

VOTING WEIGHTS AND FORMATEUR ADVANTAGES IN THE FORMATION OF COALITION GOVERNMENTS¹

Stephen Ansolabehere
Department of Political Science
Massachusetts Institute of Technology

James M. Snyder, Jr.
Department of Political Science and Department of Economics
Massachusetts Institute of Technology

Aaron B. Strauss
The Mellman Group

Michael M. Ting²
Department of Political Science and SIPA
Columbia University

March, 2005

¹Stephen Ansolabehere gratefully acknowledges the support of the Carnegie Corporation under the Carnegie Scholars program. James Snyder and Michael Ting gratefully acknowledge the financial support of National Science Foundation Grant SES-0079035. Michael Ting also acknowledges the financial and intellectual support of the Center for Basic Research in the Social Sciences at Harvard University. All three authors thank Jim Alt, Wolfgang Mueller, and Massimo Morelli for their helpful comments.

²Corresponding author. Assistant Professor of Political Science and Public Affairs, Columbia University, Dept. of Political Science, IAB Floor 7, 420 W 118 St., New York NY 10027 (mmt2033@columbia.edu). Stephen Ansolabehere is Professor of Political Science, Massachusetts Institute of Technology, Dept. of Political Science, MIT, 77 Massachusetts Ave., Cambridge MA 02139 (sda@mit.edu). James M. Snyder, Jr. is Professor of Political Science and Economics,

Abstract

Over the last two decades a large and important literature has emerged that uses game theoretic models of bargaining to study legislative coalitions. To test key predictions of these models, we examine the composition of coalition governments from 1946 and 2001. These predictions are almost always expressed in terms of parties' minimal integer voting weights. We calculate such weights for all parliamentary parties. In addition, we develop a statistical model that nests the predictions of many of these models of the distribution of posts. We find that for parties that join (but did not form) the government, there is a linear relationship between their share of the voting weight in parliament and their share of cabinet posts. The party that forms the government (the formateur) receives a substantial "bonus" relative to its voting weight. The latter finding is more consistent with proposal-based bargaining models of coalition formation, and suggests that parties gain disproportionate power not because of their size but because of their proposal power.

Keywords: Bargaining, Legislatures, Coalitions, Formateurs, Parliamentary government.

Running Title: Voting Weights and Formateur Advantages.

1. Introduction

In modern democracies, legislatures collectively decide how to allocate positions of political power and how to divide public funds. Fair legislative representation, it is hoped, will lead to a fair distribution of government resources to all interests in society. But, majority rule, it is feared, may lead to the dominance of large parties or groups over the small and to the abandonment of societies' norms of equity (*e.g.*, Dahl, 1956).

Political scientists have studied the division of government resources and positions in a wide range of settings. Two goals of this research are to measure the political power of competing parties and interests, and to test and refine theories of coalition formation. Examples include the geographic distribution of public expenditures, the allocation of patronage positions in cities, the assignment of committee positions in Congress, and the allocation of cabinet posts in parliamentary coalition governments.¹ This research is guided by analytical models, some formalized and others not, where many players or parties bargain over the division of government resources.

In this paper, we study one of these situations: the allocation of cabinet ministries in coalition governments. We focus on two empirical questions about the formation of coalition governments that have immediate positive and normative implications. First, how are cabinet posts divided among the parties in the governing coalition? Second, who is chosen to form the government, and does the choice matter? Our primary goal is to test the central conjectures of an important strain of theoretical inquiry – the predictions of non-cooperative game theoretic models of bargaining. The empirical questions raised in this literature are of normative interest as well, as they concern how legislative representation translates into political power.

Our paper follows a substantial body of empirical research on the distribution of parties' seat shares and the division of cabinet positions in postwar European parliaments (Browne

¹The literature on this first topic is vast – see, *e.g.*, Browning (1973), Wright (1974), Ritt (1976), Owens and Wade (1984), Wallis (1987, 1996), Atlas et al. (1995), Levitt and Snyder (1995), Lee and Oppenheimer (1999), Gibson, Calvo, and Falleti (2004), Horiuchi and Saito (2003), Strömberg (2004), Ansolabehere, Gerber and Snyder (2002), and Rodden (2002). On the second topic, see Holden (1973), Rakove (1975), Erie (1978), and Johnston (1979); on the third topic see, *e.g.*, Shepsle (1978); we discuss the work on the last topic in more detail below.

and Franklin, 1973; Schofield, 1976; Browne and Frensdreis, 1980; Schofield and Laver, 1985; Carmignani, 2001; Mershon, 2001; and Warwick and Druckman, 2001). Two key findings from these studies stand out. First, they find a strong and nearly proportional relationship between a party's share of cabinet posts and its share of legislative seats in the governing coalition. Second, they find that there is little or no advantage to being "formateur" (the party called to form the government). The estimated coefficients on variables identifying formateurs are typically small and statistically insignificant.²

The strong relationship between seats and posts is often cited as critical evidence supporting specific theoretical models of legislative bargaining. For example, Morelli (1999) writes: "All the models based on Baron and Ferejohn (1989) yield a disproportionate payoff share for the proposal maker regardless of the distribution of seats, and hence they are not consistent with the basic empirical findings... In contrast, the demand bargaining game introduced here performs very well with respect to the evidence" (Morelli, 1999, page 810).³ However, the relationship between seats and posts does not speak directly to most of the theorizing on coalition formation, including the Baron-Ferejohn and demand bargaining models. Game theoretic models almost always express their predictions in terms of *voting weights*, while the empirical studies almost always consider parties' *seat shares*.⁴

We link the empirical and theoretical literatures directly. Specifically, we introduce the calculation of parties' voting weights into the empirical analysis of the composition of coalition governments in order to test the main tenets of recent theoretical research on legislative bargaining.

Game theoretic models constitute a large and important part of the theoretical literature

²One exception is Warwick and Druckman (2001), who find a noticeable formateur effect after weighting cabinet posts according to their "importance." The proportional relationship between posts and seats was first conjectured by Gamson (1961), and is sometimes called "Gamson's hypothesis" (Mershon, 2001, page 286), or "Gamson's Law" (Morelli, 1999, page 810).

³See also Schofield and Laver (1985), Merlo (1997), and Warwick and Druckman (2002). Schofield and Laver (1985) study the relationship between post shares and seat shares, and between post shares and two game theoretic solution concepts (the kernel and the bargaining set). They find a mixed picture. Seat shares appear superior in predicting post shares for the largest and second largest parties, while the bargaining set does better for smaller parties. Also, seat shares are superior predictors in some countries, while the bargaining set is better in others.

⁴One exception is Merlo (1997). See footnote 32 below.

on legislative bargaining. These models are used to explain which coalitions are most likely to form, the likely distribution of payoffs, how long governments last, and the consequences of various institutional arrangements.⁵ The bulk of the recent work in this literature – more than two dozen papers in the last fifteen years – employs proposal-based bargaining models. This type of model was developed by Baron and Ferejohn (1989). In these models, one party or legislator is selected to make a proposal, and any proposal that garners a majority (or an appropriate quota) is approved, thereby ending the game.⁶ Other non-cooperative approaches employ demand-based bargaining models and two-stage proposal-based bargaining models. These models involve different sequences of decision-making and lead to different predictions about the division of payoffs.⁷ Also, various cooperative solution concepts are used to analyze coalition formation, including the Shapley value, the Banzhaf index, bargaining sets, bargaining aspirations, and the kernel.⁸

One characteristic shared by almost all of these formal models is that legislative bargaining is treated as a game of weighted voting. Parties' potential contributions to coalitions are typically represented in the simplest possible terms – minimum integer voting weights. Predictions about parties' expected payoffs are then derived in terms of their shares of voting weight, rather than shares of legislative seats. The Baron-Ferejohn model predicts that the formateur party will receive a share of cabinet posts disproportionate to its share of the total voting weight in the legislature, and the other parties in the government (the coalition

⁵There is also an important informal literature on legislative bargaining, and a literature that while formal is not fully game theoretic in that it does not employ any of the standard game theoretic solution concepts. We focus on the formal literature, since that is where much of the work is today.

