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Party-centrality and government membership: A comparative analysis of the degree of centrality of political parties and government membership in twelve Western multiparty democracies

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I. Introduction

The majority of theory guided government composition research has focused either on the 'minimal' or 'connected' status of government (Riker 1962; Axelrod 1970; De Swaan 1973; Taylor and Laver 1973; Bueno de Mesquita 1975; Morgan 1976; Dodd 1976; Grofman 1982; Grofman, Straffin and Noviello 1995; Luebbert 1986) or, more recently, on governments as 'stable' or 'credible' allocations of portfolio's (Austen-Smith and Banks 1990; Laver and Shepsle 1990, 1994) and governments as outcomes of Downsian type electoral interaction models (see Austen-Smith and Banks 1988; Baron 1993). The earlier theories have been tested extensively in empirical settings, the more recent ones have not (for an overview, see Laver and Schofield 1990). Another recent development in government composition theory, following the work of Black (1958) and Kadane (1972), highlights the importance of central parties (Einy 1985; Van Deemen 1987, 1990, 1991; Van Roozendaal 1992a, b, 1993) and of the related multi-dimensional concepts of the 'core' party (McKelvey and Schofield 1986; Schofield 1986, 1993; Schofield, Grofman, and Feld 1988; Schofield and McKelvey 1986) and recently Laver and Shepsle's 'strong' party (Laver and Shepsle 1996).

The importance of central parties for government formation is the starting point of this paper. In the formal definition of centrality, the central party is the party that includes the median voter of the policy dimension. One and only one party can be central on a policy dimension. In uni-dimensional empirical applications to government composition in western multiparty democracies it is found that the central party of the left-right dimension is included in the majority of governments (Van Deemen 1987; Van Roozendaal 1992a, b). Rigorous multi-dimensional empirical applications of 'core' theory have not yet been conducted. Laver and Shepsle (1996) did perform a multivariate empirical analysis. They find that the 'strong' party is an important factor in government formation.

The principal idea in this article is that centrality may be important for the

government membership of parties, but that the 'binary' nature of the central party concept (one party is central, all the others are not) is too narrow.¹ This is true for the related concepts as well. Instead, we propose that every party in a parliament has a certain *degree of centrality*, and that the higher the degree of centrality of a party, the greater its power with regard to policy making, and the greater the likelihood that it will be included in the government.

The article is structured as follows. In Section 2 we discuss the notion of centrality in more detail. On the basis of an analogous prediction from social networks theory, we state a prediction that links the degree of party-centrality to government membership. In Section 3 we propose two measures of party-centrality. We transform the basic definition of centrality in such a way that it is quantified, i.e. that each party gets a certain centrality-value. In Section 4 we discuss the data and the method of analysis. In Section 5 we confront the centrality measures in a rigorous manner with data of government membership in twelve countries, in the time frame between 1918 and 1988. In Section 6 we state our conclusions.

2. Party centrality and government membership

2.1 Binary centrality

Our starting point is the original uni-dimensional central player concept. Some of its history, however, should not be left out. Black (1958) developed the Median Voter theorem. It says that, if we assume that each voter in a uni-dimensional voting system has an ideal position on the dimension, then there is one point that is preferred by a majority of voters to any other point on the dimension. This point is the ideal position of the median voter. With regard to policy development Black's theorem informs us that the outcome will be at the median of the positions of the actors involved in the process. This result was generalized to multi-dimensional policy space by Kadane (1972). Kadane has shown that when decision making in multi-dimensional space is done by majority voting then the outcome (if an equilibrium exists) will be the multi-dimensional median position.

The basic form of uni-dimensional centrality, which we label 'binary' centrality, is as follows: the central party of a parliament is the party that includes the median voter on the underlying policy dimension. If party *i* includes the median voter, then *i* is the central party. The total weight of the connected coalition of all parties whose policy positions are to the left of *i* is lower than the majority criterion. Also, the total weight of the connected coalition of all parties whose policy positions are to the right of *i* is lower than the majority criterion. However, the total weight of union of the connected

coalition of the left with *i* is greater than the majority criterion. The same is true for the total weight to the union of *i* and the connected coalition of the right.

This basic form of centrality says that every party is either central or it is not. Furthermore, it says that one and only one party at the time can be central.²

2.2 Degree of centrality

The above conceptualization of centrality is unsatisfactory. In this paper we propose that every party has a certain degree of centrality, with a value that is higher for some parties than for others.

In the last two decades there have been a number of studies in which, one way or another, assessments of the 'power' of actors in different settings, usually conceptualized as games, have been made. Translated to the topic of this article, different conceptualizations of the power of parties in parliaments have been introduced.

