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ABSTRACT

We analyse and assess the qualified majority (QM) decision rule for the Council of Ministers of the EU, adopted at the Council of the European Union, Brussels, 23 June 2007. This rule is essentially the same as that adopted at the Inter-Governmental Conference, Brussels, 18 June 2004 [2]. We compare this rule with the QM rule prescribed in the Treaty of Nice, and the scientifically-based rule known as the 'Jagelonian Compromise'. We use a method similar to the one we used in [6], [7] and [8].

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1 Introductory remarks

The agreement reached at Brussels by the Council of the European Union (the 'EU Summit') on 23 June 2007 confirmed the qualified majority decision rule for the EU Council of Ministers first adopted at the Brussels IGC, 17–18 June 2004. This rule, which is due to take effect not earlier than 1 November 2014 and not later than 31 March 2017,[1] states:

Article I-24

> 1. A qualified majority shall be defined as **at least 55%** of the members of the Council, **comprising at least fifteen of them** and representing Member States comprising at least **65%** of the population of the Union.
>
> **A blocking minority must include at least four Council members, failing which the qualified majority shall be deemed attained.**
>
> 2. **By derogation from paragraph 1,** when the Council is not acting on a proposal from the Commission or from the Union Minister for Foreign Affairs, the qualified majority shall be defined as **72%** of the members of the Council, representing Member States comprising at least **65%** of the population of the Union.[2]

We shall not deal with the last paragraph (2), which applies in certain exceptional circumstances.

Also, we shall only deal with the effect of the new QM rule in the context of the present 27-member EU.

Using the latest (2006) population figures available to us,[3] we find that the clause excluding blocking coalitions with less than four members rules out just ten coalitions of three member-states, whose populations comprise more than 35% of the total, and therefore would otherwise be able to block.

[1] See [3, Annex I, Article 13, p. 18].

[2] See [2, p. 7].

[3] Taken from EUROSTAT [4].

As far as voting-power calculations are concerned, the effect of this clause is negligible, and it may therefore be ignored.

We denote by $\mathcal{C}_{27}$, $\mathcal{N}_{27}$ and $\mathcal{J}_{27}$, respectively, this new QM rule, the rule prescribed by the Nice Treaty, and the 'Jagelonian' rule – all applied to the present 27-member EU.

For the exact formulation of $\mathcal{N}_{27}$, see Treaty of Nice [1, p. 167]. In our previous papers [6, 7, 8] we denoted this decision rule by $\mathcal{N'}_{27}$, in order to distinguish it from a conflicting formulation of the rule, which appears a few pages earlier in the Treaty (see [1, p. 164]). However, it is by now firmly established that this p. 167 version is the correct one, and it is the decision rule currently applied.

The 'Jagelonian' rule $\mathcal{J}_{27}$, proposed by two scholars in the Jagelonian University (Cracow, Poland), Słomczyński and Życzkowski [9], is a (pure) weighted voting rule, in which the weight of each member-state is proportional to the square root of its population. The quota q is determined by the formula

$$q := \frac{1}{2}\left\{\sum_i w_i + \sqrt{\sum_i {w_i}^2}\right\},$$

where w_i is the weight of the i-th member-state. This quota has two advantages. First, the resulting voting power of each member-state in the CM (according to Penrose's measure of voting power, ψ) is very nearly proportional to its weight, and hence to the square root of its population – as prescribed by Penrose's Square-Root Rule. This ensures that under $\mathcal{J}_{27}$ the distribution of voting power is almost perfectly equitable.[4] A second, no less important, advantage of this quota is that the resulting rule $\mathcal{J}_{27}$ has a very reasonable level of efficiency, as measured by Coleman's index A or by the closely related resistance coefficient R: approval of an act by the CM is made neither too easy (which would result in instability) nor too hard (which would lead to immobilism).

2 Presentation of results

Our analysis and assessment is based on extensive data presented in detailed Tables 1–6. The basic structure of the tables in this paper is the same as in our [7], to which the reader is referred for further explanations.

