Title
National representation in international organizations: The seat allocation model implicit in the European union council and parliament

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What determines the allocation of voting weights to member states in international organizations? What drives the seat and voting weight allocation in the European Parliament (EP) and in the Council of the European Union (EU)? Our objective in this article is to develop a universal logical model and to demonstrate that the resulting equation indeed captures negotiated outcomes on seat and voting weight allocations in EU institutions from their beginning. We predict seat and voting weight allocations for both the EP and the Council of the EU within one general model. Hence, we do not employ actual data on seat allocations or voting weights in either the EP or the Council of the EU, but instead, use logical constraints exclusively, as posed by the following elements: the total number of seats/voting weights \( S \), the number of member states \( N \) and, finally, their respective population size \( P_i \). Only our final model selection among several theoretical options is guided by empirical information. With no post hoc parameters used, our model fits both the Council of the EU and the EP rather well, over a time span of nearly 40 years. Inspired by the ‘seat–vote equation’ (Taagepera, 1973) for seat allocation in national legislatures, the new ‘seat–population equation’ calculates the number \( S_i \) of EP seats or Council voting weights of member state \( i \) as follows:

\[
S_i = \frac{S_P n}{\sum P_k n},
\]

where \( n = \frac{1}{\log N - 1/\log S} \), \( P \) being the total population (as summed over all member states). We posit that this equation is applicable to predict outcomes in practice whenever voting weight or seat allocations in international organizations are allocated on the basis of the population shares of their component entities.

What determines the seat or voting weight allocation of member states in international (and supranational) organizations? More specifically, what drives the seat allocation in the European Parliament (EP) and the attribution of voting weights in the Council of the European Union (EU)? This question has gained prominence with recent re-allocations of seats in the EP and of voting weights in the Council of the EU (the ‘Council of Ministers’).

In the framework of national elections, when seats are to be allocated to electoral districts, the technique usually resorted to is to utilize some mathematical formula based on the respective populations of these districts. In an international setting, however, the situation is more complex: not only populations, but also countries (member states) as such must be represented. When
member states are of grossly unequal size, international organizations face a tension between representation per capita and representation per country. The objective of this study is to develop a universal logical model and to show that the resulting mathematical formula has been implicit in negotiated outcomes on institutional provisions in the European Community (EC), and later the EU, from the beginning. Adopting such a formula explicitly might save considerable effort, while resulting in essentially the same seat allocations that have prevailed in the EP and the Council of the EU over time.

We propose that a universal model must satisfy three constraining conditions, which can be expressed roughly as follows (see Appendix for details):

1. If the number of seats to be allocated matches the number of countries, each country should get one seat.
2. If the number of seats becomes huge, representation should be proportional to the populations of countries.
3. If there is only one seat to be allocated, it would have to go to the largest country.

As the total number of seats expands, with no new members added, no country should lose seats, and proportionality to population should increase gradually. To be politically acceptable, the model should yield results close to the existing distribution of seats.

Our model does yield distributions remarkably close to the actual seat distributions in the EP and voting weights in the Council of the EU, over a span of more than 40 years. It does so for both of these bodies, without any free parameters. Indeed, the fit is practically as close as are analyses based on empirical data and curve estimations ex post. Parameters in some equations presented earlier are used to assess actual seat distributions rather than to forecast changes for the future. They can be established only retroactively, using the known seat distributions themselves. In contrast, our model has a more general aim and proceeds solely with information on the basis of the total number of seats to be allocated, the number of countries and their respective populations. It aims to predict the distribution of seats for any such combination that might be proposed.

The model may seem to run counter to the notion that more skillful negotiators may be able to gain more seats for their country. However, a prevalent norm, at least until the recent expansion of the EU, seemed to be that a smaller country (in terms of population) should not be given more seats than a larger one. This constraint reduces the negotiable range for an individual country. Delegations can only make a case, for example, for stronger representation of medium-sized countries as a group, as compared to the small and the large countries. Alternatively, a government representative may strive for all ‘large’ countries to hold an equal number of seats, and then aim to make his or her
own country join this group as its smallest member. To avoid such political haggling, and ad hoc results, one might instead settle on a logically grounded mathematical formula that leads to almost the same outcomes as do applied negotiations. This principle may apply equally to seat distributions in any other international organization.

Our study is structured as follows. We first present our predictions and the actual distribution of seats in the EP and the Council of the EU in 1995, i.e. after the EU’s enlargement by Austria, Finland and Sweden, in order to demonstrate that it might be worthwhile to consider our model. Subsequently, the model is outlined, with details left to the Appendix to this article. Our next section compares the logical model with the actual seat (voting weight) allocation in the Council and the EP at their various stages of development. Here we also provide some critical remarks regarding vote allocations proposed by the Treaty of Nice. Subsequently, we review a selection of equations based on empirical data that have been presented earlier. Finally, we discuss the reasons why the actual choices made in terms of seat allocations, on the basis of intergovernmental negotiations, may fit the logical model. Possible hidden assumptions are then discussed, establishing the possible limits to the model’s applicability.


The predictive power of our model is illustrated in Figure 1, for the situation of the EU in 1995. The number of seats in the EP (shown by round symbols) and the voting weights in the Council of the EU (shown by square symbols) are graphed against the population size of the member states, both on logarithmic scales. The lines shown are not best fit (i.e. OLS regression) lines, but represent the predictions of the logical model used in this article. The model correctly predicts a much steeper line (slope 0.672) for the EP than for the Council (slope 0.456). Except for Luxembourg, the theoretical lines are close to constituting the best-fit lines. When rounded off to integers, only 2 (2.3 percent) of the voting weight units in the Council of the EU are misallocated, out of the total of 87. These two weights are allocated to Luxembourg and Portugal, instead of Germany. The model precisely predicts the voting weights of the remaining twelve countries. Out of the total of 626 EP seats, 21 seats (3.4 percent) are misallocated.

The model presented in this study is a true logical quantitative model. Hence, no seats/voting weights data for countries, past or present, enter the equation. The lines in Figure 1 are based solely on inputs that pre-exist before any seats are allocated: (1) the number of countries; (2) the population size of each country; and (3) the total number of seats to be distributed. The first two factors, evidently, are the same for both the EP and the Council; it is the total...
number of seats that differs, and produces lines with different slopes and locations. We will now proceed to describe the model that produces such predictions.

