Supporting Information

Coalition-Building and Consensus in the Council of the European Union.

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SUMMARY

This online appendix presents supporting information for the article 'Coalition building and consensus in the Council of the European Union'. The first two sections provide results of replication analyses based on models that incorporate real-world voting weights and thresholds, and in which the sequence of moves of member states is ordered according to voting weights (from smallest to largest). The first section shows the replication results for the empirical assessment of the aggregate model output, and the second for the predicted effect on consensus rates of the entry into force of the Lisbon treaty voting rules. The third section presents a table of member states' voting weights and thresholds used in the preceding analyses. Finally, the fourth section provides further technical details about the non-linear quantile regression analysis used in the main text to summarize the relationship between voting threshold and winning coalition size.

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ADDITIONAL RESULTS FOR 'AN EMPIRICAL EVALUATION OF AGGREGATE MODEL OUTPUT'

TABLE A1   Observed vs. predicted consensus rates for various model specifications

| | | Treaty rules and membership size | | | |
	Execution	Pre-Nice 12	Pre-Nice 15	Nice 25	Total
Observed mean		75	82	86	
Expected by chance		50	50	50	
Unweighted votes	Random	89	85	85	
	PRE	68	96	97	95
	Ordered	90	84	82	
	PRE	65	96	97	94
Weighted votes (Nice: Voting weight threshold only)	Random	86	85	88	
	PRE	81	96	96	95
	Ordered	85	82	86	
	PRE	83	97	97	96
Weighted votes (Nice: Voting weight and population size thresholds)	Random	86	85	93	
	PRE	81	96	92	94
	Ordered	85	82	92	
	PRE	83	97	93	95
Weighted votes (Nice: Voting weight, population size, and member state thresholds)	Random	86	85	94	
	PRE	81	96	91	94
	Ordered	85	82	91	
	PRE	83	97	94	95

Notes: Table entries refer to the number of consensual decisions as a percentage of all decisions during a certain treaty rule and membership size regime. The first row provides the time average of the observed yearly rates. The second row provides the rates expected by chance. The remaining rows provide rates predicted by various model specifications, together with the proportional reduction in error (*PRE*) value of those predictions as a measure of model fit (the entry in the last column provides the total *PRE* value for each specification across all three regimes). The third row reproduces the result for the base model with no voting weights and random sequence of member states' moves as reported in Figure 4 of the main text. The fifth row replicates these results based on a model in which member states' moves are ordered according to voting weights and states with smaller weights move before states with larger weights. The other rows show results using weighted votes in the calculation of coalition sizes and a varying number of thresholds under the Nice treaty rules. For further details on member states' voting weights under different treaty rules and the different thresholds under Nice, see Table A3.
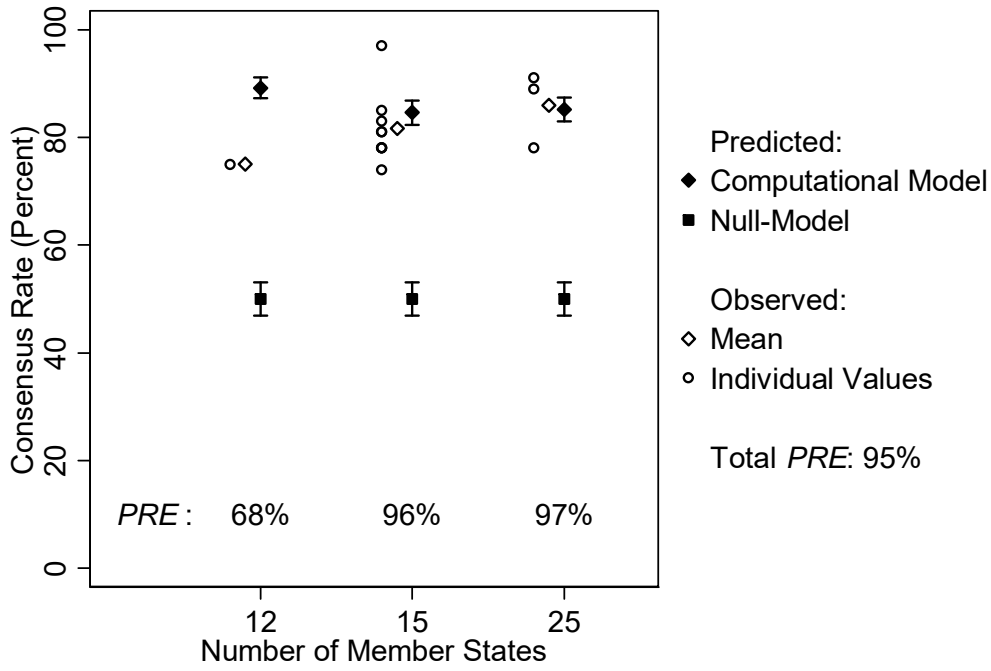
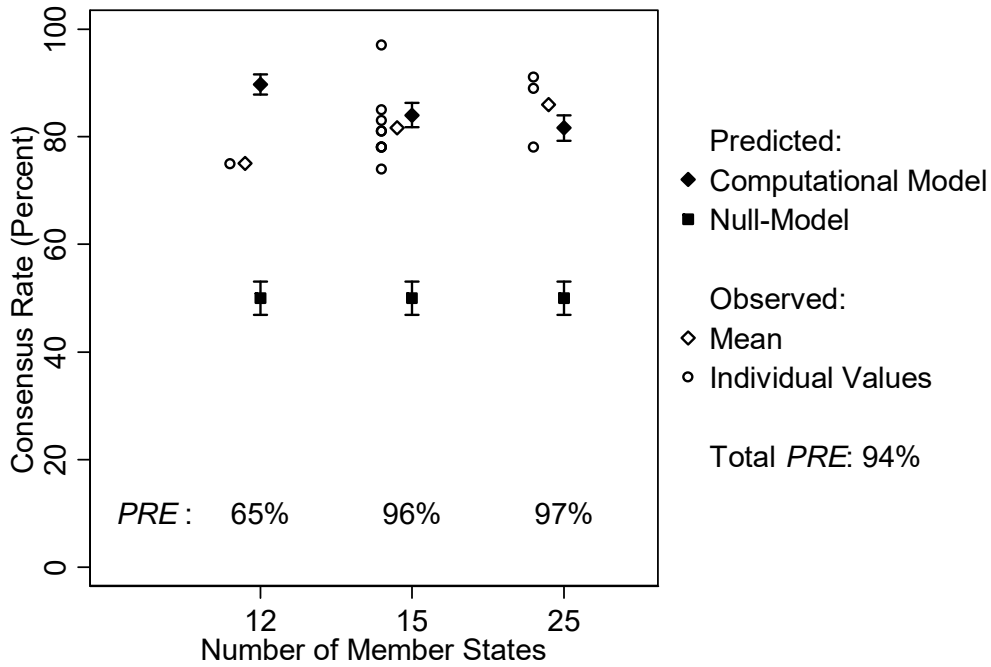*Fig. A1*   *Unweighted votes, random sequence of moves (base model)*

