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ABSTRACT

This paper takes a multivariate approach to explaining coalition formations in Parliamentary democracies. It starts with a number of hypotheses deriving from game theory which are used to suggest the existence of variables that might separately or together influence coalition formation. Additional variables permit us to investigate the effects of differing assumptions made by previous researchers. We discover that choice of universe is far more important than any other assumption in conditioning research findings. In contrast to the primacy previously given to ideological considerations, we find that size is generally the more fundamental determinant of formation outcomes.

Introduction

Early in the past decade a number of attempts were made at confronting theories of coalition formation deriving from game theory and rational choice models with data taken from actual situations in Parliamentary democracies (Browne, 1970; de Swaan, 1973; Taylor and Laver, 1973). (1) Two major findings emerged from this research: firstly that the size of a potential coalition appeared not particularly influential in determining the likelihood that it would form, but secondly that its ideological complexion was a more important factor. The studies went into more detail than this but at a more detailed level their findings were somewhat contradictory. (2) The importance of these contradictions is hard to assess. This is because each researcher adopted different conventions and assumptions in assembling his data which, in turn, were drawn from different universes in terms both of time and space.

In more recent years the focus for investigating the importance of coalition theories has shifted from formation to duration (Laver, 1974: 286-270; Dodd, 1976; Warwick, 1979), and these more recent studies have suggested that size is at least as important as ideology in determining the durability of coalition governments. This disparity between research findings in different contexts is curious and deserves investigation.

It is of course possible that the early coalition

researchers were mistaken in thinking that game theoretic notions would apply in the formation stage of the coalition process. Political actors may, after all, frequently be ignorant of game theory, and their purposive behaviour may neglect the realities (if such they be) of game theoretic concerns. So coalitions may form that have no realistic prospect of enduring for very long, and the study of coalition durability may be the proper focus for investigating game-theoretic constraints upon coalition government. This is an attractive notion, held implicitely or explicitely by those who have turned to the study of coalition durability (eg. Warwick: 466). But looked at closely the notion contains a fundamental contradiction. If it were the case that coalition formations often ignored the "realities" of game theoretic constraints, and that the durability of coalition governments did reflect them, then it would only be a matter of time before politicians discovered the nature of these realities. If coalitions tend soon to fail which are the wrong size in game-theoretic terms, then politicians should soon learn not to take part in such coalitions.(3)

So we are thrown back on the study of coalition formations to look more closely at the tests that have been performed which appeared to show that size was less important in determining formation outcomes. In particular, we are led to question the assumptions and methods employed in these studies, and the universes (in both time and space) that were chosen for investigation.

The most obvious manner in which duration studies differ from formation studies lies in the methods of analysis employed. In formation studies, each theory has only been subjected to a simple and separate statistical test, designed to determine whether the theory in question generated predictions that were fulfilled in practice more often than chance would dictate. The analyses were not conducted in such a way as to tell us under what circumstances and to what extent different factors influence the formation of governing coalitions. In other words, these studies were all bivariate rather than multivariate, and concerned with significance testing rather than with elaboration analysis. By contrast, duration being an interval-level concept, investigators of coalition durability have tended to employ statistical tools, in the specific form of regression analysis, which are more readily adapted to multivariate investigations and less oriented towards significance testing. (4)

With these differences in mind, the primary purpose of the present article is to take a regression approach to the study of coalition formations, even though formation is a discrete concept not traditionally associated with such analyses. (5) In this approach, instead of treating each theory as generating a separate set of predictions under common assumptions, the theories are instead conceived of as suggesting the existence of variables that might influence in one way or another the formation of governing coalitions; and the assumptions which other authors have taken as given are here conceived of as

additional variables defining the nature of the universe under study.

This approach has several advantages. In the first place it permits us to investigate the possibility that different theories each have something to offer, so that in combination they may explain more than any one does in isolation. In the second place, the coefficients generated in the course of such a study (correlation and regression coefficients) are readily interpretable by social scientists as indicating the extent to which effects are important, rather than simply their likelihood of having arisen by chance.(6) In the third place, by treating assumptions as variables we can investigate to what extent specific assumptions are important in determining the nature of the findings. In this fashion we will establish the extent to which research findings in formation studies are artifacts of the assumptions employed, and particularly whether suitable sets of assumptions would give us findings consistent with those that have emerged from studies of coalition duration. At the same time we will be able to identify assumptions which needlessly complicate our understanding of the real world, and to emphasize the importance of other assumptions. Because we attempt to replicate as far as possible the findings of previous researchers, we can also indicate the effect of different coding decisions made during data collection

The Theories

In this section we will take a brief look at the theories of coalition formation which past research has sought to test. Very baldly, coalition theorists have proposed that there are three desirable qualities for any governing coalition of political parties in a multi-party legislature. In the first place the coalition should be a winning coalition. That is, it should control more than fifty per cent of the seats in the Parliament. If it is not a winning coalition it cannot be sure of being able to carry its policy proposals into law. In the second place a coalition should be as small as possible, consistent with the first requirement. All parties in a governing coalition gain some measure of control over the machinery of government, and any addition to the size of the coalition means less influence for each member. In the third place, a coalition should be as ideologically cohesive as possible. That is, it should consist of parties which are as far as possible in agreement on fundamental policy issues. Government shared between parties having differing policy objectives evidently means less chance for each party of achieving their own policy goals.

These various desirable qualities appear straightforward enough, and perhaps even self-evident. However, each of them can be interpreted in a number of different ways. We will pass over the debates that have taken place as to whether a winning coalition needs as many as fifty percent of seats, or perhaps

more than fifty percent, since past research has not shown any advantages for any other definition of winning (Taylor and Laver 1973:229). Similarly, in the case of ideology, while a number of methods of measuring ideological affinities have been proposed, one particular measure has performed better than any other in both major attempts to assess the performance of different ideological theories.(7) This is the theory originally proposed by Axlerod (1970) that governing coalitions should be ideologically closed, or "connected" in that, when the parties in a Parliament are placed in ideological rank order, intermediate ranks should always be included in a coalition whether or not the parties concerned are strictly necessary to securing a majority.(8)

In the case of size, three different propositions have been put forward, and although one of them has twice performed better than the others, in a third study this theory did much less well.(9) The first version of the size principle is that a governing coalition should contain no parties unnecessary to securing a majority. This is the so-called minimal winning proposition originating with Von Neumann and Morgenstern (1944). Often there may be several potential coalitions that would have qualified as minimal winning in these terms, and the other two versions of the size principle seek to make less ambiguous predictions by proposing that the smallest minimal winning coalition should form. Smallness here is interpreted either in terms of parties, as proposed by Leiserson (1968) in his Bargaining Proposition (which suggests that smaller groups

of parties will find it easier to reach agreement) or in terms of seats, as proposed by Gamson (1961) and also by Riker (1962). These two authors both point out that parties have different weights in a coalition partnership depending on their size, and each party will have an interest in reducing to a minimum the weight of other parties in any coalition they choose to join. We will refer to Leiserson's proposition as the Minimum Parties proposition, and to the Riker/Gamson proposition as the Minimum Seats proposition.

These four propositions (three relating to size and one to ideology) may be viewed separately as making different (though often overlapping) predictions as to likely coalition formations, or they may be combined in various ways. Axelrod (1970), for example, proposed his ideological theory as one which would predict minimal connected winning coalitions. In other words this most successful of the ideological theories was from the start seen in conjunction with one of the size propositions. (It was later abstracted from this context and presented, both by de Swaan and by Taylor and Laver, as the "Connected Winning" theory to which we shall refer below.) De Swann (1973) combined size and ideological considerations in a number of ways, and Taylor and Laver (1973) were most inventive in cycling through all lexicographic possibilities not only in terms of combining size and ideology, but even in terms of combining different kinds of size theory with each other. From the perspective of multiple regression analysis, however, all these combinations have taken the form of interaction terms.

That is, they have attempted to define more stringent criteria for predicting a coalition formation by requiring that a potential coalition fulfil some requirement at the same time as fulfilling another requirement. No attempt has yet been made in the context of formation research to combine the different theories in the additive manner that is customary in multivariate analysis. Thus if it has been found that minimal winning coalitions are more likely to form than non-minimal winning coalitions, and also that connected coalitions are more likely to form than unconnected coalitions, it does not seem necessary to combine these two theories by stating that only coalitions that are both minimal winning and connected will form. At least as plausible is the supposition that coalitions are likely that are connected, likely if they are minimal winning, and particularly likely if they are both. With this in mind, we might be able to construct a regression equation of the form

FORMING = a + b1 (MW) + b2 (CW) (equation 1)

so that the coefficients a, b1 and b2 might be given the following interpretations:

a Probability of formation of a potential coalition that was neither minimal winning nor connected;

a + b1 Probability of formation of a potential coalition that was minimal winning but not connected;

a + b2 Probability of formation of a potential coalition that was connected but not minimal winning;

a+b1+b2 Probability of formation of a potential coalition that was both connected and minimal winning.

Other theoretical expectations could be combined in a similar manner.