The Model: Seat–Population Equation

The model we apply here evolved from electoral studies concerned with the relationship between seats and votes in national assembly elections (Tagepera, 1973; Henri Theil, 1969) – see the Appendix for details. Theil (1969) suggested that a resulting general formula could also be applied to seat allocation in international institutions whenever one wishes to over-represent smaller member states. Consider the ratio of seats \((S_i/S_j)\) of any two countries \(i\) and \(j\) and the ratio of their populations \((P_i/P_j)\). If there are more than two countries in the system, the only format connecting \(S_i/S_j\) and \(P_i/P_j\) that does not lead to inconsistencies is

\[
S_i/S_j = (P_i/P_j)^n
\]  

(1)

This equation can be reformulated to express the number of seats of a given country \((S_i)\) in terms of the populations of all countries and the total number of seats \((S)\):

\[
S_i = S \left( \frac{P_i}{\sum P_j} \right)^n
\]
where the summation is over all parties. The exponent $n$ in these equations reflects various possibilities. When $n = 1$, countries are represented proportionally to their populations. The more the exponent $n$ falls short of 1, however, the stronger is the extent of over-representation of small countries and under-representation of large member states. When $n = 0$, all countries are represented equally (e.g. on the basis of the principle ‘one state, one vote’), regardless of their populations. The value $n = 0.5$, halfway between these extremes, was proposed by Lionel Penrose (1946) and elaborated on by Lewis F. Richardson in 1953 (see Richardson, 1993). This value has a mathematical rationale and has been used in practice, for example, to allocate seats in the International Federation of Operational Research Societies (Theil, 1969). It tends to come close to the voting weight distribution in the Council of the EU, but it cannot explain why $n$ is around 0.7 for EP seats. Hence, something needs to be added to the analysis.

Since the Council of the EU and the EP are composed of the same member states, with the same populations, it is interesting to see whether the different sizes of these bodies (in terms of total seats or voting weights) somehow motivate less over-representation of small countries in the larger body (the EP) as compared to the smaller one (the Council of the EU). Indeed, in electoral studies, the value of the exponent $n$ has been shown to depend on the total number of seats as well as on the total number of votes ($V$), following the equation $n = \log V/\log S$ (Taagepera, 1973). In the case of international institutions, member-state populations substitute for votes, but a third quantity also matters: the number of countries (member states) to be represented.

This fact complicates the assessment. While small political parties are not entitled to seats just because they exist, small countries within international organizations derive this justification by the very fact that they constitute member states. Hence, member states receive seats not only on the basis of their population sizes, but also because they constitute distinct, sovereign countries. Thus, in the case of international organizations, the exponent $n$ must depend, apart from total population ($P$) and the total number of seats ($S$), on the total number of member states ($N$). As shown in the Appendix to this article, the logical constraints guide us toward a set of specific options, among which only the following comes close to fitting data empirically:

$$n = (1/\log N - 1/\log S)/(1/\log N - 1/\log P).$$

In conjunction with equation (2), this equation may be termed the seat–population equation. It may look complex, but it is simple in one respect: it has no free parameters. The question is whether it fits the actual seat (voting weight) distributions in practice and, in particular, whether it can account for the dif-
ferent patterns of allocation in the Council of the EU (exponent $n$ around 0.5) and in the EP (exponent $n$ around 0.7).

**Testing the Model with Seat (or Voting Weight) Distributions in EU Institutions, 1958–2004**

Subsequently, we first test the model’s robustness over time in predicting the seat (or voting weight) allocation when membership, respective populations and the total number of seats/weights change over time, within the same organization. A second check is conducted when identical values for $P$ and $N$ are combined with different values of $S$, as is the case for the EP and the Council of the EU when assessed at the same point in time. In order to be valid, the model must provide a close fit in such successive and parallel constellations. A single line with slope $n = 0.5$ obviously could not fit both institutions, and it would be unable to capture changes over time. A third test is a comparison with the results of post hoc curve estimations on the basis of empirical data, with various underlying equations. A logical model with no adjustable parameters obviously cannot be expected to do better than retrospective data estimations that use adjustable, free parameters. The comparison will be by assessing how much worse prediction performs as compared to post-diction.

**Robustness Over 40 Years**

The seat and voting weight constellations of the EP and the Council of the EU at different points in time enable us to see how the seat–population equation reacts to expansions in membership (which also alter total population, and induce an increase in assembly size). We will first consider the Council of the EU, and then the EP.

From 1958 to 1995, EU membership increased from 6 to 15 countries, total population from 172 to 368 million and the number of voting weight units in the Council from 17 to 87 (Table 1). Yet, during this time span, the exponent $n$ changed fairly little. It jumped from 0.406 to 0.518, and then slid back to 0.456. Exact implementation of the Treaty of Nice would first have increased $n$ markedly to 0.585 (with 15 members) and then have decreased it again to 0.522 (with 27 members). Finally, according to the 2005 version of the new constitutional treaty, $n$ for the Council (25 EU member states) would be 0.566. It seems as if there were an unconscious attempt, in the framework of respective negotiations, to keep $n$ around 0.5 by adjusting $S$.

Table 1 lists the model-predicted and actual voting weight unit shares for the individual EU member states, along with their populations (in millions). When rounded off to integers, the calculated voting weights for the year 1958 correspond perfectly to the ones agreed upon in practice. For the
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Table 1: Predicted and Actual Voting Weights of Member States in the Council of the EU
### Table 1: Continued

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<td>58</td>
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<tr>
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<td>Number of seats</td>
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<tr>
<td></td>
<td>0.406</td>
<td>0.518</td>
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<tr>
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<td>0.488</td>
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**Notes:**

- P: population, in millions.
- S_{PR}: allocation predicted by seat–population equation.
- S_{A}: actual allocation.

**Sources for population figures:**
- 2) Figures are for the censuses of the following years: 1960 (Luxembourg and the Netherlands), 1961 (Belgium, Germany and Italy) and 1962 (France).
situation in 1973, however, some discrepancies can be discerned. Compared to
the model, Luxembourg, Ireland and Belgium are overpaid by one unit, at the
expense of Germany, the UK and France. Similarly, for the situation as of 1986,
Germany and Spain are under-represented by one seat, Luxembourg is over-
represented by one seat, and in order to maintain the total, either Greece or
Belgium would, compared to the model predictions, have to be ‘overpaid’ by
one seat. In 1995, Luxembourg and Portugal hold one extra unit each, com-
pared to the model prediction, both at the expense of newly expanded
Germany, whose extra population would call for two units beyond the actual
ten received.

The share of misallocated voting weights is also given in Table 1. This share
decreases from 5.2 percent in 1973 to 2.3 percent in 1995. After implementa-
tion of the changes agreed upon at the December 2000 summit meeting in
Nice, however, the fifteen-member EU fit with the theoretical model worsens
to a misallocation of 4.2 percent: Germany would receive seven units less than
predicted by the model, while Spain would receive three, and Luxembourg two,
units in excess. The UK and Italy, by comparison, would be under-represented
by one unit, resulting in a total ‘shortfall’ for the ten largest countries of nine
units.17

Table 2 addresses the expansion to 27 EU states, as envisioned by the Treaty
of Nice, as well as the provisions of the (revised) EU draft constitution, for
25 EU member states. This table comprises information on both the Council
and the EP. Out of the total of 345 Council voting weights as foreseen by the
Treaty of Nice, the model misallocates 15 (or 4.3 percent). Germany would
receive five units less and Romania three units less compared to the model’s
pre-diction. By comparison, Spain and Poland would receive four units more
and Luxembourg two more, than predicted. One-unit winners would be Italy,
Hungary, Portugal, Cyprus and Malta, whereas one-unit losers (compared
to the model predictions) would be the Netherlands, Sweden, Slovakia,
Denmark, Finland, Latvia and Slovenia. The voting weight distribution accord-
ing to the constitutional treaty, however, is more difficult to predict: since a
double-majority clause was introduced with the draft constitution, we will
measure voting weights as the (non-weighted) average between equal weight
shares for each country and actual population size of each member state.18

Applying our model to this weight distribution, predictions for the constitu-
tional treaty (25 EU states) are less accurate compared to predictions for earlier
stages in the EU. Model predictions misallocate a total of 109 units (or 23.8
percent of the total). Germany receives 31 units less than predicted, the UK
and France 17, and most of the medium-sized and smaller EU states, by com-
parison, are ‘overpaid’.

