A weighted-voting electoral system that performs quite well

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Abstract: The paper describes a weighted-voting system for the election of a Parliament. The system is easy to implement, and it *dominates* plurality, where "dominates" means that it performs better with reference to both representativeness and stability. The system has some other nice properties, namely (a) it offers an easy-to-read evaluation of the loss of representativeness of an electoral system; and (b) it makes it relatively easy to adopt the best system *after the vote*, i.e. the best system conditional to the choice of electors. Indicators for representativeness and stability are defined. Results are experimental.

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1. Introduction.

This paper describes a system for choosing a (one-Chamber) Parliament with some nice properties, namely:

a) It *dominates*[1] simple plurality system, possibly sophisticated ones too;

b) It offers an easy-to-read evaluation of the loss of representativeness of an electoral system, i.e. of the cost of choosing a system with a higher stability;

c) It makes it quite easy to adopt the best system *after the vote*, i.e. the best system conditional to the choice of electors.

A possible fourth propriety will be discussed in sect. 5.

Representativeness, R, may be roughly defined "the capacity to correctly represent the choices of the electors"; and *stability*, G, "the capacity to effectively govern the State", i.e. with low transaction and information costs. Most scholars accept that proportional systems allow for a high representativeness but at the price of a low stability, while the opposite holds for plurality systems (to my knowledge, only Breton and Galeotti, 1985, do not agree). The point is discussed in more detail in a previous paper (Ortona, 1998).

If we have indicators of representativeness and of stability, **r** and **g** respectively, we may place the electoral systems on a two-dimension graph[2], where every system will appear as a point. Next, we may safely admit that first-order partial derivatives of all plausible functions of social preference for electoral system f(**r**,**g**) are both positive. This is sufficient to obtain two results:

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[1] This term will be defined below.

[2] What follows, duly generalized, holds for more dimensions too. In this paper we will deal only with R and G; possible further dimensions will be briefly discussed in sect. 8.

a) A system A located Northeast of all the others is the best one; I label A *dominant.*

b) A system B located Southwest of another system C may be excluded; I label B *dominated*, and I say that C *dominates* B.

As noticed, the system discussed in this paper *dominates at least simple plurality systems, and probably sophisticated ones too*; while it does not dominate proportional ones. This is an *experimental* result, obtained in all the simulations I performed, under some assumptions to be discussed immediately. It is maybe possible to find out cases, albeit peculiar, where it does not hold, and it may be interesting to find out the validity conditions analytically. This is left to further research. The assumptions are:

(a) the majority coalition is always the minimum winning coalition;
(b) there are no jumps on the left-right axis;
(c) the relative majority party always forms the government.

Assumptions (a) and (b) are usual in this kind of experiments, and harmless in our setting. This is not the case, however, for assumption(c). Let's accept it for the time being; I will discuss what happens if it does not hold in sect. 8.

The paper is organized as follows. Section 2 introduces indexes **r** and **g**. Section 3 describes the new system. Section 4 and 5 present the experiments, results a) (see above) and an ancillary result. Sections 6 and 7 illustrate results b) and c). Further considerations are in sections 8 and 9.

2. The indexes.

The indexes adopted here are different from those adopted in Ortona, 1998. Index **r** is:

$$r_j = 1 - \left(\sum_{i=1}^{n} \left| S_{j,i} - S_{pp,i} \right| \right) \Big/ \left(\sum_{i=1}^{n} \left| S_{pp,i} - S_{u,i} \right| \right)$$

where j refers to the electoral system, N is the number of parties, $S_{j,i}$ is the number of seats obtained by party i under system j, $S_{pp,i}$ is the number of seats obtained by party i under perfect proportionality rule, and $S_{u,i}$ is the number of seats obtained by party i if all the seats go to the largest party[3].

The index may be read as follows. The first sum is the loss of representativeness of system j, measured as the sum of the differences between seats obtained by all parties under j and those obtained under perfect proportionality. The second sum defines a maximum for the loss of representativeness, that of the unanimity system. The ratio normalizes the loss or representativeness to the range 0-1: in the case of unanimity system the value of the ratio is 1, while in the case of perfect proportionality is 0. The subtraction from 1 transforms the index of "non-representativeness" in an index of representativeness.

[3] The value of $S_{u,i}$ is the total number of seats for relative majority party, and 0 for the other ones.

The index is quite similar to the first, χ^2 like, index suggested by Mudambi (1996); The main difference is that it is normalized. Note that the "real" values of the extremes are contingent upon the real constituency; differently from the second index of Mudambi, this one does not allow comparisons among constituencies[4].