If we view combinations such as Minimal Connected Winning as giving rise to interaction terms,(10) this provides us with a well-established means for determining whether size or ideology dominates the process of coalition formation, and whether the other influence adds appreciably to our ability to explain formation outcomes. In multiple regression analysis, the status of an interaction term is analogous to that of any other term: it is only included if it adds significantly to the variance that could be explained without it. So Minimal Connected Winning would only be employed as a predictor of coalition formations if it explained significantly more variance than either Minimal Winning or Connected Winning taken alone.(11)

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TABLE 1 ABOUT HERE

Table 1 summarizes the findings of past formation research

Table 1 Summary of past findings in formation research

Researcher and coefficient type	MS	MP	MW	MCW	R2 change(a)
Browne probabilities	.024	.124	.043		
De Swaan test statistic	90	115	93	240	
Taylor-Laver test statistic	.162	.235	.282	.322	
Browne correlation equivalent(b)	.029	.204	.148		
De Swaan correlation equivalent(b)	.229	.206	.241	.332	5.2%
Taylor-Laver correlatn equivalnt(b)	.162	.235	.282	.322	2.4%

(a) The square of the MCW correlation less the square of the MW correlation.

(b) For Taylor and Laver the correlation equivalent is their test statistic. For other researchers the coefficient was calculated from evidence contained in their publications.

and also presents correlations equivalent to the various coefficients generated by previous researchers. In the final column the additional variance explained by minimal connected winning over what can be explained by minimal winning alone is shown to be twice as great in de Swaan's findings as in those of Taylor and Laver; but in both cases the addition is unquestionably significant. Even in the Taylor and Laver findings the MCW interaction is seen to explain about two and a half percent more variance than Minimal Winning taken alone.

The table also emphasizes the extent of the differences between the findings of past researchers, which are to be explained on the basis of differing assumptions and universes. Not only do de Swaan and Taylor and Laver differ in the extent to which they place ideology ahead of size, but also in the order in which they rank the size theories; and Browne differs from both of them in this respect. So it is to the differing assumptions and universes that have conditioned past findings that we now turn our attention.

The Assumptions

Just as previous authors have proposed a variety of different theories and combined these in a variety of different ways, so also have they made various different assumptions about what constitutes a political party, a political coalition, and a

coalition-forming situation

(a) Parties. It might be thought that the concept of a political party was straightforward enough. Any parliamentary grouping consisting of one or more members, so long as it describes itself as a separate party, could be counted as such. But both de Swann and Taylor and Laver have cutoff criteria for excluding parties smaller than a given threshold. In Taylor and Laver's case this threshold is set at one percent of parliamentary seats, while in de Swann's case the threshold is set to include only parties with more than two and a half percent of parliamentary seats. The adoption of cutoff points makes it easier to derive ideological rankings for all included parties, since small parties whose positions might be hard to establish are excluded. However, such exclusions may well affect the findings of different researchers. Furthermore strange anomalies can result from strict application of cutoff points, as in post-1945 Italy when on three occasions the country was governed by coalitions which included a party with less than one percent of seats. Both de Swann and Taylor and Laver are led to ignore their cutoff points in the case of small parties which become "pivotal", leading to some question as to whether the assumption can be applied in other than an *ad hoc* manner. (12)

(b) Coalitions. Browne (1970) makes it clear that he was only interested in explaining the emergence of winning coalitions,

and hence excluded from his dataset all instances of single party and minority government. Taylor and Laver take a somewhat different approach to the same problem, excluding situations where a single party could have formed a majority government alone, whether or not this actually happened. They thus include minority governments. De Swaan follows Taylor and Laver in removing all majority situations from consideration, but goes further in also removing from consideration any situation in which a minority government took office. Single-party governments are effectively excluded from his data as a consequence of these two requirements. Thankfully, the three authors agree on excluding the not infrequent non-party governments that occur in Finland.

Clearly, any of the three restrictions alone or in combination will affect the outcome of any investigation, by eliminating instances where theories might fail to make correct predictions. Two of the requirements (elimination of minority and single-party governments) are particularly unfortunate in that such situations cannot be anticipated before a coalition forms. They thus smack particularly of ad-hockery.

(c) Coalition-forming situations. All three of the authors who have tested the theories we are considering agree in defining a new coalition-forming situation to occur following an election, whether or not there is in fact any change in the composition of the government, but beyond this great differences emerge. Browne regards a new coalition as taking

office each time a government resigns. This appears logical until one considers that such resignations can be non-political if, for example, a Prime Minister dies or retires. Regarding the next government as a new coalition will accentuate the success or failure of theories that had predicted (or failed to predict) the formation of the previous government. Taylor and Laver deal with this problem by not counting such resignations. This also appears reasonable until one confronts the difficulty of deciding whether a resignation is non-political, or whether an apparently innocuous resignation on 'ill health' grounds is in fact a face-saving cover-up for extreme intra-coalition disagreement. The fact that a coalition might prefer to stay on in such circumstances with new leadership would constitute an important piece of evidence in favour of whatever factors led to its formation in the first place. De Swaan follows Taylor and Laver in eliminating "technical resignations" from consideration, but goes further in also eliminating any situation in which the forming coalition repeats an earlier configuration of parties occuring since the previous election. Thus any theory can only gain more than one confirmation between elections if it predicts more than one formation, and more than one if its predictions are fulfilled. Again the exclusion of particular situations may well hurt the performance of theories that would have predicted the formations concerned, and again the occurrance of a repeat coalition cannot be anticipated before it forms.

(d) Weighting. Apart from these explicit differences between the different studies, which give rise to variations in the restrictions applied to the analyses conducted by past researchers, our three authors differ implicitely in one final respect that does not fall neatly under any particular heading. Browne treats his analysis in such a way as to be able to say, of any potential governing coalition, how likely it is that this particular coalition will form. The other authors are more concerned to be able to say, of each coalition-forming situation, how likely it is that they would correctly have predicted the formation outcome. That the two different approaches have very different implications will become clear when we describe the weighting characteristics of our own dataset. Suffice it to say for the present that we are concerned to evaluate the effects of different weighting strategies on research findings in precisely analageous fashion to our concern for evaluating the effects of other assumptions (or lack of assumptions) mentioned above.

The Universes

In order to be able to investigate the effects of different assumptions on the findings of past researchers, it was important for us to be able to replicate as far as possible the different universes employed by each of them as sources for their data. Moreover, it seemed reasonable to suppose that the

choice of different countries and time-periods would constitute a further implicit assumption of each study, having effects independent of the effects of explicit assumptions outlined above. As it became clear how great this latter effect was proving to be, so we redoubled our efforts to extend our final universe as widely and over as long a time span as reasonably possible. As a result of these efforts our data cover a variety of overlapping universes and time periods.

(a) The core universe. This consists of the six countries held in common between de Swaan, Browne and Taylor-Laver over the time period 1945 to 1969. These were Denmark, Finland, Italy, Netherlands, Norway and Sweden.

(b) The Intersection Universe. This is as close as we can come to the universe employed by de Swaan, consisting of core countries plus Israel from 1945 to 1969. From the de Swaan universe we thus omit France, and years between 1917 and 1939.

(c) The Browne Universe. This consisted of the core universe with the addition of seven countries over the same time span The additional countries were Austria, Belgium, Iceland, Ireland, Israel, Luxembourg and West Germany.

(d) The Taylor-Laver Universe. This overlapped almost completely with the Browne universe, having one less country (these authors omitted Israel from their universe) but two more years coverage, to the end of 1971.

(e) The extended universe. This contained the same countries as the Browne universe, but over an additional time span to the end of 1979. (13)

The Data

The principal source of data on parliamentary seats for the present study was the International Almanac of Electoral History (14) Government data was initially compiled from Keesing's Contemporary Archives and then checked against official and other sources.

For the countries and time period which we held in common, the coding of the ideological complexion of political parties was taken from Taylor and Laver (1973). For other parties, we used our own judgement. (15)

These data pertain to the Parliamentary settings within which coalition formations take place. However, more than one coalition may form during the life of a Parliament, and so the case base for our study becomes the coalition-forming situation. Since different authors have employed different assumptions about what constitutes a coalition-forming situation, and since we wanted to investigate the effect of these different assumptions, we have had to treat the case base as variable in our data. (16)

A unique feature of our study is that the case base (the coalition-forming situation) differs from the unit of analysis (the potential coalition). In order to perform conventional multivariate analysis in which the formation (or not) of a potential coalition was considered the dependent variable to be explained by some combination of independent variables, the potential coalition had to become the unit of analysis. Now the potential coalition is a purely imaginary entity. In any coalition-forming situation there is only one forming coalition, but it is chosen from what may be a very long list of potential forming coalitions, namely all possible combinations of parties represented in a Parliament.(17) Under these circumstances if the case base were to be the same as the unit of analysis then most weight in the analysis would go to those situations in which there were large numbers of parties generating huge numbers of potential coalitions. In practical terms any study which included the Italian parliament would then generate findings weighted heavily towards that parliament, no matter how many other Parliaments were included in the study. Clearly, for most purposes each coalition-forming situation should be given equal weight in an analysis of this kind regardless of the number of parties competing for inclusion in the coalition concerned. Generally we have given each coalition-forming situation a weight of two in our analysis, by counting one for the forming coalition and one for all others taken together and weighted down by identical fractions. This means that with the exception of Table 2 (in which Browne's findings are replicated) and the

final section of this paper (in which an alternative weighting scheme is proposed) all coefficients reported in later sections have to be interpreted in terms of the case base rather than in terms of the unit of analysis. We cannot in fact say how probable it is that a particular potential coalition will form as proposed above, but only what was the probability of correctly predicting a forming coalition. (18)