We now shift our attention to the EP. This organization started out later than
the Council, but still with a total of only six member states (Table 3).19 Ini-
tially, the EP distinguished only between three size categories, allocating 6 seats
Table 2: Predicted and Actual Constellations in the Council of the EU and the European Parliament

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<tr>
<td>Total</td>
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<tr>
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<td>0.599</td>
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**Misallocation:**
- Number of Seats: 15, 109, 43, --
- Percentage: 4.3%, 23.8%, 5.9%, --

1) Double-majority rule: voting weights calculated as average between equal number of votes (one country, one vote) and actual population size (in millions, 2003).
Table 3: Predicted and Actual Seats of Member States in the European Parliament

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<td>S&lt;sub&gt;A&lt;/sub&gt;</td>
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<td>S&lt;sub&gt;PR&lt;/sub&gt;</td>
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<td>–</td>
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<td>Greece</td>
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<td>Sweden</td>
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<td>–</td>
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<td>–</td>
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<td>Denmark</td>
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<td>–</td>
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<td>14.1</td>
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<td>Finland</td>
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<td>–</td>
<td>3.4</td>
<td>10.5</td>
<td>15</td>
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<td>1</td>
<td>6</td>
<td>0.4</td>
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<td>6</td>
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<tr>
<td>Total</td>
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<td>142</td>
<td>276.7</td>
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<tr>
<td>n</td>
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<td>0.716</td>
<td>0.690</td>
<td>0.696</td>
<td>0.672</td>
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Misallocation:

<table>
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<tr>
<th>Number of Seats</th>
<th>7</th>
<th>21</th>
<th>22</th>
<th>13</th>
<th>21</th>
<th>17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>4.9%</td>
<td>5.1%</td>
<td>4.2%</td>
<td>2.3%</td>
<td>3.4%</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

1) European Assembly (preceding introduction of direct EP elections).

Note: Years have been selected where the number of members or seats allocated changed significantly.
to Luxembourg, 14 to Belgium and the Netherlands and 36 to the three large member states (Germany, France and Italy). Out of the total of 142 EP seats, the discrepancy of the actual seat distribution compared to the prediction by the logical model is 7 seats (or 4.9 percent) for 1964: whereas the model attributes only one seat to Luxembourg, this member state received six seats in practice. Belgium also obtained a surplus (of two seats) in practice compared to the model’s prediction, whereas Germany incurred a deficit of five seats, and Italy a deficit of two, again compared to the seat allocation predicted by the logical model.

Throughout the different stages of the EP, the exponent $n$ in the logical model has been even more stable than it was for the case of the Council (compare with Tables 1 and 2). From a high of 0.716 in 1979, the value of $n$ in our model for the EP decreased to 0.672 in 1995. The Treaty of Nice, however, reduced the exponent to 0.659 for 15 member states and would have reduced it even further (to 0.599) for an EU consisting of 27 member states (see Table 2 and Figure 3). The constitutional treaty encompassed no clear provisions regarding the total number of EP seats. But, assessment of the seat distribution for the Treaty of Nice provisions with 25 EU states again increases the value of $n$ of the seat–population equation (to 0.617), as shown in Figure 4. Assessment of the distribution of EP seats over time, up to the present, demonstrates a decreasing discrepancy between the actual seat allocation and the model predictions: after the introduction of direct EP elections in 1979, this discrepancy was 5.1 percent. After the Mediterranean enlargement and German reunification it decreased, being 2.3 percent in 1994 (but 3.4 percent again in 1995). The Treaty of Nice generates a discrepancy level of 3.2 percent for the 15-member EU, but discrepancy would increase to 5.9 percent for an EU consisting of 27 member states.

As Table 2 indicates, according to the Treaty of Nice (27 member states), Germany would get 19 EP seats more than the seat–population equation predicts. The UK, France and Italy, at the more populous end, would also get five to seven seats in excess of what the model indicates. By comparison, among the EU’s smallest states, Cyprus, Luxembourg and Malta would get one to three extra seats. In contrast, almost all intermediary countries would obtain fewer seats than the model predicts. Most ‘underpaid’ would be the Netherlands (by five seats), Romania (four), the Czech Republic, Hungary, Sweden, Bulgaria and Austria (by three seats each).

We may well ask whether Nice has made the seat allocation more erratic than it used to be. The revised draft constitution, adopted by the European Council on 17 and 18 June 2004, at the close of the intergovernmental conference process, does not give a provision for the seat allocation to EU states. However, article I-19 of the draft constitution contained a legal basis that gave the European Council (on the basis of a proposal from the EP and with its consent), the responsibility to determine the new EP seat allocation before the 2009 EP
elections. It stipulated that allocation had to occur on the basis of the principle of ‘degressively proportional’ representation of EU citizens, a minimum of 6 seats and a maximum of 96 seats per EU member state. Since the constitutional treaty does not provide numbers for EP seat allocation, the number of seats we will use in the subsequent analysis is the one applicable since the 2004 EP elections.

**Distinguishing between Assemblies of Different Sizes**

The second check of the model concerns the situation when identical values for \( P \) and \( N \) combine with different values of \( S \), as is the case for the EP and the Council of the EU at the same point in time. This is the approach we used previously to generate Figure 1. Similar graphs can be constructed also for other years. Subsequently, we show model calculations only for the early six-member constellation of 1964 (Figure 2) and the projected expansion to 27 member states (Figure 3). Except for the case of Luxembourg, the model’s correspondence with the actual seat distribution for the year 1964 comes close to the best fit with any simple curve. This also holds for the 1995 constellation (see Figure 1 above). For the projected expansion to 27 member states according to the Treaty of Nice, however, two marked changes occur: the two lines get

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**Figure 2: Seat and Voting Weight Distribution in the European Assembly and in the Council of Ministers (1964): The Logical Model and Actual Values**

![Figure 2](image-url)

Note: Data are from Tables 1 and 3. The lines are not statistical best-fit lines, but predictions by the logical model, based solely on the number of countries, total seats (or voting weight units) and country populations.
close to each other, due to a sharp increase in the voting weights total of the Council. In addition, the aforementioned discrepancy for the case of the EP becomes well visible: low representation in practice for member states with medium-size populations, and high actual representation at the extremes. The pattern that the logical model predicted well for a time period of some 40 years was on the point of being altered.

