Tadeusz Sozański

Institute of Sociology
JAGIELLONIAN UNIVERSITY

WHICH GAME TO CHOOSE?

In Search of an Acceptable Voting System for the EU Council

Introduction

This paper is an extended record of my presentation given at the conference on *Decision Making in the EU Council* which took place March 29, 2004 in Krakow. The conference was jointly organized by the Institute of Strategic Studies (a Polish non-governmental organization), the Chair of European Studies at the Jagiellonian University, and Konrad Adenauer Foundation. The panel discussion was chaired by Bogdan Klich, the ISS president, and vice-chair of the Foreign Affairs Committee at the Polish Parliament (Sejm). He invited all Polish mathematicians and political scientists who were known to have published about voting systems used by the EU governing bodies.

The participants were encouraged to analyze recent attempts to settle the dispute over what voting system should be implemented by the EU Council. Recall that the controversy arose when the EU Convention (a somewhat mysterious body which worked out the EU Constitution draft) had chosen to replace the rules agreed-on in the Nice Treaty by a double majority voting system in which a one state - one vote simple majority rule is combined with a qualified majority system with weights directly proportional to the countries' populations.

The author hopes that his analyses, results and conclusions will appear useful for the EU politicians to cope with the difficult task to achieve a compromise between conflicting expectations of EU member states as to the future political structure of the Union. This paper, for its scientific nature, is not a report for secret use by the diplomats. I insist that it must remain open to everyone interested in the topic: university professors and students, commentators, government officials, political party activists, etc. Thus, I'm placing my text in a pdf file on my homepage: *http://www.cyf-kr.edu.pl/~ussozans/.*

Feel free to write to me (use my email address) to obtain my program named POWERIND with which one can calculate the power distribution corresponding to any voting system considered for use by the EU Council. The program is user-friendly so that every European who happens to encounter in press a statement such as "Germany is ready to consider the double majority 55% plus 55% system", can check by himself or herself what power distribution will be obtained if such a solution is accepted.

Clearly, some competence in the mathematical theory of voting games is necessary to run POWERIND and to understand results. When you load the program, begin from reading the user's guide (35 screens each having some 20 lines, now available also in a pdf file). Read Section 6 entitled `A personal story' to learn how I joined (in December 2003) the group of Polish scientists working on voting games.

Unless you make your work known to the world through Internet, others may never get informed of what you have been doing. This happened to me and two fellow specialists in applied mathematics, Wojciech Słomczyński and Karol Życzkowski, also working at the Jagiellonian University. In January 2004, they put forward a new proposition of a voting system for the EU Council. Their solution was

presented by the authors at the very the beginning of the Kraków conference. In this paper, I will compare their "single majority game with square root weights" with the range of voting games that are currently being or might be considered by the negotiators representing the EU Member States who are going to resume their meetings now under the presidency of Ireland.

Europe's population and the Nice Treaty

The Nice Treaty voting system is based on a "political" mapping of Europe's population structure into an allocation of 345 votes among the assembly made up of 27 countries (25 will form the EU since May 1, 2004 and 2, Romania and Bulgaria, are going to join the EU in few years). The Nice Treaty stipulates that

> *Acts of the Council shall require for their adoption at least 258 votes in favor, cast by a majority of members, where this Treaty requires them to be adopted on a proposal from the Commission. In other cases, for their adoption acts of the Council shall require at least 258* (74.8% of 245) *votes in favor cast by at least two-thirds of the members. When a decision is to be adopted by the Council by a qualified majority, a member of the Council may request verification that the Member States the qualified majority represent at least 62% of the total population of the Union. If that condition is shown not to have been met, the decision in question shall not be adopted.1*

This paper focuses on the voting system that is going to be used before the accession of Romania and Bulgaria. When there are 25 member states, the simple majority in the one voter - one vote component game equals 13. Under the total amount of nominal votes restricted to 321, the relative qualified majority of ¾ translates into the quota of 241. The population threshold remains unchanged (62%).

Formally, the Nice Treaty voting system is a combination of three *weighted voting games*, that is, any set *C* of *k* states is a *winning coalition* (the will of all members of *C* suffices to take a decision by the EU Council) if and only if three conditions are met simultaneously: (1) $k \geq 13$ (*C* is a winning coalition for the simple majority game with 25 players); (2) the sum of *political weights*, or votes allocated to these states, equals at least 241; (3) the sum of *relative population weights* equals at least 620[2].