All our calculations are based on the population data shown in Table 1. The first column of figures in this table, headed 'Population', shows the pop-

[4]For a discussion and proof of Penrose's Square-Root Rule, see [5, pp. 63–72].

ulation of each member-state. The next column, headed 'Pop.%', gives the population of each member-state as a percentage of the total population. The next column, headed 'Pop. sqrt.' gives the square root of the size of the population for each member-state. The last column, headed 'Pop. sqrt.%', gives the square root of the population size of each member-state as a percentage of the total (which appears at the bottom of the penultimate column). These square-root data are needed for assessing the equitability of the rules.

Extensive data for the three decision rules $\mathcal{C}_{27}$, $\mathcal{N}_{27}$ and $\mathcal{J}_{27}$ are presented in Tables 2, 3 and 4 respectively. These tables have the same structure, with one exception: as $\mathcal{J}_{27}$ is a pure weighted rule, Table 4 lists in its first column of figures, headed 'w', the weight of each member-state. These weights are equal to the figures in the last column of Table 1 multiplied by 100. Thus they are proportional to the square root of the size of the population.

$\mathcal{C}_{27}$ and $\mathcal{N}_{27}$ are, technically speaking, composites of several weighted rules, involving several weighting systems, which are not presented in Tables 2 and 3.

The column headed 'ψ', in Tables 2, 3 and 4 shows the value of Penrose's measure of a priori voting power (aka 'the absolute Banzhaf index') for each member-state.

The next column, headed '100β', shows the value of the (relative) Banzhaf index for each member-state, in percentages. Thus the 100β value for a given member-state is the percentage share of its ψ value out of the sum total of ψ values.

The next column, headed 'γ', shows the value of Coleman's measure of a priori blocking power (or, as he called it, 'the power to prevent action') for each member-state. The figures in this column are proportional to those in the ψ column, and can be obtained from the latter by multiplying them by $2^{26}/\omega$. Here ω – whose value is shown under each of the tables – is the number of divisions of the 27 CM voters whose outcome under the given decision rule is positive (that is, approval of the act in question).[5]

The last column, headed 'Quotient' gives, for each member-state, the quotient obtained by dividing the value 100β shown in the previous column by the figure shown for that member-state in the last column ('Pop. sqrt.%') of Table 1. These figures will be used for assessing the equitability of the rules.

Tables 5 and 6 provide a direct comparison of the position of each member-

[5] As we are ignoring the clause of $\mathcal{C}_{27}$ that excludes blocking coalitions of fewer than four members, the value of ω we use for this rule, as shown under Table 2, is smaller by 10 units than the true value. The effect of this difference is negligible.

state under $\mathcal{C}_{27}$ with its position under $\mathcal{N}_{27}$ and $\mathcal{J}_{27}$, respectively. For each member-state, these tables give the ratio between the values of ψ, β and γ under $\mathcal{C}_{27}$ and the respective values of these measures under $\mathcal{N}_{27}$ and $\mathcal{J}_{27}$.

3 Criteria of assessment

In this section we explain the criteria used in our assessment. Our method here is largely the same as in [7], where the reader can find some further explanatory details.

3.1 Voting power: absolute, relative and negative

Each of the three series of values $\psi, 100\beta$ and γ conveys information on a different aspect of voting power.

Penrose's measure ψ is an objective measure of *absolute* a priori voting power; its value for a given voter quantifies the amount of influence over the outcomes of divisions that the voter derives from the decision rule itself.

Thus, if the value of ψ for a member-state is higher under decision rule $\mathcal{U}$ than under $\mathcal{V}$, it follows that the position of that member-state is objectively better – in the sense of having more influence – under $\mathcal{U}$ than under $\mathcal{V}$. The importance of ψ for comparing the position of a given voter under different decision rules is not sufficiently appreciated even by some academic commentators.

Politicians are obviously interested in comparing the *relative* position of their country with those of other member-states, especially ones whose populations are close in size to their own. As far as we know, they do not employ the precise scientific measure of relative voting power, the Banzhaf index β, which is obtained from ψ by normalization. Instead, they look at the voting weights, which can give a rough idea about relative voting power.

Another aspect of voting power in which politicians are keenly interested is negative or blocking power – the ability to help block an act that they oppose. Of course, this does not mean that they have more than a vague notion as to how to quantify this power.