The unspoken rule against a situation in which less populous countries hold more seats than more populous ones would, according to the Treaty of Nice, also be breached: Belgium and Portugal were to obtain 22 seats according to the treaty, whereas the Czech Republic and Hungary would hold only 20 seats, despite their slightly higher population sizes. It seems as if the EU was contemplating a form of ‘second-class EU membership’. Hence, the Treaty of Nice has introduced several unprecedented irregularities into provisions for seat allocation. Some of these irregularities have been ironed out with later adaptations.

Quite a different test for the applicability of the seat–population equation could be introduced at this point. The relationship between the population of the

---

**Figure 3: Seat and Voting Weight Distribution in the European Parliament and in the Council of the EU (According to Treaty of Nice, 27 Member States): The Logical Model and Actual Values**

![Graph showing seat and voting weight distribution in the European Parliament and Council of the EU](image)

**Note:** Data are from Table 2. The lines are not statistical best-fit lines, but predictions by the logical model, based solely on the number of countries, total seats (or voting weight units) and country populations.
member states and the sizes (total number of voting weights or of seats) of the Council and the EP, respectively, implies an analogous direct relationship between the two institutions. We can start out with the actual EP seats as the initial population, and then proceed to calculate the expected shares in the Council. The rationale for such a test is that politically motivated deviations from sheer population concerns, such as over-representation of Luxembourg, may well affect the EP and the Council to an equal degree. If so, then the prediction of voting weight allocation in the Council on the basis of EP seats could be even more accurate than a prediction based on population size.21

This is indeed broadly the case, especially regarding Luxembourg. In 1995, for example, the population-based calculations misallocate 2 out of 87 Council seats, while the EP-based calculations misallocate only 1 (from Portugal to Germany). The remaining discordance reflects the fact that Germany succeeded in 1995 in having more representation than France in the EP, but not in the Council. Once more, the Treaty of Nice introduced new irregularities, especially at the 27-member stage. In particular, Germany would have been markedly over-represented in the EP, compared to the model, yet under-represented in the Council (see Table 2).
Comparison with Selected Models Based on Empirical Data

Different authors have attempted to estimate the distribution of voting weights in the Council as a function of population size, usually in order to demonstrate that voting weights are indeed dependent primarily on member states’ population (rather than any other variables, such as Gross Domestic Product (GDP) or contributions to the EU budget). In most of these studies, voting weight estimation does not constitute the actual centerpiece of the analysis, but is rather presented as a by-product of studying other institutional features. Nonetheless, we will provide a brief summary of such models. Strikingly absent, to our knowledge, are analogous estimates for the EP. Our model, however, explicitly aims to encompass both institutions.

Mika Widgrén (1994, p. 1155) estimates the relationship between the voting weights in the Council and population size on the basis of regression analysis. The formula he derives is, in our notation,

\[ \ln S_i = 0.00633 [\ln P_i]^{2.456} \]  

where natural logarithms must be used, \( S_i \) denotes the voting weight of member state \( i \) in the Council and \( P_i \) its population, measured in thousands, not in units. The \( p \)-value for the slope estimate is 0.00009 and \( R^2 = 0.972 \). In the lower part of our Figure 1, this equation would provide a slightly upward-curved pattern that corresponds to our model for populations larger than three million, but passes closer to the Council data point for Luxembourg (this is illustrated in Figure 5 below). As the author indicates (1994, p. 1162), if the formula were to be applied to the Council in the early 1990s, reunified Germany, however, might obtain twelve votes rather than ten. Of course, this equation would be markedly off, for example, for the Council allocations in 1964 (Figure 2) or for the Treaty of Nice 27-member allocation (Figure 3), short of changes in parameter values.

Sven Berg and Jan-Erik Lane (1996, pp. 27–8) use a formula of the form \( S_i = a + bP_i^{c.22} \) An application to the 1995 Council generates the following result, in our notation:

\[ S_i = -1.09260 + 2.80467P_i^{1.3} \]  

where, this time, \( P_i \) must be in millions, not units. In our Figure 1, this equation would provide a slightly downward-curved pattern that drops lower than our line at populations below one million (see Figure 5). This very different empirical equation also provides a highly significant and close linear fit for 1995 (with \( R^2 = 0.971 \)).

Hosli and Wolffenbuttel (2001), applying theoretically driven curve fitting to the voting weight distribution in the Council, derive a power function to express the relationship between population size and voting power from 1973
– the first enlargement of the EC – until the changes agreed upon at the EU Nice Summit meeting:23

\[ S_i = 1.73P_i^{0.43} \]  

where \( S_i \) once more stands for the population size of the given member state measured in millions. In our Figure 1, this equation would provide a straight line with a very slightly steeper slope: 0.43 vs. 0.46 (see also Figure 5).

The Hosli-Wolffenbuttel model seems to have two relative advantages (apart from its simplicity in application). First, it also captures earlier vote distributions in the EC rather exactly, and its functional form has been derived theoretically. Second, it conforms to the form of equation (1), the only form, according to Theil (1969), which does not lead to inconsistencies in the presence of more than two subunits.24

Table 4 provides the results for the Council in 1986 and 1995 for these various approaches, comparing them with the results of the seat–population model presented in this article.25 All of these models do capture the voting weight distribution quite well, for these particular dates. (Widgrén’s model, after rounding, even provides the exact number of votes for all member states.) What such agreement also indicates, however, is that equations of many different forms can fit the voting weight allocations at a given date, as long as they have two adjustable parameters. The model we present here has no adjustable parameters, however, and yet fits both the Council and EP over a long time.
### Table 4: Voting Weight Allocation in the Council of the EU: Empirical Estimates and the Logical Model