The Shapley-Shubik and Banzhaf power indices for instance, discussed in most basic books on game theory, are well known measures of political power. Recent extensions of these indices toward the potential of the players to form winning coalitions in spatial voting games can be found in Shapley (1977), Grofman, Owen, Noviello, and Glazer (1987), and Shapley and Owen (1989). For a rare empirical application to government composition, albeit limited to governments in Israel only, see Rapoport and Golan (1985). A concept developed in spatial voting games that can be applied in this context is the 'yolk' (Ferejohn, McKelvey and Packel 1984; Feld, Grofman, and Miller 1988). In a two-dimensional game in which players have euclidian preferences, the yolk is the smallest circle that touches all median lines. For a connection of the yolk to the recent power indices, see Feld and Grofman (1990). Empirical applications have not yet been performed.

We are concerned in this article with the power of parties in another manner, namely the power with regard to government formation that can be derived from a more or less central, or median, policy position. Centrality of actors is an important concept of power in social network analysis. The notion there is that *the more central an actor is, the greater his or her involvement in network relations* (i.e. more interactions with other network members). This was first stated by Bavelas (1950) and Leavitt (1951) and further developed by Freeman (1979). The implication is that if an actor has a greater involvement in network relations vis-a-vis the other actors in the network, then this can be seen as an indication for a more powerful position.

For political situations we can translate the amount of 'involvement' of an actor in the network, to an indication of the amount of political power with regard to policy a party might be able to derive from its more central or less

central position on a policy dimension (or dimensions). This form of political power can also be regarded as the positional power of a party. Thus, in an analogy to findings in social networks theory, we would expect that the more central the position a political party is in the parliament the greater its political, or positional, power. The straightforward manner to conceptualize what more central means in this context, is to regard it as a smaller distance between the position(s) of the party and the objective centre of policy space.

The amount of political or positional power of a party should be visible in a number of areas. First of all, one would expect that the outcomes of policy making processes are influenced more by parties with high positional power than by parties with small positional power. The degree to which party policy positions influence government policy making is addressed in, for example, Laver and Budge (1992). Based on the assumption that a government formation process is a process of 'super decision making' over the policy issues that are of importance to government, the second area in which the amount of political or positional power of a party should be visible is the composition of governments. Our prediction is that: the more central a party is the greater its influence on the process of 'super decision making' over the policy issues that are of importance to government, and the greater the likelihood that a party becomes a government member. As the first area has already been addressed in empirical analyses, in this article we focus on a study of the second area.

It is important to note at this stage that it is not our aim to introduce a new model of coalition formation. Analogous to what has already been empirically demonstrated in other fields of social science research, most specifically in social network theory, we merely want to propose, and subsequently empirically investigate, that the likelihood of party-inclusion in government will increase when parties are closer to the centre of policy space (or, similarly, that it will decrease when parties are closer to the extremes of policy space).

In the next section we propose two different operationalizations of the notion of degree of centrality. They will be used in the remainder of this article to investigate the empirical importance of our proposition with regard to government composition.

3. Two measures of centrality

In this section we develop two centrality measures, one using uniform policy distances between the players of the game, and one using interval policy distances. We give an informal discussion of the concepts. The formal definitions are given in Appendix A.

Before we can introduce these centrality measures, two general assumptions have to be introduced. First of all, we have to define what we mean by

the objective centre of policy space. In the context of government composition studies, it is customary to define the centre of policy space as the position of the median voter. As we have seen above, the central party of a parliament is the party that includes the median voter. Therefore we take the position of the binary central party, and regard it as the objective centre of policy space.

Secondly, we assume that the number of seats in a parliament corresponds to the total weight of the game. The number of seats of a party corresponds to the weight of a player. The majority criterion is half the total number of seats, plus one.

3.1 Uniform distance centrality

For our first conceptualization of degree of centrality we introduce the specific assumption that the distance between any two players that are adjacent on the underlying policy dimension is uniform. That is, we assume that the distance between any two adjacent players on the policy dimension is equal to 1. Thus, if one player is located between a certain player and the central player, the distance between the latter two is 2, and so on.

We define as the *uniform distance centrality* value of a player (henceforth abbreviated as UDC) the value one (1), divided by the uniform distance between a player and the central player, plus one:

$$\text{UDC-value player } i = 1 / (\text{uniform distance player } i \text{ to central player} + 1)$$

The UDC value is maximal for the binary central player, as it gets the value 1, and minimal for the player that has the largest number of players between itself and the central player on the policy dimension, i.e. a player that is located at one of the extremes of the dimension. The players adjacent to the binary central player get UDC values of 0.5 and, the players that have with one player between themselves and the binary central player UDC values of 0.33 and so on.³

Appendix A also describes a multi-dimensional version of this measure of degree of centrality. Our discussion was uni-dimensional so far, and our analyses will be so too. Therefore we restrict our attention in the main text to uni-dimensional conceptualizations.

3.2 Interval distance centrality

The simplest way to introduce a centrality measure for interval orders would be to determine the central player of the game, compute the distance be-

tween the interval position of each player and the central player, and then compute the centrality-values. However, a conceptual problem occurs if we adopt this approach. The central player concept was defined for policy dimensions with ordinal measurement, not with interval measurement. It is not appropriate to define an interval distance measure on the basis of the interval position of the player that is ordinal central.