An example may be useful.

Example 1. Suppose the following constituency, where three systems are under scrutiny.

Parties	Number of seats under		
	Perfect proportionality	Plurality	Intermediate
A	40	60	60
B	30	40	20
C	10	0	10
D	10	0	10
E	10	0	0

The index takes the values 1-0/120 = 1, 1-60/120 = 0.5, and 1-40/120 = 0.67 respectively.

Now, the index **g**. Stability amounts by large to "efficiency" in producing a government. I admit that it depends from (a) the number of parties of the governing coalition *that may destroy the majority if they withdraw, m*;

(b) the variance of the share of seats of the parties that form the governing coalition, σ^2_s (a coalition of two parties with 26 seats each out of 100 is sounder than a 49-3 coalition); and (c) the share of seats of the majority, F. I adopt a Cobb-Douglas form, mostly to leave room for adding further factors, if theory or empirical research suggest[5]. Consequently, the index is

$$\mathbf{g}_j = (1/m_j)^b(1-\sigma_{j,s})^c F_j^d$$

Lacking information, I admit for the time being b=1 and c=d=0, so the maximum value of **g** is again 1 (when there is only one party, presumably the largest or the only one, that may cause the crashing of the governing coalition), and the minimum tends to 0 as the number of "fatal" parties increase. The relevance of the first factor is suggested by experiments (see Ortona, 1998) and by the Italian evidence of shortlived governments. Government coalition used to be formed by one (sometimes two) large party, and some small or very small. Understandably, the last ones were the most turbulent, and most crises were produced by their withdrawal. This aspect of stability was not duly appreciated, for instance, by Vannucci (1997). With the values of the parameters suggested above, the index is not that different from a simpler and more traditional one - the number of parties in the government coalition. However, plurality systems are likely to be dominated with different values of parameters too, provided they are plausible (see sect.3). With references to example 1, **g** takes the values 0.5, 1 and 1 respectively.

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[4] This point is also discussed in Ortona (1998).
[5] An instance will appear below.

3. The VAP system.

The new system suggested here, that I labelled VAP[6], is a simple weighted-voting system, and bears some resemblance with the majority premium system. In a majority premium system, the party or the parties that form the government get additional seats as a premium. This system has two serious inconveniences. First, it calls to the Parliament someone who has not been elected, and who may well have obtained less votes than someone who will stay out. Second, and more seriously if we adopt a Schumpeterian approach, this feature does not offer a guarantee against the "blackmailing" power of small parties, based on the (credible) menace of withdrawing[7]. Both inconveniences are resolved in the VAP system, that runs as follows.

a) MPs are elected through a proportional system; in what follows we will assume perfect proportionality, for sake of simplicity.

b) Parties form a government coalition as usual, and the government gets its confidence vote as usual.

c) Since the government is in charge, votes for the government count more: they are multiplied by some factor, **a**. For instance (but it is an important one), if we want to have one *crucial party*, i.e. that the government coalition

[6] VAP is the acronym of *varduma péi*, "let's see later" in Piedmontese; and also of "*Voting a posteriori*". The reason will become clear in sect. 7.

[7] Following Schumpeter (1943), and Stigler (1979), "The main accomplishment of political competition is not to please voters, but to eliminate unnecessary returns to the incumbent" (Galeotti, 1994, p.363).

can still keep a majority of, say, 1 if all members but the party that has the relative majority leave it, the value of **a** is provided by

(1) $X\mathbf{a} = (X\mathbf{a} + T - X)/2 + 1$

Where X is the number of seats of the relative majority party, and T the total of seats. If the desired majority is Y instead of 1, it is sufficient to introduce Y instead of 1 as the last figure.

In other words, there will be two parliaments: a "real" one of, say, 100 seats with a governing coalition of, say, 26+25 seats; and a "virtual" one of 196, with 147 belonging to the majority. If the smaller party of the coalition leaves the government, its 72 "virtual" seats reduce to the "real" 25, and the majority still keeps 75 seats against 74. The value of **a**, 2.9, that produces these figures is obtained from (1).

Obviously, **r** and **g** for the VAP system must be computed out on the basis of virtual seats. The following example 2 shows how they are obtained for the case of example 1.