⁶This follows the seminal work of Selten (1981) and Rubinstein (1982). See Harrington (1989, 1990a, 1990b), Austen-Smith and Banks (1988), Baron (1991, 1996, 1998), McKelvey and Riezman (1992), Baron and Kalai (1993), Calvert and Dietz (1996), Winter (1996), Diermeier and Feddersen (1998), Banks and Duggan (2000), LeBlanc, Snyder and Tripathi (2000), McCarty (2000a, 2000b), Montero (2001), Eraslan (2002), Eraslan and Merlo (2002), Jackson and Moselle (2002), Norman (2002), Snyder, Ting, and Ansolabehere (2005), Ansolabehere, Snyder and Ting (2003), and Kalandrakis (2004a, 2004b).

⁷On the first of these, see, *e.g.*, Bennett and Van Damme (1991), Selten (1992), and Morelli (1999). On the second, see Merlo (1997), Diermeier and Merlo (2000), Montero (2003), and Diermeier, Eraslan and Merlo (2003).

⁸See, *e.g.*, Schofield (1976, 1978, 1982, 1987), Browne and Rice (1979), Bennett (1983a, 1983b), Holler (1987), and Morelli and Montero (2003). Applications of these solution concepts to legislatures can be found in Holler (1982), Rapoport and Golan (1985), Strom, Budge, and Laver (1994), and Calvo and Lasaga (1997).

partners) will receive payoffs that are proportional to their voting weight.⁹ Alternatively, Morelli’s (1999) demand bargaining model and Montero’s (2003) two-stage bargaining model, as well as the demand bargaining set (Morelli and Montero, 2003), predict “pure proportionality” in payoffs – each party in a winning coalition, including the formateur, will receive a share of the posts that is exactly proportional to its share of the voting weight in a minimum integer representation of the underlying weighted voting game.¹⁰

Voting weights complicate empirical testing of these models. Seat shares do not equal voting weight shares, and, as we show below, the approximation can be quite poor. As a result, regression analyses relating seat shares to shares of posts, as done in most empirical work on this topic, will generally yield biased estimates of the relationship between voting weights and cabinet posts. The estimated coefficients on other variables, such as an indicator of the formateur, will also be affected.¹¹

We make three specific contributions. First, we examine the relationship between seat shares and voting weights. Voting weights are difficult to calculate, especially for situations involving a large number of players. We have developed an algorithm to calculate the minimum integer weights for a wide class of games (see Strauss, 2003). Second, we develop a statistical model that allows us to nest a wide range of formal bargaining models, including the most prominent proposal-based and demand-based bargaining models. This allows us to provide a relatively precise interpretation of the estimated coefficients, and to conduct strong statistical tests of the predictions of specific theoretical models.¹² Third, we analyze the relationship between parties’ shares of voting weights and their shares of cabinet posts, using an augmented version of the data set developed by Warwick and Druckman (2001). We estimate the effect of being formateur, and how voting weights translate into shares of

⁹See, *e.g.*, Proposition 4 in Montero (2001), and Propositions 1 and 2 in Snyder, Ting and Ansolabehere (2005).

¹⁰See, *e.g.*, Theorem 3 in Bennett and Van Damme (1991), Propositions 2 and 3 in Morelli (1999), Proposition 4 of Montero (2003), and Theorem 3 of Morelli and Montero (2003).

¹¹For the estimated formateur effect to be biased it must also be the case that voting weights are correlated with formateurs. This is in fact the case, as shown in section 5.

¹²Merlo (1997), and Diermeier, Eraslan and Merlo (2003) also link theory and empirical analysis explicitly by estimating a structural model of coalition governments. They focus on the types of governing coalitions that form and the length of time governments last, and do not examine the distribution of posts across the parties in government.

cabinet posts in parliaments.

We find that formateurs *do* enjoy sizable advantages. Also, after controlling for the formateur “bonus,” there is a linear relationship between a party’s share of the voting weight share in parliament and the share of cabinet posts it receives if it is part of the governing coalition. This suggests a more subtle interpretation to the importance of a party’s numerical strength and its power within the legislature. The large do not clearly dominate, but they may gain advantages from forming governments. These results also indicate that the proposal-based bargaining models, such as that of Baron and Ferejohn (1989), capture an essential feature of distributive politics – the advantage to being proposer.

2. Theory and Specification

In this section we derive a simple statistical model that captures the predictions of a variety of different models of coalition formation. We focus on bargaining models that make explicit predictions about the *ex post* distribution of payoffs – the actual division of government posts given that a particular coalition has formed. Many cooperative game theory solutions commonly used to study power, such as the Shapley-Shubik and Banzhaf indices, only characterize the *ex ante* distribution of expected payoffs (Shapley and Shubik, 1954; Banzhaf, 1965).

The distinction between *ex ante* and *ex post* payoffs is important for empirical research, since some data measure features of the *ex post* distribution and some data are more comparable to *ex ante* measures. Data on the distribution of public expenditures, in which a large number of separate budgetary and appropriations decisions are summed or averaged, are perhaps best compared to *ex ante* predictions. Data on coalition governments apply directly to the *ex post* predictions of non-cooperative models because the data available concern specific coalitions that have formed in particular ways – typically, in each case observed a specific party was recognized as formateur and succeeded in forming a government.

The equilibria of non-cooperative bargaining models in which decisions are made by majority rule – or any quota rule short of unanimity in which there are no veto players – typically feature a “competitive pricing” condition. This condition states that the equilibrium “price”

required to secure a player’s support is proportional to the player’s voting weight. Some cooperative solution concepts, such as bargaining aspirations and the demand bargaining set, make the same prediction (see, *e.g.*, Bennett, 1983a, 1983b; Morelli and Montero, 2003).

The logic underlying competitive pricing is straightforward. Consider two players, A and B , each with a vote weight of 1, and one player, C , with a voting weight of 2. Player C is a perfect substitute for the pair $\{A, B\}$ in terms of forming winning coalitions – each brings a voting weight of 2 to a coalition. Competition will then drive the cost of obtaining A ’s support to be the same as the cost of B ’s support, and it will also drive the cost of player C ’s support to be exactly twice that of A ’s (or B ’s). Any player D who tries to form a winning coalition should treat C and the pair $\{A, B\}$ as interchangeable and, thus, D should be willing to give the pair $\{A, B\}$ as many posts as it would give to C .

To operationalize this condition more generally, consider a weighted voting game in which $n \geq 3$ players bargain over the division of one “dollar” using simple majority rule. Let each player i ’s individual voting weight be w_i , and let the total voting weight in the game be $W = \sum_i^n w_i$. To keep things simple, we restrict attention to homogeneous games, which share the feature that all minimal winning coalitions have the same weight. Each homogeneous game has a unique minimal integer representation (see Isbell, 1956); assume that the w_i ’s are these minimal integer weights. Then the total voting weight of each minimum winning coalition is $(W+1)/2$ for W odd and $W/2+1$ for W even. We focus on the case of odd W and note that the following derivation is virtually identical for even W .¹³

The competitive pricing argument establishes that each potential coalition partner’s “price” should be proportional to her voting weight, but it does not pin down the exact value of the price. Thus it might be the case that each vote has a negligible cost, which would allow a formateur to assemble $(W+1)/2$ votes a very low cost and keep almost the entire dollar for herself. Alternately, votes could be so expensive that building a minimum winning coalition leaves the formateur with little more than that necessary to keep her in the coalition (*i.e.*, her own price). Clearly, these two extreme cases encompass a wide range of possibilities for the desirability of being a formateur.

¹³For some non-homogeneous games, the formulation below will only approximate the true relationship.

The empirical parameter of interest is therefore a number $c > 0$, such that for each player i the cost of obtaining i 's support is cw_i/W . Thus, c is the price per unit-share of voting weight. Suppose player j is the formateur. Then j will construct a minimal winning coalition and will pay each member of the coalition the required amount, and will pay zero to all the excluded players. Let x_i denote player i 's *ex post* payoff. Then for each $i \neq j$:

$$x_i = \begin{cases} cw_i/W & \text{if } i \text{ in coalition} \\ 0 & \text{if } i \text{ not in coalition,} \end{cases}$$

The total amount paid by the formateur is therefore $c\frac{W+1}{2W}$, so the formateur's share of the dollar is:

$$x_j = 1 - c\frac{W+1}{2W} + c\frac{w_j}{W}.$$

This is the dollar minus the amount paid to all coalition partners plus the amount that the formateur did not have to pay to herself because of her own votes.

