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BARGAINING IN LEGISLATURES: AN EMPIRICAL INVESTIGATION

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ABSTRACT

While the theoretical literature on non-cooperative legislative bargaining has grown voluminous, there is little empirical work attempting to test a key prediction in this literature: proposal power is valuable. This paper aims to fill this gap in the literature by investigating the role of proposal power in the allocation of transportation projects across U.S. Congressional districts in 1991 and 1998. The evidence supports the key qualitative prediction of the Baron and Ferejohn legislative bargaining model: members with proposal power, those sitting on the transportation authorization committee, secure more project spending for their districts than do other representatives. Support for the quantitative restrictions on the value of proposal power, which are more powerful than the qualitative restrictions, is more mixed. I then empirically address several alternative models of legislative behavior, including partisian models, informational roles for committees, models with appropriations committees, and theories of committees as preference outliers.

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"Our office was approached and offered \$15 million for projects in Tulsa, and I told them my vote was not for sale. It was just \$15 million, dangling, cash for projects in the 1st Congressional District"

U.S. Rep. Steve Largent (R, OK).[1]

1 Introduction

While the theoretical literature on non-cooperative legislative bargaining has grown voluminous, there is little empirical work attempting to test a key prediction in this literature: proposal power is valuable. This paper aims to fill this gap in the literature by investigating the role of proposal power in the allocation of Congressionally earmarked transportation projects across Congressional districts in 1991 and 1998. Throughout the legislative process, the transportation committee was granted significant proposal powers, thereby allowing for a direct test of this theoretical prediction.

For several reasons, Congressional negotiations over the allocation of transportation funds are well suited to an empirical test of predictions from non-cooperative bargaining models. First, these episodes meet the classic definition of a bargaining situation, which exists when agents engaged in negotiations have a common interest in agreement but conflicting preferences over the terms of agreement (Muthoo, 1999). While there was widespread interest within Congress in funding these transportation projects, there was sharp disagreement and significant controversy over the cross-district allocation, which, in the end, was skewed for the benefit of members of the transportation committee. Second, while payoffs are difficult to measure in many bargaining environments, the distribution of transportation projects across Congressional districts is both observable and publicly available. Third, the stakes involved in Congressional bargaining tend to be large. The funding for the transportation projects examined here totaled \$5 billion in 1991 and \$8 billion in 1998, and these funds translate into increased re-election probabilities. Levitt and Snyder (1997) estimate that an additional \$100 per capita in federal spending is worth as much as 2 percentage points of the popular vote for the incumbent in Congressional elections. Fourth, these funds were earmarked for specific projects in Congressional districts, rather than distributed to states according to formula, giving representatives significant discretion over the allocation of project spending across districts. Finally, while bargaining procedures are difficult to discern in many economic settings, Congressional procedures of voting and proposals are well documented and correspond in a reasonable way to the process outlined in bargaining models.

[1] Transcript from The News Hour with Jim Lehrer, March 30, 1998.

The empirical specification in this paper adheres as closely as possible to the non-cooperative legislative bargaining model of Baron and Ferejohn (1989, 1993), which is itself closely related to the seminal bargaining model of Rubinstein (1983). I incorporate only the following necessary modifications to the Baron and Ferejohn model: committees of multiple representatives, rather than a single proposer, and recognition probabilities that vary across representatives. This paper first provides a simple test of the predictions of this legislative bargaining model regarding the value of proposal power. The evidence supports the key qualitative prediction of the legislative bargaining model: members with proposal power, those sitting on the transportation committee, secure higher project spending than do other districts. Support for the quantitative predictions, which are more powerful than the qualitative predictions, is more mixed. I then empirically address several alternative theories of legislative organization and behavior.

2 Related Literature

A related empirical literature has documented a positive correlation between federal spending in jurisdictions and representation by politically powerful Congressional delegations. Ferejohn (1974) finds that states with Congressional representatives on relevant committees, especially those with tenure or in the majority party, received more water projects than other states. Atlas et. al (1995) show that inequality in per-capita political clout, due in part to each state having two Senators regardless of population, has predictable and significant effects on the distribution of federal spending, net of federal taxes, across states. Levitt and Poterba (1999) find that states with powerful representatives, captured through seniority and service on influential committees, experienced more rapid economic growth than states with less powerful delegations. My empirical analysis of transportation projects offers several advantages over this existing literature. First, I correct for the possibility of preference outliers among the transportation committee members using fixed effects and instrumental variables approaches. Second, the theoretically-guided approach used in my paper allows for a more powerful test of the model. In addition to the qualitative predictions examined in the existing literature, the theoretical legislative bargaining model provides quantitative restrictions on the value of proposal power. Finally, I consider specific Congressional bargaining episodes, tightening the connection between the theoretical model of legislative bargaining and the empirical analysis. The previous literature has tended to aggregate bargaining outcomes across either federal spending programs or time.[2]

[2] A related literature studies the relationship between political power and electoral outcomes. Milyo (1997) finds that the Gramm-Rudman-Hollings budget rules, which increased the power of the Budget committees relative to the Appropations commitees, led to both an increase in campaign contributions to members of the

A second related literature studies bargaining over the formation of coalition governments in Europe, with a specific focus on the timing of agreements and government stability. While the bargaining model of Baron and Ferejohn predicts immediate agreement, Merlo and Wilson (1995) construct a bargaining model in which the discounted total surplus is stochastic and thus may increase in future rounds of bargaining, creating incentives to delay agreement. Merlo (1997) and Diermeier, Eraslan, and Merlo (2001) estimate the parameters of stochastic bargaining models and find that the model explains well data on the timing, size, and durations of coalitions. Overall, this literature is complementary to my analysis. While these papers focus on the timing of agreements and government stability, I assume (and observe) that agreement is reached in the first round of bargaining and focus on measuring distributive properties of agreements, namely the value of proposal power.

Finally, there is a large literature on bargaining experiments, which is surveyed by Roth (1995). Most relevant to this paper is Frechette, Kagel, and Lehrer (2000), who conduct classroom experiments designed to test legislative bargaining models. They find support for the qualitative predictions of the model: if legislative rules permit amendments, agreement is reached less quickly, coalitions are larger, and benefits are more evenly distributed. However, as is often the case in bargaining experiments, proposers consistently provide themselves less than what the model predicts. Again, I view my approach as complementary to the experimental approach. Disadvantages of the approach using field data include the lack of direct control over the bargaining procedures and the possibility of logrolling across federal spending programs; this latter issue could play an important role in the equilibrium coalition that emerges with respect to a single issue. Advantages of my approach using field data are twofold. First, relative to the bargaining surplus in experimental settings, which is typically less than 100 dollars, the transportation projects considered here totaled in the billions of dollars. Second, while agents in experimental settings are often unfamiliar with the bargaining procedures, Congressional representatives are experts in their field, having significant experience with and knowledge of legislative procedures.

3 Transportation projects

In the United States, the federal government provides closed-end, or capped, matching grants to state governments for highway construction and maintenance. These grants are paid from the Highway Trust Fund, into which federal gasoline tax receipts are deposited. Historically, the federal government has allocated highway grants to state governments according to a formula that depends upon state characteristics. The recipient government then decides how to allocate

Budget Committee and a reduction in the vote share of members of the Appropriations Committee.

these funds among specific projects, subject to the constraint that projects are designated as part of the Federal Highway Aid System. Recently, rather than delegating to states this authority to allocate funds across projects, Congress has earmarked a significant portion of these funds for specific projects. The U.S. House of Representatives authorized $5 billion for earmarked projects in 1991 and $8 billion in 1998.

The process through which these projects were allocated was highly political, with members of the transportation authorization committee granted significant proposal power. Representatives first submitted project requests and associated funding levels to the committee, which then accepted, rejected or modified these requests in its proposed distribution of project spending. In 1998, several representatives claimed to have received calls during this process from committee staff who offered them project funding in exchange for their support for the bill.[3]

In addition to having significant control over the initial allocation of projects, the committee and its proposal faced little or no competition once the measure was brought to the House floor. The authorization bill was considered under a modified closed rule, which sharply limited the number of amendments under consideration. While over 50 amendments were submitted for consideration in 1991 and over 30 were submitted in 1998, only a handful, twelve in 1991 and six in 1998, were deemed in order by the Rules Committee and voted on by the entire House.[4] Although no member was allowed to submit an alternative, or competing, list of projects, Rep. Lindsey Graham (R, SC) was permitted to submit an amendment that would have stripped in total these projects from the bill in 1998. The amendment failed 79-337 on April 1, 1998, and the earmarked projects were included in the final version of the bill passed in the House. There was a strong correlation between support for the legislation and project spending; one source familiar with the process in 1998 claimed that any lawmaker who voted against the bill on the House floor would lose his road project.[5] While the Senate added projects during both conference committees, the bulk of projects authorized were those passed in the House. Presidents Bush and Clinton had threatened to veto the entire authorization bill over the inclusion of these projects, but both signed the legislation in the end.

[3] Congressional Quarterly Almanac, 1998.

[4] Congressional Quarterly Almanac and Bureau of National Affairs, Daily Report for Executives, March 31, 1998.

[5] Tulsa World, March 25, 1998.