The variables in our study define each potential coalition according to whether it was the forming coalition (yes/no), whether it was minimal winning, minimum seats, minimum parties or minimal connected winning. (19) Additional variables were included in order to permit us to evaluate the effects of assumptions made by previous researchers. These allowed us to select different subsets of our data to accord with different combinations of assumptions. (20)

Effects of assumptions and universes on past findings

The various different assumptions and universes have a complex network of complementary and reinforcing effects. The removal of a restrictive assumption when other restrictions remain in effect often appears to have different consequences from the imposition of that same restrictive assumption when no other restrictions are in effect. Because of this, our findings could be presented in endless permutations and

combinations. (21) Thankfully, the theme of this article calls for us only to account for differences between the findings of formation researchers before we proceed to look at the differences between formation findings and those of duration research. We can thus simplify the presentation in this section by showing first why Browne and de Swaan reached conclusions different from those of Taylor and Laver, and then why Taylor and Laver place ideology ahead of size in predicting formation outcomes.

TABLE 2 ABOUT HERE

Table 2 begins with the Browne findings, and starts by investigating the effects of coding decisions and differences in universe before proceeding to investigate differences in explicit assumptions below the broken line. Above this line all changes are cumulative but, once we have taken account of all the implicit differences between the two studies, the effects of different explicit assumptions can be taken one at a time until the final row, where the simultaneous effect of all the differences between Browne's explicit assumptions and those of Taylor and Laver are investigated. The rightmost column summarizes the extent to which a change in restrictions affects the findings by showing the additional variance explained by the interaction between ideology and size over what can be explained by size alone. (Sometimes this coefficient is

Table 2 Reconciling the Browne findings with those of Taylor and Laver

Restrictions in force	N	MS	MP	MW	MCW	r2 change*
(1) Browne's (equivalent r)*	19,205	.029	.204	.148		
(2) Our coding decisions	106,575	.034	.215	.130	(.253)	4.7%
(3) 2 + removing Israel	94,390	.043	.226	.166	(.306)	6.6
(4) 3 + adding 1970 and 1971	104,485	.044	.251	.148	(.282)	5.8
(5) 4 + weighting by situation	202	.090	.294	.374	(.404)	2.3
(6) 5 + adding minority govts	226	.116	.312	.398	(.402)	0.3
(7) 5 + deleting technical resig	170	.088	.286	.369	(.386)	1.3
(8) 5 + deleting ptys below .01	201	.106	.260	.333	(.418)	6.4
(9) 5 + substituting majority situation deletion	186	.175	.419	.535	(.498)	-3.8
(10) 5 + All the above (Taylor-Laver)	240	.122	.248	.306	(.349)	2.8

* See Table 1. Browne's explicit assumptions exclude minority and single party governments.

negative, when the interaction explains less variance than size alone). From this table it can be seen that the bulk of the differences between the two studies arose from only one difference in assumptions. This was the weighting strategy employed, which was responsible both for the large disparity in the average level of correlations, and also for the different ordering of the size theories.(22) Major effects of including small parties and excluding single party governments are seen largely to cancel out in rows 8 and 9. We will return below to the erosion of differences between size and ideology in row 6, and to the reversal of these two variables in row 9.

TABLE 3 ABOUT HERE

Table 3 follows the same pattern as table 2, but starting with de Swaan's findings and investigating the effects of the assumptions he made that were different from those made by Taylor and Laver. Moving down the table, rows are included which recompute the findings in such a way as to progressively approximate the findings which de Swaan would have made had he employed the Taylor and Laver universe of countries. This row is followed by a broken line in the table, under which assumptions are changed one at a time so that their individual effects can be seen by comparing with the row above the broken line. Once again, the bottom line takes all changes into account at the same time in order to yield findings under the

Table 3 Reconciling the de Swaan findings with those of Taylor and Laver

Restrictions in force	N	MS	MP	MW	MCW	r2 change *
(1) De Swaan's (equivalent r)*	180	.229	.206	.241	.332	5.2%
(2) Our coding assumptions for intersection universe	88	.160	.126	.242	.363	7.3
(3) 2 + Taylor-Laver universe	158	.188	.376	.485	.485	0.0
(4) 3 + including minority govts	244	.124	.229	.290	.327	2.3
(5) 3 + substituting technical resignation deletion	163	.200	.365	.493	.483	-1.0
(6) 3 + substituting .01 cutoff for small pty deletion	160	.189	.401	.513	.486	-2.7
(7)3 + all of the above	240	.122	.248	.306	.349	2.8

* See Table 1. De Swaan's explicit assumptions exclude minority governments, majority situations, and situations which repeat an earlier formation. He also excludes parties with 2.5 percent of seats or less.

same assumptions as were employed by Taylor and Laver. The table shows clearly that the greater part of the differences between de Swaan's findings and those of Taylor and Laver arose from the different universes under study, with the treatment of minority governments and small parties following closely, and coding differences playing a more prominent role than in Table 2 (See footnote 15). The transposition of size theories (de Swaan was the only past researcher to place Minimum Seats ahead of Minimum Parties) appears also to have been largely a result of the universe under study, since the change occurs between rows 2 and 3 of Table 3. Once again there are combinations of restrictions that put size ahead of ideology, and again we will defer discussion of this point.

Having reconciled the findings of past formation researchers, we can now turn to the more important question of reconciling the findings of formation studies in general with those that have emerged from duration research. So far all we have done in Tables 2 and 3 is to replace the restrictive assumptions of one researcher with those of another. The bottom row of these two tables still has several restrictions in effect. In the first place, parties with less than one percent of seats have been excluded from consideration. In the second place, situations in which one party controlled a majority of seats have been excluded whether that party then proceeded to govern alone or in coalition with other "unnecessary" parties. Then, situations have been excluded which followed a resignation deemed "technical". Finally the

universe is restricted in terms of both time and space. Table 4, therefore, investigates the effect of each of these assumptions on Taylor and Laver's findings. Once again, there is a broken line across the table after coding differences have been taken into account (the line above matches the bottom lines of Tables 2 and 3), and below this line each row reflects the removal of one assumption while all others remain in effect. The bottom row represents the situation where all changes are taken simultaniously into account.

TABLE 4 ABOUT HERE

None of the individual changes registered in Table 4 appear to have had an effect on findings remotely equivalent to some of the effects visible in Tables 2 and 3. Nevertheless, two of the changes listed below the broken line are worthy of note for different reasons. Inclusion of situations when a single party controls a majority of seats does increase somewhat the average values of the resulting correlations in row 4, but has little effect on the relative importance of different theories. The inclusion of small parties with less than one percent of legislative seats, by contrast, has little effect on average correlations but does serve to reverse the relative importance of size and ideology in row 5.

This is not the only way in which the findings of formation

Table 4 Reconciling the Taylor-Laver findings with those of duration research.

Restrictions in force	N	MS	MP	MW	MCW	r2 change *
(1) Taylor-Laver's (equivalent r)*	264	.162	.235	.282	.322	2.4%
(2) Our coding decisions	240	.122	.248	.306	.349	2.8
(3) 2 + no technical resignation deletion	284	.125	.262	.317	.364	3.2
(4) 2 + no majority situation deletion	274	.206	.296	.343	.382	2.8
(5) 2 + no small party deletion	240	.109	.269	.340	.316	-1.6
(6) 2 + Israel	258	.116	.236	.288	.333	2.8
(7) 2 + years to 1979	306	.138	.229	.297	.325	1.7
(8) 2 + none of 5-9 above	448	.226	.307	.361	.355	-0.4

* Taylor and Laver's explicit assumptions exclude technical resignations, majority situations and parties with fewer than one precent of parliamentary seats. Implicitely, they also exclude Israel and years after 1971.

studies can be reconciled with those of duration research We saw in Table 3 that even with small party deletion, the relative impact of size and ideology can be reversed by employing de Swaan's assumptions regarding minority and repeat coalitions (row 6). Indeed, the deletion of minority coalitions is enough by itself to put size ahead of ideology, as was shown in row 9 of Table 2, while the substitution of repeat coalition deletion for technical resignation deletion is enough on its own to reduce the variance explained by ideology to less than one percent more than that explained by size alone. (This is not shown in our tables.) Also in Table 2 we can see that the deletion of single party coalitions is enough on its own to erode the lead of ideology over size to less than half a percent of variance explained (row 6).