Whereas high complexity distinguishes the *Nice Treaty game* from single majority games used earlier by the European Community Council of Ministers, the allocation of political weights in the second component of the triple majority game, still reflects the *parity principle* which has so far guided institutional changes necessitated by each consecutive enlargement. According to this principle four largest EU member states, Germany, France, United Kingdom and Italy have always been granted the same amount of votes as shown in Table 1. The parity principle was not questioned when the EU came into being by virtue of the Maastricht Treaty nor on the occasion of the 1995 enlargement. Population disparity within the *Big Four* following the reunification of Germany had been ignored until the Convention proposed the Union's reform. Political leaders of united Europe who had so far been faithful to the agreement concluded by the father founders of European Community changed their mind.

---

[1] *The Nice Treaty. Official Journal of the European Communities*. 10.3.2001, C 80/82,83.

[2] Following Bilbao et al. ("Voting Power in the European Union Enlargement." *European Journal of Operational Research* 143 (2002): 181-196) we express the relative quota as an integer *q* where q stands for q/1000. The relative population weight assigned to a given country is obtained by dividing its population by the total EU population, multiplying the fraction by 1000 and rounding the number obtained to an integer.

Table 1. Single majority voting systems used by
the Council of Ministers 1973-1995

State	EU-9 1973	EU-10 1981	EU-12 1986	EU-15 1995
Germany	10	10	10	10
France	10	10	10	10
Italy	10	10	10	10
UK	10	10	10	10
Netherlands	5	5	5	5
Belgium	5	5	5	5
Denmark	3	3	3	3
Ireland	3	3	3	3
Luxembourg	2	2	2	2
Greece		5	5	5
Spain			8	8
Portugal			5	5
Sweden				4
Austria				4
Finland				3
Total	58	63	76	87
Qual. majority (%)	41 (70.6)	45 (71.4)	54 (71.1)	62 (71.3)

I had not been aware of the significance of this change until I found in Internet a conference paper3 whose author quoted Jean Monnet's record of his meeting with Konrad Adenauer in April 1951.

> **Monnet**: *I am authorized to propose you that the relationship between Germany and France within the Community be governed by the parity principle in the Council, as well as in the Assembly and in all European institutions, current or future, whether France's participation includes the Union francaise and whether Germany be that of the West or reunified.*[…].
>
> **Adenauer**: *I am happy to give my full agreement to your proposal because I don't conceive the Community without total parity*.

Why did the Convention resolve on rejecting the parity principle? Why did France, Britain and Italy give their consent to such a radical move? The *population principle* which makes 82 million Germany more powerful than each of three 60 million states must have been recognized as the only remedy to stop the process shown in Table 2.[4] and described by Bobay in the following words. *Over time, at each enlargement, the share of the overall votes of the large member states tended to shrink significantly in comparison to the overall votes of small members*.

[3] Frédéric Bobay. *Political Economy of the Nice Treaty: Rebalancing the EU Council*. Paper presented at French-German Economic Forum, 9th meeting, June 25-26 2001.

[4] Table 1 and Table 2 are based on the data provided by Felsenthal and Machover in Chapter 5 (*Weighted Voting in the CMEC*) of their book *The Measurement of Voting Power. Theory and Practice, Problems and Paradoxes*. Cheltenham, UK-Northampton, MA, USA 1998.

Table 2. The share of the total EU population and the share of the total amount of votes of 4 largest EU member states at 5 enlargements.

Enlargements	1973	1981	1986	1995	2004
Pct of the EU total population	87.7	84.2	71.4	68.7	57.3
Pct of the total amount of votes	69.0	63.5	52.6	46.0	36.1

To examine how the Nice Treaty vote allocation is related to the EU population structure after the last enlargement, let us divide the set of 25 countries into 6 groups which, except for the "tail" made up of 11 smallest states, reveal remarkable homogeneity with respect to the number of citizens. In statistical terms, the between-groups population variance by far exceeds the within-groups variance.

1. The first group is formed by **Germany**, Europe's population leader with 82 million citizens, or .182 of the total EU-25 population.

2. The second group consists of 3 big states, **France**, **UK**, and **Italy** which are nearly same size approaching 60 million citizens.

3. **Spain** and **Poland**, two middle-size countries with population by some 20 million smaller than the Big Three, and by over 20 million larger than the country coming next in the decreasing population ordering.

4. The **Netherlands** must be classified a single member of the fourth group because its population (closest to the mean over 25 countries equal to 18 million) is by 6 million larger than that of the leader of the next group.