Different bargaining games yield different predictions about the value of c and the size of the formateur's bonus. Demand bargaining models predict that each party receives an *ex post* payoff equal to its share of the voting weight in the winning coalition. The formateur cannot extract more than its proportionate share.¹⁴ This is also the prediction of the two-stage bargaining game of Montero (2003), and the demand bargaining set, a cooperative solution concept (Morelli and Montero, 2003). In this case, all players in the governing coalition, including the formateur, receive $x_i = cw_i/W$. This implies that $c = \frac{2W}{W+1}$, which means $c \approx 2$ for large values of W . Intuitively, the reason this occurs is that a minimum winning coalition contains approximately half of the total voting weight, and the subset of parties that form the government will divide the spoils (the dollar) among themselves in proportion to the voting weight that they contribute to the coalition.

The weighted voting version of the Baron-Ferejohn bargaining model with a closed rule and no discounting predicts that $c = 1$. That is, coalition partners are paid exactly their share of the total weight in the legislature, and the formateur receives a large surplus (see Montero, 2001; Snyder, Ting, and Ansolabehere, 2005).¹⁵

¹⁴See Morelli (1999). Also see Bennett and Van Damme (1991), who derive this from a different demand bargaining model for a special class of weighted voting games (apex games).

¹⁵Again, there is the caveat that non-homogeneous games will deviate slightly from these predictions. For

Variants of these models predict different values of c and the formateur bonus. It is implausible that $c > 2$, because then there would be no incentive for any formateur to build a coalition. A wide range of situations lead to values of $c > 1$. Under proposal bargaining, institutional features that make it more difficult to form a coalition, such as amendments, supermajority rules, and bicameralism, tend to weaken the proposer's bargaining position, resulting in a lower formateur advantage. These features might also increase c . As an example, consider the Baron-Ferejohn game, with three players each with a voting weight of 1. Under a closed rule, the formateur's payoff is $2/3$ and the partner's payoff is $1/3$ (which is $c = 1$). Under an open rule, the formateur's payoff is $3/5$ and the partner's payoff is $2/5$ ($c = 1.2$). A supermajority requirement in the Baron-Ferejohn model does not affect the value of c , but it does reduce the formateur's bonus.¹⁶ Risk aversion or discounting are likely to produce $c < 1$. These features increase the incentive of coalition partners to accept a proposal, thus lowering their price and strengthening the formateur's advantage.¹⁷

The competitive pricing condition leads immediately to a statistical specification. Let the dependent variable, Y_i , be the share of cabinet posts distributed to each party in a coalition. Let F_i be an indicator of whether party i is formateur of a government. Then,

$$\begin{aligned} Y_i &= F_i \left[1 - c \frac{W+1}{2W} + c \frac{w_i}{W} \right] + (1-F_i) \left[c \frac{w_i}{W} \right] \\ &= \left[1 - c \frac{W+1}{2W} \right] F_i + c \frac{w_i}{W}. \end{aligned}$$

Hence, a reasonable statistical specification is to regress parties' shares of posts on their shares of voting weights in the legislature, an indicator variable for formateur, and a constant:

$$Y_i = \beta_0 + \beta_1 F_i + \beta_2 \frac{w_i}{W} + \epsilon_i.$$

homogeneous games, the results are exact.

¹⁶See Proposition 2 in Snyder, Ting, and Ansolabehere (2005). Constitutional provisions requiring supermajorities for certain types of legislation are often cited as one factor that explains the existence of surplus coalitions. See, *e.g.*, chapters on Austria, Belgium, Finland and Germany in Mueller and Strom (2000).

¹⁷Baron and Ferejohn (1989), Harrington (1990a), and others prove many of these results for the case of unweighted majority games. Except for the supermajority condition noted, the extension to weighted voting games has not been worked out, but appears to be straightforward. Diermeier, Eraslan, and Merlo (2002) analyze a proposal-based game with bicameral governments. They note that Italy, Belgium (until 1995), and Sweden (until 1970) are the only European parliaments that require bicameral support of the government.

If any of the game theoretic bargaining models is the true model, then the intercept, β_0 , should equal zero. The coefficient β_2 provides an estimate of the price per unit of voting weight, c . The coefficient β_1 provides an estimate of $[1 - c\frac{W+1}{2W}]$. Note also that β_1 depends on c , as well as the total voting weight of the legislature, W . The ratio $(W+1)/2W$ is close to $1/2$, except for legislatures where the total voting weight is small. Thus, another specification check is whether the estimates of β_1 and β_2 imply the same value of c . Using the approximation $(W+1)/2W \approx 1/2$, this means $\beta_1 \approx 1 - \beta_2/2$.¹⁸ Further violations of the specification are non-linearities, either in the form of polynomials or interactions, which we examine as well.

Two features of the bargaining models, then, are relevant for statistical estimation. First, a linear regression relating shares of posts to shares of voting weights can be used to measure the “price” of coalition partners and the formateur effect and, thus, to test the key conjectures of the bargaining models. Second, the theoretically appropriate independent variable that measures a party’s bargaining strength is its share of the voting weight in the legislature.

3. Seats and Weights

As discussed in the previous section, the predictions of game theoretical legislative bargaining models are almost always expressed in terms of minimal integer voting weights – not seat shares. These voting weights can be derived from seat shares, but the relationship is not an immediate one.

An example drawn from recent electoral experiences illuminates the calculation of voting weights. Following the 2002 German National Election, the SPD had 251 seats in parliament, the CDU had 248 seats, the Greens had 55 seats, the Free Democrats had 47 seats, and the PDS had 2 seats. Three possible minimum winning coalitions could have formed: SPD-Greens, CDU-SPD, and CDU-Greens. Since the SPD, CDU, and Greens had equal bargaining leverage, they must all receive the same voting weight. The Free Democrats and the PDS are both “dummy” players – i.e., they are never members of any minimal winning

¹⁸A more complete specification, which incorporates the fact that $\frac{W+1}{2W}$ is not a constant but depends on W , is: $Y_i = \beta_0 + \beta_1 F_i + \beta_4 \frac{w_i}{W_k} + \beta_3 \frac{W_k+1}{2W_k} + \beta_2 F_i \frac{W_k+1}{2W_k} + \epsilon_i$, where W_k is the size of the k th legislature. We are unable to estimate this model, however, because of severe multicollinearity.

coalition – and receive zero voting weight. The minimum integer voting weights, then, are $(1,1,1,0,0)$.

The mathematical convenience of minimum integer voting weights masks an important complication in linking theory to data. Seat shares, which researchers observe, do not map readily into voting weights, which theorists analyze. The correspondence breaks down in both the relation of seats into voting weights and of voting weights into seats.

First, many different divisions of the seats can correspond to a single minimum integer weight representation. This is most apparent for three party games in which no party has an outright majority. All such coalition games have the minimum integer representation of $(1,1,1)$.

Second, the seat share for a given party may correspond to different bargaining situations and, thus, different voting weight shares, depending on the seat shares of other parties. Consider again the case of Germany in 2002. Suppose the CDU had won 235 seats, the SPD had won 264, the Greens 55, the Free Democrats 47, and the PDS 2. The altered division between the top two parties in this hypothetical case changes the set of possible minimum winning coalitions that can form. The new seat distribution results in new voting weights, even for those parties whose seats shares are the same as in the example above. Now, it is possible for the Free Democrats to enter minimum winning coalitions: they can join with the SPD or with the CDU and Greens to form minimum winning coalitions. The minimum integer voting weights in the hypothetical are $(2,1,1,1,0)$. In the actual situation (above) the Greens have voting weight share of $1/3$ and the Free Democrats have 0 share of the voting weight, but in the hypothetical example each of these parties has voting weight of $1/5$.