So far we have concentrated on showing the effect of the removal of restrictions, one at a time and all together, on the findings of particular authors. It remains to show what would have been the effect of introducing restrictions one at a time on the findings that would have been made when no restrictions were in effect. Table 5 shows what the consequences would have been of introducing any one of the changes we have referred to so far, when no other restrictions were in effect. The baseline for this table is a universe of all countries in which coalition governments are customary over all years from 1945 to 1979 (the same as row 8 of Table 4). In this table we focus only on the best of the size and ideological theories (except when weighting by potential coalition these are Minimal Winning

Table 5 Effects of different restrictions taken one at a time, 1945-79.

Restrictions imposed	N	Size(a) r	Size(a) r^2	Ideology(b) r	Ideology(b) r^2	r^2 change
Baseline for comparisons	448	.361	13.0%	.355	12.6%	-0.4%
Party restrictions						
Cutoff 0.01	448	.338	11.4	.360	13.0	1.5 *
Cutoff 0.025	442	.311	9.7	.350	12.3	2.6 *
Coalition restrictions						
Excluding minority governments	314	.407	16.6	.408	16.6	0.0
Excluding single party governments	314	.362	13.1	.341	11.6	-1.5
Excluding majority situations	396	.314	9.9	.305	9.3	-0.6
Situation restrictions						
Technical resignation deletion	372	.348	12.1	.337	11.4	-0.8
Repeat coalition deletion	362	.351	12.3	.343	11.8	-0.5
Weighting						
By potential coalition (c)	293,184	.169	2.9	.210	4.4	1.6 *
Time restrictions						
Excluding years after 1971	376	.369	13.6	.366	13.4	-0.2
Excluding years before 1949 (d)	396	.375	14.1	.372	13.8	-0.3
Space restrictions						
Excluding Israel	408	.379	14.4	.377	14.2	-0.2
Excluding all but core countries	242	.226	5.1	.313	9.8	4.7 *

* With this restriction in effect, the interactive ideology theory performs appreciably better than size alone.

(a) Generally MW(but see note c).

(b) Generally MCW (but see note c).

(c) The theories that performed best under Browne weighting were MP and MCP.

(d) This is a restriction we suggest below.

and Minimal Connected Winning), but in addition to correlation coefficients we present variance explained in formation outcomes (the square of the correlations).

TABLE 5 ABOUT HERE

What the table shows is that there are only three restrictions that can be imposed on the research enterprise which will, by themselves, result in ideology explaining more than an additional one percent of variance over what could be explained by size alone. The most potent of these is to restrict the countries studied to the core universe that all our three past researchers had in common. In this context, ideology adds almost five percent to the variance that can be explained by size alone. The only other means for giving ideology a noticeable advantage is either to weight by potential coalition rather than by situation, or to exclude small parties. Either of these restrictions will give to ideology an advantage of between 1.5 and 2.6 percent of variance explained. The different weighting strategy also affects which particular size and ideological theories perform best. We return to this last point in a postscript to the present article.

The only other effect in Table 5 that is worthy of note derives from a restriction which seems to emphasize the

importance of size theories rather than the other way around. The exclusion of single party governments results in a change in the relative importance of size and ideology by over one percent of variance explained in favour of the size theory.

Table 5 reinforces the message of Table 3, that the bulk of the differences between past research findings is clearly attributable to differences in the universes studied. With this in mind, we felt it necessary to go beyond a simple enumeration of the differences between universes employed by past researchers and to take advantage of the possibilities inherent in our extended dataset to find out whether there were any clear time periods or groups of countries in which ideology appeared more important than size, or vice versa. But first let us summarize our findings to date.

The status of past findings

It is clear that the supposed findings of past research into coalition formations in Parliamentary situations were in large part misleading. Ideology is not the most important determinant of formation outcomes except when restrictive assumptions are made about what is to count as a political party, when a particular weighting strategy is employed, or when the universe of countries investigated is restricted to a smaller group than those in which coalition governments are

customary. Specifically, the differences between de Swaan's findings and those of Taylor and Laver are due primarily to the different universes of countries investigated in the two studies. De Swaan's universe was one in which ideological influences were particularly powerful. The differences between Browne's findings and those of Taylor and Laver were due primarily to the weighting of potential coalitions (or lack of it) employed by Browne. (23) This weighting strategy was also responsible for the fact that, had Browne tested the ideological theories investigated by the other researchers, he would not have found the same one dominating (see postscript).

Within the Taylor-Laver universe, and employing their weighting strategy, the remaining dominance of Minimal Connected Winning Theory turns out to be due to the deletion of parties with fewer than one percent of seats in the Parliament. Although this restriction is only sufficient to give ideology an advantage in the absence of further restrictions imposed by the other two authors whose findings we have examined, it nevertheless constitutes the only explicit assumption with clearly significant consequences for research findings.

It is not our purpose in this article to criticize the reasoning that led past researchers to impose the restrictions they did on their research enterprises. (24) We have, however, pointed out that different researchers did reach quite different restrictive assumptions. A research strategy that employs none of the explicit restrictions concerning parties,

coalitions or situations has several advantages, as follows:
(1) it constitutes what is arguably the lowest common denominator of past research strategies, since no two past researchers agree precisely on any of the explicit assumptions;
(2) it permits an outcome to be predicted whenever a government resigns or an election is held, rather than leaving a residuum of coalition-forming situations to be explained on other grounds;
(3) it avoids the need for arguably ad-hoc extensions to the assumptions such as the notion of a "pivotal" small party;
(4) the findings made when these restrictions are removed do not contradict the findings of duration studies.
The last of these advantages is the fundamental one from the perspective of the present article.

Nevertheless, to close our enquiry with the conclusion that ideology has nothing to add to a more parsimonious explanation of coalition formations on the basis of size alone would also contradict the findings of duration studies, since Warwick did find ideological features contributing to the durability of coalition governments (Warwick, 1979: 478) and research into historical experience of coalition government in a number of countries supports this finding (Browne and Dreijmanis, 1982: 352). Moreover, the theoretical basis for assuming the importance of ideological factors in coalition formation is persuasive (de Swaan, 1973: 68-119).

Happily we have not exhausted the possibilities offered by

multiple regression analysis for finding ways in which ideology could add to the variance explained by size alone. Indeed, through concentrating on the re-evaluation of past research findings, we have been led to ignore the simple additive effects with which regression analysis usually starts. Instead we have focussed straight away on the more complex interaction terms that are generally only investigated after more straightforward additive models have been thoroughly evaluated. But in order to go back to the evaluation of a simpler additive model, we need to re-introduce an ideological theory of coalition formation that was mentioned in our introduction but ignored in our analyses, because past researchers did not find it performed very well.

Separating the effects of ideology and size

The need to introduce at this point a theory ("connected winning") that does not predict very well derives from the fact that we can never be sure why Minimal Connected Winning theory performs as well as it does. In one situation it might be the "connected" element that is important while in the next situation it might be the "minimal winning" element. As long as our interest is centred upon the question of which theory performs best and whether this is a theory that contains an ideological component or not (as has been the case so far in this article) the contamination need not worry us very much

But as soon as we come to investigate circumstances under which ideology is important on its own account, the correlation of 0.692 between Minimal Winning and Minimal Connected Winning becomes a source of confusion.(25)

TABLE 6 ABOUT HERE

Table 6 displays the separate relationships between formation outcomes and each of size (Minimal Winning) and ideology (Connected Winning) under different assumptions and for different universes. In addition it displays the effect of attempting to predict coalition formations from an additive combination of size and ideology. Variance explained for Minimal Connected Winning is also shown in order to facilitate comparisons. Moving down the table, the rows are arranged more or less in order of the importance of the effect of each restriction in turn; and in this table, in contrast to previous tables, the effects are treated cumulatively. That is, the effect of removing each restriction in turn that Taylor and Laver placed upon their analysis are taken together with the effects of removing all prior restrictions.

As expected, the additive combination of ideology and size performs better than either of its components; but more importantly it can be seen to perform better than the

Table 6 Effects of size and ideology (additive and interactive)

Assumptions	N	MW		CW		MCW		M+CW		Add
		r	r2	r	r2	r	r2	r	r2	r2 *
(1) Equivalent to Taylor and Laver	298	.324	10.5%	.269	7.2%	.347	12.0%	.356	12.7%	2.2%
(2) 1 + no small party deletion	298	.348	12.1	.250	6.2	.336	11.3	.367	13.5	1.4
(3) 2 + no majority situation deletion	346	.394	15.5	.311	9.7	.386	14.9	.423	17.9	2.4
(4) 3 + years after 1972	408	.379	14.4	.293	8.6	.377	14.2	.401	16.1	1.7
(5) 4 + Israel	448	.361	13.0	.296	8.8	.355	12.6	.391	15.3	2.3

* When CW is added to an equation already containing MW.

interactive combination (Minimal Connected Winning) employed by previous researchers under all the combinations of circumstances displayed in the table. Because the effects shown in the table are cumulative, the table does not contain rows to indicate the effect of alternative assumptions employed by Browne and de Swaan, of removing single party and minority coalitions from consideration; but under both these sets of assumptions Connected Plus Minimal Winning (as we shall call the new combination) outperforms Minimal Connected Winning by a healthy margin, with a correlation of 0.434 compared to 0.341 when single party governments are excluded, and 0.487 compared to 0.408 when minority governments are excluded.