We use the following straightforward alternative. We first determine the weighted median interval position of the dimension. Using the weighted median will in many cases, albeit not all, approximate the interval position of the binary central player. We then compute the distance between each player and the weighted median position of the dimension, and we use these distances in our centrality measure. The interval distance between a player and the weighted median interval position of the uni-dimensional policy order is simply the absolute difference in the policy positions. The *interval distance centrality* (IDC) of a player is:

$$\text{IDC-value player } i = 1 / (\text{interval distance player } i \text{ to central player})$$

Note that this measure is defined in a similar fashion to the uniform distance centrality measure. For the exact definition and extension toward a multi-dimensional formulation, see Appendix A.

4. Operationalisation, data and method

In the next section we confront the degree of centrality of political parties, using the centrality measures introduced above, with data of government membership in western multi-party democracies. In the multi-variate analyses we use uni-dimensional data from twelve western multi-party democracies, and we control for the weights of the parties. Although Appendix A also gives multi-dimensional versions of the measures, for reasons to be discussed below a multi-dimensional analysis is not yet feasible. In this section we discuss our main operationalisations, the data and the analysis technique.

4.1 Operationalisation of the policy scale

Crucial in the analysis is the choice of the policy dimension on which parties will be located spatially.⁴ This brings us to an important problem of the data analysis, and of most studies in the field of government in western multi-party democracies for that matter: there is not (yet) a complete overview of the

positions of all parties in many countries for a longer time period, neither for the uni-dimensional nor the multi-dimensional case.

The following policy position information is available. There are self-constructed ordinal uni-dimensional scales of De Swaan (1973) and Taylor and Laver (1973), and self-constructed interval multi-dimensional scales of Dodd (1976). All take one time point, i.e. they use one basic and static scale for the entire analysis period. There are interval level uni-dimensional scales, developed on the basis of expert opinions by Morgan (1976), who takes two time points (interwar period (1918-1940) and post-1945 period), and Castles and Mair (1984) who implicitly take one time point (somewhere in the early 1980s) as focal point. The same is true for Laver and Hunt's (1992) multi-dimensional scales developed on the basis of expert opinions. Their time point is at the end of 1980s. Finally, there are the interval level multi-dimensional assessments in the volume edited by Budge, Robertson, and Hearl (1987). These scales, which have also been used in Laver and Budge (1992), are developed on the basis of content analyses of party's election programmes in the ECPR Party Manifestos Project.

The latter study is the most elaborate in the field to date. Unfortunately, however, it does not give the positions of *all* parties present in certain countries for a longer period of time. In most of the country specific chapters the most important parties are dealt with, but some parties of somewhat lesser importance, especially those that have never been government members, are sometimes left out.⁵ At first sight this might seem a perfectly reasonable decision. However, for the purpose of a test of the ideas put forward in this article, the parties that have not been included in governments are as *crucially important* as those that have been included. Why some parties become government members and other do not, is exactly the subject of this study. By means of an assessment of the degree of centrality of parties we want to explain why some parties become government members, while others do not. Although the Budge, Robertson and Hearl (1987) multi-dimensional results are often best suited for many analyses of government composition and government durability, for an empirical analysis of the kind we propose they simply are too limited. The multi-dimensional scales developed by Laver and Hunt (1992) also seem to be very useful. However, the most important dimensions in this study were obtained by breaking up the left-right dimension in separate dimensions (see pp. 39). We believe it is more useful, and more parsimonious, to use the left-right dimension as it is.

Morgan (1976) provides comprehensive interval-level left-right information, especially in combination with the scales reported by Castles and Mair (1984).⁶ We have chosen to use the positions on the left-right dimension of parties as described in these two studies. For the countries not included in Morgan's analysis but included in Castles and Mair's analysis, we use the

scales reported by the latter. Below we will discuss the extent to which these scales will be used in this study.

4.2 Countries and time periods

The number of countries for our analysis, as well as the time periods we can look at, is constrained by the policy scales that are available. Morgan (1976) gives uni-dimensional information on a large number of countries. Some of the countries it does not cover are covered by Castles and Mair (1984). We include the following countries in the analysis: Austria, Belgium, Denmark, Finland, Germany, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway and Sweden.⁷

The scales can be used for these countries in an ordinal fashion, i.e. as the basis for analysis of the uniform policy distances. Sometimes certain ordinal information of the basic scale is not available, but it is not difficult to find other ordinal left-right scales (De Swaan 1973; Taylor and Laver 1973; Browne and Dreijmanis 1982) that do provide the sought information. Since most left-right scales are very much related (see Laver and Schofield 1990, Appendix B; Laver and Hunt 1992), in general it is warranted to transfer ordinal information between such scales.