Absolute voting power, as measured by ψ, is the voter's ability to help secure a favourable outcome in a division. This can be resolved into two component parts: the power to help secure a positive outcome, approval of an act that the voter supports; and the power to help secure a negative outcome, blocking of an act that the voter opposes. These two components are quantified by the Coleman measures γ^* and γ, respectively. From a purely objective, disinterested viewpoint, both are equally important; and indeed ψ is a symmetric combination of γ^* and γ.[6] However, for rather obvious political reasons, EU practitioners are much more concerned about negative voting power than about its positive counterpart.

So in this paper we present all three sets of data about the QM rules under consideration: ψ as an objective measure of absolute voting power; as well as β and γ, which quantify aspects of voting power that are of particular concern to practitioners.

3.2 Democratic legitimacy

The CM can be regarded as the upper tier of a two-tier decision-making structure: if we assume that each minister votes in the CM according to the majority opinion in his or her country, then the citizens of the EU are seen as indirect voters, voting via their respective representatives at the CM. The criteria considered under the present heading are *equitability* and *adherence to majority rule*. These address different aspects of the functioning of the CM as the upper tier of the two-tier structure.

As explained elsewhere (see [5]), a perfectly equitable decision rule for the CM – in the sense of equalizing the indirect voting powers of all EU citizens across all member-states – would give each member-state voting power proportional to the square root of its population size. So under such a decision rule the value of 100β for a member-state would equal the value given for that member-state in the last column ('Pop. sqrt.%') of Table 1, and the quotient of these two values would therefore be 1 for all member-states. The amount by which the quotient for a given member-state exceeds or falls short of 1 indicates the amount by which the voting power of this member-state exceeds or falls short of what it should have got under an equitable distribution of the same amount of total voting power.

In order to assess the degree to which a given rule is equitable, we therefore gauge how close its '100β' column is to the ideal presented by the last column of Table 1. For this purpose we use the following three synoptic parameters.

D This is the widely used *index of distortion*. We use it to measure the *overall* discrepancy between the '100β' column in the table of the given rule and the last column of Table 1. It is given in percentage terms, obtained as half of the sum of the absolute differences between the 100β

[6] In fact, ψ is their *harmonic mean*. For further details see [5, pp. 49–51].

values and the corresponding figures in the last column of Table 1. The *smaller* the value of D, the closer the fit between the two columns.

$\max |d|$ Maximal relative deviation. This is obtained from the 'Quotient' column in the table of the rule. It is the largest absolute difference between a figure in this column and 1.

$\text{ran}(d)$ Range of relative deviations. This is also derived from the 'Quotient' column. It is obtained by subtracting the smallest entry in this column from the largest.

We now turn to our criterion of adherence to majority rule. In any non-trivial two-tier decision-making structure it can happen that the decision at the upper tier (in our case: the CM) goes against the majority view of the lower-tier indirect voters (in our case: the citizens of the EU at large). In a case where this happens – that is, the CM approves an act that is opposed by a majority of EU citizens, or blocks an act that is supported by a majority of the citizens – the margin by which the majority that opposes the decision exceeds the minority that supports it is the *majority deficit* of this decision. In a case where the majority of citizens support the CM decision the majority deficit is 0. The majority deficit can be regarded as a random variable (taking only non-negative integer values), whose distribution depends on the decision rule of the CM. The mean value (mathematical expectation) of this random variable is the *mean majority deficit* (MMD).[7] The larger the MMD, the further the CM decision rule is from the majoritarian ideal.

3.3 Efficiency

The criteria we consider under this heading address the functioning of the CM as a decision-making body in its own right rather than as part of a two-tier structure.

The [absolute] sensitivity of a decision rule is the sum of the voting powers (as measured by ψ) of all members of the CM. It measures the degree to which the CM collectively is empowered as a decision-making body, the ease with which an average member can make a difference to the outcome of a division. It is thus a good indicator of efficiency.

The *relative sensitivity index*, denoted by S, measures the sensitivity of the given rule on a logarithmic scale, on which $\mathrm{S} = 0$ holds for the least sensitive rule (unanimity) with the same number of voters, and $\mathrm{S} = 1$ holds

[7] For details, see [5, pp. 60–61].

for the most sensitive rule (the ordinary majority rule) with that number of voters.[8]

The second criterion under the present heading is that of *compliance*. A direct measure of this is Coleman's 'power of the collectivity to act', which is simply the a priori probability A of an act being approved rather than blocked.