4 Legislative Bargaining Model

4.1 Setup

Consider first the canonical legislative bargaining model of Baron and Ferejohn.[6] The legislature consists of N_d (odd) districts, subscripted by d, and each district is represented by a single legislator. This legislature determines the cross-district distribution of projects from a fixed budget of size G, which can be interpreted as the surplus in the Highway Trust Fund. Payoffs depend upon the project size (g_d) in district d and the time period (t) in which agreement is reached:

$$U(g_d, t) = \delta^t g_d \tag{1}$$

where $\delta \in [0, 1]$ is the common discount factor.[7] A discount factor less than one may be interpreted in several ways: constituent impatience, uncertain re-election prospects for representatives, or simply an opportunity cost of continued bargaining.[8]

The legislative process is represented as a non-cooperative bargaining game with infinite horizon. The legislative procedures for a three-member legislature are depicted in Figure 1. In the first stage, a proposer is recognized and puts forward a distribution of projects [$\mathbf{g} = (g_1, g_2, ..., g_{N_d})$]. This proposal cannot exceed the budget [$\sum_{d=1}^{N_d} g_d \leq G$] and must consist of non-negative project sizes [$g_d \geq 0$, all d]. Under a closed rule, the proposer has gatekeeping power; that is, no legislator can offer an amendment to the proposal. Given a proposal, all legislators vote over whether or not to accept the proposed distribution of funds or to continue the bargaining process. If a majority of legislators vote in favor, the proposal is implemented; otherwise, another proposer is recognized to offer a distribution of projects. This process continues until a proposal is approved.

[6] Applications of the legislative bargaining model include comparative politics (Persson, Roland, and Tabellini, 2000), federalism (Besley and Coate, 2000 Lockwood, 1998, and Knight, 2001), intergovernmental transfers (Knight, 2002), legislative elections (Chari, Jones, and Marimon, 1997 and Coate, 1997), legislative seniority (McKelvey and Riezman, 1992), pork barrel inefficiencies (Baron, 1991), social choice (Banks and Duggan, 2000), special interest politics (Persson, 1998, Persson and Tabellini, 2002, Helpman and Persson, 2001 and Bennedsen and Feldman, 2001), tax expenditures (Dharmapala, 1999), and public investment goods (Leblanc, Snyder, and Tripathi, 2000).

[7] While utility in this specification is linear in money, Bernheim, Rangel, and Rayo (2001) generalize this legislative bargaining model to incorporate non-transferrable utility. Also, their model has more general dynamic procedures (namely a policy development stage).

[8] Note that, in contrast to Rubinstein's model, whatever the interpretation, a discount factor less than one is not required for the existence of an equilibrium. Even with a discount factor equal to one, the possibility of exclusion from future coalitions creates some political impatience.

Since proposal power is valuable in equilibrium, each representative will seek to be recognized. To resolve this tension, Baron and Ferejohn adopt a random recognition rule first suggested by Binmore (1982). Under a simple version of the rule, which is employed by Baron and Ferejohn, each legislator is recognized in each period with equal probability ($1/N_d$). This recognition rule will be generalized to include heterogeneous recognition probabilities below.

4.2 Equilibrium characterization

Baron and Ferejohn restrict attention to the unique stationary, subgame perfect equilibrium.[9] In order to have his proposed budget implemented, the proposer must form a coalition, defined as the collection of non-proposers receiving positive project spending, of minimum size $(N_d - 1)/2$. Non-proposers will support the proposed allocation if the associated payment meets or exceeds the discounted value from continued bargaining, which, given the symmetry of the game in future rounds, equals $\frac{\delta G}{N_d}$. In order to minimize the cost of forming a coalition, the proposer forms a minimum winning coalition, whose members receive exactly their discounted continuation value:

$$V_c = g_c = \frac{\delta G}{N_d} \tag{2}$$

$$N_c = (N_d - 1)/2 \tag{3}$$

where V_c represents the value to coalition members and N_c denotes the coalition size. Since agreement is reached in the first period, legislators excluded from the coalition receive no payments and the proposer receives the residual:

$$V_{-c} = g_{-c} = 0 \tag{4}$$

$$V_p = g_p = G - N_c \frac{\delta G}{N_d} \tag{5}$$

where V_p is the value to the proposer. Finally, the value of proposal power ($V_p - V_{-p}$), the key measure in the empirical analysis, is given as follows:

$$V_p - V_{-p} = G\left[1 - \frac{\delta N_c}{N_d - 1}\right] > 0 \tag{6}$$

[9] While Rubinstein shows that a subgame perfect equilibrium exists and is unique in bilateral bargaining games, Baron and Ferejohn prove a folk theorem for their multilateral, majority-rule game. Given that legislators are sufficiently patient, any division of the surplus can be supported as a subgame perfect equilibrium. However, only one of these equilibria is stationary, or time independent. Baron and Ferejohn (1989) argue that non-stationary equilibria involve overly complex strategies, and thus restrict focus to the unique stationary equilibrium, which is supported by relatively simple strategies. Baron and Kalai (1993) formalize these notions of complexity and simplicity.

As shown in equation 6, the proposer uses the impatience of other legislators and his ability to exclude legislators from the coalition in order to secure an above-average share of the bargaining surplus.

4.3 Extensions

Consider next two extensions of the model, which are made for the purpose of empirical implementation. First, given that proposal power in Congress rests in committees, which have multiple members, I generalize the model from a single proposer to a proposal committee (P), a collection of N_p representatives. Denote membership on the committee by the indicator variable $P_d = 1[d \in P]$. From the members of this committee, a single representative, denoted the proposer, is recognized, each with probability $1/N_p$, and puts forward a distribution of projects. Given my aim to explain funding differences between committee and non-committee districts in a simple model, an equal-sharing rule is assumed within the committee: the proposer is required to provide equal funding to each committee member, including himself. The role of this assumption is explored later in this section.

Second, Baron and Ferejohn focus on equal recognition probabilities, an assumption that seems overly strong. Consider a generalized recognition rule, under which non-members in period t are selected to the proposal committee in period $t+1$ with probability $q \in [0, \frac{N_p}{N_d - N_p}]$, and members are selected with probability $1 - q(N_d - N_p)/N_p$.[10] The transition matrix associated with this Markov process is provided in Table 1. In order for the upper bound on q to be less than unity, it must be the case that $N_p < N_d/2$; as will be shown, this condition holds empirically.

Appendix A provides a complete solution to the extended model. The equilibrium outcome can be summarized as follows:

$$V_c = g_c = \frac{G}{N_p}\left[\frac{\delta q(N_d - N_p)N_p}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] \tag{7}$$

$$N_c + N_p = (N_d + 1)/2 \tag{8}$$

[10] Ideally, one would use data from Congress on recognition probabilities. Unfortunately, given that the committee's proposal was adopted in the first vote in both cases, future recognition probabilities are unobservable. There are several possible interpretations of q. First, this may capture the possibility of jurisdictional battles between committees over the distribution of federal funds; such battles, which have largely been won by authorizers, are described more fully in section 6. In particular, the authorization committee may have been concerned that a protracted authorization process would increase the control of the appropriations committee, leading to unauthorized appropriations and thus less control for authorizers over the geographic distribution of federal funds. Second, q may capture the likelihood of individual transfers onto the transportation committees in future legislative sessions. See Groseclose and Stewart (1998) for an empirical analysis of such transfers.

$$V_{-c} = g_{-c} = 0 \tag{9}$$

$$V_p = g_p = \frac{G}{N_p}\left[\frac{N_p(N_d - N_p - (1-q)\delta N_c)}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] \tag{10}$$

The value of proposal power, which forms the basis for the empirical analysis, can be expressed as follows:

$$V_p - V_{-p} = \frac{G}{N_p}\left[\frac{N_p(N_d - N_p - \delta N_c)}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] > 0 \tag{11}$$

As shown in equation (11), members of the proposal committee use both the impatience of other legislators and their ability to exclude representatives from the winning coalition in order to secure an above-average share of the bargaining surplus. Note that an increase in proposal rights (q), a source of bargaining power for non-committee members, is associated with an increase in payments to members of the coalition (V_c) and a decrease in the value of proposal power ($V_p - V_{-p}$).

While Baron and Ferejohn's model is obviously a special case of this extended model ($N_p = 1$ and $q = N_p/N_d$), Table 2 demonstrates that this extended model nests two other prominent bargaining models. Rubinstein studies two-player bargaining ($N_d = 2$) with a unanimity requirement ($N_c = 1$) and alternating offers ($q = 1$). In this case, the proposer offers $\delta G/(1+\delta)$ to the other player and keeps a larger amount $[G/(1+\delta)]$ for his home district. In the ultimatum game, non-proposers have no prospects of future recognition ($q = 0$), and thus receive zero spending.

While the assumption of an equal sharing rule within the committee is restrictive, Appendix B, which constructs a model that incorporates within-committee bargaining, demonstrates that the key qualitative prediction, a positive value of proposal power, does not depend on this equal sharing assumption. Further, under certain parameter restrictions, the quantitative predictions are robust to a model of within-committee bargaining. In this extended model, the proposer is not bound by the equal sharing rule but must instead secure majority support within the committee before bringing the proposal to the floor for a vote by the entire legislature. If future proposal rights for non-committee members are sufficiently high ($q > N_p/N_d$), the votes of committee members are cheaper to secure and, similarly to the baseline model, the proposer prefers to provide zero funding to only non-committee members. In this case, both the qualitative and quantitative predictions regarding the value of proposal power are identical to those of the baseline model. For the case of low future proposal rights [$q < N_p/N_d$], the votes of non-committee members are cheaper to secure, and the proposer offers zero funding to $(N_p - 1)/2$ committee members. Thus, this extended model with low future proposal rights predicts that roughly one-half of committee members will be excluded from the coalition and will do substantially worse than a subset of non-committee members, namely those who are included in the coalition. Ex-post, these excluded committee members receive payoffs of zero, and thus the ex-ante, or average, value of proposal power, which is the primary focus of the regression analysis to follow, is lower, relative to the baseline model with an equal sharing rule, but remains positive.