Perhaps more important than the fact that Connected Plus Minimal Winning outstrips the predictive capabilities of Minimal Connected Winning under all combinations of circumstances is the fact that Connected Winning always adds enough to Minimal Winning to put to rest any suspicion we may have started to harbour, that Minimal Winning theory taken alone was to be preferred on the grounds of parsimony. By separating the effects of ideology from those of size we find that the additional explanatory power we gain from adding the effects of ideology to those of size is never less than one per cent of variance explained, and averages 3.5 per cent under all the different combinations of assumptions referred to above and in Table 6.

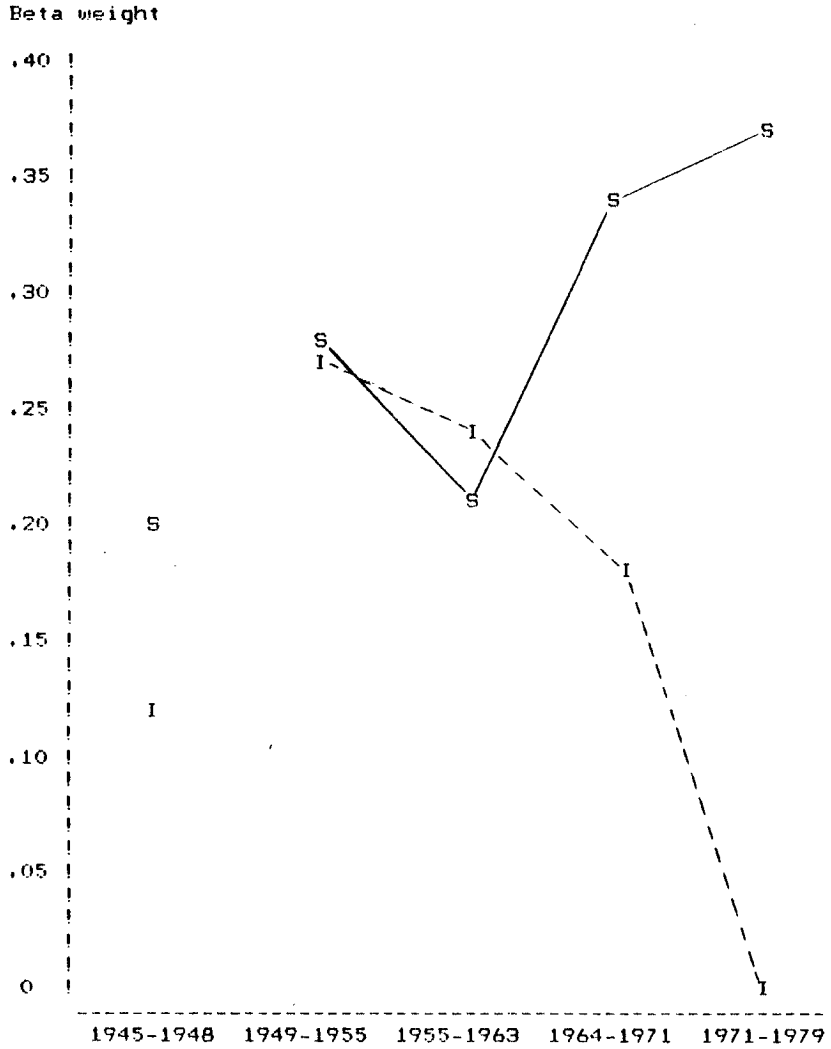
Types of Coalition Universe

Having established the importance of an uncontaminated measure of ideology, we can now return to our investigation of the effects of differing universes on coalition formations. By looking separately at the relationships found between formation outcomes and our separate size and ideology variables for each of the thirty-five years included in our extended dataset, we find a number of distinct periods. As shown in Figure 1, we first have a period from 1945 until 1948 when size and ideology are both relatively unimportant. This is followed by a period lasting until 1955 when the two considerations between them explain more variance than at any other time. From 1955 ideology appears to be in continuous decline, but size first dips and then rises, dropping below ideology during the eight years between 1956 and 1963.

FIGURE 1 ABOUT HERE

The distinctive nature of the period up until 1948 is easily discovered from inspection of the data. This was the only period during which more coalitions formed that were larger than Minimal Winning than were Minimal Winning in size. It was also a period of post-war reconstruction when governments of national unity were common, transcending both size and ideological considerations. Since we consider these years to be atypical of our universe as a whole we have not joined up

Figure 1 Effects of size and ideology by time period, from a regression analysis of all countries.*



N	52	92	116	102	86
r2	7.4	24.1	15.1	19.8	12.0

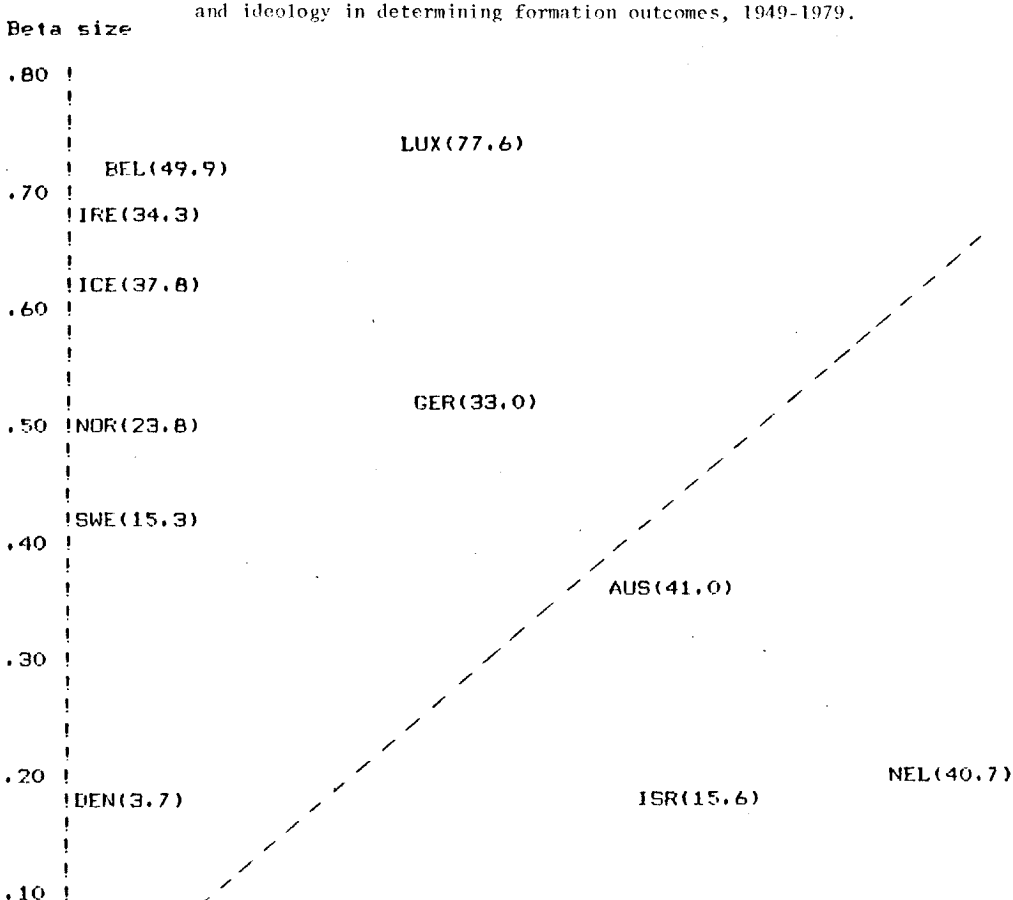
* S = size (MW); I = ideology (CW).

the points representing this period in Figure 1 with the points representing the following period. The lines in the illustration thus extend over the period we consider to have been "normal" and show a continuous decline in the importance of ideology. More importantly, from the perspective of our present concerns, size is shown to be either equal to or more important than ideology except during one quite brief period; and the difference becomes dramatic after 1971. Evidently, any continued predictive power of Minimal Connected Winning Theory after this date is due to its minimal rather than to its connected component. But even employing the interactive measure, any study which excludes years after 1971 will find ideology to be relatively more important than a study which includes those later years (compare row 4 of Table 6 with row 3 of the same Table), and all three of the previous authors under review terminated their enquiries by this date.

FIGURE 2 ABOUT HERE

On the basis of our discovery that the years prior to 1949 were importantly atypical, we excluded these years when we turned our attention to considering whether there were individual countries in which size or ideological considerations stood out as being particularly important. Our findings in this regard are summarized in Figure 2 which places each country on a two-dimensional chart according to the

Figure 2 A two-dimensional depiction of the relative importance of size and ideology in determining formation outcomes, 1949-1979.