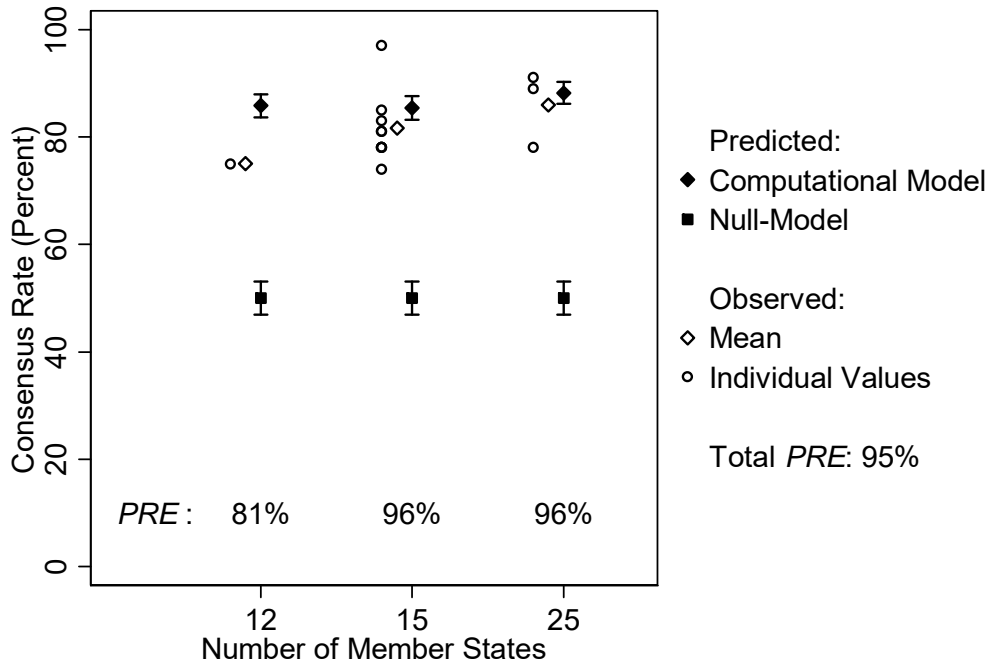*Fig. A2*   *Unweighted votes, sequence of moves ordered by size*