5 Empirical Analysis

5.1 Data Description

In order to match each of the projects with a Congressional district, I relied on the project description in the bill. These descriptions provide a city or county name, which could be matched with a district in the Congressional District Atlas. For those cities or counties with multiple districts, I used a variety of additional sources, including maps from the Atlas, testimony before the Subcommittee on Surface Transportation, and press releases from representatives' websites. Some projects could not be assigned to a specific district, either due to the project being located in multiple districts or insufficient information in the project description. Given this lack of information, I simply exclude these projects from the analysis.[11] Finally, project spending is converted into 1998 dollars. Since the projects authorized in 1998 cover the years 1998-2003, I use a discount rate of 2.7 percent, the average inflation rate between 1990 and 1999.

Table 3 provides summary statistics by year and committee representation. In both authorization years, committee members received significantly more project spending than non-committee members. Committee members tend to be from more rural districts and from districts with slightly lower income, relative to non-committee members. As shown near the bottom of Table 3, committee members tend to have less political power in general: they have served fewer years in Congress and are less likely to chair another committee. These differences suggest the possibility of selection onto the transportation committee based upon observed characteristics. The empirical analysis to follow will control for these observed differences and also attempt to control for unobserved differences using fixed effects and instrumental variables techniques.

Figures 2 and 3 depict the distribution of transportation projects by year and committee representation. While almost all committee members received at least some project spending,

[11] There were 56 projects coded as spanning multiple districts (totaling $1.468 billion) in 1991 and 145 projects (totalling $824 million) in 1998. As a robustness check on the decision to omit these projects from the baseline analysis, I estimated alternative specifications that allocated the project spending equally among the relevant districts. Results of these regressions, not reported here, provided similar estimates of the value of proposal power.

72 percent of non-committee members in 1991 and 21 percent in 1998 were excluded from the coalition. Committee members and non-members averaged $55 billion and $6 billion, respectively, in 1991 and $38 and $14 million, respectively, in 1998. In both figures, the empirical distribution of projects for committee members has a spike around $35 million. While there is certainly variation around these spikes, especially in 1991, this evidence provides some support for the assumption in the baseline model of an equal sharing rule within the committee. Regarding the extended model, which allowed for within-committee bargaining, the homogeneity of payments within the committee demonstrates that very few committee members received zero payments and is thus supportive of the case of high proposal rights for non-committee members (q). This high value of proposal rights is a somewhat surprising result as, a priori, low proposal rights seem most reasonable given the likelihood that a rejected proposal would be returned to the same committee for reconsideration. Unfortunately, this issue cannot be addressed directly as future recognition probabilities are inherently unobservable given that the committee's proposal was adopted in the first vote in both years.

5.2 Coalition sizes

The theoretical model suggests two possible measures of coalition sizes: 1) the proportion of representatives voting in favor of the committee's proposal, and 2) the proportion of districts receiving positive project spending. Using either measure, the model predicts minimum winning coalitions. Unfortunately, the first measure can only be incorporated in 1998 given that, in 1991, Congress voted only over the entire authorization bill and thus no separate vote was recorded over the earmarked projects. During the 1998 authorization, a separate vote, in the form of an amendment to strip the earmarked projects from the larger bill, was permitted; a significant majority (337 to 79) voted to reject this amendment, and thus fund the projects, suggesting an oversized coalition.[12] Using the alternative, spending-based measure, the coalition was close to majoritarian in 1991, with committee and coalition members totaling 200 districts, or 46 percent of all districts. By contrast, the coalition in 1998 was over-sized, with committee and coalition members totaling 357 districts, or 82 percent of all districts.

Of course, one could also view the over-sized nature of the 1998 coalition using both the voting-based and spending-based measures as a rejection of the assumptions, rather than the predictions, of this model. One possible interpretation for this over-sized coalition involves competing vote buyers. In an alternative legislative bargaining model, Groseclose and Snyder

[12] Knight (2003) demonstrates a strongly positive relationship between district project spending and support for the funding of these projects in the vote over the 1998 amendment. The positive correlation between project spending and voting patterns demonstrates that the two measures suggested by the theoretical model are closely related.

(1996) argue that over-sized coalitions are cheaper to form than are bare majority coalitions in the presence of competing vote buyers. In particular, if vote buyers move sequentially, and if the losing buyer is always granted a final opportunity to attack the winner's coalition, then minimum winning coalitions will not necessarily be the cheapest and equilibrium coalitions will not generally be of minimum size. There were at least three possible competing vote buyers in negotiations over the 1998 passage of the transportation authorization bill. The first potential competitor was Rep. Lindsey Graham (R, SC), who, as noted above, was permitted to offer an amendment that would have stripped the projects in total from the bill. Noting this opposition to the projects in 1998, the large size of the coalition may reflect the committee's desire to command widespread political support within the U.S. House, thus undermining this effort in the House to remove such projects from the bill. Second, some representatives viewed the Senate bill, which at least initially contained no earmarked projects, as a possible competitor. Third, as noted above, President Clinton had threatened to veto the entire transportation authorization bill over the inclusion of these earmarked transportation projects. Thus, the committee may have wanted a veto proof coalition size. Given the two-thirds requirement to override a Presidential veto, however, this veto threat seems unable to explain the very large coalition in which 82 percent of all districts receiving at least some project funding.

5.3 Value of Proposal Power: Baseline Estimates

The remainder of this section takes coalition sizes as given and more formally tests predictions related to the value of proposal power. For empirical purposes, consider project spending in district d as a function of committee membership:

$$g_d = \alpha + \beta P_d + u_d \tag{12}$$

where α and β represent parameters to be estimated and u_d is a mean-zero unobservable. The parameter β represents the value of proposal power [that is, $\beta = E(g_d|P_d = 1) - E(g_d|P_d = 0) = V_p - V_{-p}$] and can thus be related to the theoretical model as follows:

$$\beta = \frac{G}{N_p}\left[\frac{N_p(N_d - N_p - \delta N_c)}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] \tag{13}$$

Qualitatively, the theoretical model predicts that the value of proposal power is positive ($\beta > 0$). As a test of this prediction, Table 4 provides baseline OLS estimates of the value of proposal power.[13] As shown in columns (1) and (2), the qualitative prediction regarding the positive value of proposal power is supported empirically as the coefficient on the committee

[13] This OLS estimator assumes homoskedasticity. The theoretical model suggests heteroskedasticity, as $\mathrm{var}(g_d \mid P_d = 0) > \mathrm{var}(g_d \mid P_d = 1) = 0$ by the equal sharing rule within the committee. To address this issue,

membership indicator is positive and statistically significant in both 1991 and 1998. Moreover, the R-squared of 0.2459 in 1991 and 0.2959 in 1998 demonstrates that committee membership alone explains a significant share of the distribution of these projects. This R-squared is quite high, given the reliance on cross-sectional data and an indicator as the sole right hand side variable.

While this qualitative prediction has been verified in the existing literature, such as in Ferejohn (1974), quantitative restrictions on the value of proposal power have not been explored to date. Using theoretically implied bounds on the discount factor ($\delta \in [0,1]$) and recognition probabilities ($q \in [0, \frac{N_p}{N_d - N_p}]$), one can place the following quantitative restrictions on the value of proposal power:

$$\beta \in \left[\frac{G}{N_p} \left(\frac{(N_d - N_p)N_{-c}}{(N_d - N_p)N_{-c} + N_c N_d} \right), \frac{G}{N_p} \right] \tag{14}$$

The upper bound of this restriction simply requires that committee members offer non-negative project spending to non-committee members. While this upper bound is somewhat uninformative, the lower bound has more power: using the observed coalition sizes, the minimum value of proposal power was \$57 million in 1991 and \$20 million in 1998. While the point estimates in Table 4 fall in this restricted range for the 1998 authorization, the estimated value of proposal power for 1991 is below the theoretically-implied minimum. The final row of Table 4 provides a more formal statistical test of these quantitative restrictions, based on the following one-sided null and alternative hypotheses:

$$H_0 : \beta \geq \frac{G}{N_p} \left[\frac{(N_d - N_p)N_{-c}}{(N_d - N_p)N_{-c} + N_c N_d} \right] \tag{15}$$

$$H_1 : \beta < \frac{G}{N_p} \left[\frac{(N_d - N_p)N_{-c}}{(N_d - N_p)N_{-c} + N_c N_d} \right] \tag{16}$$

Based upon a standard 5 percent significance level, the tests reject the quantitative restrictions for the 1991 authorization but fail to reject the restrictions for the 1998 authorization. Thus, the 1991 data support the qualitative restrictions of the theoretical model, a positive value of proposal power, and the 1998 data support both the qualitative and the more powerful quantitative restrictions on the value of proposal power.