<table>
<thead>
<tr>
<th>Model</th>
<th>Actual voting weight</th>
<th>Berg and Lane (1996) $S_i = -1.09260 + 2.80467 P_i^{1/3}$</th>
<th>Widgrén (1994) $\ln S_i = 0.00633[\ln P_i]^{2.496}$</th>
<th>Hosli and Wolffensbuttel (2001) $S_i = 1.73P_i^{0.430}$</th>
<th>This Study $S_i = SP_i/\Sigma P_i^n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>10</td>
<td>9.9</td>
<td>11.0</td>
<td>10.4</td>
<td>12.1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>10</td>
<td>9.7</td>
<td>9.8</td>
<td>10.0</td>
<td>10.2</td>
</tr>
<tr>
<td>France</td>
<td>10</td>
<td>9.6</td>
<td>9.7</td>
<td>9.9</td>
<td>10.1</td>
</tr>
<tr>
<td>Italy</td>
<td>10</td>
<td>9.7</td>
<td>9.7</td>
<td>10.0</td>
<td>10.1</td>
</tr>
<tr>
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<td>8</td>
<td>8.4</td>
<td>8.4</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5</td>
<td>5.7</td>
<td>5.9</td>
<td>5.3</td>
<td>5.4</td>
</tr>
<tr>
<td>Greece</td>
<td>5</td>
<td>4.9</td>
<td>5.0</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Belgium</td>
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<td>4.9</td>
<td>5.0</td>
<td>4.5</td>
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<td>Portugal</td>
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<td>5.0</td>
<td>4.9</td>
<td>4.6</td>
<td>4.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>4 (since 1995)</td>
<td>–</td>
<td>4.7</td>
<td>–</td>
<td>4.3</td>
</tr>
<tr>
<td>Austria</td>
<td>4 (since 1995)</td>
<td>–</td>
<td>4.5</td>
<td>–</td>
<td>4.1</td>
</tr>
<tr>
<td>Denmark</td>
<td>3</td>
<td>3.7</td>
<td>3.8</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Finland</td>
<td>3 (since 1995)</td>
<td>–</td>
<td>3.7</td>
<td>–</td>
<td>3.5</td>
</tr>
<tr>
<td>Ireland</td>
<td>3</td>
<td>3.2</td>
<td>3.2</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2</td>
<td>1.0</td>
<td>1.0</td>
<td>1.7</td>
<td>1.7</td>
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<tr>
<td>Total</td>
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<td>90.3</td>
<td>75.8</td>
<td>90.0</td>
</tr>
<tr>
<td>87 (1995)</td>
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</table>

Note: Calculations based on population figures in 1986 and 1995.
Why do International Institutions Conform to the Logical Model?

Why – and how – have governments in the framework of negotiations on EU decision-making provisions picked allocation patterns that fit the logical model, evidently without being aware of its existence? Could it be that the model expresses some harmonic proportions to which our human brains are tuned? Could the negotiator or seat allocator for an international organization be a mathematicien malgré soi? Let us follow the evolution of the Council of the EU in more detail in order to evaluate this aspect.

The first ground rule used in the EC’s beginnings in 1958 obviously was that even the smallest participant must have one seat or voting weight unit. This is close to our Constraint I given in the Appendix. The next principle must have been that larger states should have more representation than smaller ones. This pulls in the direction of our Constraint II. The simplest way to comply with this was to give the medium-sized states twice the minimum number of units (i.e. two voting weights) and the largest ones double that number (i.e. four voting weights). This distribution happens to fit the logical model, and the total size of the Council (seventeen) automatically emerged.

Repercussions of the first expansion of the Council, in 1973, are more complex. Why was the UK not simply fitted into the already existing pattern of voting weight allocation, obtaining 4 voting weight units, and Denmark and Ireland obtaining 2, resulting in a total of 25 voting weights in the Council? Why was the total number of voting weight units more than doubled? In order to understand this process, we can try to study the negotiations in detail, or to unearth further logical constraints on assembly sizes. Was the rationale that even the smallest participant should gain something from a major expansion, but not to the same degree as the others? Once Luxembourg gained one further voting weight, the need arose to more than double the number of weights for Belgium and for the Netherlands (to five voting weights each) and those of large countries to twice that number (to ten). Although Germany clearly surpassed the UK, Italy and France in population size in the early 1990s, providing Germany with a larger share was unacceptable largely for political and historical reasons. Finally, newcomers Ireland and Denmark were deemed to be appreciably smaller than Belgium and the Netherlands, and received three voting weight units – little more than the number of voting weights held by the tiny founding member Luxembourg.

Prior to 1973, the seat–population equation would have predicted the relative shares of voting weight units in the Council with few deviations. (The actual allocation overpaid Luxembourg, Ireland and Belgium at the expense of
Germany, the UK and Italy.) Or, did the aforementioned semi-quantitative considerations leave the decision-makers fairly little leeway in practice? The subsequent expansions of the Council all remained bracketed by Luxembourg (two voting weights) and Germany (ten), with interpolations between these end points for newcomers. The appreciable total expansion, from 58 to 87 voting weight units, affected the exponent in the logical model only moderately (with $n$ going from 0.518 to 0.456), given the logarithmic nature of the equation. Even with the re-weighting of votes according to the Treaty of Nice, $n$ would be 0.585 (15 members), or 0.522 (27 members), respectively. Generally, the degree of agreement with the model tended to improve over time, until the Treaty of Nice reversed the trend.

Similar comments can be made regarding assessment of the seat distribution in the EP, where its larger size seems to introduce more random ‘noise’. In addition, on average, deviation from the model is around three percent for the Council, but four percent for the EP. Once one accepts that each member must get at least one seat to begin with (Constraint I) and, thereafter, that proportionality to population should increase, but only gradually (akin to Constraint II), little leeway remains for seat allocation in practice.

**Discussion**

The major achievement of this study has been to develop a single logical quantitative model that actually seems to have been implicit in the seat allocation process both for the Council of the EU and the EP, for a time span of over 40 years. As such, it offers an institutionalized, formal approach to seat allocation in these bodies, doing away with perennial prolonged negotiations whenever new members join or the total number of seats is altered. Such tedious negotiations occurred, for example, in the framework of bargaining on the provisions of the Nice Treaty, and the more recent ‘haggling’ over voting weights in negotiations on the EU constitutional treaty. While such bargaining processes end up, anyway, with results rather close to what our seat–population equation predicts, they are time consuming and appear to be determined by *ad hoc* deals. Clearly, the Nice provisions and the latest double-majority clause embodied in the revised draft EU constitution – implying that 55 percent of EU member states, representing at least 65 percent of EU population, must endorse a decision – constitute a departure from earlier patterns of seat allocation. Nonetheless, our formula also captures the latest modifications (although with a comparatively larger margin of error).

National first chamber seats are usually allocated according to a firm formula based on subunit populations. The model presented in this article offers international bodies a way to do the same. Such a formula is strikingly absent in the current EU. In a normative sense, the resulting pattern of allocation might
indeed be preferable to the scheme recently adopted for the Council of the EU, not least since the formula takes into account EU memberships as such, in addition to populations, without the need for a triple-majority or double-majority clause. In addition, our model offers a suggestion for future seat allocation in the EP, an issue to be decided upon by the European Council before the 2009 EP elections.

In principle, the seat–population model may claim wider application than just to EU institutions. Many international organizations face the problem of dividing $S$ seats between $N$ entities of equal standing, taking unequal populations into account. Our logical model presumes to predict the outcome in all such cases. There are no adjustable parameters or coefficients. Once $S$, $N$ and the respective population figures are available, the same equation would fit all cases.

This is our substantive contribution. It remains to discuss the methodological aspect of this approach. The logical model, built on the notion of inbuilt constraints, enters a field where a number of more empirically oriented models, based on post hoc data estimations, have been previously proposed. But they did not aim to have the same general ability to both explain and forecast vote allocations. What are the respective advantages and disadvantages of these methodologies?