5. The group of five 10-million countries, **Greece**, **Portugal**, **Belgium, Czech Republic, Hungary** together with two a little smaller countries, **Sweden** and **Austria**.

6. The remaining 11 smallest EU member states with populations ranging from 5.4 to .4 million people: **Denmark, Slovakia, Finland, Ireland, Lithuania, Latvia, Slovenia, Estonia, Cyprus, Luxembourg, Malta**.

Table 3 shows where the Nice Treaty vote allocation departs from the population structure. Whereas the middle-size states, Spain, Poland, and the Netherlands (groups 3 and 4) received equally large share of overall votes (20.9%) as their share in the total EU-25 population (21.0%), 18 smaller countries (groups 5 and 6) were given more votes to the detriment of the Big Four (groups 1 and 2).

Detailed population figures and votes allotted to 25 countries are given in Table 4. The state of Europe's population as for January 1, 2003 is quoted from an official bulletin of Eurostat (*Statistics in focus*, Theme 3–1/2004) with each country's population rounded to 5 figures.[5] Next to the Nice Treaty vote allocation there is given an alternative allocation with nominal votes calculated by

[5] In the first draft of this paper, I used the population data from the latest 2003 edition of the *Yearbook of International Statistics*, an official publication of the Polish Central Statistical Office. I switched to the official EU statistics following a suggestion by W. Słomczyński. The main difference between the two sources is the population of Greece. According to Eurostat Greece has moved ahead of other 10 million countries, while the Polish Yearbook has still Belgium in the leading position in group 5.

multiplying relative “square root weights” by the same total amount of votes (321) and rounding each product to closest integer.

Table 3. Relative population distribution and two vote allocations by 6 groups of member states

Group	Pct of the total EU population	Pct of the total amount of Nice Treaty votes	Pct of the total amount of sq. root votes
1	18.2	9.0	10.3
2	38.8	27.0	26.1
3	17.4	16.8	14.4
4	3.6	4.1	4.7
5	15.2	24.7	25.0
6	6.8	18.4	19.5

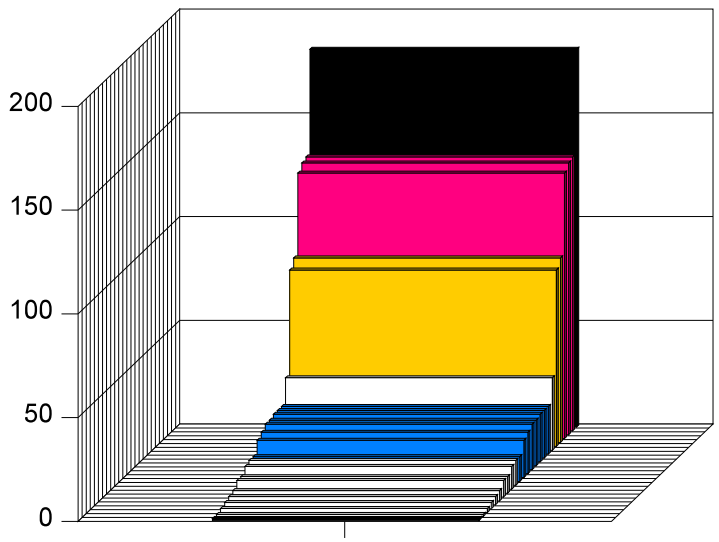

Figure 1. EU-25 population structure

Square root weights will be explained later in this paper. For now, notice that Germany has 33 votes instead of 29, while Poland and Spain have each by 4 votes less compared to the Nice Treaty. France, UK, and Italy have by 5 votes more than Spain and Poland, and by 5 less than Germany. Thus, the square root vote allocation breaks with the parity principle, resembling in this respect the voting system proposed in the EU Constitution Draft. Would such a change in weights produce a shift in relative power distribution? According to a widespread belief, a share of the total amount of nominal votes, and similarly, a share of the total population, or, in general, a country’s *relative weight* in a weighted voting game should automatically translate into a greater or smaller *voting power*. Under the Nice Treaty allocation of nominal votes, Poland’s relative weight equals 27/321=8.4%. By dividing Poland’s population (38.2 mln.) by the population of EU-25 (453.7 mln.), we get the same fraction.