One can calculate the minimum integer voting weights in two steps. First, enumerate all possible coalitions and then search the space of all possible coalitions for sets of identical coalitions with smaller integer voting weights. For even modest-sized games this task becomes quite difficult, but can be done using non-linear simplex methods. We calculate the minimum integer voting weights for all parliaments using an algorithm developed by Strauss (2003).¹⁹

Figure 1 shows the empirical relationship between parties' *Share of Seats* among all parties

¹⁹This algorithm can be accessed at <http://web.mit.edu/polisci/>.

in a coalition and their *Share of Voting Weight* for parliamentary governments from 1946 to 2001.²⁰

[Figure 1 here]

The seat shares and voting weights correlate strongly, but, as the figure reveals, they differ in important ways. First, seat shares clearly overstate the voting weight of larger parties. The regression of seat shares on voting weight shares has a slope of 1.7 and an intercept of approximately 0. Second, the relationship shows several non-linearities. There are a large number of parliaments with three and four parties. The voting weights for all three player games are (1,1,1) and the weights for four player games are (2,1,1,1). These ratios appear in the graphs as horizontal clusters of cases with voting weight equal to 1/3 in the first case and 2/5 and 1/5 in the second case. Third, the association between seat shares and voting weight shares is not tight. The R^2 of the regression of seat shares on voting weight shares is .67. This will take the form of random measurement error in the regressor if one uses seat shares to test game theoretic models that are expressed in terms voting weights.²¹

Our goal is to test the conjectures of non-cooperative bargaining models, and that requires assessing parties' shares of voting weights.

4. Coalitions and Cabinet Allocations

The distribution of cabinet portfolios in parliamentary coalition governments provides an excellent field in which to test the *ex post* predictions of non-cooperative bargaining models. Researchers can readily observe voting weights of parties, who forms coalitions, and the allocation of cabinet ministries.

We study coalition governments from 1946 to 2001 in Australia, Austria, Belgium, Denmark, Finland, Germany, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway,

²⁰See section 4 for more information about the sample. This is approximately the same set of countries and parliaments used in other studies. For example, Warwick and Druckman (2001) study all of these countries except Australia and Portugal, over the period 1946-1989.

²¹The mean squared error from regressing Share of Seats on Share of Voting Weight is .14. This measures the standard deviation of the random measurement error. The standard deviation of Share of Voting Weight — the independent variable of interest — is .12. In other words, the variable Share of Seats equally reflects the true variation in Share of Voting Weight and random variation around that variable. These results are for the subset of parties in coalition governments. The results are similar for the entire sample.

Portugal, and Sweden. Data on parties' seat shares, government cabinet post allocations, and formateurs are from the following sources: data generously supplied by Paul Warwick, used in Warwick (1994); Brown and Dreijmanis (1982); Mueller and Strom (2000); and the *European Journal of Political Research* "Political Data Yearbook" special issues, 1992-2001.²² As in all previous work on government formation, we assume that each party's members vote as a bloc, and therefore each parliament may be viewed as a weighted voting game. Each observation is a party, and we only study parties that receive cabinet posts. We consider all parliaments in which no single party had an outright majority.²³

One difficulty with the parliamentary data is that the value of the different cabinet ministries is unknown. Almost all prior research has treated posts as equally valuable. Because the aim of this research is to show the value of the statistical model derived above and the importance of using weights instead of seats, we start with this measurement convention as well. Laver and Hunt (1992) and Warwick and Druckman (2001) offer thorough discussions of the values of different ministries. Laver and Hunt survey party leaders and find that Prime Minister is by far the most valuable post, usually followed by Finance and Foreign Affairs. It is difficult, however, to measure the relative valuation of the ministries beyond the obvious difference between Prime Minister and all others. Following Warwick and Druckman (2001), we also analyze the data under the assumption that the post of prime minister is more valuable than other ministries.²⁴ Specifically, we assign a relative value of 3 for prime minister and a value of 1 for all other posts. We estimate the specification developed above using both the simple and weighted shares of cabinet ministries as the dependent variable. As mentioned below, we tried many other weights as well. The unweighted model produces

²²Following previous researchers, we include all governments, including minority governments and non-minimal-winning governments, except a few cases where one party had an outright majority but still formed a coalition government. These cases were in the period immediately following World War II in the former axis powers, Austria, Italy, West Germany, plus a few in Australia. France is not included in the sample because of the fluid nature of the parties. We have yet to find a consistent data set on the votes, seats and cabinet portfolios of French parties. Interestingly, there are a few governments that include dummy players, a violation of most theoretical models of coalition formation. However, these occurrences arise almost entirely in the late 1940s, in governments of national unity.

²³Following previous work, we also omit all single-party governments. Almost by definition, including cases of single-party minority government would increase the estimated formateur bonus.

²⁴Warwick and Druckman (2001) use the ministerial rankings in Laver and Hunt to estimate values for all ministries. We do not attempt that here.

a conservative estimate of the formateur effect.

It is important to keep in mind that the contribution here is the use of the theoretically appropriate independent variable, voting weight shares, in testing models of legislative bargaining. Using voting weights instead of seat shares (the variable used in all previous research) radically changes the conclusions one draws about formateur effects and bargaining strength.

4.1. *Statistical Analysis*

Consider three party legislatures – those with weights (1,1,1). This is the most common alignment of party voting weights, covering 33 of the 245 parliaments in the data. Three party legislatures do not fit the prediction of strict proportionality, as predicted, say, by demand-bargaining. But these cases do fit the simple Baron-Ferejohn model of proposal-based bargaining rather well. Any two parties form a minimum winning coalition, and each party’s share of the voting weights within the government is 1/2. Strict proportionality predicts that the parties in the coalition government will split the posts 50-50, because each brings equal voting weight to the coalition. The closed-rule Baron-Ferejohn game predicts that the formateur should receive 66.7% of the posts in these games, and the partner 33.3%. The open-rule Baron-Ferejohn game predicts that the formateur should receive 60% of the posts in these games and the partner 40% (see Baron and Ferejohn, 1989, Table 1). In fact, on average the party that proposes the coalition government receives 60% of the government posts (without giving additional value to the prime minister). The standard deviation of the division of posts is .10. Giving added value to the prime minister’s post increases the formateur’s share of government posts to 63%, with a standard deviation of .09.

The multivariate regression model developed above provides a more general framework within which to test the overall appropriateness of the bargaining models. It also allows us to estimate of the price of coalition members’ votes, c .

Table 1 presents two regressions. In column (1) the dependent variable is the *Share of Posts* that a party received. In column (2) the dependent variable is the *Weighted Share of Posts*, where the post of Prime Minister has a weight of 3. We regress parties’ shares of

cabinet posts on their *Shares of Voting Weights* and on an indicator for the *Formateur*.

[Table 1]

The regression analyses show a significant formateur advantage. In column (1), the coefficient on the indicator of *Formateur* is .15, with a standard error of .05. The immediate interpretation of this coefficient is that a party receives 15% more of the ministries when it forms the government than when it does not, holding constant that party's share of the overall voting weight. The average government has 15 posts, so the estimated formateur effect translates into approximately 2 additional ministries. In column (2), the estimated formateur effect is .25, which translates into approximately 4 additional (weighted) posts.

The estimated formateur effects in Table 1 are not simply capturing the numerical advantage of the largest party, which is often the formateur. We conducted analyses parallel to those in Table 1 but omitting all coalitions in which the largest party was the formateur. The results are very similar. The specification corresponding to column (1) produces a formateur effect of .13 (s.e. = .04) and a slope on voting weights of 1.16 (s.e. = .12). The specification corresponding to column (2) produces a formateur effect of .23 (s.e. = .03) and a slope on voting weights of 1.02 (s.e. = .11). The sample size is smaller ($n = 254$), and the R^2 is somewhat smaller but still respectable (.61 and .73 in specifications (1) and (2), respectively).

Overall, the results in Table 1 provide strong evidence for proposal bargaining models. The large and statistically significant coefficient on *Formateur* provides strong evidence for models in which the party that sets the agenda has added leverage. The significant and sizable formateur effect clearly runs counter to the demand-bargaining approach. Also consistent with proposal bargaining, the coefficient on voting weight shares, β_2 , is close to 1. In the first panel, the regression coefficient is significantly larger than one, but the difference in the second panel, when Prime Minister is given added value, is not statistically different from 1. Thus, the estimated price of votes is about 1 or slightly higher. In both cases the data overwhelmingly reject the hypothesis that $\beta_2 = 2$, which is the value predicted by strict proportionality.