Countries are identified by the first three initial letters, except that the Netherlands is identified by the letters NEL. N's in these analyses range from a low of 18 to a high of 56. Variance explained is given in parenthases after each country name.

importance of size (up the chart) and ideology (across the chart) in determining formation outcomes by means of multiple regression analysis performed separately for each country. Variance explained in each analysis is given in parenthases following the abbreviated name of each country. Also plotted is a line at forty-five degrees to the horizontal which represents the various positions at which ideology and size would be having equal effect. A country's position on the vertical axis is determined by the beta weight given to Minimal Winning for that country, while its position on the horizontal axis is determined by the beta weight given to Connected Winning. Thus a country that finds itself above the 45 degree line is one in which size is more important than ideology, while one placed below the 45 degree line is one in which ideology appears more important than size. Countries finding themselves close to the origin are those in which neither consideration appears very important, while countries appearing towards top or right hand sides of the chart are those in which size or ideology or both appear to dominate formation outcomes. Thus Luxembourg at the top of the chart finds more than three quarters of the variance in coalition formations determined by an additive combination of size and ideology, with size playing the dominant role.

Clearly too much should not be made of small differences between the positions of different countries on the chart, since the number of cases available for placing each country is never particularly large, but it is obvious that any study

which excluded the Netherlands, Israel or Italy would grossly underestimate the effect that ideology can have on formation outcomes, while any study which excluded Luxembourg, Belgium, Ireland or Iceland would equally underestimate the effect that size could have. De Swaan appears to have been particularly unlucky in picking a universe of countries which excluded precisely those in which size turns out to be most important.

From Figure 2 a number of country types can be distinguished. In the first place there are two countries in which coalition governments cannot be confidently predicted either from size or from ideological considerations. These are Denmark and Finland. There are then three countries in which ideological considerations are more than twice as important as size: the Netherlands, Italy and Israel. The third group consists of countries in which size and ideological considerations are both important, either at the same or at different times. This group contains Germany and Austria. Finally there are six countries in which size considerations appear to be paramount: Luxembourg, Ireland, Norway, Sweden, Belgium and Iceland.

The way ahead in formation studies

Although we have succeeded in reconciling the findings of formation studies with those of duration research by showing

that there are reasonable sets of assumptions under which consitent results emerge,(26) there remains a further discrepancy between the findings of each type of study. This has to do with the adequacy of the explanations given for the behaviour of the dependent variable (formation or duration) in each case. Specifically, this discrepancy relates to the absolute value of the correlations found in studies of each type. In studies of durability even bivariate correlations have generally been substantial (in the region of 0.5 to 0.65 for theories that predict well, implying over a third of the variance explained) whereas in formation studies they have generally been much lower (in the region of 0.35 for the better theories, implying little more than a tenth of the variance explained).(27)

Reasons for this discrepancy must be sought partially in the nature of what is being explained. In formation studies, it is our ability to predict the formation of certain coalition types from among all those which are logical possibilities that is in question. In duration studies it is our ability to predict the longevity of certain coalition types from among all those which actually form which is in question. Forming coalitions constitute a much more restricted universe than potential coalitions, and so an attempt to discriminate between different coalitions on the basis of a single indicator is much less ambitious. Although the notional N in our analysis is not very different from the N in Warwick's analysis, our notional N is a simplifying construct. In reality we are trying to identify

from among the hundreds of thousands of potential coalitions that tiny fraction which will actually form, whereas Warwick and other duration researchers are trying to identify from among only a few hundred forming coalitions that much larger fraction which will endure. These are different sorts of research questions and, although it is important to be able (as we have done) to explain any inconsistency in findings regarding the relative importance of different variables, consistency in terms of correlation magnitudes is hardly to be expected.

The lack of adequate discrimination in formation studies as opposed to duration studies points to a need to find additional variables that might help in distinguishing forming coalitions from other potential coalitions. One line of attack is suggested by the findings of the present study. (28) We have discovered that in certain countries and time-periods either ideology or size prove to be much more powerful than in other countries and at other times. If we could discover what it was about these countries and periods that made them different, this might provide us with powerful additional variables with which to attack the problem of predicting coalition formations. (27) Thinking back to the regression equation we briefly discussed in our Introduction (equation 1), what Figure 2 implies is that for different countries this equation takes different forms. For some the b2 term is larger than the b1 term, for others it is zero, and so on. By trying to impose a single equation on all countries we are clearly going to

explain less variance than we could with different equations to suit the clearly different processes of coalition formation that are occurring.

TABLE 7 ABOUT HERE

The extent of the additional variance waiting to be explained in this fashion is suggested if we regard the differences between countries that we have detected as an unspecified "country effect" with three categories, and calculate regression estimates separately within each category. Table 7 summarizes the findings from this analysis, which produces a pooled multiple correlation of 0.55 when Denmark and Finland are omitted from the analysis,(30) indicating that some 30 per cent of the variance in formation outcomes can be explained by size and ideology in interaction with our unspecified country effect. This is still a modest total, but it is almost twice the 15.3 per cent of variance that we can explain by means of size and ideology applied uniformly across countries (Table 6, row 5) and it suggests that more powerful explanations of formation outcomes may not be beyond our grasp.

Table 2 Separate and pooled predictions of formation outcomes within three and four categories of country, 1949-1979.

Category	Includes	N	Beta size	Beta ideology	r	r2
Ideology	Israel, Italy, Netherlands	118	.139	.416	.453	20.5%
Size	Belgium, Iceland, Ireland Luxembourg, Norway, Sweden	152	.613	.043	.589	34.7
Both	Austria, Germany	44	.465	.254	.602	36.2
Neither	Denmark, Finland	82	.105	.057	.128	1.6
Pooled	All thirteen countries	396			.487	23.8
Pooled	All but Denmark and Finland	314			.545	29.5

Conclusions

In this paper we have established three important propositions. In the first place, ideology is best looked at as a consideration separate from size. Only in this way does measurement of its effect escape contamination from variations in the effect of size on coalition formations, and only in this way can one explore the different ways in which size and ideology might together influence formation outcomes. In the second place, the best predictor of coalition formations is not a variable suggested by any past theorist, but one that results from the simple minded application of multiple regression analysis to variables embodying uncontaminated size and ideological concerns. The additive combination of size and ideology is a more powerful predictor of formation outcomes than is either variable taken alone, or any interactive combination previously proposed. In the third place, unless we do regard ideology as a separate influence, we find the dominance accorded to it by previous students of coalition formations to have been entirely due to idiosyncratic assumptions made in collecting their data or conducting their analyses, or due to their choice of countries to investigate.

Even when an uncontaminated measure of ideology is employed, we find that it adds appreciably to our ability to predict formation outcomes only when we include in our analysis a particular fifteen year span during which ideological considerations appear to have had their greatest impact,

between 1949 and 1963, and three countries which appear particularly disposed towards ideologically connected coalitions: Israel, Italy and the Netherlands.(31) Elsewhere, ideological considerations have either shared their influence with size (simultaneously or at different times in Germany and Austria) or had little part to play (in other countries). Differences in assumptions have much less effect than differences in universe, and among assumptions only the explicit deletion of small parties and the implicit choice of weighting strategy come remotely close to being as important as choice of years or choice of country. We return to the question of weighting in a postscript to this article.

Our own preference is to make the minimum of restrictive assumptions, although we do see merit in the argument that analysis of coalition formations should be restricted to countries and periods in which normal conditions for such formations prevail. Thus years immediately following a major cataclysm that has interrupted the normal functioning of democratic institutions should probably be excluded, in just the same way as countries in which coalition governments are unconventional (Herman and Pope, 1973).

Within our preferred universe of countries and years, the lack of restrictions corresponding to our preferred assumptions lead to a view of coalition formations as being dominated sometimes by size and sometimes by ideology, with one or the other consideration playing a leading role in different

countries and at different times. However, ideology shows a clear decline in importance over the entire period we consider normal to the extent that, by 1979, it was playing virtually no part at all in formation outcomes. This view is consistent with the priority accorded to size theories in studies of coalition duration, although research is needed to verify that the importance of size and ideology for the longevity of governing coalitions do indeed vary over time and from country to country in a fashion similar to their importance in determining formation outcomes.(32)

It should be noted in conclusion that the application of regression analysis to explaining the formation of governing coalitions has hardly been exhausted by the research reported here. A change of focus in Parliamentary coalition formation studies, from employing data in tests of pre-existing theories to employing data in describing the world, has yielded promising results and may give us still greater insights in the future.

A postscript on weighting strategies

In previous sections we have made the discussion of alternative weighting strategies as non-technical as we could by simply duplicating as closely as possible the weighting strategies corresponding to the research designs of previous researchers.

In the case of the de Swaan and Taylor and Laver analyses, their weighting schemes are inherent in the manner in which they sum the probabilities deriving from a statistical test which, with our orientation towards multivariate analysis, is not something we can duplicate. Instead we have chosen a scheme that permits us to replicate their findings when we employ the same assumptions and universes as they do. We do not, however, feel able to leave the question of weighting strategies without stating our opinion that this scheme has deficiencies almost as serious as those of the Browne weighting scheme.