Therefore, if relative weight were to entirely determine voting power, Poland should not object to population weights, and Spain whose share of the EU population reaches 9% should welcome the reform proposed the Convention. Why did the two governments reject the voting system based on replacing “political” weights with population weights?

Table 4. The EU population by member states. The Nice Treaty and square root vote allocations.

Group	EU Member State	Population in mln.	Rel. pop in .001	Nice T. weight	Sq. root weight
1	Germany	82.537	182	29	33
2	France	59.629	131	29	28
	UK	59.329	131	29	28
	Italy	57.321	126	29	28
3	Spain	40.683	90	27	23
	Poland	38.219	84	27	23
4	Netherlands	16.193	36	13	15
5	Greece	11.018	24	12	12
	Portugal	10.408	23	12	12
	Belgium	10.356	23	12	12
	Czech R.	10.203	22	12	12
	Hungary	10.142	22	12	12
	Sweden	8.941	20	10	11
	Austria	8.067	18	10	10
6	Denmark	5.384	12	7	9
	Slovakia	5.379	12	7	9
	Finland	5.206	11	7	8
	Ireland	3.964	9	7	7
	Lithuania	3.463	8	7	7
	Latvia	2.332	5	4	6
	Slovenia	1.995	4	4	5
	Estonia	1.356	3	4	4
	Cyprus	0.715	2	4	3
	Luxembourg	0.448	1	4	2
	Malta	0.397	1	3	2
	Total	453.685	1000	321	321

(June 5, 2004, to be continued).

Appendix A

The Banzhaf power index distributions for 30 voting games obtained by combining one state – one vote games with games based on relative population weights

Table A1

6 voting games whose one state – one vote component has a quota of 13

Grp	EU-25 Member State	Double majority games					
		13/550	13/600	13/650	13/700	13/750	13/800
1	Germany	1174	1336	1457	1445	1470	1318
2	France	849	949	1052	1135	1186	1240
	UK	849	949	1052	1135	1186	1240
	Italy	821	918	1012	1099	1144	1214
3	Spain	640	696	724	848	856	847
	Poland	606	674	667	797	832	760
4	Netherlands	378	365	381	356	392	430
5	Greece	317	296	290	269	275	296
	Portugal	314	291	283	262	266	285
	Belgium	314	291	283	262	266	285
	Czech R.	308	285	275	254	256	274
	Hungary	308	285	275	254	256	274
	Sweden	298	273	262	238	237	252
	Austria	288	262	246	223	218	229
6	Denmark	259	227	201	176	161	162
	Slovakia	259	227	201	175	161	162
	Finland	254	222	194	168	152	150
	Ireland	244	210	179	152	131	128
	Lithuania	240	204	172	144	123	117
	Latvia	225	187	150	120	94	83
	Slovenia	220	181	142	112	85	71
	Estonia	215	175	135	104	75	60
	Cyprus	210	169	127	96	66	49
	Luxembourg	205	164	120	88	56	37
	Malta	205	164	120	88	56	37
Efficiency (%)		29.42	22.52	16.12	10.17	6.04	2.80
Std. deviation		258	315	363	400	422	420

Table A2

6 voting games whose one state – one vote component has a quota of 14

Grp	EU-25 Member State	Double majority games					
		14/550	14/600	14/650	14/700	14/750	14/800
1	Germany	943	1088	1248	1266	1348	1248
2	France	705	805	901	1007	1071	1169
	UK	705	805	901	1007	1071	1169
	Italy	686	781	872	975	1033	1142
3	Spain	568	613	647	758	807	781
	Poland	543	597	607	708	792	701
4	Netherlands	381	374	375	371	387	439
5	Greece	341	326	311	296	288	311
	Portugal	338	320	306	289	280	301
	Belgium	338	320	306	289	280	301
	Czech R.	335	316	301	283	272	290
	Hungary	335	316	301	283	272	290
	Sweden	328	308	290	269	256	269
	Austria	322	299	279	256	240	248
6	Denmark	303	273	246	216	193	184
	Slovakia	303	273	246	216	193	184
	Finland	300	269	240	209	185	174
	Ireland	294	261	229	196	168	152
	Lithuania	290	256	224	189	160	142
	Latvia	281	243	208	169	136	109
	Slovenia	278	239	202	162	128	99
	Estonia	275	235	197	155	120	88
	Cyprus	272	231	191	147	112	77
	Luxembourg	268	226	186	142	104	66
	Malta	268	226	186	142	104	66
Efficiency (%)		23.00	18.22	13.56	8.86	5.48	2.63
Std. deviation		178	231	283	329	367	382

Table A3.