4.2. Comparison with Alternative Specifications

Past empirical research differs from the regressions in Table 1 in two ways. First, other specifications use seat shares instead of voting weights and are, therefore, not directly applicable to the predictions of most non-cooperative models. Second, other empirical studies define the independent variable to be conditional on being in the government, rather than as a fraction of all voting weights in the legislature. The theoretically appropriate specification uses voting weights as a fraction of all legislative voting weight.

Contrasting Table 1 and Table 2 reveals the consequences of these two specification choices. All four specifications in Table 2 use seat shares instead of voting weights. The first two regressions in the paper replicate specifications used in the prior research.²⁵ In columns (1) and (2), the independent variable is a party's share of the seats among all parties that are in the government, called *Share of Seats In Government*. Columns (3) and (4) parallel the specifications in Table 1. The independent variable is a party's share of *all seats* in the legislature, called *Share of All Seats*.

[Table 2]

The specification reported in column (1) replicates past findings about formateurs. The estimated coefficient on *Formateur* is tiny and statistically indistinguishable from 0. Giving the Prime Ministerial post a weight of 3 yields a larger and statistically significant formateur effect of .13.²⁶ However, it is difficult to interpret this number since it is not tied clearly to any analytical model.

Comparing columns (3) and (4) in Table 2 with columns (1) and (2) in Table 1 reveals the limitations of drawing inferences about bargaining models when seat shares are used as the independent variable. The coefficients on *Formateur* are substantially lower when seat shares are used instead of voting weights. Comparing column (3) of Table 2 with column (1) of Table 1, when seat shares are used the estimated formateur effect is .06, which is less than half as large as the estimated effect using voting weights.

It is noteworthy that the specification with seat shares has a slightly higher R^2 than

²⁵See, e.g., Equation 1 of Browne and Franklin (1973) or Table 2 of Warwick and Druckman (2001).

²⁶This is similar to results in Warwick and Druckman (2001).

the specification with voting weight shares. Because the statistical specifications are not nested, one cannot compare them from R^2 alone. Specifically, there is a very high degree of multicollinearity among the independent variables *Share of Seats*, *Share of Voting Weight* and *Formateur*.²⁷ As a result, one cannot nest these models and get reliable estimates of the coefficients on the variables. One way to test for the appropriateness of one specification over another in the face of high collinearity is the Davidson-McKinnon J -test (Greene, 2002, page 302). The J -test consists of, first, estimating the regression of post shares on vote shares plus a formateur effect and, second, including the predicted values from that regression in a regression of post shares on seat shares. If the seat shares specification is correct and the voting weight shares specification is incorrect then the coefficient on the predicted values should be approximately 0. The relevant t -test statistic ($\hat{\alpha}$ in Greene's notation) was 19.54, so we clearly cannot reject the voting weight specification in favor of the seat shares specification. Nor can we reject the seat shares specification in favor of the voting weight specification. Such inconsistencies often arise when there is insufficient data or when both specifications have some validity. It is, then, a matter for future study whether seat shares have additional predictive power beyond the specification using voting weights and the formateur indicator.

4.3. Specification Checks

Our results provide clear support for non-cooperative bargaining models, especially proposal bargaining, as in the Baron-Ferejohn model. Four important specification checks allow us to assess the empirical fit of the general approach and the specific model in question.

First, we tested for the linearity of the relationship between weight shares and post shares by including a polynomial specification of voting weight shares. Including *Weight Share*, *Weight Share Squared*, and *Weight Share Cubed* did not affect the estimated formateur effects. The formateur effect is .15 (s.e. = .02) using unweighted data and .25 (s.e. = .02) using prime minister weighted data. The coefficient on weight share went up somewhat in

²⁷The correlation of seat shares with voting weight shares and formateur is .9. The auxiliary R^2 of seat shares on voting weight shares plus formateur is above .8, and it is over .9 for parliaments involving more than 7 parties.

both specifications. Neither *Weight Share Squared* nor *Weight Share Cubed* had statistically significant effects on their own, though an F -test shows that one cannot reject their joint significance. The problem is that weight share squared and cubed are correlated .98 and are highly collinear with weight share.

A related non-linear specification looks for interactions among the independent variables. We also estimated interactive terms, $\text{Formateur} \times \text{Share of Weight}$, for each of the specifications. The interaction effect picks up some of the formateur effect in the regression. But, again, there is a high degree of collinearity. *Formateur* and $\text{Formateur} \times \text{Share of Weight}$ are correlated .93. In sum, it is difficult to justify and estimate a non-linear specification with the parliamentary data because *Share of Voting Weight* is highly correlated with polynomials of that variable and interactions with the *Formateur* indicator.

Two additional checks apply to the overall competitive pricing bargaining framework. One implication of the competitive pricing condition is that the constant term in the regression ought to equal zero. The constant is .07 in column (1) of Table 1, and .06 in column (2). This translates into about 1 cabinet post in the average coalition government. The estimates are statistically different from 0, violating both the proposal-based and demand-based bargaining models.

A second test derives from the analytical model presented in section 2. The prices implied by the formateur effect should be consistent with those contained in the slope parameter. In column (1) of Table 1, the value of c estimated directly from the coefficient on *Share of Voting Weight* in the legislature is 1.12. The implied value of c from the coefficient on *Formateur* is approximately 1.55.²⁸ The F -statistic for testing the hypothesis that the estimated values of c are equal is 3.18, with a p -value of .10. In column (2) the estimated and implied values of c are .98 and 1.36, respectively, the F -statistic for the hypothesis that they are equal is 1.48, and the p -value is .24. Both models therefore do not fail this test.

We suspect that the non-zero intercept is accounted for by the “lumpiness” of ministries. It may be impossible to divide a single post. As a result, the formateur may have to give away too much because it has to give something to every partner. Relatedly, many theoretical

²⁸The coefficient on *Formateur* is .15, and the average value of $(W+1)/2W$ is .55, so the implied value of c solves $.15 = 1 - .55c$.

results apply to homogeneous games, and about half of the coalition governments are non-homogeneous, which raises problems in calculating predicted divisions of ministries.²⁹ The exact explanation for the non-zero intercept deserves further attention.

The intercept might also arise as a prediction of some models. The pricing logic is only approximately true in some situations (see Snyder, Ting, and Ansolabehere 2005). We consider such cases for the closed rule Baron-Ferejohn model and conducted an analysis paralleling that in Table 1. The estimated value of the intercept falls by half, but is still statistically distinguishable from 0. The estimated formateur effect remains substantial, though below the predictions of the model, and the estimate of β_2 rises slightly.³⁰

A final possible explanation concerns the measure of the value of the posts. We attempt to correct for this problem by imputing various weights to different ministries, following the method of Warwick and Druckman (2001). In columns (2) of Table 1 and (2) and (4) of Table 2 we give the Prime Minister weight of 3. This only increases the formateur effect. In a set of estimates, not presented, we use the rank order data and imputed a range of possible alternative weights (for example, Prime Minister 10, Treasury 5, Foreign Affairs 5, and all others 1). In all of these estimates, the formateur effect was larger than in the Unweighted estimates in Tables 1 and 2. The estimates using the simple shares of posts, then, appear to be biased downward and are a conservative estimate of the formateur effect.

A fourth specification test relates to the closed rule version of the Baron-Ferejohn model. The average value of $(W+1)/2W$ in the data is .55, so the Baron-Ferejohn model predicts that the formateur effect should be approximately .45. The estimated formateur effect in column (1) of Table 1 is just one-third of the predicted value, and the estimate in column (2) is one-half of the predicted value.

The broad empirical picture is consistent with non-cooperative bargaining models. The division of cabinet portfolios is proportionate to the distribution of voting weight shares.

²⁹Non-homogeneous games are more likely to occur with larger numbers of players (Strauss 2003). In non-homogeneous games, there will be portfolios that are minimum winning but whose total voting weight exceeds the minimum winning threshold. Because every coalition member gets at least one post, smaller parties in non-homogeneous games may receive slightly more than their share of the voting weight.

³⁰For the our sample of parliamentary governments, the regression of the simple Baron-Ferejohn payoffs on Voting Weight Shares has an intercept of .02, which is statistically different from 0, and a slope of .98.