Fig. A3   *Weighted votes, random sequence of moves, one threshold under Nice*
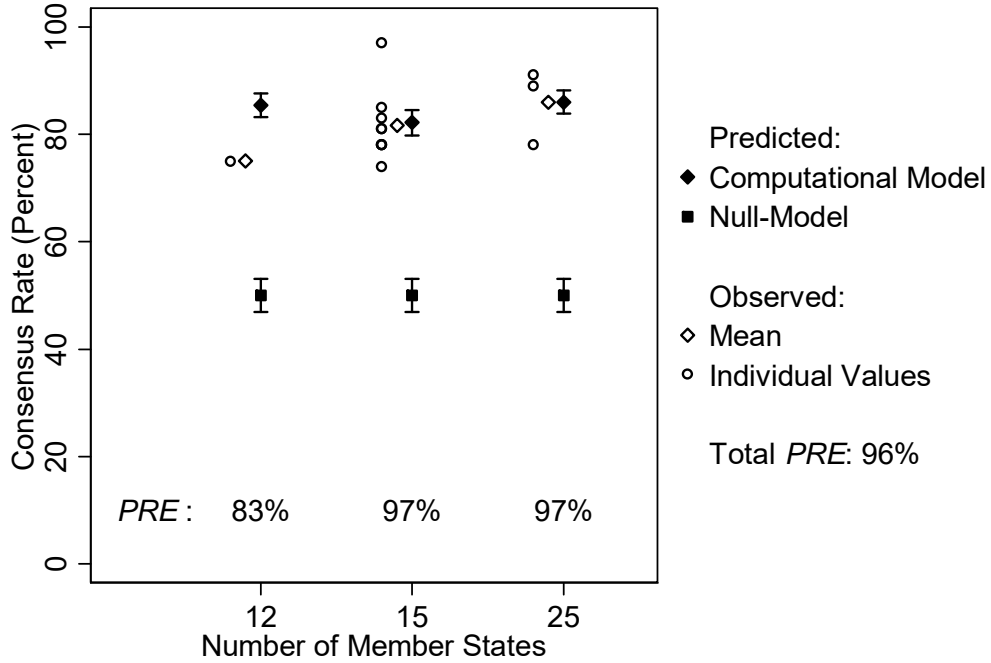

Fig. A4   *Weighted votes, sequence of moves ordered by size, one threshold under Nice*
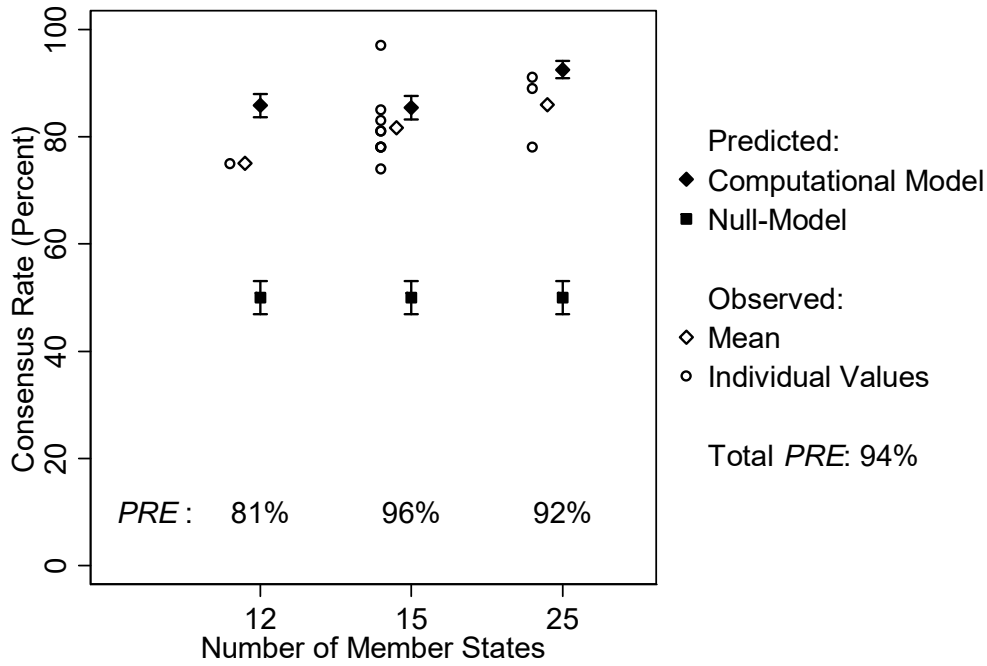
Fig. A5   *Weighted votes, random sequence of moves, two thresholds under Nice*
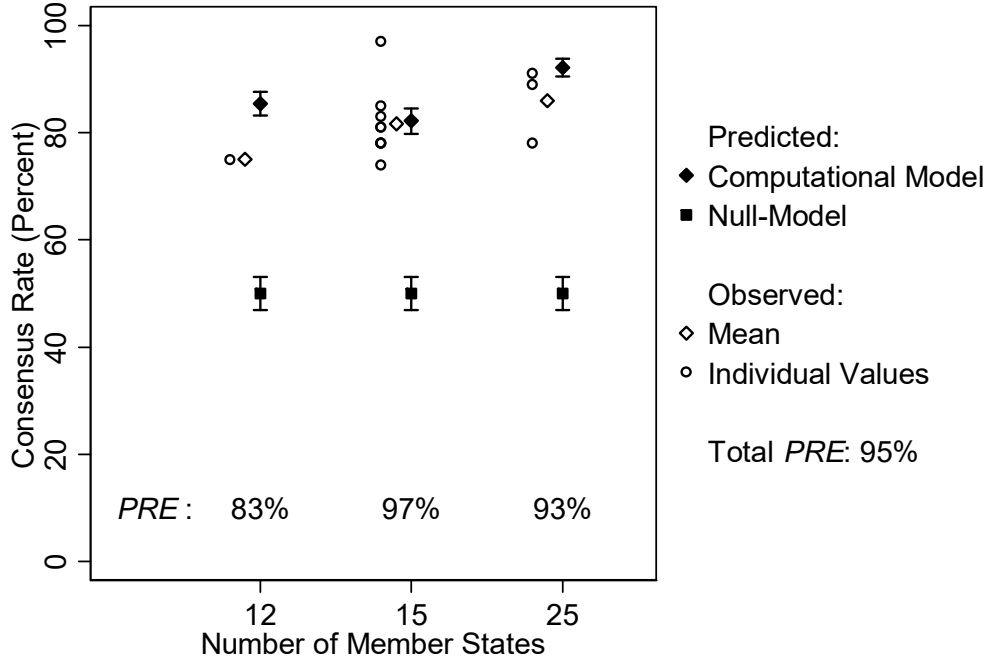