It is not this easy when interval scales are concerned. The problem can be illustrated with the following example. The post-1945 Morgan scale, which was constructed around the year 1975, gives interval positions of three adjacent christian parties in the Netherlands: the Christian People's Party, the Anti-Revolutionary Party, and the Christian Historical Union. In 1977 these three parties merged into the Christian Democratic Appeal. It is easy to infer an ordinal position for this new party, it simply takes the position of its three predecessors. However, it is difficult to give this new party a unique interval position. Problems of this sort, as well as problems that pertain to possible position changes of parties, arise in a number of countries such as Belgium, Denmark, Finland, Italy, the Netherlands, Norway and Sweden. For these countries we have chosen not to extrapolate the Morgan scale beyond 1975. Instead we use 1975 as the point where the application of the Morgan scale ends, and where application of the more recent Castles and Mair scale takes over. Table B1 in Appendix B summarizes the countries included, the exact time periods we looked at in the analyses, and the scales used.

4.3 Parliaments, parties and governments

Regarding the inclusion of parliamentary data, i.e. the seat distributions of the political parties, we have to recognize that in most countries the Parliament consists of two Houses. The question is what information should be used for which countries? We have chosen to use the following rule of thumb: if there is a clear division of powers between the different legislative houses in a certain country, we will only take the most important one into account. If both houses are equally important, we will include both, and we add up the seats of the parties in the different houses into one total party weight.⁸ As to the parties which are to be included in the analysis, in a number of studies (for example Axelrod 1970; De Swaan 1973; Morgan 1976; Taylor and Laver 1973; Budge, Robertson and Hearl 1987; Laver and Budge 1992) parties that do not reach a certain weight-criterion are left out. We do not follow this route. The only criterion in choosing between parties in this study is that we must be able to give each of the parties a position on a policy scale. This gives us the opportunity to include as many as possible of the political parties that have played a role in the countries studied.

Our analyses will be multi-variate. As a counterpart to the policy seeking centrality values of parties, we will control for the office seeking notion of weight of parties. That is, as control variable we use in the analyses we use the number of seats of each party in the parliament.

In our analysis we treat each government that is separately discussed in Keesing's Contemporary Archives, as a separate case for analysis. Thus, our operationalization of government is very similar to the operationalizations used by Luebbert (1986), Strom (1990a), and Budge and Keman (1990). Caretaker governments are excluded from the analysis.

Finally, we have to operationalise government membership of parties and decide which parties are to be seen as genuine government members and which are not. Important at this point is to distinguish between the theoretical notion of a winning coalition and the empirical definition of a government. In our analysis a party is a government member when it has accepted formal government responsibility. That is, political parties that merely support a government, and are included in the winning coalition that helps a government pass, for instance the investiture vote, but do not have formal responsibility for one or more ministerial portfolios will not be counted as government members.

4.4 Method of analysis

In total the above operationalisations and data result in 357 government formation situations for analysis. If we add up the number of parties that have

been included in the 357 different government formation processes, then we arrive at a total of 2054 parties. Each party in every government formation situation either became a government members or it did not. We examine the extent to which this can be explained by degree of centrality. That is, we analyze the effect of degree of centrality of parties, controlling for party weight, on their government membership chances on whether a party becomes a government member or not. The statistical technique most suited to carry out these analyses is the Logistic Regression (Logit) model. In this paper we will apply this technique.⁹

5. Centrality and government membership: empirical evidence

Section 5.1 gives an overview of the results of our analyses. In Section 5.2 we address a point of criticism that can be (and has been) raised against the analyses reported in Section 5.1: if we do find an effect of centrality then this could be due to the binary central parties only, without contribution of the centrality values of other parties. Therefore we will run some analyses again, this time excluding the binary central parties and their centrality values.

5.1 Results of the analysis

The results of our analyses are listed in Tables 1 and 2. The results are presented in a country and period specific fashion.¹⁰ Thus the initial 12 countries are presented as 18 countries and periods. Table 1 lists the results of the logit analyses of government membership as affected by uniform distance centrality and weight. Table 2 does the same for the interval distance measures.

Generally speaking, the results of the uniform distance centrality confirm our proposition. They show that the notion of party-centrality as developed in this paper is indeed a factor of considerable importance with regard to government membership. The 'all data' result shows that both uniform distance centrality and weight have positive and statistically significant effects on government membership.

Table 1 Logit analyses of party membership in coalition government: the effect of uniform distance centrality and weight.

Country	Period	Estimates (s.e. in parentheses)		N/n	Chi ² (2)
		Party-centrality	Party-weight		
All	all	3.888 (.233)**	.005 (.001)**	2054/357	476.44
Austria	1945-1990	.042 (1.711)	.049 (.013)**	63/20	31.43
Belgium	1918-1939	-	-		
	1945-1990	1.559 (.960)~	.040 (.008)**	181/31	70.00
Denmark	1918-1939	9.780 (2.84)**	.108 (.038)**	44/11	31.55
	1945-1990	1.117 (.751)	.046 (.009)**	169/24	28.88
Finland	1918-1939	4.647 (1.047)**	-.014 (.009)	137/24	30.42
	1945-1990	3.550 (.777)**	.010 (.008)	228/33	39.12
Germany	1948-1990	6.853 (2.13)**	.002 (.003)	66/17	24.05
Iceland	1945-1990	.110 (.946)	.102 (.043)*	84/20	7.37
Ireland	1945-1990	6.853 (2.13)**	.002 (.003)	66/16	24.05
Italy	1945-1990	6.540 (1.17)**	.003 (.003)	301/38	119.03
Luxembourg	1945-1990	-.076 (3.14)	.264 (.098)**	52/13	28.29
Netherlands	1918-1939	6.421 (2.38)**	.072 (.041)~	72/9	25.22
	1945-1990	9.221 (1.97)**	.015 (.017)	156/17	74.44
Norway	1918-1939	3.989 (1.82)*	.054 (.031)~	36/9	6.70
	1945-1990	3.477 (.938)**	.026 (.010)*	123/21	36.15
Sweden	1918-1939	.645 (1.19)	.018 (.006)**	64/13	10.17
	1945-1990	13.212 (4.63)**	.001 (.001)	95/19	69.20