6 voting games whose one state – one vote component has a quota of 15

Grp	EU-25 Member State	Double majority games					
		15/550	15/600	15/650	15/700	15/750	15/800
1	Germany	763	875	1041	1079	1193	1148
2	France	595	682	759	871	932	1066
	UK	595	682	759	871	932	1066
	Italy	584	664	739	843	902	1038
3	Spain	509	544	578	665	744	697
	Poland	492	532	555	618	736	632
4	Netherlands	382	382	376	387	380	441
5	Greece	360	348	333	323	304	328
	Portugal	358	345	329	318	298	317
	Belgium	358	345	329	318	298	318
	Czech R.	356	342	325	312	292	309
	Hungary	356	342	325	312	292	309
	Sweden	352	336	318	302	280	291
	Austria	348	330	310	291	268	272
6	Denmark	337	313	288	258	231	216
	Slovakia	337	313	288	258	231	216
	Finland	335	310	284	253	225	207
	Ireland	332	304	276	242	213	188
	Lithuania	330	301	273	237	207	178
	Latvia	324	292	261	220	188	150
	Slovenia	323	289	258	214	182	140
	Estonia	321	286	254	209	176	130
	Cyprus	319	283	250	203	170	121
	Luxembourg	317	280	246	198	163	111
	Malta	317	280	246	198	163	111
Efficiency (%)		15.84	13.09	10.15	7.00	4.52	2.31
Std. deviation		116	160	208	254	299	329

Table A4.

6 voting games whose one state – one vote component has a quota of 16

Grp	EU-25 Member State	Double majority games					
		16/550	16/600	16/650	16/700	16/750	15/800
1	Germany	629	709	860	911	1029	1031
2	France	519	585	644	746	799	939
	UK	519	585	644	746	799	939
	Italy	513	572	631	723	779	910
3	Spain	465	495	523	581	673	617
	Poland	455	485	510	542	666	574
4	Netherlands	385	390	382	396	372	432
5	Greece	374	366	352	345	321	343
	Portugal	373	364	350	341	317	335
	Belgium	373	364	350	341	317	335
	Czech R.	372	363	347	337	313	328
	Hungary	372	362	347	337	313	328
	Sweden	370	359	342	329	304	312
	Austria	368	356	337	321	296	297
6	Denmark	362	343	322	297	270	252
	Slovakia	362	343	322	297	270	252
	Finland	361	341	320	293	266	244
	Ireland	359	337	314	285	258	229
	Lithuania	358	335	312	281	254	221
	Latvia	355	329	305	267	240	198
	Slovenia	353	327	302	264	236	192
	Estonia	352	325	299	260	232	183
	Cyprus	351	323	297	256	228	175
	Luxembourg	350	321	294	252	224	167
	Malta	350	321	294	252	224	167
Efficiency (%)		9.41	8.15	6.59	4.86	3.28	1.82
Std. deviation		72	104	145	186	230	267

Table A5.

6 voting games whose one state – one vote component has a quota of 17

Grp	EU-25 Member State	Double majority games					
		17/550	17/600	17/650	17/700	17/750	17/800
1	Germany	534	590	713	775	873	914
2	France	470	513	559	639	690	806
	UK	470	513	559	639	690	806
	Italy	466	504	550	623	678	776
3	Spain	436	461	478	514	602	559
	Poland	429	453	471	488	594	538
4	Netherlands	391	394	388	394	368	421
5	Greece	385	379	368	359	338	356
	Portugal	383	378	366	357	336	350
	Belgium	384	378	366	357	336	350
	Czech R.	384	377	364	354	333	344
	Hungary	384	377	364	354	333	344
	Sweden	383	374	361	349	328	333
	Austria	382	372	358	344	322	321
6	Denmark	378	365	350	329	306	287
	Slovakia	378	365	349	329	306	287
	Finland	377	363	347	326	303	281
	Ireland	376	361	344	321	297	269
	Lithuania	376	360	342	319	294	263
	Latvia	374	357	338	311	285	246
	Slovenia	373	355	336	308	283	240
	Estonia	373	354	334	306	280	234
	Cyprus	372	353	333	303	277	229
	Luxembourg	371	352	331	301	274	223
	Malta	371	352	331	301	274	223
Efficiency (%)		4.76	4.31	3.64	2.86	2.03	1.25
Std. deviation		42	64	96	130	169	205