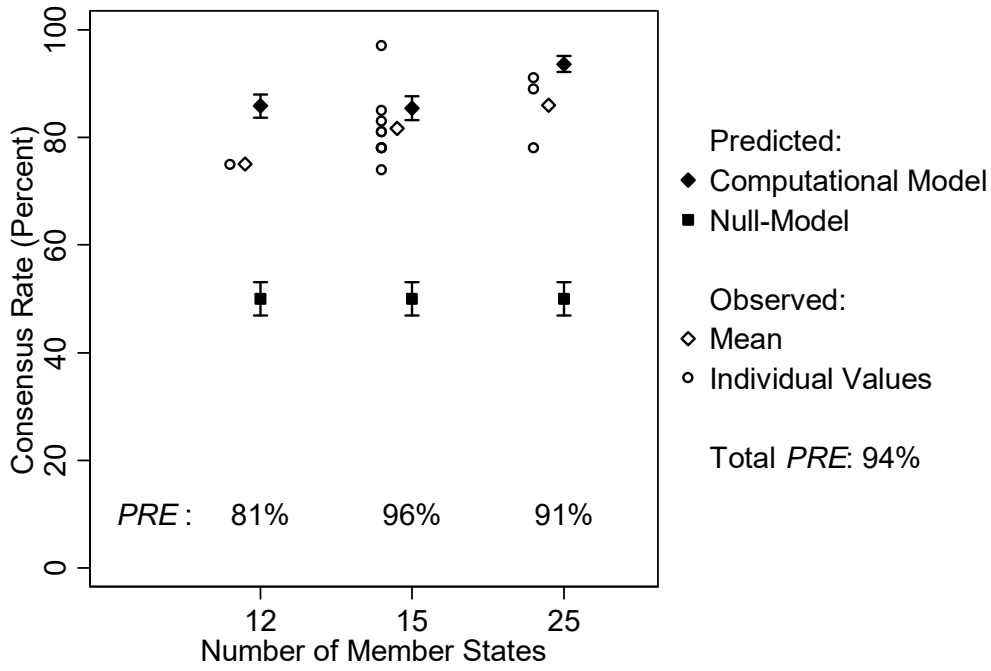*Fig. A6*   *Weighted votes, sequence of moves ordered by size, two thresholds under Nice*

Fig. A7   *Weighted votes, random sequence of moves, three thresholds under Nice*
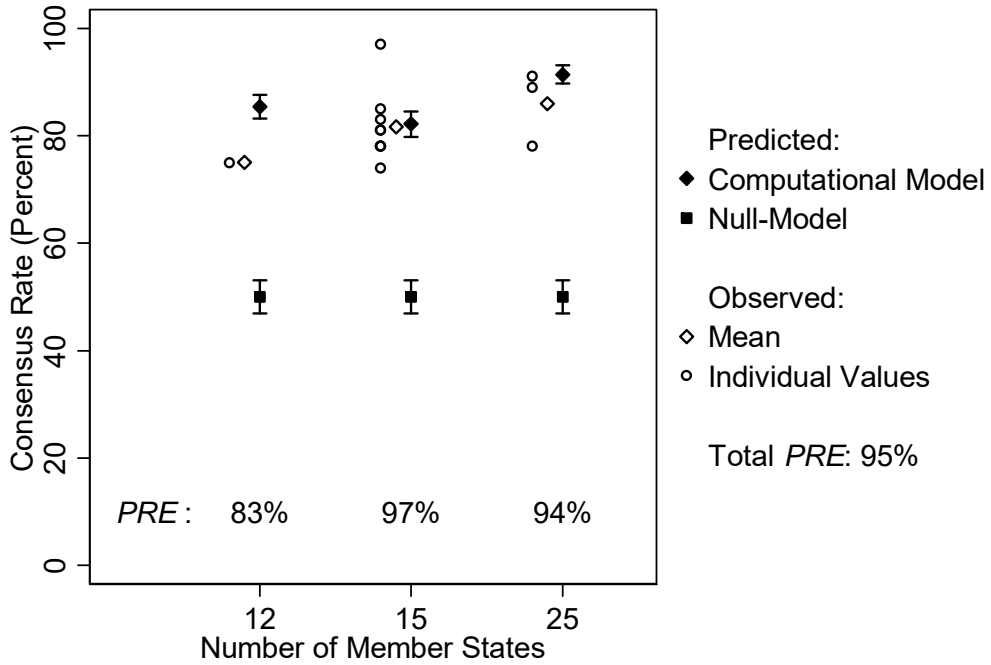