As a first robustness check of these baseline results, the final two columns of Table 4 provide OLS estimates with control variables. While committee membership explains a significant

I calculated heteroskedasticity-corrected standard errors as a robustness check. These standard errors, not presented here, are similar to the standard errors in Table 4. Also, Tobit estimates, which account explicitly for zero spending in some districts, are not presented here but provide similar estimates of the value of proposal power.

share of the distribution of projects, other factors may have also played a role in the bargaining process. Most importantly, although the theoretical model assumes homogenous preferences across Congressional districts, preferences for transportation services likely vary, and representatives from districts with a strong preference for transportation services may face incentives to serve on the transportation committee. This self-selection may bias upwards the estimates of the value of proposal power in the baseline specification. To account for this possibility of heterogeneity in preferences, the final two columns provide estimates conditional on the following observable measures of preferences for transportation services: district area, percent urban, median income, and industry employment composition.

The results of this regression demonstrate that the inclusion of these variables does not significantly add explanatory power, as the R-squared rises from 0.2459 to 0.2647 using the 1991 data and from 0.2959 to 0.3327 in the 1998 estimates. In both years, rural districts secure more funding than do urban districts. Even conditional on these observable control variables, the estimated value of proposal power, the coefficient on committee membership, changes only slightly and the tests of the qualitative and quantitative restrictions are similar to those associated with the baseline specifications.

5.4 Estimation of Underlying Parameters

The preceding analysis uses the theoretical model to provide testable restrictions on the geographic distribution of federal funds. This logic can also be reversed: given a distribution of funds, which parameters from the theoretical model could generate the observed outcome? This section uses the baseline 1998 estimated value of proposal power, which fell in the quantitative bounds implied by the theoretical model, in order to estimate these underlying parameters. Unfortunately, one cannot use the single estimated value of proposal power (β) to separately identify the two key bargaining parameters (δ, q). Rather, I use two alternative approaches, which are described below.

First, given its frequent use in the theoretical literature on legislative bargaining, consider equal recognition probabilities ($q = N_p/N_d$). Under this assumption, the implied discount rate is given as follows:

$$\delta = \left[\frac{G}{N_p} - \beta\right] \frac{(N_d - N_p)N_p}{N_c G} \tag{17}$$

Using the baseline estimated value of proposal power ($\beta = 24.6298$), the estimated discount factor, which is presented in Table 5, equals 0.9837.[14]

[14] This estimate suggests significant patience on the part of legislators and, under the interpretation the discount factor as a re-election rate, is consistent with the high incumbency re-election rate (which was roughly 98 percent

The second approach places joint bounds on the two parameters using the estimated value of proposal power and restrictions on the parameter space. To generate these bounds, solve equation 13 for future recognition probability as a function of the discount factor and the value of proposal power:

$$q = \left[\frac{G}{N_p} - \beta\right]\left[\frac{N_p(N_d - N_p) - \delta N_c N_p}{\beta\delta N_c N_d}\right] \tag{18}$$

Figure 4 plots this relationship between the recognition probability and the discount factor using the assumed bounds on the discount factor ($\delta \in [0,1]$) and future recognition probabilities ($q \in [0, \frac{N_p}{N_d - N_p}]$). As shown, this approach places tight bounds on the two parameters, allowing one to rule out a wide range of parameter values. These lower and upper bounds are displayed in the final two columns of Table 5.

6 Alternative Legislative Theories

This section empirically addresses the following alternative theories of legislative organization and behavior: 1) partisan models, 2) models with committees as informational specialists, 3) models that explicitly account for the role of appropriators, and 4) models with committee members as preference outliers. Several of these models, as will be discussed below, provide alternative explanations for the positive correlation between project spending and membership on the transportation committee; wherever possible, I will attempt to incorporate additional variables in order to distinguish between these alternative theories and the baseline model of legislative bargaining.

6.1 Partisan models

Political parties play a key role in the organization and operation of legislatures.[15] Of particular interest for this study is the role of majority party leaders in the organization and operation of Congressional committees. Committee chairs, who may have substantial within-committee bargaining power, are members of the majority party and are appointed by party leaders. Thus, while the committee may have significant proposal power, this power was granted by the majority party and thus may be ultimately used to further partisan objectives.

In order to address the role of political parties in Congressional committees, I incorporate measures of representative affiliation with the majority party, and column 1 of Table 6

among incuments seeking re-election) in 1998.

[15] While this literature on political parties is too voluminous to survey here, interested readers can consult Rohde (1991) and Krehbiel (1993) for an introduction to the literature.

presents of the results of this regression. To conserve space, the regressions are pooled across the two authorization periods, and, given that redistricting occurred between 1991 and 1998, standard errors are clustered at the state, rather than Congressional district, level. As shown, conditional on membership on the transportation committee, which retains a positive and statistically significant effect, there is no evidence of an additional benefit associated with majority party affiliation as this coefficient is small, negative, and statistically insignificant. I also estimated a specification, not reported here, that included an interaction term between committee membership and majority party affiliation but found no evidence of a differential partisan benefit for committee members, relative to non-committee members. In summary, affiliation with the majority party does not significantly alter the cross-district distribution of funds, and the coefficient on committee membership remains positive and statistically significant.

6.2 Informational models

Gilligan and Krehbiel (1987) provide a theory of committees based upon informational specialization. In this model, committees uses this information in order to enact policies with better outcomes, which benefits both committee and non-committee members. In particular, this improvement in outcomes is formulated as a reduction in the uncertainty associated with policy benefits. As a type of quid-pro-quo for the costly acquisition of this information, the floor provides the committee with a closed rule, which moves the equilibrium policy closer to the committee's most preferred policy. This generalized model has empirical predictions that are similar to those of the baseline model: proposal power is valuable to committees. Taking a broader view, however, proposal power is valuable only because this power was delegated to the committee as part of an agreement that ultimately benefits non-committee members.[16] While this informational model of committees incorporates only a single dimensional policy, as opposed to the multidimensional policy space inherent in bargaining over the distribution of federal funds, similar ideas may apply in a multidimensional setting. In exchange for the costly acquisition of information regarding transportation issues, the House may have provided the committee with a closed rule and the resulting disproportionate project benefits for committee members.

In order to empirically address the predictions of this generalized model, I incorporate measures of potential differences in informational specialization within the committee. To the extent that legislators are rewarded for the costly acquisition of information, there should pre-

[16] This informational model of committees belongs to a larger literature arguing that legislatures are majoritarian institutions, adopting rules and procedures that ultimately benefit the median legislator. For empirical evidence on this point, see, among others, Krehbiel's (1996) study of the airline smoking ban.

sumably be, in addition to a premium paid to committee members, a within-committee premium paid to well-informed members. Indeed, the transportation committee is organized in this very fashion: members on the surface transportation subcommittee, a subset of roughly two-thirds of members on the transportation authorization committee, are charged with responsibility over policy issues surrounding the adoption of the transportation authorization bill. Other transportation funding, such as federal grants to airports, were provided under separate authorization bills that were charged to other subcommittees, such as aviation. As shown in column 2 of Table 6, however, there is no additional effect associated with membership on the surface transportation subcommittee, and the baseline committee coefficient remains positive and statistically significant. While subcommittee members do receive more than non-committee members, as reflected in the baseline coefficient on committee membership, there is no evidence of any within-committee informational specialization in surface transportation that is rewarded with higher payments to the Congressional district.

6.3 The role of appropriators

While the empirical analysis focused on the role of the authorization committee and the associated authorization bill, which provides a multi-year legal basis for transportation spending, transportation funds must subsequently be appropriated, or made available for spending by federal agencies, on an annual basis. This multiplicity of authority has led to a turf battle over control of the process and the resulting geographic distribution of funds between the authorization and appropriations committees.

Schick (2000) argues that, at least within the sphere of federal transportation policy, this jurisdictional battle has been largely won by the authorization committee.[17] In 1993, two years following passage of the 1991 transportation authorization bill, the appropriations committee attempted to redirect $300 million in funding from projects specified in the authorization bill to 58 projects outlined in the appropriations bill; many of these new projects were located in Michigan, the state represented by the chair of the House Transportations Appropriations Subcommitee. The Rules Committee ultimately sided with the authorization committee, finding that these 58 projects represented unauthorized appropriations, and the new projects were stricken from the appropriations bill. Following the passage of the 1998 authorization bill, the appropriations committee did insert a handful of new projects; these projects, however, were far fewer in number than those included in the authorization bill, were in addition to, rather than replacements for, authorized projects, and were arguably unanticipated during the 1998 passage of the authorization bill given the victory of the authorization committee over

[17] See, in particular, pages 178-180.

appropriators in 1993.[18]

The lesson from this episode is that, broadly speaking, the authorization committee controlled the geographic distribution of funds during this period, while the appropriations committee controlled the timing of the spending. In order to test for whether or not this control over the timing provides appropriators with bargaining power during the authorization process, I next include regressors indicating membership on the Transportation Appropriations Subcommittee at the time of passage of the authorization bill; no representatives were members of both the authorization and appropriations committee. As shown in column 3 of Table 6, there is no evidence that appropriators received additional project funding on the margin as this coefficient is small and statistically insignificant; the coefficient on the authorization committee membership, however, remains positive and statistically significant. It is important to note that these results are not necessarily generalizable to other federal spending programs as the strong role for authorizers in the transportation program is somewhat unique. Funds for many federal programs are appropriated without authorizing legislation; according to Schick (2000), such unauthorized appropriations accounted for 40 percent of total non-defense appropriations in fiscal year 2000.