Our objection to the Browne weighting strategy has already been alluded to. It gives equal weight to each potential coalition, thus giving more weight to situations in which a multitude of political parties imply the presence of an even greater multitude of potential coalitions. But there is a solution to this problem which is different from the one we have adopted in previous sections. As suggested by Browne himself, in a footnote to his article, a more judicious evaluation of the relative power of different theories might be reached by adjusting the calculation of probabilities to give equal weight to each coalition-forming situation through finding the probability of a correct prediction seperately for each before calculating a grand average over all situations (Browne, 1970, note 9). Browne did not adopt this strategy in his own evaluation because it was more complex to compute and would not, he felt, make much difference. Our own research

shows him to have been correct in assuming that the choice of his own revised weighting scheme would have made little difference to his findings. However, we have demonstrated in the present article that it does make a considerable difference whether the weighting scheme adopted is his or ours. To recapitulate, the effect of employing the Browne strategy is to emphasize the importance of theories concerned with smallness in terms of numbers of parties at the expense of theories concerned with smallness in terms of minimal winning.

The problem with the alternative weighting scheme which we adopt in order to replicate the findings of de Swaan and of Taylor and Laver is that it is oriented towards evaluating the probability of correctly predicting a formation outcome. The logic of the scheme is based on the assumption that if one does not predict the forming coalition then it does not much matter which of the myriad alternative potential coalitions is selected. It takes the view that there are only two possible outcomes: the forming coalition is either correctly predicted or it is not. Upon this view rests the strategy of giving a weight of two to each coalition-forming situation of which half goes to the forming coalition and half to the rest of the potential coalitions, no matter how many of them there may be. Unfortunately for this strategy, however, it does matter how many non-forming potential coalitions are predicted by a particular theory. As pointed out by Browne, the logic of the development of different theoretical propositions relating to smallness of winning coalitions was to reduce the size of the

solution sets predicted by Minimal Winning Theory so as to be as parsimonious as possible even at the expense of occasionally failing to predict the forming coalition. But our solution to the weighting problem is such that most of the benefits of parsimony in solution sets are lost. If all non-forming potential coalitions count for only as much as the one forming coalition, then it matters little how many of these were predicted by some theory as long as the majority of them were not.

If two theories are equally good at picking out forming coalitions but different in the size of their solution sets, they will differ little in tests of this type. There are on average 251 potential coalitions in the situations falling within our universe, and if one theory has a solution set of twenty while another has a solution set of ten, there will be almost no difference in the performance of the two theories if both of them are equally good at picking out the forming coalition

The effects of our weighting strategy can be seen most clearly if we consider a theory that has not been seriously proposed by past researchers. This is that a coalition will form if it is connected. Shorn of the winning requirement, connected theory has not been proposed because it makes very little sense. In Parliaments with large numbers of parties a very high proportion of losing coalitions are connected because they consist of pairs of adjacent parties. But with our

weighting this theory performs very well indeed: better than any of the theories we have considered in this article, and better even than Connected Plus Minimal Winning. Its success is due entirely to the fact that its very much larger solution set does not count against it to the extent that it evidently should, while its successful predictions are more numerous than those achieved by any other theory. (33)

With this anomoly in mind, one is tempted to look more critically at the findings generated earlier in this article, and by previous researchers. Why does Minimal Winning Theory perform better than any other size theory? Why were Riker and Gamson and Leiserson wrong in thinking that theories with more parsimonious solution sets should perform better? Were they really wrong, or is the good performance of Minimal Winning Theory (and Minimal Connected Winning) due at least in part to the low weight given to a much larger solution set of non-forming but predicted potential coalitions?

The adoption of the revised Browne weighting scheme in preference to the one we have employed so far makes surprisingly little difference to the findings reported in the present article. Minimum Parties becomes the best theory relating to size, and Connected Minimum Parties becomes the best of the ideological theories. Connected Plus Minimum Parties still turns out to perform better than the interactive alternative, and the effects of different assumptions on the degree of fit and on the lead of ideology over size remain much

the same once the substitution of Minimum Parties for Minimal Winning has been made.

But even the revized Browne weighting scheme has deficiencies. Although each coalition-forming situation may be given equal weight, each forming coalition is not. Thus successful predictions in countries with large numbers of parties count for less than do successful predictions in countries with fewer parties. And Browne has suggested (1970: 404) that Leiserson's Bargaining Proposition (which is the one represented by our Minimum Parties variable) is advantaged by situations with fewer parties.

Some weighting scheme is necessary because it is clearly wrong to give different weights to different coalition-forming situations. And it could be argued that the scheme should be quite complex, so as to give equal weight also to different countries no matter how many coalition-forming situations might have occurred in each. Which weighting scheme should be adopted is a difficult question to which we are not prepared to give an unequivocal answer. Both of those we have investigated appear to have deficiencies, and these deficiencies should be borne in mind once the choice has been made. In the present article we have focussed upon findings generated under a system of weighting chosen in order to give maximum comparability with previous research findings. In future research it is to be hoped that the choice of weighting scheme may be based on substantive considerations.

FOOTNOTES

(1) The theories these researchers sought to evaluate were based on the work of Von Neumann and Morgenstern (1944), Gamson (1961), Riker (1962), Leiserson (1968) and Axelrod (1970). The various theories are described briefly in the following section.

(2) Thus, for example, de Swaan finds a much greater difference between the performance of size and ideological theories than do Taylor and Laver; and Browne finds size in terms of parties to be relatively more important than do either of the other researchers. It should be noted that although we shall be testing ideological theories under the same assumptions as were employed by Browne, he did not himself test any such theories.

(3) Warwick (1979:466) mentions this as a means of reaching an understanding of formation outcomes, without appearing to recognize that, in this case, existing research findings relating to formation outcomes should already reflect the findings of his own analysis.

(4) The exception to this tendency is provided by Laver (1974: 268-270) who, in a postscript to his article proposing an historical dimension in formation outcomes, enquired whether predicted coalitions lasted significantly longer than unpredicted coalitions. His conclusions anticipated the more sophisticated analyses later conducted by Dodd and Warwick.

(5) When regression analysis is employed with discrete variables, the bivariate analyses generate statistics numerically equivalent to counterparts among contingency coefficients. Thus the Pearsonian correlation is numerically equivalent to Phi or V (Chi-square over N) and the regression slope is numerically equivalent to (and has the same interpretation as) D, the difference in proportions. To interpret these coefficients in the fashion normal for regression analysis requires some stretching of the underlying requirements for such analyses, but regression analysis has generally been found very robust in coping with violations of even its most fundamental assumptions, and is nowadays frequently employed for data that, two decades ago, would have been thought completely unsuitable. See Franklin and Mughan (1980) for further discussion of this point.

(6) Significance tests are, apart from anything else, very responsive to the number of cases under analysis. A large case base will generate more highly significant results, all other things being equal. Without getting into the old argument as to whether there is any meaning to be ascribed to statistical significance when the case base constitutes a universe rather than a sample, it is clearly

unfortunate that a larger universe will generate more apparently significant results, since it makes it hard to compare the findings of different studies. Correlation and regression coefficients, by contrast, are much less influenced by the size of the dataset under analysis, and constitute something of an "industrial norm" within the social sciences for measuring relationships and effects.

(7) In recent years new variants have been proposed upon the theme of ideological compatibility, and tested for example by Ordeshook and Weiner (1980). These tests however did not cover anything like the universe of countries investigated by earlier researchers, so it is not yet clear how these new variants stand in relation to earlier theories in terms of predictive ability. Consequently we propose to ignore them in the present study.

(8) In the findings of both de Swaan (1973) and Taylor-Laver (1973) this theory not only performs best overall, but also does consistently well when the data are looked at country by country.

(9) Even in the two studies which found the same size theory performing best overall, this theory did not perform consistently well when the data were subdivided by country. Nor did these two studies agree on which size theory should take second place.

(10) Strictly speaking, MCW is not an interaction between MW and CW because it indexes coalitions that cannot lose a partner without ceasing to be either winning or connected. Thus an MCW coalition could cease to be connected without ceasing to be a winning coalition if it was only oversized in order to achieved connected status. The strict interaction of MW and CW would include no oversized coalitions since it would index only those MW coalitions which happened to be connected. Nevertheless, the correspondence is close enough for us to be able to employ the same procedure as in multiple regression analysis for deciding wether the combination is significantly more valuable than either of its components.

(11) How much additional variance MCW would have to explain in order to be preferred to either of its component parts is not something that can be strictly stated. On the one hand, what we have here is not a sample but a universe in which any difference at all is "significant" in the strictly statistical sense. On the other hand, considerations of parsimony militate against the unnecessary elaboration of explanations. Thus in practice one might choose to regard a difference of half or perhaps even one percent in variance explained as being required in order to justify the loss in parsimony.

(12) A further problem derives from the fact that, as noted by

Taylor and Laver, a basic assumption of their analysis is that the coalition forming context remains stable between elections. In practice this assumption may not always be fulfilled, and if two deputies leave one party to join another between elections, the whole universe of potential coalitions changes. If this happens infrequently it can be accommodated by treating such a change as conceptually equivalent to an election but if it happens often (and particularly if the governing coalition does not change as a consequence) the phenomenon becomes much harder to handle. A coalition that was minimal winning may become non-minimal winning. Do we count it as a failure of the size theories that a new government does not form to rectify the anomaly? Fortunately, in the universe under consideration, this problem is only a serious one for pre-1958 France, and only de Swaan includes France in his dataset. The effects of different coding decisions and other conventions for handling the French data can be dealt with by the simple expedient of excluding France from consideration. Similar sorts of difficulties occur from time to time in the data for other countries, and give rise to the possibility of different coding decisions on the part of one researcher from those made by another.