Fig. A8   *Weighted votes, sequence of moves ordered by size, three thresholds under Nice*

ADDITIONAL RESULTS FOR 'THE PREDICTED EFFECTS OF VOTING THRESHOLD AND

MEMBERSHIP SIZE'

TABLE A2   Predicted consensus rates for various model specifications

Execution	Voting weights	Treaty rule and membership size				
		Pre-Nice 12	Pre-Nice 15	Nice 25	Nice 27	Lisbon 27
Random	Unweighted	89	85	85	88	63
	One threshold	86	85	88	92	59
	Two thresholds	86	85	93	94	64
	Three thresholds	86	85	94	94	64
Ordered	Unweighted	90	84	82	88	64
	One threshold	85	82	86	90	55
	Two thresholds	85	82	92	93	59
	Three thresholds	85	82	91	94	59

Notes: Table entries are predicted consensus rates in per cent for different treaty rule and membership size regimes, based on various model specifications. The results presented in the first four rows are based on models in which the sequence of moves of member states is determined randomly. The first row provides the results for the base model with no voting weights, as discussed in the main text. The results in the second row are based on a model with a single threshold of weighted votes. The results in the third and fourth row are based on models that incorporate the second and third voting threshold under the Nice and Lisbon treaty rules. Rows five to eight show the results for models in which the sequence of moves of member states is determined according to voting weights and states with smaller voting weights move before states with larger weights. For further details on member states' voting weights under different treaty rules and the different thresholds under Nice and Lisbon, see Table A3.
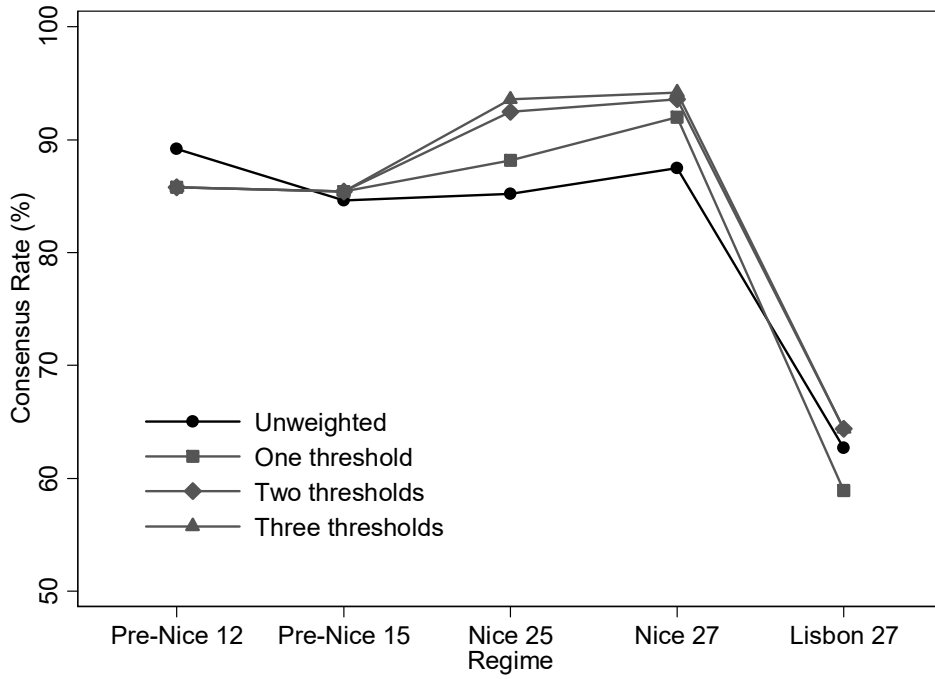
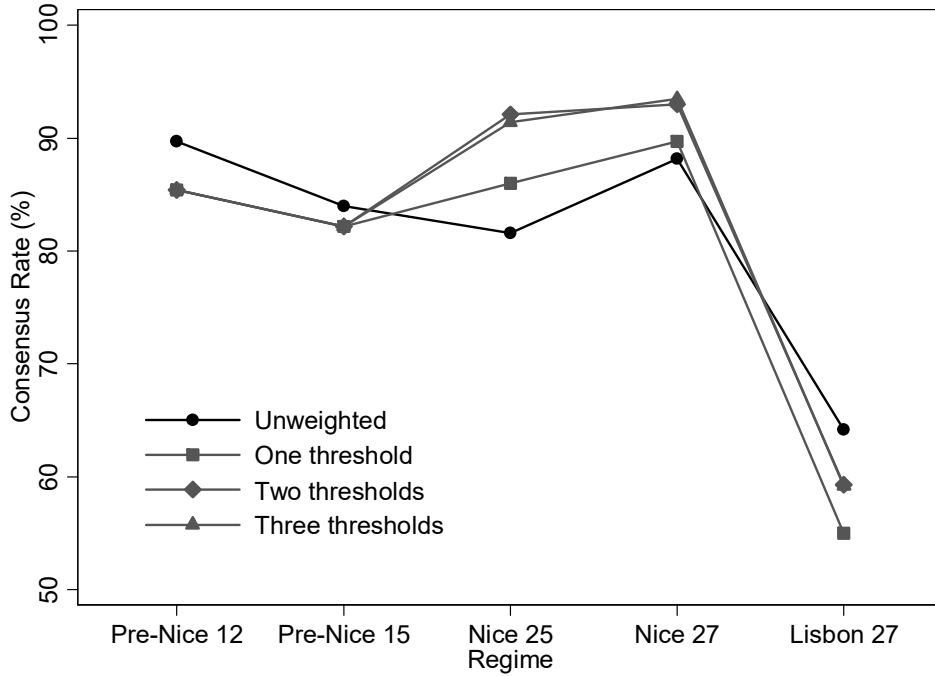*Fig. A9   Predicted consensus rates for models with random sequence of moves*