Finally, column 4 includes controls for all three of the political measures described above as well as two additional political measures often employed in empirical studies, such as Levitt and Poterba (1999), on the geographic distribution of federal funds: chair of other committees and tenure, defined as the number of years served in Congress. The first measure controls for the possibility of logrolling across committees, while the second accounts for the importance of seniority in the Congressional committee system. As shown, none of the three measures described above have a statistically significant effect on the geographic distribution of transportation projects. In addition, there is no evidence of logrolling across committees as the coefficient on chair of other committees has a counterintuitive negative sign and is statistically significant.[19] Increases in tenure, or seniority, do have a positive and statistically significant effect on the distribution of funds. After controlling for these other political factors, however, membership on the transportation committee continues to have a positive and statistically significant effect on the distribution of transportation projects.

[18] For example, the approriations committee included in the 2000 appropriations bill $600 million in funding for the Wodrow Wilson Bridge in the Washington, DC area (Congressional Quarterly Almanac, 2000).

[19] This negative coefficient may reflect retaliation in 1998 by the transportation committee against Republican party leaders regarding a 1997 dispute over the level of transportation funding in the Congressional budget resolution (Congressional Quarterly Almanac, 1997).

6.4 Committees as Preference Outliers

The final alternative theory of legislatures involves differences between committee and non-committee legislators. In particular, many have argued that legislators choose to serve on committees vital to their constituent interests and thus committees consist of "preference outliers".[20] This self-selection of legislators from districts with strong preferences for transportation projects could explain the positive correlation between transportation project funding and committee representation.[21] Although the regressions have included observable measures of preferences for transportation services, there may be important unobservable factors, such as the physical condition of highways in the district, that play an important role in the assignment of representatives to committees.

I use two approaches to address this possibility of self-selection onto committees: fixed effects and instrumental variables. Regarding the first approach, there were significant changes in committee membership during the sample period. Following the Republican takeover of Congress in 1995, committees were re-organized; in addition to changing the partisan composition of committees to reflect the new Republican majority, Congress voted to both eliminate three standing committees and limit the number of committee assignments per representative to two. Prior to 1994, some representatives served on three Congressional committees. In addition, the transportation authorization committee, named the Public Works and Transportation Committee in 1991, was expanded from 55 members to 72 members by 1998, when the committee had been re-named Transportation and Infrastructure.

Unfortunately, redistricting for the 1992 elections complicates the matching process. Using maps of Congressional district borders from the Census Bureau publication Congressional District Atlas, I have attempted to link districts in 1998 with a 1991 counterpart. Whenever possible, I then corroborated this match by both tracking the districts in which 1991 incumbents ran for re-election in 1992 and consulting descriptions of districts, which in some cases explained the relationship between district borders before and after redistricting (Politics in America, 1992). Overall, I was able to match 394 out of 435 districts in 1998 to a 1991 counterpart; thus, for 41 districts, no reasonable match could be found. Note that, for the 394

[20] See, for example, Londregan and Snyder (1994) and Groseclose (1994). Krehbiel (1990) finds less support for the preference outlier hypothesis.

[21] Introducing heterogeneity in preferences for public goods into a simple version of the legislative bargaining model, one with a single period of bargaining and exogenous default payments, has an ambiguous effect on payments to districts. Votes of representatives from those districts with a strong preference for transportation projects are cheaper to secure; thus, these districts are more likely to be included in the coalition but, conditional on inclusion in the coalition, receive smaller payments. The universalism model of Weingast, Shepsle, and Johnsen (1981), an alternative to the legislative bargaining model, by contrast, predicts a positive correlation between preferences for public goods and equilibrium payments.

matches, these are approximate, rather than exact, counterparts as all Congressional districts experienced at least minor changes in boundaries between 1991 and 1998. Even in states in which the number of districts was unchanged, district boundaries were altered to reflect changes in the within-state distribution of population.[22] Of these 394 matched districts, a significant number experienced a change in committee representation, with 35 districts gaining seats and 26 losing seats.

Column 1 of Table 7 provides the fixed effects results for this matched sample of 394 districts. Note that, in the special case of only two time periods, fixed effects estimates are quantitatively identical to regressions of changes in project spending on changes in committee representation.[23] As shown, changes in committee membership also correspond to changes in project funding as the coefficient remains positive and statistically significant, supporting the predictions of the legislative bargaining model.

Given the redistricting-related difficulties in matching 1998 districts to an exact 1991 counterpart, I next conduct an alternative matched analysis that uses states, whose borders did not change between these two authorization years, as the unit of observation. All variables are averaged across districts within the state. This state-level specification can be generated by summing equation 12 over states (s) and then dividing by the number of districts (N_s) in state s:

$$\frac{1}{N_s}\sum_{d\in s} g_d = \frac{1}{N_s}\sum_{d\in s}(\alpha + \beta P_d + u_d) \tag{19}$$

While this analysis has the benefit of direct geographic matching of states in 1991 and 1998, the drawbacks, relative to the matched Congressional district analysis, are two-fold. First, there is a loss of information in aggregating outcomes from the district to the state level. Second, there is a loss of power from the reduced sample size. Column 2 provides the estimates from this state-level fixed effects analysis. Again, the state-level estimates support the qualitative restrictions on the value of proposal power, as the committee coefficients are large and statistically different from zero. In summary, both the district and state fixed effects analyses provide strong support for the qualitative prediction of a positive value of proposal power.

One potential drawback of fixed effects analyses, at both the district-level and state-level, involves endogenous *changes* in committee membership. In particular, residents of those districts

[22] Of course, this statement does not apply to states with a single Congressional district.

[23] To see this, note that the fixed effects regression model can be written using deviations from the sample means: $g_{dt} - \overline{g}_d = \beta(P_{td} - \overline{P}_d) + (u_{td} - \overline{u}_d)$ where $t = 1, 2$ indexes the two years. Note that with only two time periods, $\overline{g}_d = (g_{d1} + g_{d2})/2$ and thus $g_{d1} - \overline{g}_d = -\Delta g_d/2$ and $g_{d2} - \overline{g}_d = \Delta g_d/2$ and similarly for the committee variable (P_{dt}). Thus, fixed effects regressions with two time periods are identical to regressions in first differences.

securing significant funds in the 1991 due to membership on the transportation committee may experience diminished marginal utility from transportation projects in 1998 and thus choose to transfer off of the committee. To address this limitation of the fixed effects analysis, I also perform an alternative instrumental variables analysis using the presence of newly elected members as an instrument for committee representation. This instrument arguably satisfies the two criteria for a valid instrument: explanatory power and exogeneity. Regarding explanatory power, this choice of instrument is motivated by increases in the size of the transportation authorization committee witnessed during periods just preceding passage of the authorizing legislation. In particular, between the 1989-1990 legislative session and the 1991-1992 session, the committee grew from 49 members to 55 members, while the committee grew even more substantially, from 60 to 72 members, between the 1995-1996 session and the 1997-1998 session. Schick (2000) argues that such increases in authorization committee sizes may have been designed to increase their power in the jurisdictional battle against appropriators described above, and the most likely candidates for new committee members are newly elected members, who have no pre-existing committee responsibilities. Indeed, the first stage results, shown in column 3, demonstrate that newly elected members are roughly eight percentage points more likely to be included on the transportation committee, a large effect relative to a baseline committee membership rate of 15 percent, and this relationship is statistically significant at the 95 percent level. The second requirement for a valid instrument is exogeneity; that is, the newly elected indicator should affect project spending only through committee representation. While newly elected members certainly have less political power than other members, a potential direct effect on project spending, note that these results are conditional on a linear measure of tenure and the instrument thus captures only the non-linearity associated with being a newly elected member. As shown in the second stage results in column 4 of Table 7, after correcting for the possibility of self-selection onto the committee, committee membership continues to have a positive and strong effect on the distribution of transportation funds.[24] The standard error, however, is significantly larger, likely reflecting the loss in power from focusing on a single determinant, newly elected representatives, of committee representation, and the coefficient is statistically significant at only the 90 percent level.

[24] Given that committee membership is endogenous, membership on the surface transportation subcommittee, a subset of committee members, is also endogenous. Thus, I drop this subcommittee variable from the instrumental variables analysis.

7 Endogenous Amendment Rules

A closed rule, through its prohibition of competing proposals, plays a key role in the quantitative value of proposal power predicted by the legislative bargaining model. The introduction of amendment rights, formally modeled as an open rule under which floor members can offer alternative proposals, results in the possibility of delay in equilibrium, larger coalition sizes, larger payments to coalition members, and thus a lower value of proposal power (Baron and Ferejohn, 1989). While the theoretical model assumed the exogenous assignment of a closed rule, the choice of rule in the U.S. House is made endogenously, through majority vote by the floor. This endogeneity of the choice of amendment rules raises a puzzle: why would the floor be willing to vote in favor of a closed rule that transfers resources from non-committee members to committee members? I argue here that the resolution of this puzzle lies in the timing of the vote over the rule. More specifically, during the passage of both transportation authorization bills, the House floor voted to approve a closed rule *after* the committee's bill, and most notably the distribution of projects across districts, was made publicly available.[25] Thus, non-committee members who received projects under the committee's proposal may have preferred the certainty of inclusion in the coalition under the committee's proposal with a closed rule to the possibilities of delay and exclusion from the coalition under an open rule; the introduction of risk aversion would only serve to reinforce this preference.