Notes

For Belgium 1918-1939 estimates could not be computed because uniform distance centrality is a perfect predictor of government membership.

The cases for the analyses are the individual parties (N). Also indicated are the number of government formation situations (n).

The intercept term for each analysis is not included in the table.

** $p < .01$, * $p < .05 \sim p < .10$

All chi² values are significant at (at least) $p < .05$ with two degrees of freedom.

Table 2 Logit analyses of party membership in coalition government: the effect of interval distance centrality and weight.

Country	Period	Estimates (s.e. in parentheses)		N/n	Chi ² (2)
		Party-centrality	Party-weight		
All	all	-.015 (.047)	.011 (.001)**	1917/357	114.30
Austria	1945-1990	-20.968 (48.603)	.059 (.026)*	63/20	32.62
Belgium	1918-1939	128.646 (37.741)**	.025 (.010)*	111/22	61.97
	1945-1990	.301 (1.235)	.047 (.007)**	181/31	67.27
Denmark	1918-1939	73.228 (24.436)**	.165 (.050)**	44/11	31.12
	1945-1990	-.013 (.074)	.046 (.009)**	169/24	26.88
Finland	1918-1939	22.817 (4.597)**	.002 (.009)	137/24	41.25
	1945-1990	17.597 (5.208)**	.024 (.008)**	228/33	26.41
Germany	1948-1990	-	-		
Iceland	1945-1990	-2.257 (4.217)	.111 (.043)*	84/20	7.64
Ireland	1945-1990	-	-		
Italy	1945-1990	.088 (.114)	.008 (.001)**	301/38	34.35
Luxembourg	1945-1990	34.064 (56.173)	.226 (.086)**	52/13	28.66
Netherlands	1918-1939	5.125 (2.837)~	.110 (.035)**	72/9	18.51
	1945-1990	2.654 (1.590)~	.070 (.014)**	156/17	45.76
Norway	1918-1939	13.551 (7.049)~	.048 (.030)~	36/9	5.08
	1945-1990	16.554 (5.079)**	.050 (.010)**	123/21	32.45
Sweden	1918-1939	-.163 (.524)	.017 (.006)**	64/13	9.98
	1945-1990	33.654 (11.650)**	.030 (.006)**	95/19	44.88

Notes

The cases for the analyses are the individual parties (N). Also indicated are the number of government formation situations (n).

Germany and Ireland are not included in this table because of insufficient interval data.

The intercept term for each analysis is not included in the table.

** $p < .01$, * $p < .05$ ~ $p < .10$

All chi² values are significant at (at least) $p < .05$ with two degrees of freedom, except Norway (1918-1939) significant at $p < .10$.

For most of the individual countries included in the analyses we find a positive and statistically significant estimates for the party-centrality. Three country-periods have a positive but non-significant effect, while one country-period shows a negative but also non-significant effect. Interestingly, for all the country periods that showed non-significant effects we find a significant effect of party-weight. This indicates that in most country-periods the policy seeking concept of party-centrality is more important than the weights of parties, while in a smaller number of country-periods it is exactly the other way around. It also shows that the pooled all data effect hides quite a variety of different country-period effects.

The results for uniform distance centrality measure reported in Table 1 are much better than for the interval distance centrality measure reported in Table 2. The 'all data' estimator for interval distance centrality is not in the right direction and also not significant. And in fact, as the 'all data' effect again hides some country-period effects, we find that only nine of the 16 country-periods have the expected significant and positive effect. Three other have a positive effect but are not significant, while in four country-periods we find an effect of centrality in the wrong direction, albeit not significant.