Fig. A10   Predicted consensus rates for models with sequence of moves ordered by size

VOTING WEIGHTS AND THRESHOLDS USED IN DIFFERENT MODEL SPECIFICATIONS

TABLE A3   Voting systems under different treaty and membership regimes

	Pre-Nice 12	Pre-Nice 15	Nice 25		Nice 27		Lisbon 27	
Threshold			First:	Second:	First:	Second:	First:	Second:
	71.1% Votes	71.3% Votes	72.3% Votes	62% Population	73.9% Votes	62% Population	65% Population	55% Votes
Germany	10	10	29	82531,7	29	82438,0	81802,3	1
France	10	10	29	61684,7	29	62886,2	64714,1	1
United Kingdom	10	10	29	59651,5	29	60421,9	62008,0	1
Italy	10	10	29	57888,2	29	58751,7	60340,3	1
Spain	8	8	27	42345,3	27	43758,3	45989,0	1
Poland			27	38190,6	27	38157,1	38167,3	1
Romania					14	21610,2	21462,2	1
Netherlands	5	5	13	16258,0	13	16334,2	16575,0	1
Greece	5	5	12	11041,1	12	11125,2	11305,1	1
Belgium	5	5	12	10474,7	12	10569,6	10827,0	1
Portugal	5	5	12	10396,4	12	10511,4	10637,7	1
Czech Republic			12	10211,5	12	10251,1	10506,8	1
Hungary			12	10116,7	12	10076,6	10014,3	1
Sweden		4	10	8975,7	10	9047,8	9340,7	1
Austria		4	10	8114,0	10	8265,9	8375,3	1
Bulgaria					10	7718,8	7563,7	1
Denmark	3	3	7	5397,6	7	5427,5	5534,7	1
Slovakia			7	5380,1	7	5389,2	5424,9	1
Finland		3	7	5219,7	7	5255,6	5351,4	1
Ireland	3	3	7	4027,5	7	4209,0	4467,9	1
Lithuania			7	3445,9	7	3403,3	3329,0	1
Latvia			4	2319,2	4	2294,6	2248,4	1
Slovenia			4	1996,4	4	2003,4	2047,0	1
Estonia			4	1350,6	4	1344,7	1340,1	1
Cyprus			4	730,4	4	766,4	803,1	1
Luxembourg	2	2	4	451,6	4	459,5	502,1	1
Malta			3	399,9	3	404,3	413,0	1
Total	76	87	321	458599,0	345	492881,2	501090,4	27
Winning	54	62	232	284331,4	255	305586,3	325708,8	15
Blocking	23	26	90	174267,7	91	187295,0	175381,7	13

Notes: The Nice and Lisbon treaty rules specify an additional third threshold. According to the Nice treaty rules, a winning majority must also consist of at least 50% of member states (i.e. 13 out of 25 or 14 out of 27 states, depending on membership size). According to the Lisbon treaty rules, a blocking minority must consist of at least four member states. This implies that a coalition of 24 out of 27 member states (i.e. 89%) can adopt a decision even if it does not satisfy the population threshold (the 55% member state threshold is automatically satisfied). Population data are measured in thousands and refer to the first year of the respective membership regime under Nice (i.e. 2004 and 2007) and to the latest year available for the Lisbon regime to (i.e. 2011).

Sources for population data:

Year 2004: Official Journal, Council Decision of 11 October 2004 amending the Council's Rules of Procedure (2004/701/EC, Euratom). 22 December 2004, L 319/16. Luxembourg: Publications Office.