Models derived empirically clearly offer maximal fit, because they contain freely adjustable parameters. When each case – a given assembly in a given year – is fitted separately, recalculating the parameters according to actual allocation data, the fit is almost by definition better than it could be with a logical model aiming to apply to all cases. However, it is remarkable that, in the case of the Council of the EU in 1986 and 1995, our general logical model still performs almost on a par with equations specifically adjusted to these particular constellations (see Table 4). By comparison, the latest changes according to the draft constitution imply a larger margin of error when applying our model.

The difficulty with ‘empirical models’, when trying to use them in a more general sense, or actually to predict seat or voting weight allocations, is that they are, due to their aim of explaining specific existing seat or voting weight distributions, post-dictive rather than predictive in nature. Accordingly, their free parameters differ for each best fit. Of course, one can combine many cases, such as all voting weight allocations in the Council between 1958 and 2004, but then the scatter around the best-fit line may widen beyond usefulness – and it says nothing about the corresponding seat allocation in the EP. Short of a logical model, there seems to be no way to tell why the parameters for the two bodies have changed in the past – and how they could change in the future (except for short-term extrapolations).

An overriding asset of logical models is that they tell us why the parameters change – and how they would change in the future, if there is alteration in
tangible inputs, such as the number and populations of member states and/or changes in the assembly size. Thus, these models aim to be predictive beyond short-term extrapolation. This applies in time and also laterally: when the same entities participate in two assemblies of different sizes, such as the EP and the Council of the EU, the seat allocation in one can be used to calculate the respective distribution in the other. Of course, predictions by logical models may well be inferior to post-dictions by estimations made on the basis of empirical data. But it is always harder to predict than to post-dict. Validity of logical models depends on the validity of stated assumptions, as well as possible hidden ones. When cases with poor fits arise, assumptions should be re-inspected. A basic assumption in our model is that population size of the member states matters. The model would not apply to bodies such as the UN General Assembly, for example, that use a ‘one state, one vote’ rule.

As far as the Council of the EU and the EP are concerned, it is revealing that the same equation fits bodies as different as the 17-vote Council of 1958 and the 626-member EP of 1995, within a margin of 0 to 5 percent accuracy. Persistent minor deviations, such as under-representation of Germany or over-representation of Luxembourg, reflect well-known purposeful deviations from the rule ‘more people, more representation’ – deviations to which models based on empirical voting weight data also find it difficult to adjust.

Using the model for prescriptive (i.e. normative) purposes does not mean that it should be followed blindly. Rather, it could be taken as the baseline upon which modifications derived from other concerns are based. Instead of arguing for a large EU Council allocation for Spain and Poland on the fleeting grounds of ‘more than Romania, but less than Italy’, one might fruitfully start with the seat–population equation as a first step. This would have avoided many of the cumbersome recent discussions on appropriate voting weight choices in the EU. One may then argue that a larger representation is needed in those particular cases, possibly taking into account the role of Spain as a gateway to Latin America, or Poland as the largest modernizing state in Central-East Europe. How many extra seats (i.e. voting weight units) should they obtain? This might be easier to determine when one does not have to haggle over what the purely population-driven number is.31

Resorting to a model-based formula could contribute significantly to an increased transparency of seat allocation, and hence to the long-run perceived legitimacy and fairness of member states’ representation in EU institutions. This stands in contrast to the decisions taken at the December 2000 Nice EU Summit meeting – which appeared to include last-minute compromises after rounds of tedious negotiations – or the difficult bargaining over voting weight allocations in the framework of the new EU constitution. Future revisions of seat allocations in the EP, and even in the Council of the EU, might still take the seat–population equation into account.
Appendix: Establishing the Seat–Population Model

The starting point is the relationship between seats and votes in national assemblies. Consider the ratio of seat shares of any two parties \(i\) and \(j\) \((S_i/S_j)\) and the ratio of their vote shares \((V_i/V_j)\). Theil (1969) has shown that, if there are more than two parties in the system, any equation connecting \(S_i/S_j\) and \(V_i/V_j\) must be of the form

\[ S_i/S_j = (V_i/V_j)^n \]  \hspace{1cm} (A1)

Any other form would lead to inconsistencies. True proportional representation corresponds to \(n = 1\). The more the exponent \(n\) exceeds this value, the stronger the large-party over-representation and small-party under-representation – a feature observed in most national elections. This equation can be reformulated to express the number of seats of a given party \((S_i)\) in terms of the vote shares of all parties and the total number of seats \((S)\):

\[ S_i = S V_i^n / \sum V_j^n \]  \hspace{1cm} (A2)

where the summation is over all parties. For national elections in single-member districts with plurality rule, Taagepera (1973) showed that the exponent \(n\) is subject to logical constraints imposed by the total number of voters \((V)\) and seats \((S)\). The only form that does not lead to inconsistencies is a ratio of the same functions of \(V\) and \(S\): \(n = f(V)/f(S)\). More specifically, only a logarithmic relationship agreed with data:

\[ n = \log V / \log S \]  \hspace{1cm} (A3)

In conjunction with equation (A2), this has been called (Taagepera, 1973) the ‘seat–vote equation’. Lijphart (1990) and Reed (1996), among others, have tested this equation and its extensions.

Theil (1969) pointed out that the same general formula (A2) may be applied to seat allocation in international institutions whenever one wishes to over-represent smaller states. It suffices to replace votes \((V)\) by the populations \((P)\) of the countries:

\[ S_i = S P_i^n / \sum P_j^n \]  \hspace{1cm} (A4)

where the summation is over \(N\) countries, and uses an exponent smaller than 1. The value \(n = 0\) would provide each country with the same number of seats, regardless of population size, while \(n = 1\) represents countries in direct proportion to their populations. The value \(n = 0.5\), halfway between these extremes, has a mathematical rationale (Penrose, 1946; Richardson, 1993), but it cannot explain, for example, why \(n\) is around 0.7 for EP seats.

Equation (A3) inspires us to look for logical constraints on the value of \(n\) in the case of international bodies. The idea behind \(n = \log V / \log S\) is that the total number of seats and votes determines the power index \(n\). In the case of
international institutions, the total number of seats \((S)\) remains a factor, total population \((P)\) easily substitutes for total votes, but the number of countries to be represented \((N)\) also matters. The way \(P, S\) and \(N\) enter the calculations is subject to logical constraints. This means that the function \(n = f(N, S, P)\) must still apply at extreme or other special cases, if it is to be general. We posit three such logical constraints.

I If the number of seats to be allocated matches the number of countries \((S = N)\), then the only reasonable way to distribute them is to give each country one seat. Mathematically, this requires that \(f(S = N, P) = 0\). Indeed, if \(n = 0\) is entered into equation \((A4)\), it becomes \(S_i = S/N = 1\), given that \(d^0 = 1\) for any finite number \(a\). Here the difference between party representation and country representation becomes important. When seats are scarce, one could easily leave a tiny party with no seat and provide a huge party with several seats. In the case of countries, however, even the tiniest participating member state is entitled to one seat, before even the largest country receives a second one.