As empirical evidence on this hypothesis, Table 8 displays the results from a Probit analysis of voting over the closed rule. As shown, in both 1991 and 1998, the probability of supporting the closed rule was increasing in project funding for the district under the committee's proposal, and this relationship is statistically significant in both years. Conditional on project spending in the district, committee members were also more likely to vote in support of the closed rule, although this relationship was not significant at conventional levels in either year. Taken together, the sequencing of the vote over the closed rule after the distribution of projects was known and the documented positive correlation between project funding and support for the closed rule are consistent with the hypothesis that closed rules can be rationally supported by a majority of legislators, including those not represented on the transportation committee.

[25] During the 1991 authorization, the committee's proposed list of projects was made available during July, while the vote over a closed rule was not taken until October of that year; the closed rule passed by a vote of 302-102. During the 1998 authorization, committee's proposal was known during late March, a few days before the vote over the rule in early April, which passed 357-61.

8 Conclusion

This paper has provided a simple test of the theoretical literature on non-cooperative legislative bargaining using evidence from bargaining episodes in Congress over the distribution of transportation projects. The evidence supports the key qualitative prediction of the bargaining model: members with proposal power, those sitting on the transportation committee, secure higher project spending than do other districts. Support for the quantitative predictions regarding the value of proposal power, which are more powerful than the qualitative predictions, is more mixed. I then empirically address several alternative legislative theories, and, in most cases, find that, after controlling for these alternative political measures, the proposal power story is retained. In finding support for the theoretical prediction regarding the positive value of proposal power, this paper contributes to a larger literature, as surveyed in Poterba (1996) and Besley and Case (2003), demonstrating the importance of political institutions in determining both political and economic outcomes.

A Extended Model Solution

The following section derives the unique stationary subgame perfect equilibrium for the extended model under a closed rule. Denote V_p^t, V_c^t,and V_{-c}^t as the time t value of the game to members of the proposal committee, members of the coalition, and those excluded from the coalition, respectively. Let V^{t+1} simply denote the value of the game in time $t+1$, prior to the revelation of the proposal committee and coalition members.

In a subgame perfect equilibrium, a single representative prefers to implement the proposed allocation if the payment provided in this allocation exceeds the discounted value from continued bargaining. Non-proposers support the allocation if the following inequality holds:

$$g_d^t \geq \delta \left[qV_p^{t+1} + (1-q) \left(\frac{N_c^{t+1}}{N_d - N_p} V_c^{t+1} + \frac{N_{-c}^{t+1}}{N_d - N_p} V_{-c}^{t+1} \right) \right] \tag{20}$$

where N_c denotes the coalition size and N_{-c} in the number of districts excluded from the coalition.

In order to maximize their own payoff, the proposer has an incentive to use the entire budget, to restrict the coalition size to that required for passage, and to provide non-proposers just enough in order to secure their support for the proposal. These three conditions are given as follows:

$$G = N_p g_p^t + N_c^t g_c^t \tag{21}$$

$$N_c^t + N_p = (N_d + 1)/2 \tag{22}$$

$$g_c^t = \delta \left[qV_p^{t+1} + (1-q) \left(\frac{N_c^{t+1}}{N_d - N_p} V_c^{t+1} + \frac{N_{-c}^{t+1}}{N_d - N_p} V_{-c}^{t+1} \right) \right] \tag{23}$$

Finally, proposers offer an allocation that will be implemented. Thus, the value of the game to those excluded from the coalition is zero:

$$V_{-c}^t = 0 \tag{24}$$

Next, note that in a stationary equilibrium, coalition sizes and the values of the game are time independent:

$$N_{-c}^t = N_{-c}^{t+1} = N_{-c} \tag{25}$$

$$N_c^t = N_c^{t+1} = N_c \tag{26}$$

$$V_{-c}^t = V_{-c}^{t+1} = V_{-c} \tag{27}$$

$$V_c^t = V_c^{t+1} = V_c = g_c \tag{28}$$

$$V_p^t = V_p^{t+1} = V_p = g_p \tag{29}$$

Combining equations 21–29, one can express the values of the game associated with the unique subgame perfect stationary equilibrium as follows:

$$V_c = \frac{G}{N_p}\left[\frac{\delta q(N_d - N_p)N_p}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] \tag{30}$$

$$V_p = \frac{G}{N_p}\left[\frac{N_p(N_d - N_p - (1-q)\delta N_c)}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] \tag{31}$$

B Extension to Within-committee Bargaining

This appendix relaxes the assumed equal sharing rule within the committee. The proposer, a member of the committee, may now offer any allocation that provides non-negative project spending to each district. Before bringing the proposal to a vote on the floor, the proposer must first secure the support of a majority of legislators within the committee. If either vote fails, a new committee is formed and a new proposer is selected. For simplicity, assume that the size of the proposal committee (N_p) is odd and that committee members comprise less than a majority of all districts $[N_p < (N_d + 1)/2]$.

In this extended model, the proposer may prefer to provide project spending to a minimum winning coalition of districts within the committee. In order for this to be the case, the cost of securing the vote of committee members must exceed the cost of securing the vote of non-committee members:

$$\left[1 - \frac{q(N_d - N_p)}{N_p}\right] V_p^{t+1} + \left[\frac{q(N_d - N_p)}{N_p}\right] \frac{N_c^{t+1}}{N_d - N_p} V_c^{t+1} \geq q V_p^{t+1} + (1-q)\frac{N_c^{t+1}}{N_d - N_p} V_c^{t+1} \tag{32}$$

Note that, for the Baron and Ferejohn assumption of equal recognition probabilities ($q = N_p/N_d$), the costs of securing votes of committee and non-committee members are equal. This suggests three cases:

B.1 Case 1: $q > N_p/N_d$

In this case, votes of committee members are cheaper to secure and the proposer thus provides payments to all committee members before extending payments to non-committee members:

$$N_c^t = (N_d + 1)/2 - N_p \tag{33}$$

Since coalition sizes are equal to those in the baseline specification, the value of proposal power is unchanged from the baseline specification:

$$V_p - V_{-p} = \frac{G}{N_p}\left[\frac{N_p(N_d - N_p - \delta N_c)}{N_p(N_d - N_p - \delta N_c) + \delta q N_c N_d}\right] \tag{34}$$

B.2 Case 2: $q < N_p/N_d$

In this case, votes of non-committee members are cheaper to secure and the proposer thus provides payments to just a bare majority of committee members before extending payments to non-committee members:

$$N_c^t = (N_d + 1)/2 - (N_p + 1)/2 \tag{35}$$

The value of proposal power ($V_p - V_{-p}$) is decreasing in the coalition size and is thus at a lower level, relative to the baseline specification. While this quantitative prediction of the model is altered, the qualitative predictions are unchanged as the value of proposal power remains positive.

B.3 Case 3: $q = N_p/N_d$

In this case, votes of non-committee members are equal to votes of non-committee members. Therefore, multiple equilibria exist in which the size of the coalition ranges from that of case 1 [$N_c = (N_d + 1)/2 - N_p$] to that of case 2 [$N_c = (N_d + 1)/2 - (N_p + 1)/2$].

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Table 1

Transition Matrix, Proposal Committee

	$P_d^t = 0$	$P_d^t = 1$
$P_d^{t+1} = 0$	$1 - q$	$q(N_d - N_p)/N_p$
$P_d^{t+1} = 1$	q	$1 - q(N_d - N_p)/N_p$

Table 2

Special Cases of the Bargaining Model

	Baron/Ferejohn	Rubinstein	ultimatum
Parameters			
number districts	N_d	2	N_d
committee size	1	1	N_p
coalition size	N_c	1	N_c
recognition probability	$1/N_d$	1	0
Values of the game			
coalition (V_c)	$\delta G/N_d$	$\delta G/(1+\delta)$	0
proposer (V_p)	$G(1 - N_c\delta/N_d)$	$G/(1+\delta)$	G/N_p
proposal power ($V_p - V_{-p}$)	$G[1 - \delta N_c/(N_d - 1)]$	$G(1-\delta)/(1+\delta)$	G/N_p

Table 3: Summary statistics, 435 Congressional districts

[sample averages, standard deviations in parentheses]

	1991		1998		
variable	committee (N=55)	others (N=380)	committee (N=72)	others (N=363)	description
coalition		0.3789		0.7851	
member		(0.4858)		(0.4113)	
project	54.8377	6.1135	38.4605	13.8307	millions of
spending	(74.8663)	(11.1448)	(19.9686)	(12.7047)	1998 dollars
area	5.2667	8.5438	13.6034	6.9314	square miles
	(6.0412)	(32.1791)	(67.2563)	(15.0209)	(thousands)
percent urban	0.6772	0.7456	0.5835	0.6435	
	(0.2516)	(0.2199)	(0.3036)	(0.3194)	
median income	23.1694	24.1214	34.7242	36.2777	thousands of
	(4.0508)	(4.8815)	(8.1339)	(9.5103)	1998 dollars
% agriculture	0.0310	0.0337	0.0297	0.0291	percent employed
& mining	(0.0261)	(0.0360)	(0.0243)	(0.0292)	in industry
% construction	0.3389	0.3094	0.2650	0.2455	percent employed
& manufacturing	(0.0772)	(0.0780)	(0.0815)	(0.0945)	in industry
% transportation	0.0485	0.0488	0.0508	0.0491	percent employed
& communication	(0.0161)	(0.0163)	(0.0157)	(0.0165)	in industry
% trade	0.2189	0.2287	0.2407	0.2364	percent employed
	(0.0254)	(0.0268)	(0.0415)	(0.0375)	in industry
majority party	0.5818	0.6105	0.5694	0.5289	member
	(0.4978)	(0.4883)	(0.4986)	(0.4999)	
tenure	6.7818	11.7500	7.1806	10.0716	years served
	(6.4541)	(8.4883)	(6.0101)	(8.1043)	in U.S. House
other committee	0.0000	0.0553	0.0139	0.0551	chair of other
chair	(0.0000)	(0.2288)	(0.1179)	(0.2285)	House committee
transportation	0.0000	0.0237	0.0000	0.0358	member
appropriations	(0.0000)	(0.1523)	(0.0000)	(0.1861)	
surface transportation	0.6545	0.0000	0.6528	0.0000	member
subcommittee	(0.4799)	(0.0000)	(0.4794)	(0.0000)	