Year 2007: Official Journal, Council Decision of 1 January 2007 amending the Council's Rules of Procedure (2007/4/EC, Euratom). 4 January 2007, L 1/9. Luxembourg: Publications Office.

Year 2011: Official Journal, Council Decision of 14 December 2010 amending the Council's Rules of Procedure (2010/795/EU). 22 December 2010, L 338/47. Luxembourg: Publications Office.

FURTHER DETAILS ON THE NONLINEAR QUANTILE REGRESSION ANALYSIS

Figure A11 describes the relationship between voting threshold and winning coalition size. The figure presents the results of a nonlinear quantile regression analysis.[2] Each individual panel shows the differences in winning coalition size predicted from changes in the voting threshold, keeping the membership size constant. The data points in the panels represent the conditional medians of the simulated winning coalition sizes for different values of the voting threshold. The black curve indicates the nonlinear median fit. The conditional distributions of winning coalition size are often strongly skewed and include outliers. Thus, median regression is a more appropriate technique to identify the typical value of winning coalition size for a certain voting threshold than mean regression.

Median regression is only a special case of quantile regression. In general, any conditional quantile of a distribution can be estimated by minimizing the weighted sum of absolute distances

[2] Roger Koenker and Kevin F. Hallock, 'Quantile Regression', *Journal of Economic Perspectives*, 15 (2001), 143-56; Lingxin Hao and Daniel Q. Naiman, *Quantile Regression* (Thousand Oaks: Sage, 2007), 34; Roger Koenker and Beum J. Park, 'An Interior Point Algorithm for Nonlinear Quantile Regression', *Journal of Econometrics*, 71 (1996), 265-83; Roger Koenker, 'Quantile Regression in R: A Vignette', available from http://cran.r-project.org/web/packages/quantreg/vignettes/rq.pdf (3 January 2010). To fit the nonlinear median regression curve, I relied on the quantile regression package quantreg in R; see Roger Koenker, Quantreg: Quantile Regression, Version 4.44 (2009), available from http://CRAN.R-project.org/package=quantreg; R Development Core Team, R: A Language and Environment for Statistical Computing (Vienna: R Foundation for Statistical Computing, 2010), available from http://www.R-project.org. I used Stata 11 to generate the plots and to perform all other statistical calculations; see StataCorp, Stata Statistical Software: Release 11 (College Station: StataCorp, 2009). The replication data set, Stata do-files, and R-scripts are available for download from www.frankhaege.eu.

between predicted and observed values.[3] Estimates of conditional quantiles other than the median provide information about the effect of the independent variable on the shape rather than the location of the dependent variable's distribution.[4] The shaded areas in Figure A11 represent the predicted inter-quartile ranges of the conditional distributions. They clearly indicate the changing variability of winning coalition size across values of the voting threshold. For low voting thresholds, winning coalition size varies over almost the entire theoretically possible range of values, but this variability decreases rapidly with increases in the voting threshold. The predicted median and quartile curves in Figure A11 are based on the following functional form:

$$y = a + (1 - a)[1 - (1 - x)^b]$$

where y stands for winning coalition size, x for the voting threshold, and a and b are parameters to be estimated from the data. Both y and x are normalized to have values ranging between 0 and 1. Although this equation appears complex, the number of parameters to be estimated from the data is the same as the number of parameters to be estimated in the more familiar case of a bivariate linear regression analysis. Importantly, this function takes into account the form of the nonlinear relationship between the two variables and obeys the conceptual constraints imposed by the variables' definitions.[5]

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[3] Hao and Naiman, *Quantile Regression*, 33.

[4] Hao and Naiman, *Quantile Regression*, 33.