A measures the compliance of a decision rule, the ease with which a positive outcome is approved. But it is often instructive to look at its reverse, so to speak: the resistance of a decision rule to approving an act. A convenient measure of this is the *resistance coefficient* R.[9] For proper decision rules, the least value of R is 0 (attained for a simple majority rule with an odd number of voters) and its maximal value is 1 (attained by the unanimity rule).

Finally, we also present for each of the three decision rules under consideration the a priori betting odds against an act being approved by the CM. These odds are just a modified form of A.

Note that A, R and the betting odds should not be interpreted too literally. Clearly, the CM does not vote on acts at random. Before an act is tabled for a formal vote at the CM, it goes through a preparatory process of bargaining and successive modification, until a point is reached where its approval is normally a foregone conclusion. What A, R and the betting odds actually measure is the average ease or difficulty of the preparatory process and the brevity or length of the time it may be expected to take.

4 Conclusions

From Table 7 we can see that $\mathcal{C}_{27}$ is quite inequitable by the yardstick of Penrose's Square-Root Rule. Its overall distortion, as measured by the distortion index D, is not quite so bad as that of the original version included in the Draft Constitution for Europe proposed by the European Convention in July 2003 (see [7]). However, its 'local' distortions – the individual deviations from equitability – are more extreme than those of that draft. The two most egregious cases are: on the one hand Malta, which has 138.6% more than its fair share; and on the other hand Greece and Portugal, which have 17.3% too little.

From the last column of Table 2 we can see that $\mathcal{C}_{27}$ is systematically biased in favour of the four largest and seven smallest member-states. The bias is particularly pronounced for Germany on the one hand and for the five

[8] For further details see [5, p. 61].

[9] For further details see [5, p. 62].

smallest member-states (Slovenia, Estonia, Cyprus, Luxembourg and Malta) on the other.

Returning to Table 7, we observe that $\mathcal{C}_{27}$ is quite efficient: it has a relatively high value of Coleman's index A (the a priori probability of approving an act rather than blocking it) and a correspondingly low resistance R. In betting terms, this means that the a priori odds against approval of an act are approximately 27 to 4. The values of these parameters are not very different from what they were in the periods 1973–80 and 1980–85, when the EU had nine or ten members.[10] In our view they are very reasonable.

With respect to A and R, as well as with respect to sensitivity S and mean majority deficit (MMD), $\mathcal{C}_{27}$ is intermediate between $\mathcal{N}_{27}$ and $\mathcal{J}_{27}$.

Table 7 shows that $\mathcal{N}_{27}$ is rather inequitable by the yardstick of Penrose's Square-Root Rule, though not nearly to the same extent as $\mathcal{C}_{27}$. The last column of Table 3 reveals however that the bias is very unsystematic: it sways several times in an apparently erratic way from positive to negative.

From the viewpoint of democratic legitimacy, a more worrying attribute of $\mathcal{N}_{27}$ is its relatively high value of MMD, which means that it does rather badly in terms of majority rule.

It is well known that $\mathcal{N}_{27}$ is extremely inefficient. This is confirmed by Table 7. Indeed, the value of A for this rule is so low as to be dangerous. In a priori betting-odds terms, the odds against an act being approved under this rule are 49 : 1. As noted at the end of Section 3, this implies that the preparatory process of getting a proposed act to the point at which it will be approved by the CM must be expected to be, on the average, very long and difficult.

Turning now to $\mathcal{J}_{27}$, we see that the 'Jagelonian' general method for producing a decision rule works very well indeed for the present EU: $\mathcal{J}_{27}$ is almost perfectly equitable by the yardstick of Penrose's Square-Root Rule. It also has a low value of MMD. Thus is scores very highly in terms of democratic legitimacy.

$\mathcal{J}_{27}$ has a very high degree of efficiency, as measured by the values of A and R: these values are intermediate between those of the QM rules operated by the CM in its two earliest periods, 1958–72 and 1973–80.

Table 5 compares $\mathcal{C}_{27}$ with $\mathcal{N}_{27}$. We see that $\mathcal{C}_{27}$ gives all member-states more absolute voting power (as measured by ψ), but the increase is very uneven, not to say erratic.

$\mathcal{C}_{27}$ will improve the *relative* positions (measured by β) of the four largest

[10]Cf. [5, Table 5.3.10].

and six smallest member-states, as well as that of Denmark and Slovakia, compared to their present positions under $\mathcal{N}_{27}$. The relative position of all other member-states will be worsened; the greatest loss will be sustained by Hungary, followed by the Czech Republic and Belgium.

