0.4675	0.001120	0.8174
United Kingdom	107635	0.0502	0.4675	0.001120	0.8174
Belgium	111696	0.0520	0.4843	0.001143	0.8339
Netherlands	105412	0.0492	0.4583	0.001109	0.8087
Spain	92989	0.0436	0.4057	0.001029	0.7509
Italy	90968	0.0427	0.3971	0.001013	0.7389
Canada	80636	0.0379	0.3528	0.000926	0.6758
Iceland	76276	0.0359	0.3342	0.000888	0.6478
Australia	72423	0.0341	0.3176	0.000854	0.6229
Saudi Arabia	70105	0.0330	0.3076	0.000831	0.6064
Indonesia	69019	0.0326	0.3030	0.000819	0.5977
Nigeria	69005	0.0326	0.3030	0.000819	0.5977
Egypt	64008	0.0302	0.2812	0.000772	0.5633
China	63942	0.0302	0.2809	0.000771	0.5626
Switzerland	61827	0.0292	0.2716	0.000751	0.5478
Russia	59704	0.0282	0.2623	0.000733	0.5344
Brazil	53422	0.0253	0.2351	0.000660	0.4817
Iran	53247	0.0252	0.2341	0.000656	0.4789
India	52112	0.0247	0.2294	0.000644	0.4695
Chile	43395	0.0205	0.1911	0.000549	0.4003
Equatorial Guinea	30749	0.0146	0.1356	0.000401	0.2928
Sum	2171658				
Decisiveness		0.0537		0.000685	

3.5. **The International Monetary Fund (IMF): Quantitative Voting.** As responsible for the stability of the currencies of the world, the IMF is an extremely powerful international organisation. The most important decision making body within the IMF is its Board of Executive Directors. These directors are eithes appointed by membber states (United States, Japan, Germany and United Kingdom) or elected by groups of states. The current number of directors is 24, as shown in Table 7. In Appendix, Table 10 shows all members of the IMF according to these groups. To whom is it accountable? The Executive Board votes according to two schemes, both combining quantitative voting with qualified majority. Table 7, as well as Table 10 in the Appendix, shows the voting power for the key member states under the two schemes.

Voting power in the IMF is linked with financial contribution to the organisation. It is the managers of the IMF who lends this money to governments in member states. Coordination in IMF secures complete control to the member states that take the risks involved in the IMF lending through a highly skewed distribution of voting power in combination with an emphasis upon blocking power. How, then, can IMF can anything done, given that the capacity to act is so low - look at the probability of decisiveness?

3.6. **ESCB: The European System of Central Banks.** The European System of Central Banks consists of the European Central Bank (ECB) and the national central banks of the EU member states (the NCBs). The Eurosystem is ECB together with the NCBs of states which have adopted the Euro. ESCB is responsible for monetary policy to maintain its primary objective of price stability in the Union, that is, in the so called eurozone part of the Union.

ESCB is governed by the three decision making bodies of the ECB: The Governing Council, The Executive Board and The General Council. The Governing Council consists of the eurozone Central Bank governors (12), Tables 8 and 9, and the Executive Board which consists of a president, a vice president and four other elected members, see Table 8. The General Council (the Extended Governing Council) consist of ECB President and ECB Vice President and the governors of all member states' Central Banks.

Naturally, the responsibilities of these three decision making bodies vary a great deal from the mere advisory and consultative functions of the General Council to actual monetary policy-making of the Governing Council. More specific, the Governing Council (the Eurosystem) is responsible for the definition and implementation of the monetary policy of the euro area. The Executive Board is responsible for the day to day management of the ECB which is to implement monetary policy according to decisions and guidelines made buy the Governing Council and to execute powers delegated to it by the Governing Council. Hence, the most prominent decision body of the ESCB is the Governing Council.

The general mode of decision making is one-man one-vote and simple majority as shown in Table 8. The president has tie-breaking (casting) vote. The same mode of decision making adopts to the Executive Board also in shown in Table 8.

A different mode of decision making is relevant for certain decisions relating to the capital of the ECB, the key for capital subscription and foreign reserve assets to the ECB. For such decisions the votes of the Governing Council is weighted according to NCBs' shares in the

TABLE 8. The European Central Bank.

	Governing Council		Executive Board	
Members	Votes	Banzhaf Index	Votes	Banzhaf Index
President†	1	0.371	1	0.625
Vice President, Executive Board Members (4)	1	0.175	1	0.250
National Central Bank Representatives (12)	1	0.175		
Sum	18		6	
Decisiveness		0.500		0.500

†The President has casting vote

TABLE 9. ECB: The Governing Council.