The relative weakness of results for the interval centrality concept gives a boost to the effect of party-weights. In this table all but one of the 16 country-periods have a positive and statistically significant estimator of party-weight. This could also suggest that the interval information of the scales used here is not good enough, which brings us back to one of the questions raised in Section 4.1, namely the fact that there is insufficient information regarding a party's positions over a longer time period. We used the Morgan and Castles and Mair scales as static scales, which obviously is a limitation. However, except for the Budge, Robertson and Hearl (1987) results, which are not used here for reasons discussed earlier, these scales are about the best that can be used at this moment.¹¹

In some cases, however, we have reason to believe that the failure of our prediction should not, or not only, be attributed to the interval information of the scale. Some countries exhibit institutional features of government formation that are not found in other countries (see Strom, Budge and Laver 1994). For example, in most countries included in this analysis majority government, or governments that approximate the majority criterion, are often the rule. Exceptions are Denmark (post-1945) and Sweden (pre-1940). For these country-periods we find that the statistical results are among the poorest of all.¹²

5.2 Results of analyses without the binary central parties

We re-run the 'all data' analyses, this time leaving out for every case the binary central parties itself and its centrality values. We want to determine whether or not our results are the effect of the strong position of the central parties only, or that the centrality values of the parties close to the central parties also make a contribution to the result. The results are displayed in Table 3.

Table 3 Logit analyses of party membership in coalition government: analyses excluding the binary central parties and its centrality values.

Type of analysis	Estimates (s.e. in parentheses)		N/n	Chi ² (2)
	Party-centrality	Party-weight		
Uniform distance centrality	6.414 (.507)**	.003 (.001)**	1753/357	191.57
Interval distance centrality	.074 (.106)	.004 (.001)**	1649/357	8.74

Notes

The cases for the analyses are the individual parties (N). Also indicated are the number of government formation situations (n).

Germany and Ireland are not included in the interval centrality analysis because of insufficient interval data.

** $p < .01$, * $p < .05$ ~ $p < .10$

The chi² values are significant at (at least) $p < .05$ with two degrees of freedom.

The general pattern in these results confirms our earlier results. There is a positive and statistically significant effect of both degree of centrality, as measured by uniform distance centrality, and weight. Besides the positive and significant effect of uniform distance centrality we now also find a positive, albeit still non-significant, result for the interval measure of centrality. This shows that there is an effect of the binary central parties that have not been included in governments. These situations clearly have a negative impact on the overall result.

6. Concluding remarks

The main goal of this paper was to further develop the theory of party-centrality and government membership. Earlier research primarily focused on 'the' central party and its importance in coalition governments in western multi-party democracies. The analyses by and large showed that central parties are an important factor for government composition (Van Roozendaal 1992a, b). Moreover, it was shown that in situations where the central party coincides with the dominant party (Peleg 1981), it is very rare that such a dominant central party is not included in the governments. Related research has been conducted by McKelvey and Schofield (1986), Schofield (1986), Schofield, Grofman, and Feld (1988), and Schofield and McKelvey (1986) with respect to 'core' parties and Laver and Shepsle (1996) with respect to the 'strong' party. The main problem with this approach is that it only says something about the government composition behavior of one party, i.e. the central party. The importance of other parties is not, or only to some degree, taken into account.

In this study we extended the notion of centrality to all actors in the game. We developed a proposition that links the degree of centrality of parties to government membership. We operationalized the degree of centrality in two different ways, and we tested the proposition that a higher degree of party-centrality has a positive effect on the likelihood that a party becomes a government member. We used data of government participation of political parties in twelve western multi-party democracies to test this proposition.

Our data analysis generally supports the main thesis developed in this article, especially using the uniform distance version of degree of centrality. The more central parties are with respect to the uniform distances, i.e. the higher the uniform distance degree of centrality, the greater the likelihood that these parties are included in the governments. Furthermore, in most country-periods the interval distance centrality values of parties also had a positive effect on government participation, but just over half the country-periods was the result statistically significant. We also found that the weights of the parties are important, especially when the interval measurement of degree of centrality was used.

The results of this study tell us that, in addition to the established importance of the binary central parties, the closer parties are to the binary central parties the greater their chances are to be included in governments. We therefore conclude that policy-seeking behavior of political parties in the sense of moving toward the centre of the 'left-right' political spectrum (see also Downs 1957; Strom 1990b; Budge and Keman 1990) in order to improve their chances of becoming included in government indeed pays off. The more central parties are, the more often are they indeed government mem-

bers. If government participation is what political parties aim for, then it pays off to have a policy position that is as central as possible.

As regards further research, the degree of centrality developed here of parties that are government members can be important in a different field. It can be argued that government stability is related to the degree to which the government members are cooperative. Since each of the parties in governments may have individual rational incentives not to be cooperative at all times, it becomes important for them to ensure that these individual rational incentives, which are potentially defective and might lead to premature government termination (Grofman and Van Roozendaal 1994, 1996; Lupia and Strom 1995), can be overcome. As pointed out by Raub and Weesie (1992) two mechanisms are isolated in the theoretical literature on cooperation in two-actor 'matches' which show that conditional cooperation can be induced. The first is that parties are able to make credible commitments, for instance via contracts (Van Roozendaal 1996a). The second is that credible exit threats can be used. An exit threat (Hirschman 1970) by a government party is credible when the other party believes that the threat will be carried out when it does not give in. A dominant party (Peleg 1981), for instance, has a credible exit threat because it is always able to form winning coalitions with two mutually exclusive non-winning coalitions that together can not form a winning coalition (Van Roozendaal 1996b). The degree of centrality of parties might also be applicable in this sense, as a higher degree of centrality indicates a greater chance connected winning coalitions formation with other parties, which creates an exit threat potential.