[5] On the importance of developing simple models that obey conceptual constraints, see Rein Taagepera, *Making Social Sciences More Scientific: The Need for Predictive Models* (Oxford: Oxford University Press, 2008).
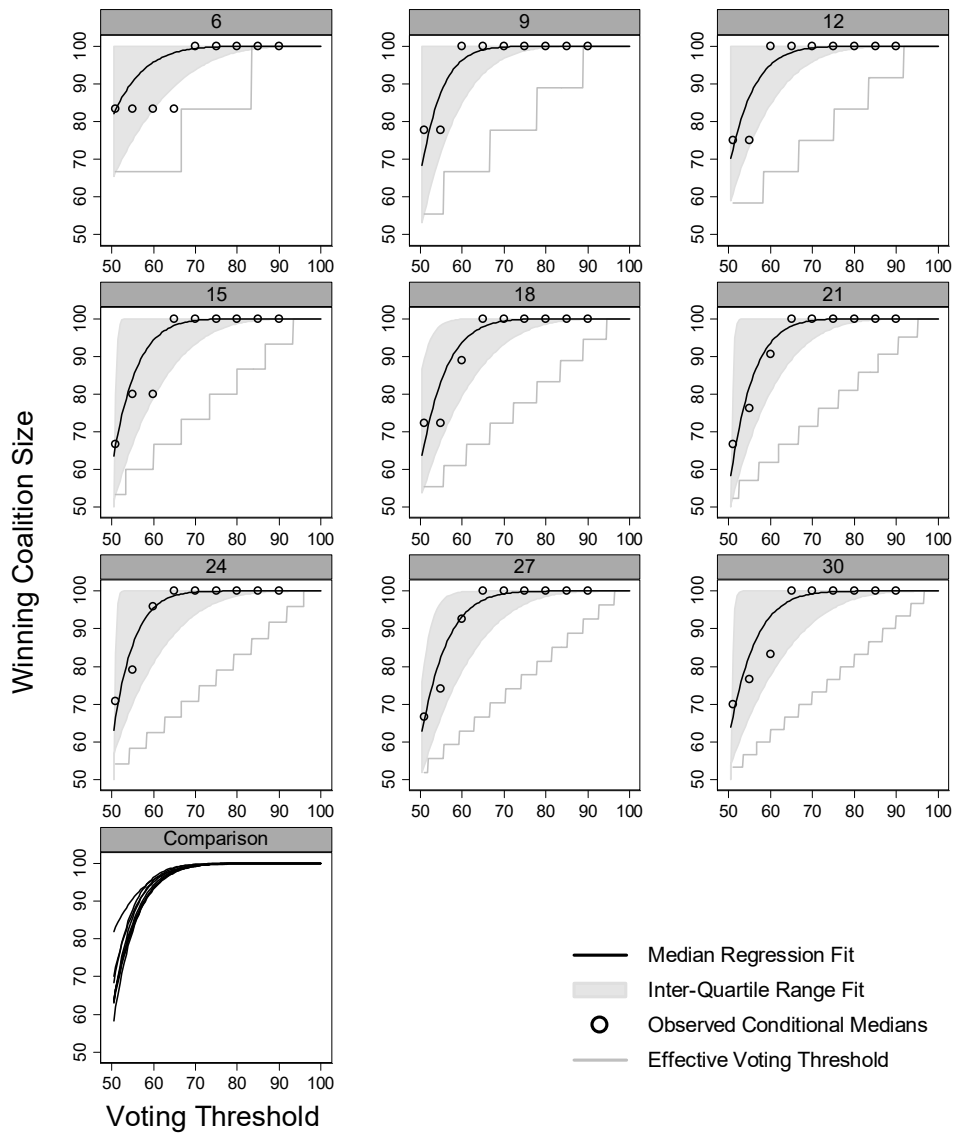
Fig. A11   *Effect of voting threshold on winning coalition size by membership size*

Note: This figure is a reproduction of Figure 5 in the main text. It shows the nonlinear relationship between voting threshold and winning coalition size for different membership sizes. The data points indicate the conditional medians of the simulated winning coalition sizes for different values of the voting threshold. The black curve represents the predicted median value and the grey area represents the predicted interquartile range, both estimated by nonlinear quantile regression. Each regression analysis is based on N = 9,000. The grey line shows the effective voting threshold as a function of the formal voting threshold. The bottom left panel compares the prediction curves across different membership sizes.

One conceptual constraint is that the predicted winning coalition size must be 1 (which corresponds to the 100% value on the untransformed variable) whenever the formal voting threshold requires the agreement of all member states. Another conceptual constraint is that the function needs to allow for a non-zero intercept. The prediction curve should not be forced to go through the origin (which corresponds to the intersection of the 50% values of the untransformed variables). If the number of member states is low, the effective voting threshold is much larger than the formal voting threshold. For example, in the case of six member states and a formal voting threshold of 51%, the effective voting threshold is 4 out of 6 member states, which is equivalent to 66% of member states. If the formal voting threshold translates into an effective voting threshold of 66%, then the winning coalition size must necessarily comprise at least 66% of member states. Therefore, it is logically impossible for the curve to pass through the origin, which corresponds to a winning coalition size of 50%. In the panels in Figure A11, the effective voting threshold is shown by the grey line taking the form of a step-function. As a comparison across panels shows, the effective voting threshold tends to be much larger than the formal voting threshold for small numbers of member states and approaches the formal voting threshold as the number of member states increases. Thus, when the number of member states is small, winning coalitions might appear more oversized than they actually are.

Figure A11 demonstrates that the nonlinear power function describes the relationship between voting threshold and median winning coalition size rather well.[6] As expected, the non-zero intercepts of the curves indicate that the winning coalitions are somewhat oversized, even when the formal voting threshold requires only a simple majority. Because the difference between the

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[6] For plotting the prediction curves, the predicted values based on the normalized variables were rescaled to the original percentage values.

effective and the formal voting threshold is larger when the number of member states is smaller, the intercept of the curve tends to be larger as well. The predicted winning coalition size increases relatively quickly with increases in the voting threshold until it reaches its conceptual maximum of 100%. This limit is usually reached at around a voting threshold of 65 to 70%, regardless of membership size, and remains constant for higher values of the voting threshold. The panel at the bottom left of the figure indicates that the curves estimated for different membership sizes are very similar, indicating a relatively small effect of changes in the number of members states, and that those changes only affect winning coalition size when the voting threshold is relatively low.