As for blocking power, γ, Malta will gain slightly in comparison with $\mathcal{N}_{27}$; all other member-states will lose blocking power, but the extent of loss is again very uneven.

Table 6 compares $\mathcal{C}_{27}$ with $\mathcal{J}_{27}$. We see that $\mathcal{C}_{27}$ gives all member-states less absolute voting power than $\mathcal{J}_{27}$ would have done.

As $\mathcal{J}_{27}$ is almost perfectly equitable, the β column of Table 6 simply confirms what we know from the last column of Table 2.

As for the comparison between $\mathcal{C}_{27}$ and $\mathcal{J}_{27}$ in terms of blocking powers, the last column of Table 6 reveals a similar, albeit somewhat more extreme, picture: $\mathcal{C}_{27}$ will give the four largest and seven smallest member-states greater blocking power than they would have under $\mathcal{J}_{27}$, whereas for all other member-states the opposite holds.

5 Tables

Table 1: Population of 27 EU members (2006 data)

Country	Population	Pop.%	Pop. sqrt.	Pop. sqrt.%
Germany	82,437,995	16.720	9,079.54	9.47
France	62,998,773	12.780	7,937.18	8.27
UK	60,393,100	12.250	7,771.30	8.10
Italy	58,751,711	11.920	7,664.97	7.99
Spain	43,758,250	8.877	6,615.00	6.90
Poland	38,157,055	7.740	6,177.14	6.44
Romania	21,610,213	4.384	4,648.68	4.85
Netherlands	16,334,210	3.313	4,041.56	4.21
Greece	11,125,179	2.257	3,335.44	3.48
Portugal	10,569,592	2.144	3,251.09	3.39
Belgium	10,511,382	2.132	3,242.13	3.38
Czech Rep	10,251,079	2.079	3,201.73	3.34
Hungary	10,076,581	2.044	3,174.36	3.31
Sweden	9,047,752	1.835	3,007.95	3.14
Austria	8,265,925	1.677	2,875.05	3.00
Bulgaria	7,718,750	1.566	2,778.26	2.90
Denmark	5,427,459	1.101	2,329.69	2.43
Slovakia	5,389,180	1.093	2,321.46	2.42
Finland	5,255,580	1.066	2,292.51	2.39
Ireland	4,209,019	0.854	2,051.59	2.14
Lithuania	3,403,284	0.690	1,844.80	1.92
Latvia	2,294,590	0.465	1,514.79	1.58
Slovenia	2,003,358	0.406	1,415.40	1.48
Estonia	1,344,684	0.273	1,159.61	1.21
Cyprus	766,414	0.155	875.45	0.91
Luxembourg	459,500	0.093	677.86	0.71
Malta	404,346	0.082	635.88	0.66
Total	492,964,961	99.996	95,920.42	100.02

Note Source of population figures: [4]. The apparent discrepancies in the totals of the second and last columns are due to rounding errors.

Table 2: QM rule $\mathcal{C}_{27}$

Country	ψ	100β	γ	Quotient
Germany	0.200104	11.6487	0.77825	1.231
France	0.155154	9.0320	0.60343	1.092
UK	0.149271	8.6896	0.58055	1.073
Italy	0.145772	8.4859	0.56694	1.062
Spain	0.112475	6.5476	0.43744	0.949
Poland	0.098062	5.7085	0.38139	0.886
Romania	0.071336	4.1527	0.27744	0.857
Netherlands	0.060063	3.4965	0.23360	0.830
Greece	0.049392	2.8753	0.19210	0.827
Portugal	0.048174	2.8043	0.18736	0.827
Belgium	0.048073	2.7985	0.18697	0.828
Czech Rep	0.047561	2.7687	0.18498	0.829
Hungary	0.047157	2.7452	0.18340	0.830
Sweden	0.045127	2.6270	0.17551	0.838
Austria	0.043499	2.5322	0.16918	0.845
Bulgaria	0.042384	2.4673	0.16484	0.852
Denmark	0.037605	2.1891	0.14626	0.901
Slovakia	0.037505	2.1833	0.14586	0.902
Finland	0.037302	2.1715	0.14508	0.909
Ireland	0.035066	2.0413	0.13638	0.954
Lithuania	0.033426	1.9458	0.13000	1.012
Latvia	0.031174	1.8148	0.12124	1.149
Slovenia	0.030558	1.7789	0.11885	1.206
Estonia	0.029113	1.6958	0.11330	1.403
Cyprus	0.027997	1.6298	0.10889	1.786
Luxembourg	0.027275	1.5878	0.10608	2.247
Malta	0.027174	1.5819	0.10568	2.386
Total	1.717799	100.0000		