Notes

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1. The central player and core player are closely related, but the two are not equivalent. For the sake of simplicity we will focus on centrality as used in the central player theory. The main difference between the two concepts is that one central player either exists or not, while there is always either one core player or two core players. This is due to the fact that the central player is defined for games that are proper (the complement of any winning coalition is losing) and strong (the complement of any losing coalition is winning) at the same time, while the core player concept is defined for proper games, which is a weaker requirement. Laver and Shepsle's Strong Party are comparable to the central player, in the sense that there is either one strong player in the game, or none. But of course this concept is defined over more than one policy dimension, while the central player is explicitly unidimensional.

2. Note that it can occur that a central player is absent in the game (see also Note 1). For instance, a game of 4 equally weighted players in which the majority criterion is half of the total number of seats plus one, has no central player. This is due to the fact that although the game is proper, it is not strong. In abstract it is very simple to think of such games. However, in application to parliamentary games (seat distributions in legislatures), the chances are very low that such a game is not proper and strong at the same time, and that central players are absent. As a matter of fact, Van Roozendaal (1992a,b) reported that of the 241 parliamentary games (election results: the number of seats and policy positions of these parties in his analysis, only three lacked a central player.

3. This conceptualization is based on our belief that the policy control of parties declines rather rapidly when they move further away from the centre. At the same time, however, this conceptualization takes into account that when a certain distance from the centre is reached, the policy control of parties does not decrease that much anymore. For example, it does not matter much whether the uniform distance between the central party and another party is 7 or 8. Both distances are great. Hence the $UDC_j^k = 1 / (D_{ij}^k + 1)$ conceptualization. Note that this is a rather conservative measure. If we would use a measure by which the centrality values of parties decline more gradually when parties are further away from the centre (for instance with $UDC_j^k(R) = 1 / \sqrt{D_{ij}^k}$) then the results of the analyses reported in Section 4 would be higher than what they are now. The all-country uniform distance centrality analyses reported in Table 2 are repeated with a conceptualization that has a 'flat' monotonic decrease rate in distance centrality. The results found were in the same direction and indeed a bit stronger than the results based on our basic conceptualization.

4. At this stage we do not want to re-iterate the long discussion as to what type of scales should be used and what type should not be used, i.e. should left-right scales be used or not. For this discussion, see for instance Daalder (1971), De Swaan (1973), Morgan (1976), Budge and Laver (1986).

5. See for example the chapters on the Netherlands and Italy in Budge, Robertson and Hearl (1987). Important to note of course, is that for this study parties were selected on the basis of, among other things, their participation in governments in the first place. It would therefore not be right to use these data in this article.

6. Elsewhere it is shown that for the countries where these scales cover the same situation, they have high positive correlations for most countries (Van Roozendaal 1992b). We use them as complimentary.

7. Israel is not included because of the great number of party mergers and split-up's that make an interval assessment extremely difficult. The French Fourth and Fifth Republics are not included in the analysis because of the difficulty to generate clear interval positions for quite a number of parties, even if the Morgan (Fourth Republic) or Castles and Mair (Fifth Republic) scales are used.

8. The houses of parliament from which data are used in the analysis are Austria: *Nationalrat*, Belgium: *Kamer van Volksvertegenwoordigers* (Chamber of Representatives), Denmark: *Folketing* (unicameral after 1953), Finland: *Eduskunta* (unicameral), Germany: *Bundestag*, Iceland: *Althingi* (both Houses), Ireland: *Dáil Éireann*, Italy: *Camera dei Deputati*, Luxembourg: *Chamber of Deputies* (unicameral), the Netherlands: *Tweede Kamer* (Chamber of Representatives), Norway: *Storting* (both Houses), Sweden: *Riksdag* (until 1971 both Houses, thereafter unicameral).

9. Related to our endeavour is Laver and Shepsle's (1996) recent analysis of government membership of 'strong' parties. The multi-variate analysis technique they use was closely related, namely the probit model.

10. For each separate government in each country (and time period) we made a separate data file. This data file includes five values for each party: whether the party is in the government or not (coded as 1 or 0), and four uni-dimensional distance centrality values that were computed using the centrality-indices developed in Section 3. For each country we then combined the separate government data into one data file, or into two separate files when different time periods are distinguished. We then computed pooled data correlations for each country.

11. An option that can be pursued in the near future is to apply the method proposed by Van Roozendaal (1994). There it is proposed to combine the ordinal positions of parties with the number of seats of a party in order to determine an interval position. Since the number of seats of parties generally change with the election, this method gives us a more dynamic account of interval positions of political parties.