Table 4: Value of Proposal Power, Estimates by Authorization Year

[** 95% significance, * 90% significance, constant not reported]

year	1991	1998	1991	1998
transportation committee member	48.7242** (4.1002)	24.6298** (1.8260)	46.5125** (4.1472)	23.7359** (1.8118)
area			-0.0187 (0.0487)	0.0296 (0.0236)
percent urban			-17.9295* (9.7919)	-10.7392** (3.1548)
median income			-0.2314 (0.3310)	-0.0082 (0.0849)
% agr. & mining			-42.0968 (58.9174)	-35.8667 (33.0946)
% constr. & mfg.			5.1603 (25.3825)	4.3250 (7.8333)
% trans. & comm.			148.3692 (98.0100)	49.8293 (47.7914)
% trade			-49.2555 (63.7762)	-25.2836 (20.4651)
R-squared	0.2459	0.2959	0.2647	0.3327
sample size	435	435	435	435
Quantitative lower bound	57.1574	20.1150	57.1574	20.1150
p-value on restriction	0.020	0.993	0.005	0.977

Table 5

Parameter Estimates, 1998 authorization

	assuming equal probabilities	lower bound	upper bound
discount factor	0.9837	0.9412	1.0000
recognition probability	0.1655	0.1537	0.1983

Table 6: Value of Proposal Power, Alternative Legislative Models

[** 95% significance, * 90% significance, standard errors clustered at state-level]

specification	partisan model	informational model	model with appropriators	other political controls
transportation	34.2782**	39.9293**	34.4335**	40.7989**
committee member	(4.4782)	(7.9118)	(4.4781)	(7.8499)
area	-0.0096	-0.0137	-0.0095	-0.0160
	(0.0131)	(0.0117)	(0.0133)	(0.1393)
percent urban	-17.2917**	-17.1128**	-16.9792**	-17.8633**
	(6.4409)	(6.2020)	(6.2335)	(6.3870)
median income	0.1027	0.1066	0.1055	0.1228
	(0.0837)	(0.0841)	(0.0820)	(0.0804)
% agr. & mining	-38.0982	-34.4695	-35.2027	-25.7135
	(38.9306)	(40.2019)	(38.5799)	(39.0357)
% constr. & mfg.	0.3499	0.7295	0.5364	-1.6175
	(11.5870)	(11.5117)	(11.3774)	(10.8313)
% trans. & comm.	119.4087	115.9121	119.5312	114.5006
	(74.0217)	(75.1123)	(71.7634)	(74.2945)
% trade	-49.5564	-49.9290	-50.1992	-41.0670
	(31.4145)	(33.2670)	(32.5757)	(29.6434)
majority party	-0.8877			-0.3398
	(2.0207)			(1.9899)
surface transportation		-8.6173		-7.6545
subcommittee		(11.7851)		(11.8149)
appropriations			4.6255	3.2082
committee			(3.1199)	(3.4777)
other committee chair				-6.4487**
				(2.6608)
tenure				0.4293**
				(0.1809)
R-squared	0.2578	0.2611	0.2583	0.2769
sample size	870	870	870	870

Table 7: Value of Proposal Power, Committees as Preference Outliers

[** 95% significance, * 90% significance, IV standard errors clustered at state-level]

specification	District FE	State FE	IV (1st stage)	IV (2nd stage)
dependent variable	funding	funding	committee member	funding
transportation	33.0829**	44.2730**		33.1671*
committee member	(6.3199)	(15.7648)		(19.8000)
area	-0.1409	0.3777*	0.0003	-0.0116
	(0.3953)	(0.2055)	(0.0003)	(0.0145)
percent urban	-12.3450	-2.6130	-0.1548**	-18.2933**
	(13.5669)	(27.4635)	(0.0624)	(8.1721)
median income	0.2479	0.4559	0.0001	0.1216
	(0.3255)	(0.5589)	(0.0001)	(0.0781)
% agr. & mining	-7.1874	-168.7841	-1.1308**	-30.6805
	(113.3305)	(197.7724)	(0.3699)	(47.1319)
% constr. & mfg.	-1.6899	-10.1872	0.2530*	-1.5542
	(23.2043)	(27.3681)	(0.1353)	(12.4907)
% trans. & comm.	215.9713	1045.8480*	1.1870	119.4736
	(171.8441)	(526.9996)	(0.8136)	(82.7502)
% trade	-36.5677	-93.0453	-0.1799	-42.0352
	(63.4150)	(134.8721)	(0.3430)	(30.4822)
majority party	-2.0278	10.3594**	-0.0013	-0.3597
	(2.0618)	(4.7610)	(0.0187)	(2.0086)
surface transportation	-10.3691	-19.1402		
subcommittee	(6.8955)	(17.1447)		
appropriations	3.8228	49.2057*	-0.1266**	2.8240
committee	(8.6176)	(25.1096)	(0.0205)	(5.0946)
other committee chair	-0.4745	-34.6288**	-0.0443	-6.5896**
	(5.5160)	(16.6631)	(0.0284)	(2.9540)
tenure	0.4807**	2.2137**	-0.0054**	0.4209**
	(0.1693)	(0.5383)	(0.0014)	(0.2017)
new member			0.0849**	
indicator			(0.0371)	
R-squared	0.6648	0.8996	0.0581	0.2729
sample size	788	100	870	870

Table 8: Probits: Voting Support for Closed Rule

[** 95% significance, * 90% significance]

year	1991	1998
transportation	0.0525	0.7247
committee member	(0.2892)	(0.4621)
project	0.0155**	0.0304**
spending	(0.0067)	(0.0083)
area	-0.0008	0.0090
	(0.0022)	(0.0098)
percent urban	1.3358**	-1.1946**
	(0.5784)	(0.4302)
median income	-0.0713**	0.0015
	(0.0186)	(0.0099)
% agr. & mining	-2.3700	-12.4227**
	(2.9581)	(4.2969)
% constr. & mfg.	-0.9401	-1.5240
	(1.5225)	(1.0152)
% trans. & comm.	9.2861*	1.9247
	(5.5046)	(5.5939)
% trade	-16.7904**	3.1264
	(4.4408)	(2.5679)
sample size	424	419