And, consistent with proposal bargaining models, there is a substantial and significant formateur advantage. Two important failings in the estimates, though, arise. Small parties seem to do better than expected, as suggested by the significant positive intercept, and the formateur advantage, while considerable, is smaller than predicted by the closed rule version of the Baron-Ferejohn model. We do not view these failings as critical (especially the former), but instead see them as opportunities for more focused theoretical investigation. More subtle formulations of proposal bargaining, such as allowing for amendments in the Baron-Ferejohn model, might produce predictions consistent with the empirical patterns noted here.³¹

5. Who Becomes Formateur?

One normative question motivating our research is the equity or fairness in the distribution of positions of power – most importantly, do the large dominate the small? The results above show that shares of cabinet posts are nearly proportionate to the voting weight contributed by parties to coalitions. This pattern suggests that the distribution of posts is, in some sense, “fair.” However, we have also found that formateurs receive a disproportionate share. To address the matter of equity fully, we must also consider who is formateur.

Diermeier and Merlo (1999) study formateur selection in parliaments of 12 countries. They examine the order in which parties are recognized to be formateur, and document that formateur selection is roughly proportionate to seat shares, with the additional caveat that the “incumbent” formateur is much more likely to be recognized first.

Here, we examine which party succeeds in forming a government, rather than the order of recognition. If larger parties are disproportionately more likely to succeed, then they may gain undue bargaining advantages because they have more opportunities to make proposals.³²

Table 3 presents a multivariate analysis of the likelihood that a party is formateur. The probability of being formateur is estimated as a function of a party’s *Share of Voting Weight*, its *Share of Seats*, its rank (*Largest Party* and *Second Largest Party*), and an indicator of

³¹We know of no general characterization of the open rule proposal bargaining model.

³²Merlo (1997) presents two theoretical examples in which post shares are predicted to be proportional to seat shares. This follows from two key assumptions: (i) “proto-coalitions” bargain under unanimity rule (even when they are surplus coalitions), and (ii) players’ proposal probabilities are equal to their share of seats in any proto-coalition. Evidently, this second assumption is only true to a first approximation.

whether that party was formateur in the previous government (*Incumbent Formateur*). We use probit estimates with standard errors clustered for each coalition. We also modeled the data using conditional logits, which estimates a fixed effect for each coalition. The results were very similar.

[Table 3]

The probits suggest that larger parties have a disproportionately higher chance of being proposer than smaller parties. Columns (1) and (2) reveal that voting weight shares and seat shares separately predict who is formateur. Columns (3) and (4) reveal that party rank matters, perhaps even more than numerical strength. Including indicators of the largest and second largest parties, the coefficient on seat shares falls but remains statistically significant and the coefficient on voting weight shares is no longer significant on its own. The coefficients on largest party and second largest party reveal that controlling for the sizes of the party and their voting weight shares, the largest party is twice as likely as the second largest party to form a government. As with Diermeier and Merlo's findings, the party that formed the previous coalition government has a higher chance to form the current government.³³

6. Conclusions

This paper has linked two important literatures on coalition politics – one theoretical, the other empirical. Empirical study of cabinet formation has uncovered important regularities, especially the proportional relationship between parties' shares of seats and their shares of cabinet ministries. Over the last two decades a large literature has emerged using non-cooperative game theoretic models of bargaining to understand the composition of legislative coalitions. Although some theorists reference the empirical literature to support specific assumptions or results, the relationship between these two literatures has been remote. Data on coalitions have rarely been used to test directly the predictions of game theoretic bargaining models because their predictions are usually expressed in terms of voting weights, while

³³One caution with model 4 is that there is a fair amount of collinearity among the independent variables. In particular, the coefficients on voting weight shares and seat shares may be poorly estimated in specifications (3) and (4). The auxiliary regression predicting voting weight shares with seat shares, party ranks, and formateur incumbency has an R^2 of .91. A joint F -test reveals that voting weights and seat shares are both highly significant ($p < .0002$).

most empirical research studies parties' shares of seats. Minimum integer voting weights simplify mathematical analyses, but they deviate from the practice of empirical research because voting weights are imperfectly correlated with seat shares.

We have used data on seat shares to construct minimum integer voting weights. We then use voting weights plus an indicator of the party that formed the government to predict shares of posts. With this more finely tuned independent variable we are able to speak directly to the main predictions of recent theoretical work.

Two inferences about the theoretical models deserve emphasis. First, consistent with non-cooperative bargaining models generally, the allocation of cabinet posts is proportionate to voting weight shares. This result captures the intuition of competitive pricing that lies behind non-cooperative bargaining models. Namely, the cost of acquiring one partner with a voting weight of k should equal that of k partners each with weight of 1. Second, there is a strong, significant formateur advantage. This result is consistent with proposal-based bargaining models as captured in Baron and Ferejohn (1989) and elsewhere. The size of that effect is smaller than the value predicted by the closed rule version of the Baron-Ferejohn model, but is potentially consistent with the open rule version of the model. Also, the direct estimate of the price of a partner is approximately that predicted by the closed rule Baron-Ferejohn model.

The relatively simple and stylized non-cooperative bargaining models do surprisingly well at describing the distribution of cabinet portfolios. However, the data point to other important challenges for further theoretical inquiry. Perhaps most important among these is explaining "surplus coalitions," which contain more parties than the minimum needed, and "minority governments," which do not have a majority of seats. The open rule version of the model can yield surplus coalitions, but all coalitions are winning. Indeed, all models of pure divide-the-dollar politics appear to have this feature. Our reading of the literature is that a model probably requires both ideological and distributive components in order to predict minority governments.³⁴ Unfortunately, as Jackson and Moselle (2002) show, general mod-

³⁴Models that incorporate both features include Crombez (1996), Diermeier and Merlo (2000), Jackson and Moselle (2002), and Diermeier, Eraslan, and Merlo (2003). In the absence of an ideological dimension, Baron (1998) finds that minority governments may form when players heavily discount future payoffs. Laver

els of divide-the-dollar politics with even a single ideological dimension do not yield sharp predictions about the distribution of payoffs without highly restrictive assumptions. Characterization and testing of the predictions of such models await further study. Our results are generally encouraging about proposal bargaining as a suitable approach to addressing these questions.

Finally, our findings are instructive about an important normative concern – that the large dominate the small. In one respect, the division of cabinet ministries runs contrary to expectations: there is a slight advantage to those with relatively small shares of voting weight, as the intercept in the regressions is higher than 0. However, the formateur advantage does suggest a route through which larger parties may dominate in legislative bargaining. The formateur advantage is substantial, and the largest party, more often than not, is the formateur. It is through the power to propose, then, that larger parties apparently gain disproportionate political advantage.

and Shepsle (1990) develop a model of the division of posts with two ideological dimensions, but to avoid cycling they assume strong restrictions on the space of feasible outcomes.

REFERENCES

- Ansolabehere, Stephen, Alan Gerber and James M. Snyder, Jr. 2002. "Equal Votes, Equal Money: Court Ordered Redistricting and the Distribution of Public Expenditures in the American States." *American Political Science Review* 96(4): 767-777.
- Ansolabehere, Stephen, James M. Snyder, Jr., and Michael M. Ting. 2003. "Bargaining in Bicameral Legislatures: When and Why Does Malapportionment Matter?" *American Political Science Review* 97(3): 471-481.
- Atlas, Cary M., Thomas W. Gilligan, Robert J. Hendershott, and Mark A. Zupan. 1995. "Slicing the Federal Net Spending Pie: Who Wins, Who Loses, and Why." *American Economic Review* 85(3): 624-629.
- Austen-Smith, David, and Jeffrey Banks. 1988. "Elections, Coalitions, and Legislative Outcomes" *American Political Science Review* 82(2): 405-422.
- Banks, Jeffrey S., and John Duggan. 2000. "A Bargaining Model of Collective Choice." *American Political Science Review* 94(1): 73-88.
- Banzhaf, John F., III. 1965. "Weighted Voting Doesn't Work: A Mathematical Analysis." *Rutgers Law Review* 19(2): 317-343.
- Baron, David, and John Ferejohn. 1989. "Bargaining in Legislatures." *American Political Science Review* 83(4): 1181-1206.
- Baron, David. 1991. "A Spatial Theory of Government Formation in Parliamentary System." *American Political Science Review* 85(1): 137-164.
- Baron, David. 1996. "A Dynamic Theory of Collective Goods Programs." *American Political Science Review* 90(2): 316-330.
- Baron, David. 1998. "Comparative Dynamics of Parliamentary Governments." *American Political Science Review* 92(3): 593-609.
- Baron, David, and Ehud Kalai. 1993. "The Simplest Equilibrium of a Majority-Rule Division Game." *Journal of Economic Theory* 61(2): 290-301.
- Bennett, Elaine. 1983a. "The Aspiration Approach to Predicting Coalition Formation and Payoff Distributions in Sidepayment Games." *International Journal of Game Theory* 12(1): 1-28.
- Bennett, Elaine. 1983b. "Characterization Results for Aspirations in Games with Sidepayments." *Journal of Mathematical Social Science* 4(3): 229-241.
- Bennett, Elaine, and Eric Van Damme. 1991. "Demand Commitment Bargaining: The Case of Apex Games." In *Game Equilibrium Models III: Strategic Bargaining*, edited by R. Selten. Berlin: Springer Verlag, pp. 118-136.