12. The Logit analysis technique makes strong assumptions regarding the independence of the alternatives. To check whether the results hold when a grouping criterion (government formation situation) is introduced, we also performed Huber Logit analyses of the different 'all data' results. In these analyses the standard errors are treated differently. The results cannot be different estimates but, because of different standard errors, they might result in different significance levels. The results of the Huber Logit analyses are as follows: (1) for the uniform distance analyses, binary central parties included: $UDC = 3.888 (.237)^{**}$, weight = .005 (.001)^{**} no differences in significance levels, (2) for the interval distance centrality, binary central parties included: $IDC = -.015 (.027)$, weight = .011 (.001)^{**} no differences in significance levels, (3) for the uniform distance centrality, binary central party excluded: $UDC = 5.946 (.442)^{**}$, weight = .003 (.001)^{**} no differences, and (4) for the interval distance centrality, binary central party excluded: $UDC = .073 (.099)$, weight = .004 (.001)^{**} no differences.

Appendix A: Mathematical formulations of centrality measures

Total weight of the game: W_N

Weight of player i : W_i

Majority criterion of the game: $1/2 W_N + 1$ when the total weight is even, and $1/2(W_N + 1)$ when the total weight is odd.

The binary central player:

Let R be a policy dimension, and let W_i be the weight of player i (its voting power, or the number of seats a party occupies in a legislature). Let R_{+i} be the connected coalition of all players whose policy positions are to the left of i on policy dimension R , and let R_{-i} be the connected coalition of all players whose policy positions are to the right of i on R . $W(R_{+i})$ and $W(R_{-i})$ indicate the weights of these coalitions. Player i is central if and only if:

$$|W(R_{+i}) - W(R_{-i})| < W_i$$

Uniform Distance Centrality:

Select the binary central player. Denote the distance between player j and central player i on dimension k by $D^k_{i,j}$. Then the uniform distance k -centrality of player j can be expressed as: $UDC^k_j = 1 / (D^k_{i,j} + 1)$. If we, alternatively, assume an M -dimensional system and use a city block metric, then the overall value of M -centrality of player j is: $UDC^M_j = M / \sum_{k \in M} (D^k_{i,j} + 1)$. In the case of these uniform distances on, what is essentially, ordinal policy dimensions it is most appropriate to use a city block metric, instead of a euclidian metric. Assume for example a 2-dimensional system in which party a is central on both dimensions, and party b is adjacent to a on both dimensions. Application of the euclidian metric in computing the distance between the two would result in $\sqrt{2}$ as the ordinal distance between the two, which is unrealistic in this framework.

Weighted median position of the policy dimension:

The game has N players. P_j and W_j are the interval position and weight of player $j \in N$. The weighted median position of the policy order is: $P_{med} = \sum_{i \in N} (W_i P_i) / \sum_{i \in N} W_i$

Interval distance between player and weighted median position:

The distance between player j and the weighted median position of the uni-dimensional order k , denoted $ID^k_{med,j}$ is simply: $ID^k_{med,j} = |P^k_{med} - P^k_j|$

Interval Distance Centrality:

The IDC value of player j in an M -dimensional system using an euclidian metric can then be expressed as: $IDC^M_j = M / \sqrt{\sum_{k \in M} (|P^k_{med} - P^k_j|)^2}$ which is equivalent to $M / \sqrt{\sum_{k \in M} (ID^k_{med,j})^2}$. The uni-dimensional version can be easily envisioned. It would be $IDC^k_j = 1 / |P^k_{med} - P^k_j|$. In the case of interval orders, the euclidian metric is more appropriate than the city block metric because, unlike the uniform distances, now we are dealing with a continuous system.

Appendix B: Countries, time period and scales

Country	Time period	Scale used
Austria	1945-1988	Castles and Mair
Belgium	1918-1940	Morgan
	1945-1988	Morgan, after 1975 Castles and Mair
Denmark	1918-1940	Morgan
	1945-1988	Morgan, after 1975 Castles and Mair
Finland	1918-1940	Morgan
	1945-1988	Morgan, after 1975 Castles and Mair
France	1945-1957	Morgan
Germany	1948-1988	Castles and Mair ¹
Iceland	1945-1988	Morgan
Ireland	1945-1990	Castles and Mair ²
Italy	1948-1988	Morgan, after 1975 Castles and Mair ³
Luxembourg	1945-1988	Morgan
The Netherlands	1918-1940	Morgan
	1945-1988	Morgan, after 1975 Castles and Mair
Norway	1927-1940	Morgan ⁴
	1945-1988	Morgan, after 1975 Castles and Mair
Sweden	1918-1940	Morgan
	1945-1988	Morgan, after 1975 Castles and Mair ⁵

Notes

1. Interval scale not used due to insufficient information. The ordinal scale was constructed using Castles and Mair and Norpoth (1982).

2. Interval scale not used due to insufficient information. The ordinal scale was constructed using Castles and Mair and Cohan (1982).

3. Italy 1946 not included because there were too many parties without a position. The 1983 election results and the governments formed in the 1983-1987 inter-election period, are not included because a central party cannot be selected.

4. We start the analysis in 1927 because the Morgan scale does not provide interval information on a number of parties that were important before 1927.

5. The 1976 election results and the governments formed in following inter-election period are not included because a central party cannot be selected.

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