Example 2. Given the figures of example 1, suppose that we want a VAP system such that the relative majority party can govern alone with a majority of 10. The value of **a**, given by $40\mathbf{a}=(40\mathbf{a}+60)/2+10$, is 2. The government coalition is made up of the first two parties. Hence we get:

Party	real seats	virtual seats	virtual seats under perfect proportionality
A	40	80	(40/100)170 = 68
B	30	60	(30/100)170 = 51
C	10	10	(10/100)170 = 17
D	10	10	(10/100)170 = 17
E	10	10	(10/100)170 = 17
Total	100	170	170

The value of $\Sigma|S_{pp,i}-S_{u,i}|$ from the third column is 102+51+17+17+17 = 204, while the value of $\Sigma|S_{j,i}-S_{pp,i}|$ from the second and third columns is 12+9+7+7+7 = 42. The value of $\mathbf{r}_{vap}$ is 1-42/204 = 0.794, and the value of $\mathbf{g}_{vap}$ is 1. In section 2 we saw that the corresponding figures for plurality system are 0.5 and 1, so VAP dominates plurality.

Note that it is not necessary to force the crucial parties to be 1. If the rule of the constituency allows for m crucial parties, **a** can be easily be obtained by

$$(1') \qquad a\sum_{i=1}^{m} X_i = \left(a\sum_{i=1}^{m} X_i + T - \sum_{i=1}^{m} X_i \right) \Big/ 2 + 1 \quad [\text{or} + Y]$$

and so on.

Before leaving the topic, we may see why the value of parameters of **g** is probably irrelevant in what concerns the dominance of plurality systems. σ is almost assuredly *higher* under plurality rule than under VAP, so assuming c>0 *increases* the dominance of VAP. The same holds for F: in the previous example, for instance, the value of F is 0.6 for plurality, and 140/170=0.82 for VAP

4. Simulations with fictitious data.

In this section I will present some[8] simulations with fictitious data. Results in table 1 are typical.

Table 1. Possible Parliaments with 8 parties and 600 seats.

Parties	Perf. Prop.	Plurality, 1	Plurality, 2	Plurality, 3	VAP (Virtual seats)
A	150	312	312	312	451
B	60	0	0	0	181
C	60	0	0	0	181
D	42	0	0	0	126
E	126	288	260	144	126
F	126	0	28	144	126
G	18	0	0	0	18
H	18	0	0	0	18
r	1	0.280	0.342	0.560	0.679
g	0.250	1	1	1	1
a					3.01

The second column corresponds to a typical two-party constituency, the third recalls by large the British case, and the fourth is not too different from the results of perfect proportionality. The minimum winning coalition is always made of one party[9]; this feature is not essential, as we saw. The value of

[8] Not all. I ran a lot of simulations on fictitious data, and always found that VAP dominates plurality and majority; however, I cannot claim this result to be necessary.
[9] Previous experiments (Ortona, 1998) indicated that a plurality system producing a two-party majority is not particularly desirable.

a is obtained from (1). As results, VAP dominates all plurality parliaments, but not the proportional one.

5. Simulations with real data.

Now we move to real data. The first set are the complete preferences over the (then) 12 parties of the Italian parliament of a sample of 253 students of the faculty of Law of the University of Torino, collected in 1995. A Parliament of 100 seats is produced, through a process of randomisation to take care of the central limit theorem[10]. The same set and the same procedure were employed in Ortona (1998). Results are in table 2.

Table 2. Simulation on sample data. 100 seats.

	Perf. Prop.	Threshold Prop.	Plurality	Runoff Majority	Perf. Prop., VAP	Threshold Prop., VAP
Number of parties in the majority	3	2	1	1	3	2
Seats of the majority	22+26+3	25+29	59	72	66+78+9= 153	62+73= 135
r	1	0.838	0.377	0.351	0.656	0.642
g	0.333	0.500	1.000	1.000	1.000	1.000
a					3	2.5

Virtual seats are 196 in 5th column and 181 in 6th. The admittance threshold in column 2 is 4%. As results, both VAP systems dominate plurality and majority, but not proportional systems.

The second set of data is more interesting: they are real data of the election of the Italian Parliament in 1996. The electoral system was mixed: 75% of seats were allocated through plurality system, and the remaining through proportional system. So electors voted with both systems, and we can

[10] The method is fully described in Trinchero (1998) and summarized in Ortona (1998).

see and use their first preferences over both. The parliament was supposed to have 600 seats[11]. Most parties grouped for running for the plurality share, while they did not for the proportional one, so we may consider as subjects either the parties or the groups of parties. I considered both in turn. Results for single parties are in table 3.

Table 3. Possible Italian Parliaments in 1996.