- Browne, Eric C. and John Dreijmanis. 1982. *Government Coalitions in Western Democracies*. New York: Longman, Inc.
- Browne, Eric C., and Mark N. Franklin. 1973. "Aspects of Coalition Payoffs in European Parliamentary Democracies." *American Political Science Review* 67(2): 453-469.
- Browne, Eric C., and John P. Frendreis. 1980. "Allocating Coalition Payoffs by Conventional Norm: An Assessment of the Evidence from Cabinet Coalition Situations." *American Journal of Political Science* 24(4): 753-768.
- Browne, Eric C., and Peter Rice. 1979. "A Bargaining Theory of Coalition Formation." *British Journal of Political Science* 9(1): 67-87.
- Browning, Clyde E. 1973. "The Geography of Federal Outlays." Studies in Geography No. 4. Chapel Hill: University of North Carolina Department of Geography.
- Calvert, Randall, and Nathan Dietz. 1996. "Legislative Coalitions in a Bargaining Model with Externalities." Unpublished manuscript, University of Rochester.
- Calvo, Emilio, and J. Javier Lasaga. 1997. "Probabilistic Graphs and Power Indices: An Application to the Spanish Parliament." *Journal of Theoretical Politics* 9(4): 477-501.
- Carmignani, Fabrizio. 2001. "Cabinet Formation in Coalition Systems." *Scottish Journal of Political Economy* 48(3): 313-329.
- Crombez, Christophe. 1996. "Minority Governments, Minimal Winning Coalitions and Surplus Majorities in Parliamentary Systems." *European Journal of Political Research* 29(1): 1-29.
- Dahl, Robert A. 1956. *A Preface to Democratic Theory*. Chicago: University of Chicago Press.
- Diermeier, Daniel, and Timothy J. Feddersen. 1998. "Cohesion in Legislatures and the Vote of Confidence Procedure." *American Political Science Review* 92(3): 611-622.
- Diermeier, Daniel, and Antonio Merlo 1999. "An Empirical Investigation of Coalitional Bargaining Procedures." Northwestern University, Center for Mathematical Studies in Economics and Management Science, Discussion Paper No. 1267.
- Diermeier, Daniel, and Antonio Merlo 2000. "Government Turnover in Parliamentary Democracies." *Journal of Economic Theory* 94(1): 46-79.
- Diermeier, Daniel, Hulya Eraslan, and Antonio Merlo. 2002. "Bicameralism and Government Formation." Unpublished manuscript, University of Pennsylvania.
- Diermeier, Daniel, Hulya Eraslan, and Antonio Merlo. 2003. "A Structural Model of Government Formation." *Econometrica* 71(1): 27-70.

- Eraslan, Hulya. 2002. "Uniqueness of Stationary Equilibria Payoffs in the Baron-Ferejohn Model." *Journal of Economic Theory* 103(1): 11-30.
- Eraslan, Hulya, and Antonio Merlo. 2002. "Majority Rule in a Stochastic Model of Bargaining." *Journal of Economic Theory* 103(1): 31-48.
- Erie, Stephen P. 1978. "Politics, the Public Sector, and Irish Social Mobility: San Francisco, 1870-1900." *Western Political Quarterly* 31(2): 274-289.
- Gamson, William A. 1961. "A Theory of Coalition Formation." *American Sociological Review* 26(3): 373-382.
- Gibson, Edward L., Ernesto F. Calvo, and Tulia G. Falleti. 2004. "Reallocative Federalism: Overrepresentation and Public Spending in the Western Hemisphere." In *Federalism and Democracy in Latin America*, edited by Edward L. Gibson. Baltimore, MD: The Johns Hopkins University Press, pp. 173-196.
- Greene, William H. 2002. *Econometric Analysis*. Englewood Cliffs, NJ: Prentice-Hall.
- Harrington, Joseph. 1989. "The Advantageous Nature of Risk Aversion in a Three-Player Bargaining Game Where Acceptance of a Proposal Requires a Simple Majority." *Economics Letters* 30(3): 195-200.
- Harrington, Joseph. 1990a. "The Power of the Proposal Maker in a Model of Endogenous Agenda Formation." *Public Choice* 64(1): 1-20.
- Harrington, Joseph. 1990b. "The Role of Risk Preferences in Bargaining When Acceptance of a Proposal Requires Less than Unanimous Approval." *Journal of Risk and Uncertainty* 3(2): 135-154.
- Holden, Matthew. 1973. *White Man's Burden*. New York: Chandler.
- Holler, Manfred J. 1982. "Forming Coalitions and Measuring Power." *Political Studies* 30(2): 262-271.
- Holler, Manfred J. 1987. "Paradox Proof Decision Rules in Weighted Voting." In *The Logic of Multiparty Systems*, edited by M.J. Holler. Dordrecht, The Netherlands: Martinus Nijhoff, pp. 425-436.
- Horiuchi, Yusaku, and Jun Saito. 2003. "Reapportionment and Redistribution: Consequences of Electoral Reform in Japan." *American Journal of Political Science* 47(4): 669-682.
- Isbell, J.R. 1956. "A Class of Majority Games." *Quarterly Journal of Math. Oxford* 7(27): 183-187.
- Jackson, Matthew, and Boaz Moselle. 2002. "Coalition and Party Formation in a Legislative Voting Game." *Journal of Economic Theory* 103(1): 49-87.

- Johnston, Michael. 1979. "Patrons and Clients, Jobs and Machines: A Case Study of the Uses of Patronage." *American Political Science Review* 73(2): 385-398.
- Kalandrakis, Anastassios. 2004a. "A Three-Player Dynamic Majoritarian Bargaining Game." *Journal of Economic Theory* 116(2): 294-322.
- Kalandrakis, Anastassios. 2004b. "Bicameral Winning Coalitions and Equilibrium Federal Legislatures." *Legislative Studies Quarterly* 29(1): 49-79.
- Laver, Michael, and W. Ben Hunt. 1992. *Policy and Party Competition*. New York: Routledge.
- Laver, Michael, and Kenneth Shepsle. 1990. "Coalitions and Cabinet Government." *American Political Science Review* 84(3): 873-890.
- LeBlanc, William, James M. Snyder, Jr., and Micky Tripathi. 2000. "Majority-Rule Bargaining and the Under Provision of Public Investment Goods." *Journal of Public Economics* 75(1): 21-47.
- Lee, Frances, and Bruce L. Oppenheimer. 1999. *Sizing Up the Senate: The Unequal Consequences of Equal Representation*. Chicago: University of Chicago Press.
- Levitt, Steven D. and James Snyder. 1995. "Political Parties and the Distribution of Federal Outlays." *American Journal of Political Science* 39(4): 958-980.
- McCarty, Nolan M. 2000a. "Proposal Rights, Veto Rights, and Political Bargaining." *American Journal of Political Science* 44(3): 506-522.
- McCarty, Nolan M. 2000b. "Presidential Pork: Executive Veto Power and Distributive Politics." *American Political Science Review* 94(1): 117-129.
- McKelvey, Richard D., and Raymond Riezman. 1992. "Seniority in Legislatures." *American Political Science Review* 86(4): 951-965.
- Merlo, Antonio. 1997. "Bargaining Over Governments in a Stochastic Environment." *Journal of Political Economy* 105(1): 101-131.
- Mershon, Carol. 2001. "Contending Models of Portfolio Allocation and Office Payoffs to Party Factions: Italy, 1963-79." *American Journal of Political Science* 45(2): 277-293.
- Montero, Maria. 2001. "The Nucleolus as a Consistent Power Index in Noncooperative Majority Games." Unpublished manuscript, University of Nottingham.
- Montero, Maria. 2003. "Proportional Payoffs in a Model of Two-Stage Bargaining with Reversible Coalitions." Unpublished manuscript, University of Nottingham.
- Morelli, Massimo. 1999. "Demand Competition and Policy Compromise in Legislative Bargaining." *American Political Science Review* 93(4): 809-820.