II If the number of seats equals total population \((S = P)\), then every person should get a seat, and we would have perfect proportional representation of populations. Mathematically, \(f(N, S = P) = 1\), because \(n = 1\) in equation \((A4)\) leads to \(S_i = SP_i/P\) and hence \(S_i/S = P_i/P\).

III If there is only one seat to be allocated, the largest member has the strongest claim. Equation \((A4)\) yields this result when \(n\) tends toward infinity. This implies that \(f(N, S = 1, P) \to\) infinity. This constraint is more debatable than the others. Why not rotate the seat among the members, as is the case for the president of the European Council? Rotation involves a different basic norm. Equation \((A4)\) is based on the norm that ‘the size of population, as well as being a distinct country, both matter’. In contrast, rotation implies that ‘being a distinct country is the only thing that matters, regardless of population’. Visibly, this norm applies to the EU presidency, but not to the Council of the EU and the EP.

The two first constraints are satisfied whenever \(n = f(N, S, P)\) has the form

\[
n = \left[ g(S) - g(N) \right] / \left[ g(P) - g(N) \right] \quad (A5)
\]

where \(g(x)\) represents the same transformation of the variable involved. Of course, more complex expressions also satisfy the constraints. But Occam’s razor principle holds that the simplest form should be chosen, unless nature imposes more complex forms. Note that \(n = 0.5\), the value stressed by Penrose (1946) and Richardson (1993), corresponds to \(g(S)\) being the arithmetic mean of \(g(N)\) and \(g(P)\):

\[
g(S) = \left[ g(N) + g(P) \right] / 2 \to n = 0.5. \quad (A6)
\]

The third constraint is satisfied when \(g(x)\) is such a function that \(g(1) \to \infty\).

Again, there are other ways to satisfy the three constraints, but this one is the
simplest. The simplest functions \( g(x) \) leading to \( g(1) \to \infty \) are \( g(x) = 1/(x - 1) \) and \( g(x) = 1/\log x \). Both are logically acceptable (unless we find further constraints), but they lead to quite different predictions. Here the choice has to be guided by the general range of \( n \) actually observed.

If \( g(x) = 1/(x - 1) \), then equation A5 becomes

\[
n = \frac{1}{(S - 1)/(N - 1))}/\left[\frac{1}{(P - 1) - 1/(N - 1)}\right]
\]

\[
= (S - N)(P - 1)/[(P - N)(S - 1)] \equiv 1 - (N - 1)/(S - 1)
\]

when \( P >> N \), which is always the case. This would predict values of \( n \) ranging from 0.69 to 0.95 for the Council of the EU, while the actual values of \( n \) have been under 0.6 ever since 1958. For the EP, the predictions would be above 0.96, while the actual values have remained under 0.75. While we cannot pin down a logical reason, the function \( g(x) = 1/(x - 1) \) clearly cannot explain the seat/voting weight allocations. In contrast, if \( g(x) = 1/\log x \), then equation A5 becomes

\[
n = \left[\frac{1}{\log S - 1/\log N}\right]/\left[\frac{1}{\log P - 1/\log N}\right]
\]

which does fit the observed values. This is equation (3) in the main text. Taagepera (1973) offers some rationales that favor \( g(x) = 1/\log x \). One may wish to continue to look for further reasons. But meanwhile, we should not ignore a form that yields essentially correct allocations for two separate institutions in Europe, during 40 years of change. In conjunction with the preceding equation (2), this equation may be termed the \textit{seat–population equation}, by analogy with the aforementioned seat–vote equation.

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\textbf{Notes}

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1 It may be argued that there is an essential difference between the number of seats a country holds in the EP and its voting weight in the Council of the EU (i.e. the number of votes a single delegate of a given country can cast as a bloc). This is true, indeed, regarding the process of voting. But the actual allocation of seats and weights in the EP and in the Council, in the first place, may still follow similar criteria. If this premise is mistaken, no common model could emerge. If it is not mistaken, then probably similarities override dissimilarities. Since popular votes are also mentioned in this study, we aim to avoid confusion by reserving the expression ‘votes’ for popular votes, and by always using ‘voting weights’ to describe bloc voting in the Council of the EU.

2 As the EU was facing enlargement, representation of the member states in EU institutions has been altered at the December 2000 EU Summit meeting in Nice, France. At this meeting, EU member governments also decided on a new pattern of representation for the European Commission. Most importantly, the five largest
EU member states were to give up one of their two Commissioner seats in 2005. Later, the Convention on the Future of Europe proposed a new double-majority rule for decision-making in the Council. The suggestion was modified by EU governments in an EU summit meeting in June 2004.

For the EU, this tension has, for example, been emphasized by Laruelle and Widgrén (1998), Moberg (1998) and Midgaard (1999). The system of per capita representation of the population might provide the smallest countries with no seats at all, while the principle of equal representation for each country would grossly underrepresent the population of the largest countries. Hence, larger countries often receive more seats in international organizations, but not in direct proportion to their population. For example, the current seat ratio of Germany and Luxembourg in the EP (99 to 6, or 16.5 to 1) is still much lower than is their population ratio (201 to 1). On a per capita basis, Luxembourg is hence over-represented in the EP clearly, population size matters, but so does being a distinct country in an international context.

The organization was originally called the European Economic Community (EEC) and then the EC. In strictly formal terms, the EC currently — in the absence of ratification of the European Constitution — still constitutes part of the (three-pillar) EU.

The United Nations combines one seat per country in the General Assembly with unequal representation — now a focus of considerable political attention — in the Security Council. Changes in possible voting schemes for the General Assembly have been discussed, for example, in Newcombe et al. (1971) and Dixon (1983), and for the Security Council in Hosli et al. (2005). See Zamora (1980) for the distribution of votes in international organizations more generally, and Rapkin et al. (1997) for voting weight allocations in the IMF.

The total number of seats is itself affected by the total population and the number of countries or other sub-units — see Taagepera and Recchia (2002).

When an assembly is being enlarged (for the same number of member states), however, the proportions may change in favor of the larger countries, for the following reason: in a very small assembly, each country must hold at least one seat, and few extra seats are left for distribution among the larger countries. An enlarged assembly, however, makes it possible to have a distribution more in line with respective population size.

The only other ‘non-empirical’ formula suggested for the Council of the EU is the ‘square root rule’, where voting weights equal each country’s square root of the population (measured in millions). Germany (population around 81 million) would then obtain nine ‘seats’ and Sweden (about 9 million) would get three. See Moberg (1998) or Laruelle and Widgrén (1998). This rule has a mathematical rationale (Penrose, 1946; Richardson, 1993) but, as discussed in a later section of this article, it cannot simultaneously account for the seat distribution in the EP. As a model applied to estimate current distributions, it also yields Council voting weights rather different from those in effect in practice. Nonetheless, in a normative sense, it would constitute a straightforward and transparent formula for voting weight allocations in the Council.