$\omega = 17,255,117$

Table 3: QM rule $\mathcal{N}_{27}$

Country	ψ	100β	γ	Quotient
Germany	0.03269	7.7835	0.80687	0.822
France	0.03269	7.7835	0.80686	0.941
UK	0.03269	7.7835	0.80686	0.961
Italy	0.03269	7.7835	0.80686	0.974
Spain	0.03116	7.4192	0.76924	1.075
Poland	0.03116	7.4192	0.76923	1.152
Romania	0.01789	4.2596	0.44155	0.878
Netherlands	0.01669	3.9739	0.41199	0.944
Greece	0.01547	3.6834	0.38196	1.058
Portugal	0.01547	3.6834	0.38196	1.087
Belgium	0.01547	3.6834	0.38196	1.090
Czech Rep	0.01547	3.6834	0.38196	1.103
Hungary	0.01547	3.6834	0.38196	1.113
Sweden	0.01299	3.0929	0.32060	0.985
Austria	0.01299	3.0929	0.32060	1.031
Bulgaria	0.01299	3.0929	0.32060	1.067
Denmark	0.00916	2.1810	0.22609	0.898
Slovakia	0.00916	2.1810	0.22609	0.901
Finland	0.00916	2.1810	0.22609	0.913
Ireland	0.00916	2.1810	0.22609	1.019
Lithuania	0.00916	2.1810	0.22609	1.136
Latvia	0.00525	1.2500	0.12960	0.791
Slovenia	0.00525	1.2500	0.12960	0.845
Estonia	0.00525	1.2500	0.12960	1.033
Cyprus	0.00525	1.2500	0.12960	1.374
Luxembourg	0.00525	1.2500	0.12960	1.761
Malta	0.00396	0.9429	0.09768	1.429
Total	0.41999	99.9995		

$\omega = 2,718,741$

Table 4: QM rule $\mathcal{J}_{27}$

Country	w	ψ	100β	γ	Quotient
Germany	947	0.201020	9.4491	0.616977	0.998
France	827	0.176002	8.2731	0.540191	1.000
UK	810	0.172416	8.1045	0.529186	1.001
Italy	799	0.170085	7.9949	0.522030	1.001
Spain	690	0.146932	6.9066	0.450968	1.001
Poland	644	0.137124	6.4456	0.420867	1.001
Romania	485	0.103214	4.8516	0.316788	1.000
Netherlands	421	0.089566	4.2101	0.274900	1.000
Greece	348	0.074016	3.4792	0.227172	1.000
Portugal	339	0.072096	3.3889	0.221279	1.000
Belgium	338	0.071882	3.3789	0.220624	1.000
Czech Rep	334	0.071030	3.3388	0.218007	1.000
Hungary	331	0.070384	3.3084	0.216024	1.000
Sweden	314	0.066773	3.1387	0.204942	1.000
Austria	300	0.063787	2.9983	0.195777	0.999
Bulgaria	290	0.061660	2.8984	0.189249	0.999
Denmark	243	0.051662	2.4284	0.158564	0.999
Slovakia	242	0.051449	2.4184	0.157909	0.999
Finland	239	0.050807	2.3882	0.155937	0.999
Ireland	214	0.045486	2.1381	0.139609	0.999
Lithuania	192	0.040815	1.9185	0.125271	0.999
Latvia	158	0.033582	1.5785	0.103070	0.999
Slovenia	148	0.031451	1.4784	0.096530	0.999
Estonia	121	0.025711	1.2086	0.078914	0.999
Cyprus	91	0.019339	0.9090	0.059356	0.999
Luxembourg	71	0.015089	0.7093	0.046313	0.999
Malta	66	0.014026	0.6593	0.043050	0.999
Total	10,002	2.127404	99.9998		

$\omega = 21,864,982$

Note The weights in the second column (headed w) are proportional to population square root – see last column of Table 1. The quota is 6158, which is 61.57% of the total weight. For explanation of how this quota is determined, see p. 2.