- Morelli, Massimo, and Maria Montero. 2003. "The Demand Bargaining Set: General Characterization and Application to Majority Games." *Games and Economic Behavior* 42(1): 137-155.
- Mueller, Wolfgang C., and Kaare Strom. 2000. *Coalition Governments in Western Europe*. Oxford: Oxford University Press.
- Norman, Peter. 2002. "Legislative Bargaining and Coalition Formation." *Journal of Economic Theory* 102(2): 322-353.
- Owens, John R., and Larry L. Wade. 1984. "Federal Spending in Congressional Districts." *Western Political Quarterly* 37(3): 404-423.
- Penrose, L. S. 1946. "The Elementary Statistics of Majority Voting." *Journal of the Royal Statistical Society* 109(1): 53-57.
- Rakove, Milton. 1975. *Don't Make No Waves, Don't Back No Losers*. Bloomington, IN: Indiana University Press.
- Rapoport, Amnon, and Esther Golan. 1985. "Assessment of Political Power in the Israeli Knesset." *American Political Science Review* 79(3): 673-692.
- Ritt, Leonard G. 1976. "Committee Position, Seniority, and the Distribution of Government Expenditures." *Public Policy* 24(4): 463-489.
- Rodden, Jonathan. 2002. "Strength in Numbers? Representation and Redistribution in the European Union." *European Union Politics* 3(2): 151-175.
- Rubinstein, Ariel. 1982. "Perfect Equilibrium in a Bargaining Model." *Econometrica* 50(1): 97-109.
- Schofield, Norman. 1976. "The Kernel and Payoffs in European Government Coalitions." *Public Choice* 26(Summer): 29-49.
- Schofield, Norman. 1978. "Generalized Bargaining Sets for Cooperative Games." *International Journal of Game Theory* 7(2): 183-199.
- Schofield, Norman. 1982. "Bargaining Set Theory and Stability in Coalition Governments." *Mathematical Social Sciences* 3(1): 9-32.
- Schofield, Norman. 1987. "Bargaining in Weighted Majority Voting Games." In *The Logic of Multiparty Systems*, edited by M.J. Holler. Dordrecht, The Netherlands: Martinus Nijhoff, pp. 137-152.
- Schofield, Norman, and Michael Laver. 1985. "Bargaining Theory and Portfolio Payoffs in European Coalition Governments 1945-1983." *British Journal of Political Science* 15(2): 143-164.

- Selten, Reinhardt. 1981. "A Noncooperative Model of Characteristic Function Bargaining." In *Essays in Game Theory and Mathematical Economics in Honor of Oskar Morgenstern*, edited by Robert Aumann, John Harsanyi, Werner Hildebrand, Michael Muschler, M.A. Perls, Joachim Rosenmuller, Reinhardt Selten, Martin Shubik, and G.L. Thompson. Mannheim: Bibliographisches Institut, pp. 131-51.
- Selten, Reinhardt. 1992. "A Demand Commitment Model of Coalitional Bargaining." In *Rational Interaction*, edited by Reinhardt Selten. New York: Springer-Verlag, pp. 245-282.
- Shapley, Lloyd S., and Martin Shubik. 1954. "A Method for Evaluating the Distribution of Power in a Committee System." *American Political Science Review* 48(3): 787-792.
- Shepsle, Kenneth A. 1978. *The Giant Jigsaw Puzzle*. Chicago: University of Chicago Press.
- Snyder, James M., Jr., Michael M. Ting, and Stephen Ansolabehere. 2005. "Legislative Bargaining Under Weighted Voting." *American Economic Review*, forthcoming.
- Strauss, Aaron B. 2003. "An Algorithm to Calculate Minimum Integer Weights for Arbitrary Voting Games." Masters of Science Thesis. Department of Computer Science, Massachusetts Institute of Technology.
- Strom, Kaare, Ian Budge, and Michael J. Laver. 1994. "Constraints on Cabinet Formation in Parliamentary Democracies." *American Journal of Political Science* 38(2): 303-335.
- Strömberg, David. 2004. "Radio's Impact on Public Spending." *Quarterly Journal of Economics* 119(1): 189-221.
- Wallis, John J. 1987. "Employment, Politics and Economic Recovery during the Great Depression." *Review of Economics and Statistics* 69(3): 516-520.
- Wallis, John J. 1996. "What Determines the Allocation of National Government Grants to the States?" NBER Historical Paper No. 90.
- Warwick, Paul V. 1994. *Government Survival in Parliamentary Democracies*. Cambridge: Cambridge University Press.
- Warwick, Paul V., and James N. Druckman. 2001. "Portfolio Salience and the Proportionality of Payoffs in Coalition Governments." *British Journal of Political Science* 31(4): 627-649.
- Winter, Eyal. 1996. "Voting and Vetoing." *American Political Science Review* 90(4): 813-823.
- Wright, Gavin. 1974. "The Political Economy of New Deal Spending: An Econometric Analysis." *Review of Economics and Statistics* 56(1): 30-38.

<p style="text-align: center;">Table 1 Voting Weight and Formateur Effects in the Allocation of Cabinet Posts in Parliamentary Governments, 1946-2001</p> <p style="text-align: center;">Dep. Var. = Share of Cabinet Posts</p>		
	Unweighted	PM Weighted
	(1)	(2)
Formateur (β_1)	.15* (.05)	.25* (.04)
Share of Voting Weight (β_2)	1.12* (.13)	.98* (.11)
Constant	.07* (.02)	.06* (.02)
R^2	.72	.82
# Observations	680	680

Clustered standard errors in parentheses, where each cluster is a country.

* statistically significant at the .01 level

Table 2
Seat Shares, Formateur Effects
and the Allocation of Cabinet Posts
in Parliamentary Governments, 1946-2001

Dep. Var. = Share of Cabinet Posts

	Share of Seats In Gov't		Share of All Seats	
	Unweighted (1)	PM Weighted (2)	Unweighted (3)	PM Weighted (4)
Formateur	-.01 (.01)	.12* (.01)	.06* (.02)	.18* (.02)
Share of Seats	.82* (.04)	.71* (.03)	1.13* (.09)	.98* (.09)
Constant	.07* (.01)	.06* (.01)	.10* (.02)	.09* (.01)
R^2	.90	.93	.80	.87
# Observations	680	680	680	680

Clustered standard errors in parentheses, where each cluster is a country.

* statistically significant at the .01 level

Table 3
Probit Estimates of the Likelihood
that a Party is Formateur
in Parliamentary Governments, 1946-2001

Dep. Var. = 1 if party is formateur

	(1)	(2)	(3)	(4)
Share of Voting Weight	7.77* (.43)	—	1.58 (.69)	1.58 (.70)
Share of Seats	—	6.64* (.28)	1.63* (.59)	.86 (.63)
Largest Party	—	—	1.64* (.25)	1.46* (.26)
Second Largest Party	—	—	0.85* (.20)	0.87* (.20)
Incumbent Formateur	—	—	—	.84* (.16)
Constant	-2.65* (.11)	-2.45* (.07)	-2.39* (.10)	-2.38* (.11)
log-likelihood	-480.6	-449.3	-410.6	-367.8
pseudo- R^2	.33	.37	.43	.45
# Observations	1744	1744	1744	1591

Clustered standard errors in parentheses, where each cluster is a government.

* statistically significant at the .01 level

Figure 1
Relationship Between Seats and Weights
in Coalition Governments, 1946-2001