	Perf. Prop.	Real	Plurality	VAP1	VAP2
Number of parties	12	10	10	12	12
Number of parties in the majority	4	6	4	4	4
Seats of the majority	316	301	308	316	316
r	1	0.869	0.763	0.620	0.739
g	0.250	0.167	0.250	1	0.5
a				3.740	2.363

The Parliament of the first and third columns are obtained from the share of votes allocated through the proportional and plurality systems respectively; while that of the second corresponds to the real one. VAP1 allows for 1 crucial party, and VAP2 for two (see the previous section). Note that non-proportional systems are dominated by perfect proportionality. However, the value of **g** in the first column is very low, so it may be advisable to resort to a VAP system in this case too. VAP system does not dominate plurality, but this is due only to the number of crucial parties, 1 or 2 in VAP systems and 4 in plurality. A four crucial party VAP system would dominate plurality, but **g**

[11] This number was chosen because of its divisibility, and because it is very similar to the real number of seats (630) of Italian Lower Chamber.

would decline back to 0.250, so it would be dominated by perfect proportionality.

If you excuse the oxymoron, this real case is unrealistic: if the only system is plurality or majority, Duverger's law forces the parties to unite to produce less, and larger, parties. During this process, all the parties lose representativeness[12]. It is impossible for me to quantify this loss[13], so I admit that the loss (or gain: see fn. 12) is nil, and that the groups of party that joined for plurality-allocated seats are comparable to single parties. Results are in table 4.

Table 4. Further Italian Parliaments in 1996.

	Perf. Prop.	Real	Plurality	VAP
Number of parties	5	5	5	5
Number of parties of the majority	2	2	1	2
Seats of the majority	333	308	315	333
r	1	0.802	0.671	0.916
g	0.500	0.500	1	1
a				1.205

The first and third columns are obtained assigning the votes of the proportional and of the plurality shares respectively to the groups of parties, while the second is obtained from the grouping of seats allocated for real. As results, VAP dominates by large real and plurality.

[12] This is the common wisdom hypothesis, and I share it. Breton and Galeotti (1985) do not.

[13] This feature could be incorporated in **r** adding a factor, for instance $(1/T)^m$, where T is the ratio between number of parties under perfect proportionality and that under plurality or majority. In absence of information, we may suppose m=0.

Interesting enough, the value of **r** for VAP1 in table 3 is quite close to that of plurality in table 4. This *suggests that it may be not necessary to force the grouping of parties to obtain a higher stability.* Remember that the reduction of the number of parties entails a loss or representativeness, and the role of the omitted factors in **g**. This is a precious hint, worthy further inquiry.

I did not compute out the indexes for more sophisticated non-proportional systems. However, experiments in Ortona (1998) provided figures very close to those of simpler methods for five such systems, i.e. Condorcet, Borda, Hare, Coombs and Approval.

So we discussed the main result of section 1. Let's move to the other two.

6. The meaning of a.

If the value of **a** is, say, 2, it means that the vote of MPs voting for the government counts twice that of the opposition. There is a violation of the principle "one person-one vote". The violation, however, is less serious than that of the plurality system with the same number of crucial parties, as results from the value of **r**. This allows us to state that the violation of the principle implied in the choice of plurality system is *at least* as sound as that of the VAP system. It follows that we may read **a** as the (minimum) cost of the violation implied in the choice of plurality system[14]. To obtain a government with only (say) one crucial party, citizens must accept that the value of votes for the majority is (say) twice that of the opposition. Obviously, there are many ways of computing this cost. The use of **a** has the only, yet relevant, merit of simplicity and readability. This is sufficient for result b) of section 1.

[14] This holds for all the systems dominated by VAP.

7. Choosing the voting system after the election.

In principle, it is quite simple to choose the electoral system after the election. All what you need is a set of relevant dimensions, a set of continuous indicator for the dimensions, and a suitable Social Preference Function. Suppose, not necessarily for simplicity, that the dimensions are two. You may plot electoral system in a graph, trace down a set of indifference curves from the SPF, and find out the best system. Note that to collect information suitable for different electoral system is not difficult, as is shown *inter alia* by the cases of Australia and Italy.

The real difficulties are two. First, as Duverger's law orders, the essence of the institution "party" may be different under different electoral systems. Second, as for other sectors of social sciences, it is probably impossible to write down for real a plausible SPF.

If the result of the end of section 4 is general[15], the first difficulty is overcome: parties represent preference better under perfect proportionality, when there are many, and there is no need to reduce their number to increase governability.