Table 5: QM rule $\mathcal{C}_{27}$ compared to $\mathcal{N}_{27}$

Country	$\psi[\mathcal{C}_{27}]/\psi[\mathcal{N}_{27}]$	$\beta[\mathcal{C}_{27}]/\beta[\mathcal{N}_{27}]$	$\gamma[\mathcal{C}_{27}]/\gamma[\mathcal{N}_{27}]$
Germany	6.121260	1.4966	0.96453
France	4.746222	1.1604	0.74787
UK	4.566259	1.1164	0.71952
Italy	4.459223	1.0902	0.70265
Spain	3.609596	0.8825	0.56867
Poland	3.147047	0.7694	0.49581
Romania	3.987479	0.9749	0.62833
Netherlands	3.598742	0.8799	0.56700
Greece	3.192760	0.7806	0.50293
Portugal	3.114027	0.7613	0.49052
Belgium	3.107498	0.7598	0.48950
Czech Rep	3.074402	0.7517	0.48429
Hungary	3.048287	0.7453	0.48015
Sweden	3.473980	0.8494	0.54744
Austria	3.348653	0.8187	0.52770
Bulgaria	3.262818	0.7977	0.51416
Denmark	4.105349	1.0037	0.64691
Slovakia	4.094432	1.0011	0.64514
Finland	4.072271	0.9956	0.64169
Ireland	3.828166	0.9359	0.60321
Lithuania	3.649127	0.8922	0.57499
Latvia	5.937905	1.4518	0.93549
Slovenia	5.820571	1.4231	0.91705
Estonia	5.545333	1.3566	0.87423
Cyprus	5.332762	1.3038	0.84020
Luxembourg	5.195238	1.2702	0.81852
Malta	6.862121	1.6777	1.08190

Table 6: QM rule $\mathcal{C}_{27}$ compared to $\mathcal{J}_{27}$

Country	$\psi[\mathcal{C}_{27}]/\psi[\mathcal{J}_{27}]$	$\beta[\mathcal{C}_{27}]/\beta[\mathcal{J}_{27}]$	$\gamma[\mathcal{C}_{27}]/\gamma[\mathcal{J}_{27}]$
Germany	0.995443	1.2328	1.26139
France	0.881547	1.0917	1.11707
UK	0.865761	1.0722	1.09706
Italy	0.857054	1.0614	1.08603
Spain	0.765490	0.9480	0.97000
Poland	0.715134	0.8856	0.90620
Romania	0.691147	0.8559	0.87579
Netherlands	0.670600	0.8305	0.84976
Greece	0.667315	0.8264	0.84561
Portugal	0.668192	0.8275	0.84671
Belgium	0.668777	0.8282	0.84746
Czech Rep	0.669590	0.8292	0.84850
Hungary	0.669996	0.8298	0.84898
Sweden	0.675827	0.8370	0.85639
Austria	0.681941	0.8445	0.86415
Bulgaria	0.687382	0.8513	0.87102
Denmark	0.727904	0.9015	0.92240
Slovakia	0.728974	0.9028	0.92370
Finland	0.734190	0.9093	0.93038
Ireland	0.764631	0.9547	0.97687
Lithuania	0.818964	1.0142	1.03775
Latvia	0.928295	1.1497	1.17629
Slovenia	0.971607	1.2033	1.23122
Estonia	1.132317	1.4032	1.43574
Cyprus	1.447696	1.7929	1.83452
Luxembourg	1.807608	2.2386	2.29050
Malta	1.937402	2.3994	2.45482

Table 7: Synoptic comparison

Rule	D	max$\|d\|$	ran(d)	MMD	S	A	R	Odds
$\mathcal{C}_{27}$	7.6010	138.6	155.9	5273	0.945	0.129	0.743	27:4
$\mathcal{N}_{27}$	4.8164	76.1	93.9	8018	0.858	0.020	0.959	49:1
$\mathcal{J}_{27}$	0.0365	0.2	0.3	4496	0.958	0.163	0.674	31:6

D, $\max|d|$ and ran(d) are given in percentages.

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