National Central Banks (NCBs)	NCB Shares	Banzhaf Index	Capacity to Block
Germany	24.494	0.2202	0.9002
France	16.834	0.1431	0.5848
Italy	14.895	0.1313	0.5369
Spain	8.893	0.1206	0.4930
Netherlands	4.278	0.0972	0.3972
Greece	2.056	0.0854	0.3493
Belgium	2.866	0.0923	0.3772
Portugal	1.923	0.0845	0.3453
Austria	2.359	0.0894	0.3653
Finland	1.397	0.0815	0.3333
Ireland	0.850	0.0776	0.3174
Luxembourg	0.149	0.0737	0.3014
Sum	80.994		
Decisiveness			0.1223

subscribed capital of the ECB. The Executive Board has no votes (zero weights) in such decisions. Furthermore. decision rule in these decisions is double qualified majority with 2/3 of the subscribed capital as well as half the number of shareholders, see Table 9.

Summing up, via their central bank governors, the member states decide on capital size and allocation of money income and net profit/losses, while the Governing Council proper decides on the monetary policy of the Eurozone, Table 9 and Table 8 respectively. From Table 8 it is obvious that the ECB president and the Executive Board members have great influence on this monetary policy.

4. THE IMPACT OF PREFERENCES ON VOTING POWER

The role of preferences has been much discussed in the literature on voting power. When players coordinate in an *n*-person game, then they pursue their interests of course. This entails that they will in general not be neutral toward voting *yes* or *no*. If one issue dominates

the coordination of the *n*-person committee, then some players will tend to vote YES consistently and other players NO. What are the implications for voting power? Or if all players have the same interests, meaning that all will vote YES or NO, then can any player exercise power?

When preferences are taken into account, then they change the logic of *n*-person coordination. When there is one dimension - left and right, integration and non-integration - then the majority will have all voting power. When there is perfect interest agreement. then there is no voting power at all when simple majority is employed.

However, analyzing coordination in *n*-person games, one cannot assume a certain preference configuration. One must try so solve the game for all situation. Players shift their preferences from issue to issue. And they may vote insincerely.

Assuming that preferences are not distributed randomly changes the coordination games, as each coalition is no longer equally likely. The players have a certain tendency to vote *yes* or *no*, reflecting their preferences. Thus, when there is one single policy dimension, then the players will vote in a determinant fashion in accordance with their sincere preferences. However, the aggregation rule still matters. If there is a unanimity requirement, then the above analysis is not changed. If the aggregation rule is simple majority, then the existence of one single dimension will result in a so-called Condorcet Winner.

Assuming that the players vote insincerely or that there are more than one policy dimension leads to the reopening of Pandora's' Box, meaning that it is again equally likely that the players vote *yes* and *no*. Thus, the only solution to the games is the power index numbers.

5. Conclusion

Coordination in *n*-person games may be done through voting, as in IGO:s. The logic of such coordination may be spelled out by means of an analysis with the power indices. The structure of the game is determined by the aggregation rule and the assignment of voting rights. One may wish to add the preferences of the players to the solution of the game, but any such attribution of preferences is ad hoc. And one cannot take for granted that the players vote sincerely and in relation to one single dimension.

Coordination in an *n*-person game occurs in the global governance of IGO:s. The key question is the place of the unanimity requirement, derived from the principle of state sovereignty. When it is relaxed, then interesting games ensue.

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APPENDIX: ALL MEMBERS OF THE IMF EXECUTIVE BOARD

TABLE 10. The IMF Executive Board.

			70% Majority		85% Majority	
Members	Country Votes	Total Votes	Banzhaf Index	Capacity to Block	Banzhaf Index	Capacity to Block
United States	371743	371743	0.1064	0.9899	0.001371	1.000000
Japan	133378	133378	0.0616	0.5729	0.001237	0.902252
Germany	130332	130332	0.0602	0.5604	0.001227	0.895295
France	107635	107635	0.0502	0.4675	0.001120	0.817375
United Kingdom	107635	107635	0.0502	0.4675	0.001120	0.817375
Austria	18973					
Belarus	4114					
Belgium†	46302					
Czech Republic	8443					
Hungary	10634					
Kazakhstan	3907					
Luxembourg	3041					
Slovak Republic	3825					
Slovenia	2567					
Turkey	9890	111696	0.0520	0.4843	0.001143	0.833899
Armenia	1170					
Bosnia and Herzegovina	1941					
Bulgaria	6652					
Croatia	3901					
Cyprus	1646					
Georgia	1753					
Israel	9532					
Macedonia	939					
Moldova	1482					
Netherlands†	51874					
Romania	10552					
Ukraine	13970	105412	0.0492	0.4583	0.001109	0.808679
Costa Rica	1891					
El Salvador	1963					
Guatemala	2352					
Honduras	1545					
Mexico	26108					
Nicaragua	1550					
Spain†	30739					
Venezuela	26841	92989	0.0436	0.4057	0.001029	0.750935
Albania	737					
Greece	8480					
Italy†	70805					
Malta	1270					
Portugal	8924					
San Marino	420					
Timor-Leste	332	90968	0.0427	0.3971	0.001013	0.738934
Antigua and Barbuda	385					
Bahamas	1553					
Barbados	925					
Belize	438					
Canada†	63942					
Dominica	332					

TABLE 10. (continued) The IMF Executive Board.