(13) It is important to remember that while both the Browne and Taylor-Laver universes are included as subsets of the extended universe, only part of the de Swaan universe is contained within it.

(14) Mackie and Rose (1974), 2nd edition forthcoming.

(15) In reconciling our findings with those of previous researchers (Tables 2-4 below) we took account of all known differences in assumptions and universe, and compared our findings with the published findings of other authors. Any residual differences were then attributed to coding. In the case of the de Swaan reconciliation (Table 3 below), we were not able to handle this to our complete satisfaction, since we could only compare our findings in the intersection dataset with his over a wider universe. Consequently, the differences attributed to coding in that table will in fact include some effects of changing universe. Other principle sources of coding difference will be as follows:
(1) Omission of a small party above the cutoff size (if any).
(2) Inclusion of a small party within a larger grouping regarded as a single party.
(3) Abstracting a "party" from what would more properly be regarded as a larger grouping.
(4) Inclusion of a situation we deemed to follow a technical resignation (we took such situations as being any with the same parties as were contained in the previous coalition, unless an election intervened).
(5) Inclusion of a small party below the cutoff size (if any). See footnote 22.

(6) Inclusion of a situation in which the forming coalition contained a party below the cutoff size (if any).
(7) Inclusion of a potential coalition which, if it formed, would have been ruled out by some assumption regarding repeat coalitions.
The difficulty of handling the last three of these problems from a computational viewpoint provides one of the most pressing arguments for eliminating unnecessary restrictive assumptions. However, as far as we could tell, none of these sources of error taken alone were important enough to warrent separate treatment in our tables.

(16) Because of the complexity of the data we have employed, a separate publication is planned in which the nature of the data will be explored in some detail, as it constitutes a potentially valuable resource for other researchers.

(17) With three parties represented, A, B and C, the coalitions that potentially might form are AB, AC, BC and the coalition of the whole Parliament, ABC. In addition, some researchers would consider the single-party "governments" of A, B and C to be possible. Including the single-party "governments" among the list of potential coalitions enables us to derive the number of potential coalitions in any Parliament by raising 2 to the power of the number of parties and subtracting one (representing the coalition of no parties). In our example, raising 2 to the power of 3 and subtracting 1 yields 7, but the number of potential coalitions clearly rises exponentially with the number of parties in a Parliament, so that with ten parties there are 1023 potential coalitions, and with fourteen parties (the maximum found in our universe) there are 16,383 potential coalitions.

(18) In point of fact, the weighting scheme adopted in the data for the present study was far more complicated even than the above account would suggest. In the first place, many of the assumptions made by previous researchers which we wished to consider as variables in our analysis gave rise to different numbers of potential coalitions (see below) so that different weights had to be calculated for different combinations of assumptions. In the second place a quite separate weighting scheme had to be adopted simultaneously with the first in order to generate a dataset of manageable proportions. In order to reduce the number of units to a level that could be handled even by large scale computing techniques, all potential coalitions which turned out to have identical characteristics were collected together as one physical unit, and their weights adjusted to reflect the number of logical units concerned.

(19) This last variable reflects a theory referred to as "Closed Minimal Range" by de Swaan.

(20) Further variables were calculated from combinations of the variables already mentioned, permitting us to investigate the effects of changing assumptions and universes on eight of the fifteen theories investigated by Taylor and Laver (six of the twelve investigated by de Swaan). The additional variables include (a) any minimum seats coalition with fewest parties, (b) any minimum parties coalition with fewest seats, (c) any connected coalition with fewest parties, (d) any connected coalition with fewest seats, (e) any connected coalition that was winning.

(21) The massive data manipulation exercise involved in these analyses could hardly have been attempted without instantanious access to intermediate findings as different combinations of restrictions were imposed. The package employed was SCSS, the SPSS Conversational Statistical System (Nie, Hull, Franklin et al, 1980).

(22) The effects of coding differences appear small until one inspects the column giving the number of cases (N) under each set of assumptions. This shows our replication of the Browne universe to have over five times the number of cases that Browne himself investigated. This difference is in fact due to small differences in the number of parties coded separately by Browne and ourselves, particularly in Israel (see footnote 15). It will be recalled that each increase by one party doubles the number of potential coalitions, so small differences in countries with many parties can have quite staggering results on the number of potential coalitions. (Deletion of parties with less than one percent of seats results in an even lower N of 9,524 under Browne's weighting scheme.) The practical consequences are, however, negligeable.

(23) We do not mean to imply that Browne's findings are wrong just because he is in the minority and his findings are different. De Swaan and Taylor and Laver employ almost precisely the same statistical test which, while it should have overcome problems in interpreting Browne's findings, is still not necessarily correct. We discuss this point further in our concluding note on weighting strategies.

(24) However, it is perhaps necessary for us to defend our contention that small party deletion is unnecessary. Clearly there are many small parties whose ideological positions are difficult or impossible to code, and we have certainly had to omit some that we could not code. But it seems unnecessary to go so far as to exclude <u>all</u> small parties just because <u>some</u> of them are hard to code.

(25) The correlation between Minimal Winning and Connected Winning of 0.447 is still more than would have been wished for in an ideal world, but it is much less likely to mislead us. The extent of correlation between Minimal Winning and Connected Winning is due to their common

requirement that a coalition be winning if it is to form. In a universe from which minority coalitions are excluded (such as that employed by Browne) the correlation between the two measures becomes negligible.

(26) The ability to derive a rank ordering in the importance of size and ideology for formation outcomes which is the same as that found in duration studies is all that is required in order to explain the first of the major discrepacies. The disappearance of ideology from the multiple regression analysis performed by Warwick (1979:473) is a statistical artifact. As we pointed out in an earlier section, there is a high correlation between Minimal Winning Status and Minimal Connected Winning such that whichever variable enters first into a multiple regression equation is likely to bring with it most of the explanatory power attributable to either variable. Because Warwick did not separate (as we have done) the ideological from the size components of Minimal Connected Winning, multiple regression analysis would find ideology adding little to an equation already containing size. When duration researchers look at the separate effects of size and ideology (Warwick 1979:471), ideology in the form of MCW emerges as an important determinant of formation outcomes (r=.56) even if less important than size in the form of MW (r=.64). By showing how variations in assumptions can reverse the rankings of size and ideological considerations in predicting formation outcomes, we have shown that consistency between these and duration studies can be achieved in one way at least. We do not rule out the possibility that consistency would have to be achieved in other ways as well. In particular it is likely that coverage of comparable universes would be needed in order to ensure comparable findings.

(27) Bivariate relationships above 0.5 are, of course, unusual in social research, and scholars have generally been pleased to explain a tenth of the variance by means of such analyses. The rule of thumb in political science (probably deriving from the use of significance tests in voting studies with typical sample sizes of under two thousand respondents) seems to be that a correlation above 0.2 is worth reporting, while one above 0.5 is spectacular. A question is raised by Browne and associates (1982) as to the replicability of Warwick's high correlations. However, Dodd (1876:160) achieved results of comparable magnitude which have never been questioned. For the present is is probably safest to assume that Warwick's results are correct, although further research is clearly needed to either confirm or remove the doubt now cast upon their replicability.

(28) Another line of attack is to reformulate the research context so as to regard coalition formations not as isolated events but as an historical process in which new

formations are not independent of past formations (Franklin and Mackie, 1983).

(29) One obvious candidate is the nature of the party system in each group of countries, but we have no space to explore this possibility here.

(30) If Denmark and Finland are included as a separate category then the pooled variance explained drops to some 24 per cent, but there does not seem to be much point in including two countries whose governments are clearly not selected according to the same criteria as elsewhere. Exploring coalition formations in these two Nordic countries must be the subject of specific future research.

(31) Table 7 above showed these countries to contribute quite disproportionately to the total number of situations in our analysis, and hence to the weight accorded to ideology in the overall results we have reported.

(32) Recent findings by Norman Schofield suggest that duration research would place the countries in our dataset in groupings very similar to those observable in Figure 2 (communication with the author).

(33) It is not possible for us to be sure that these deficiencies would also show up in the statistical tests employed by other researchers. However, the fact that our findings duplicate theirs and that we feel our findings to have been affected adversely by our weighting scheme implies that their findings are also defective, and very probably for the same reason. It is not at all clear why this should be the case. In principle the procedure adopted both by de Swaan and by Taylor and Laver should have resulted in the cumulation across situations of probabilities appropriately calculated for each situation (see in particular de Swaan, p.304). It seems possible that what has happened in practice is that, with relatively few coalitions actually forming between one election and the next, a theory either gets confirmation during an inter-election period or it does not. If it gets confirmation then the statistical probability carried forward for summation is very close to zero; otherwise it is very close to one. The variable actually being summed across situations is thus effectively binary (as ours is) rather than continuous (as theirs should have been).

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