In negotiations on the Treaty of Nice, for example, regarding re-allocating of voting weights in the Council of the EU, France has largely employed this strategy. Despite fairly large differences in population size, Germany, France, Italy and the United Kingdom all obtained 29 voting weights in the Council of the EU.

During the Nice summit meeting, for example, Spain applied this strategy. Although failing to reach that category of the largest EU states, Spain obtained 27 voting weights in the Council of the EU — only 2 voting weights less than the largest EU members.

The corresponding numerical data for this figure can be found in Tables 1 and 3.

Luxembourg holds twice the number of EP seats as predicted by the model, i.e. six instead of three. Italy and France are high by six seats and the UK by five seats. Netherlands is low by four seats, Greece and Sweden by three. The remaining 9 countries are within a distance of 0 to 2 seats to what the model predicts.

Even when total membership remains constant, population size will gradually change. But the impact is small, because population, in this model, enters the equation in logarithmic form. Even with Austria, Finland and Sweden added to the EU in 1995, for example, the decimal logarithm of total EU population increased only from 8.51 in 1986 to 8.56 in 1995.

Since a double-majority clause has been introduced into Council decision-making on the basis of both the number of EU states (a minimum of 14 out of 25 required to adopt decisions) and population size (at least 65 percent of EU population, as represented in the Council, needs to support a decision), we will here use population size (in millions, 2003) as voting weights.

This ‘keeping \( n \) close to 0.5’ refers to the Council of the EU only; it obviously cannot apply for the EP. In this study, exogenous factors may determine how many total seats the EU decides to add when new members are admitted. See Taagepera and Recchia (2002) for how total population may affect the total number of seats or voting weights. Combining their equations with the present ones could reduce the present three exogenous factors (\( P, N \) and \( S \)) to only two (\( P \) and \( N \)) — but this would be a major new step, beyond the scope of the present study.

The rounding-off procedure used here differs slightly from the usual, because the latter may lead to a ‘rounding-off error’ in the total. Our procedure is akin to what is called ‘simple quota and largest remainders’ in electoral studies. Countries first receive seats/voting weights according to the integer parts of their

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By comparison, a power model estimation by Hosli and Wolffenbuttel (2001), to be discussed later on, yields the following deviations: Germany = −5.2, UK 0.4, France 0.4, Italy 0.9, Spain 3.8, Netherlands −1.1, Greece 0.6, Belgium 0.8, Portugal 1.0, Sweden −0.4, Austria 0.1, Denmark −0.9, Finland −0.8, Ireland 0.4, Luxembourg 2.0. In accordance with the present study, Germany is also found to be under-represented and Spain and Luxembourg to be the EU members most over-represented within the new allocation scheme. Total deviation for the four largest EU members, however, is found to be smaller than in the present study, as only Germany holds fewer weights in practice than the estimates would predict.

For example, the voting weight for Germany is calculated as

\[ \frac{P_i + \sum P_j}{2} \]

\[ \frac{25}{2} = \frac{82.4 + 455.9}{2} = 50.3, \]

Before the introduction of direct elections to the EP in 1979, this institution was called the ‘European Assembly’.

On the other hand, bargaining with trade-off has taken place across three EU institutions – the Council of the EU, the EP and the European Commission – in the negotiation processes. One might consider assessment of total representation of countries in the overall institutional framework of the EU, but assigning weights to these three bodies can become debatable. Trade-offs between memberships in these bodies would have the effect of increasing error in predictions based on our model. If the predictions still hold, then this would confirm the robustness of the seat–population equation.

The choice of \( \varepsilon = 1/3 \) by the authors, however, is debatable.

This equation has the form \( S_i = aP_i^b \), corresponding to \( \log S_i = \log a + b \log P_i \). The authors also estimate the vote distribution agreed upon at Nice as a function of population size. In contrast to the first part of their analysis, which derives the function theoretically, this is done on the basis of linear regression for logarithms, leading to the following equation: \( S_i = 3.23P_i^{0.534} \). In our Figure 3, this would correspond to a straight line with a very slightly higher slope (0.534 vs. 0.522). The results are highly significant (\( p < 0.001 \) for \( \beta \)), and \( R^2 = 0.987 \).

For Widgrén (1994) and Berg and Lane (1996), such inconsistencies show up in the sum of country voting weights that deviate from the actual 1995 total by more than a rounding error (see Table 4).

In addition, for the 1995 Council of the EU, Axel Moberg has estimated the distribution simply to be one plus the square root of a member’s population size in millions (personal communication). In our notation: \( S_i = 1 + P_i^{0.5} \). This has the same basic form as Berg and Lane (1996), \( S_i = a + bP_i \), but with very simple parameter values. It does not work for 1964 or for post-Nice.

In addition, all models illustrate the following trend: Germany, after reunification, has lost its ‘group boundaries’. This is also true in 1995 for the Netherlands, Denmark and Finland, but to a more moderate extent.

Midgaard (1999) observes that the ‘Dutch proposal’ (a re-weighting formula promoted by the Dutch presidency before the 1997 Amsterdam Summit meeting), offered proportions rather similar to this first constellation, namely 1–2–5 rather than 1–2–4.

For some insight into these negotiations, see Best (2000).

Taagepera and Rucchia (2002) observe that subunit-based national second chambers tend to expand with increasing national population roughly as \( S = 0.48P^{0.3} \). They argue that, to the extent that the functions of the Council of the EU shifted in the direction of an EU-wide ‘second chamber’, its initial size was much too small.

Also see Hosli and Wolffenbuttel (2001).

Other allocation formulas could also be envisaged – such as Penrose’s (1946) square root formula. The EU has chosen assembly sizes such that the exponent \( n \) in our model has fluctuated only between 0.406 and 0.585 for the Council of the EU and between 0.599 and 0.716 for the EP. Not much might be lost in practice if the relatively complex way of calculating \( n \) (equation 3) were replaced by stipulating \( n = 0.50 \) in the case of the Council of the EU, and \( n = 0.65 \) for the EP. However, picking 0.5 for the EP, too, would produce major discrepancies, compared to both the logical model and actual past allocations. Hence, approximations in practice still might keep the logical model in mind.

When there are fewer seats than member states, the absolute value of \( n \) should be taken. One would expect the largest countries to obtain one seat each (unless fractional seats are allocated). This used to be roughly the case in the UN Security Council, and the new distribution of European Commissioner seats somewhat resembles this pattern. However, when population sizes are extremely lopsided, the formula might conceivably give the largest country several seats, while most member states have none.

The populations of individual countries are not needed to calculate the exponent \( n \). This leads to the following question: to what extent is it possible to determine the seat-allocation curve without having information on the populations of individual countries? When representing equation (2) in a log-log graph such as Figure
1, the exponent determines the slope of the line, but its height depends on the value of $\sum P_k$. One can approximate this summation by assuming that all countries have average populations ($P_k = P/N$), so that equation (2) becomes $S = SN^{n-1}(P/P')$. For the Council of the EU in 1995, this equation underestimates all actual seats by 12 percent.

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