The second difficulty may be resolved on practical grounds. For instance, the electoral constitution may establish that it is worthy to "pay" a value of **a** equal to 2.5 to obtain one crucial party, of 2 to obtain two, of 1.5 to obtain three and so on. If these thresholds are not reached, it means that correcting the (perfect or not) proportionality is too costly.

[15] And if Breton and Galeotti (1985) are wrong.

8. Minority parties coalitions.

As stated in sect.1, we admitted that the largest party is always in the government. This may and may not be true. If it is not, the VAP system *may* be inferior to plurality.

Consider again example 1, but suppose that the government is made up of parties BCDE instead of AB. Following the logic of VAP method, **a** must be obtained from (1) allowing the largest party of the coalition (B) to keep the majority if left alone. The value is 2.4, and it is simple to compute out that the values of **r** and **g** for VAP system are 0.690 and 1, so plurality is still dominated.

But suppose instead (a) that there are only three parties, with 26, 25 and 49 seats respectively under proportionality, and 24, 25 and 51 under plurality; and (b) that the first two form the government. In this case, the value of **r** will be 1 for both systems, but that of **g** will be 0.959 for plurality and only 0.524 for VAP.

The second set of figures is quite peculiar[16], yet it cannot be excluded. What to do in this case? The most obvious solution, to give the relative majority party the weight required to govern alone, goes against the spirit of VAP, as it unchains Duverger's law. A better solution is to fix a number of crucial parties lower than 1. Under this rule, not even the largest party of the governing coalition may cause its collapsing alone.

[16] The value of **r** under plurality is very high because the distribution of seats is very similar to that of proportionality. If, under plurality, seats are for instance 20, 20 and 60, **r** reduces to 0.475, and VAP dominates plurality again.

To pursue further the discussion would bring us into the (many) details of VAP system, and I prefer to leave the topic to further inquiries. Note that the possible unavailability of VAP may again be assessed *a posteriori*.

9. Further dimensions.

The whole discussion is based on the assumption that only representativeness and stability are relevant for the choice of an electoral system. This assumption is neither peculiar nor original; Cox (1997), just to quote one, admits it. These two dimensions are clearly important, and at least in Italy they are crucial for the present political debate[17]; but there is no reason to rule out that other dimensions may be important too. Levin and Nalebuff (1995), for instance, suggest five more, Sen (1995) two, Mudambi *et al.* (1996) two, Myerson (1995) one and Myerson (1993) still another one. No need to explicitly quote them (but one: see below). The obvious conclusion of this short listing is that it could be advisable to check the performance of VAP system with reference to a larger set of requirements.

Myerson (1995, p.83) claims that "electoral system should be evaluated by the incentives that they create not for the voters, but for the politicians when they form parties, choose policy positions, and offers themselves as candidates for high office". It is straightforward to add to this list "and when they form a government". From this point of view, VAP system is no more "midway" between proportional and plurality; instead, it is on one side while both other systems are on the other.

Both plurality and proportional systems tend to produce a centrist government. This is obvious and largely known for plurality, since Hotelling (1929). As for proportional system, centrist parties, even if small, can drive the

[17] But they are not the only ones. Someone prefers not to have parties at all, and consequently prefers majority systems as they, supposedly, reduce their relevance. Someone else rejects the principle "one person, one vote" on the ground of economic efficiency, and consequently prefers restricted voting systems. Both positions appear in press.

strategy of the government towards their preferences through the (credible) menace of a change of majority. Both results are largely confirmed by evidence. In VAP system, centrist parties lose a lot (not all) of their blackmailing power. Most of it is in the hands of crucial party (or parties); it does not need to move towards the center[18].

Is this a desirable feature? Maybe, and maybe not. On one side, a median government minimizes the sum of the distances of the preferences of the electors from those of government (Cox, 1997). On the other, the constraint of a median government reduce the choice set of the electors, and creates a sort of monopoly rent for the parties (Myerson,1995[19]).

I will not go deeper into this question; yet, it is relevant, and worth further inquiry.

[18] Note that the necessity to form a coalition reduces the ”blackmailing” power of the largest party, and this may be a desirable feature.

[19] According to Myerson (1993), for instance, plurality systems are more proclive to corruption then proportional ones.

10. Conclusions.

VAP system seems to work well, and it is very simple to implement. Further inquiry is consequently advisable. I suggest five direction:

a) To compare it with sophisticated plurality voting.

b) To test its validity for plausible ranges of the parameters of the indicators.

c) To test its validity under different indicators.

d) To evaluate it with reference to other dimensions.

e) To analyse its effects on government formation and, more broadly, on the behavior of MPs and candidates.

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