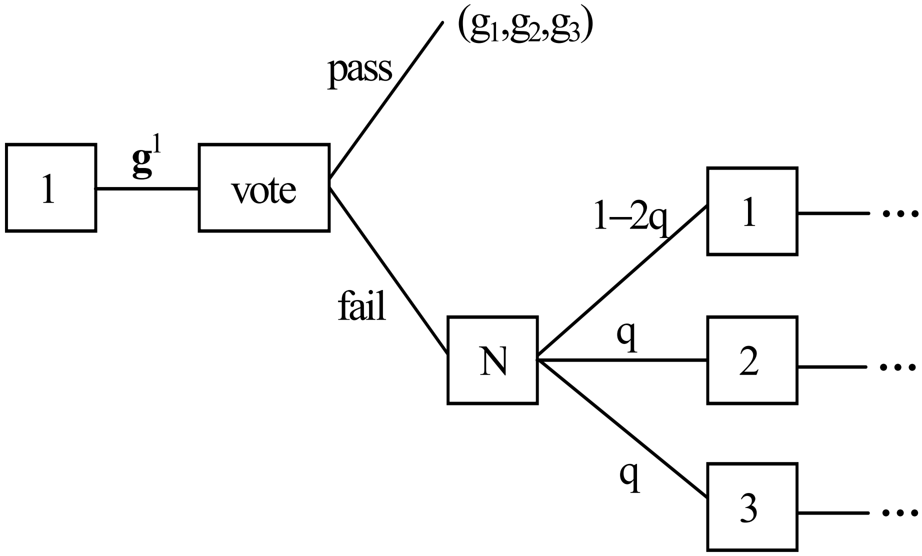

Figure 1: **Legislative Process: Closed Rule**

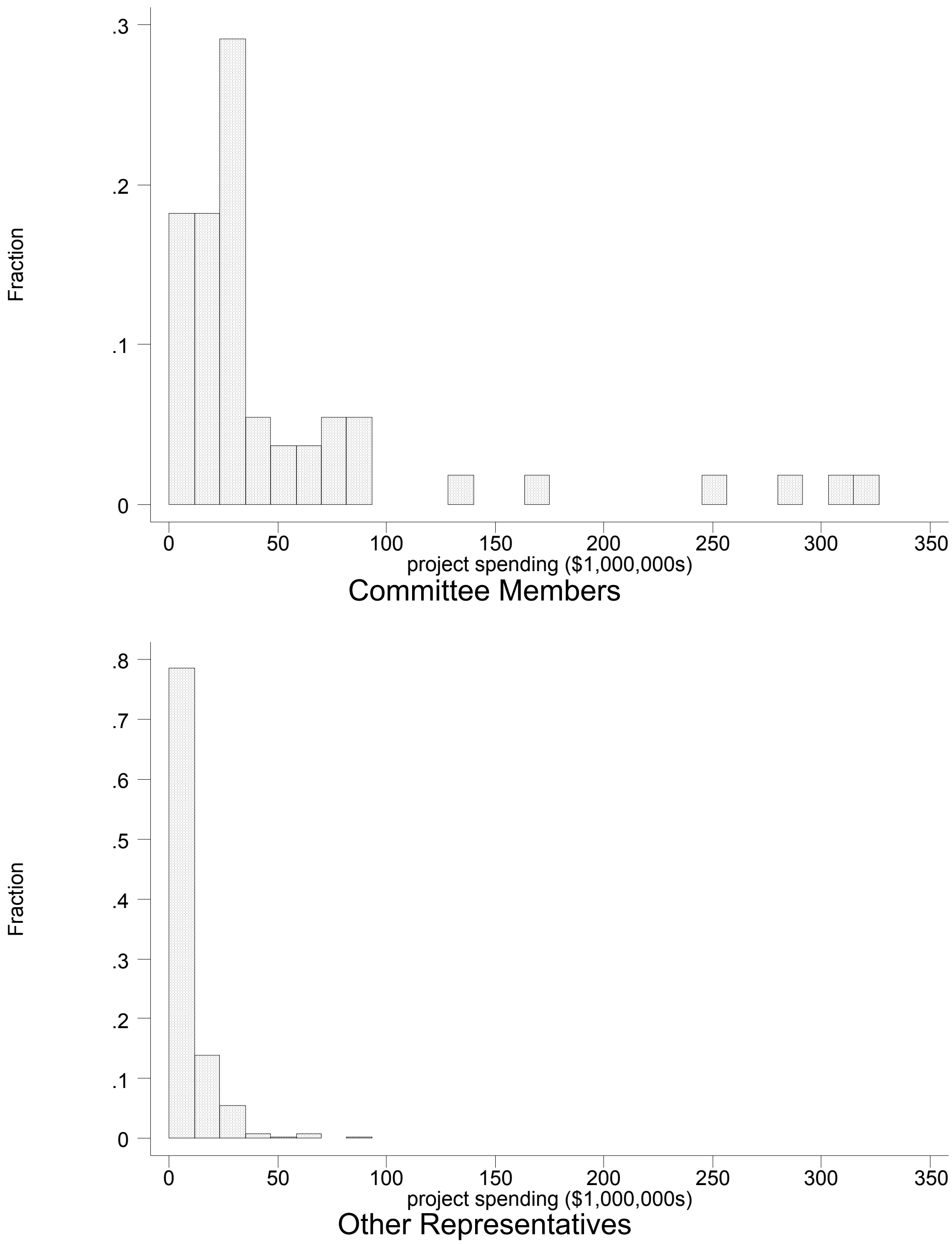

Figure 2: **Distribution of Project Spending, 1991**

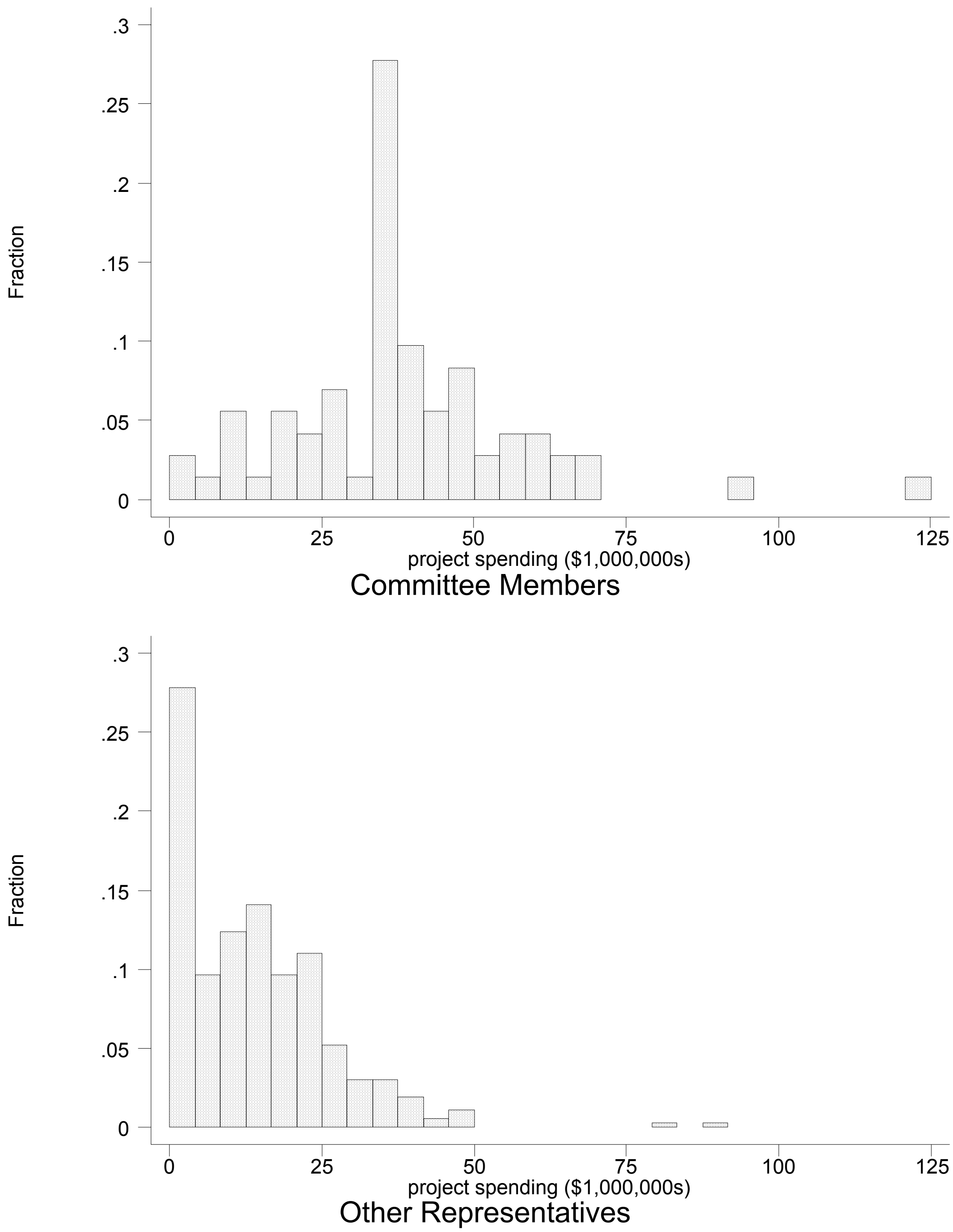

Figure 3: **Distribution of Project Spending, 1998**

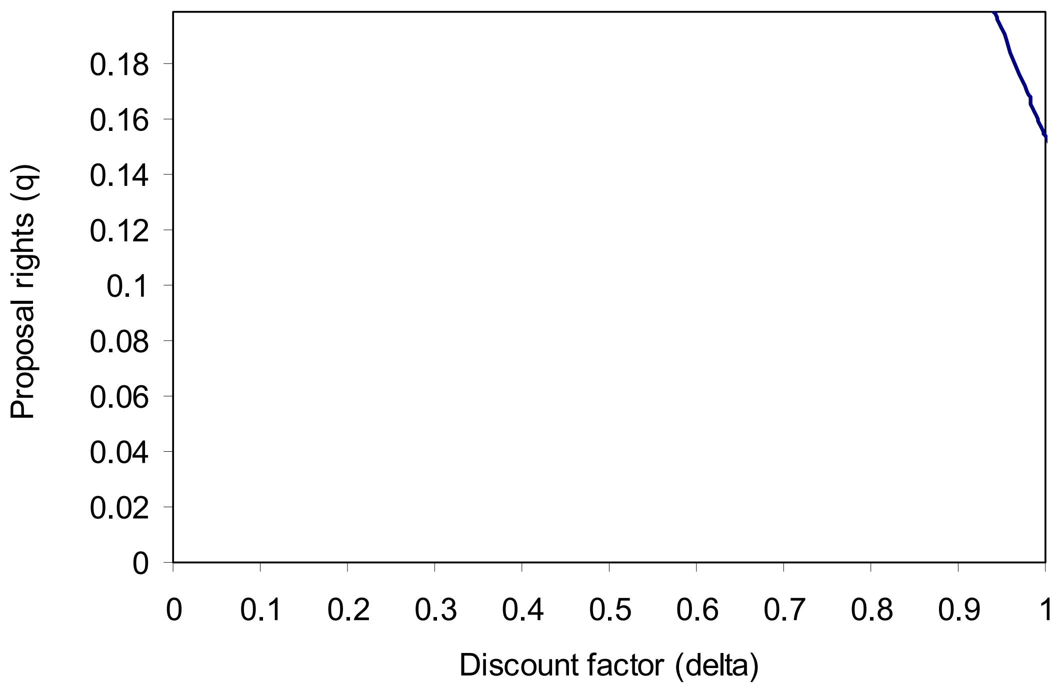

Figure 4: **Bounds on the Parameter Space**