Members	Country Votes	Total Votes	70% Majority Banzhaf Index	70% Majority Capacity to Block	85% Majority Banzhaf Index	85% Majority Capacity to Block
Grenada	367					
Ireland	8634					
Jamaica	2985					
St. Kitts and Nevis	339					
St. Lucia	403					
St.Vincent and Grenadines	333	80636	0.0379	0.3528	0.000926	0.675798
Denmark	16678					
Estonia	902					
Finland	12888					
Iceland†	1426					
Latvia	1518					
Lithuania	1692					
Norway	16967					
Sweden	24205	76276	0.0359	0.3342	0.000888	0.647795
Australia†	32614					
Kiribati	306					
Korea	16586					
Marshall Islands	285					
Micronesia	301					
Mongolia	761					
New Zealand	9196					
Palau	281					
Papua New Guinea	1566					
Philippines	9049					
Samoa	366					
Seychelles	338					
Solomon Islands	354					
Vanuatu	420	72423	0.0341	0.3176	0.000854	0.622924
Saudi Arabia	70105	70105	0.0330	0.3076	0.000831	0.606401
Brunei Darussalam	2402					
Cambodia	1125					
Fiji	953					
Indonesia†	21043					
Lao	779					
Malaysia	15116					
Myanmar	2834					
Nepal	963					
Singapore	8875					
Thailand	11069					
Tonga	319					
Vietnam	3541	69019	0.0326	0.3030	0.000819	0.597704
Angola	3113					
Botswana	880					
Burundi	1020					
Eritrea	409					
Ethiopia	1587					
Gambia The	561					
Kenya	2964					
Lesotho	599					
Malawi	944					

TABLE 10. (continued) The IMF Executive Board.

Members	Country Votes	Total Votes	70% Majority Banzhaf Index	70% Majority Capacity to Block	85% Majority Banzhaf Index	85% Majority Capacity to Block
Mozambique	1386					
Namibia	1615					
Nigeria†	17782					
Sierra Leone	1287					
South Africa	18935					
Sudan	1947					
Swaziland	757					
Tanzania	2239					
Uganda	2055					
Zambia	5141					
Zimbabwe	3784	69005	0.0326	0.3030	0.000819	0.597704
Bahrain	1600					
Egypt†	9687					
Iraq	5290					
Jordan	1955					
Kuwait	14061					
Lebanon	2280					
Libya	11487					
Maldives	332					
Oman	2190					
Qatar	2888					
Syrian Arab Republic	3186					
United Arab Emirates	6367					
Yemen	2685	64008	0.0302	0.2812	0.000772	0.563266
China	63942	63942	0.0302	0.2809	0.000771	0.562571
Azerbaijan	1859					
Kyrgyz Republic	1138					
Poland	13940					
Serbia and Montenegro	4927					
Switzerland†	34835					
Tajikistan	1120					
Turkmenistan	1002					
Uzbekistan	3006	61827	0.0292	0.2716	0.000751	0.547787
Russian Federation	59704	59704	0.0282	0.2623	0.000733	0.534394
Brazil†	30611					
Colombia	7990					
Dominican Republic	2439					
Ecuador	3273					
Guyana	1159					
Haiti	857					
Panama	2316					
Suriname	1171					
Trinidad and Tobago	3606	53422	0.0253	0.2351	0.000660	0.481694
Afghanistan	1454					
Algeria	12797					
Ghana	3940					
Iran†	15222					
Morocco	6132					
Pakistan	10587					
Tunisia	3115	53247	0.0252	0.2341	0.000656	0.478911

TABLE 10. (continued) The IMF Executive Board.

Members	Country Votes	Total Votes	70% Majority Banzhaf Index	70% Majority Capacity to Block	85% Majority Banzhaf Index	85% Majority Capacity to Block
Bangladesh	5583					
Bhutan	313					
India†	41832					
Sri Lanka	4384	52112	0.0247	0.2294	0.000644	0.469519
Argentina	21421					
Bolivia	1965					
Chile†	8811					
Paraguay	1249					
Peru	6634					
Uruguay	3315	43395	0.0205	0.1911	0.000549	0.400296
Benin	869					
Burkina Faso	852					
Cameroon	2107					
Cape Verde	346					
Central African Republic	807					
Chad	810					
Comoros	339					
Congo Democratic Republic	5580					
Congo Republic	1096					
Côte d'Ivoire	3502					
Djibouti	409					
Equatorial Guinea†	576					
Gabon	1793					
Guinea	1321					
Guinea-Bissau	392					
Madagascar	1472					
Mali	1183					
Mauritania	894					
Mauritius	1266					
Niger	908					
Rwanda	1051					
São Tomé and Príncipe	324					
Senegal	1868					
Togo	984	30749	0.0146	0.1356	0.000401	0.292808
Sum	2171658					
Decisiveness				0.0537		0.000685

†Home country of the elected director representing a certain group of countries.