Congressional Bargaining and the Distribution of Grants

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Abstract

While scholars have long been interested in how the federal government distributes funding, little is known about an important type of federal assistance: grants-in-aid. This paper examines how political and institutional factors shape, and at times distort, the distribution of federal grants. Unlike other types of spending, these funds are typically allocated based on formulas written by Congress. I find that legislators design grant programs to procure additional funding for their states but are constrained by both congressional rules and the structure of formulas. I formally show how formulas are shaped by the distribution of population, poverty, and other factors across states. Further, the formula enacted is influenced by the status quo policy and the makeup of key congressional committees. I then test this theory empirically using an original dataset of amendments to grant programs. These results have implications for understanding the congressional policymaking process as well as for the effectiveness of federal programs.

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1 Introduction

> "The rich get richer and the poor get poorer under the politically devised formula for the distribution of this aid."
>
> — Representative Ashbrook (111 Cong. Rec. 4236)

In the U.S., the federal government allocated $721 billion in grants to state and local governments in 2019. This type of federal funding, known as grants-in-aid, includes programs such as Medicaid, the Title I-A education program, Temporary Assistance for Needy Families (TANF), Section 8 Housing Choice Vouchers, and the Community Development Block Grant (CDBG). Grants-in-aid account for 16.5% of all federal spending and over half of state government funding for health care and public assistance (Dilger and Cecire 2019). However, legislators have criticized these programs for allocating money based on political reasons as opposed to need.[1] And, in line with these criticisms, some programs are not responsive to changes in population (Larcinese, Rizzo, and Testa 2013; Szymendera 2008) and provide more per capita funding to small states (Lee 2000) and to areas with lower economic need (Hall 2010).

How do political factors shape, and at times distort, the distribution of federal assistance? Existing research highlights the role that congressional rules and political considerations play in the distribution of federal funding (e.g., Fenno 1966; Ferejohn 1974; Mayhew 1974; Cox and McCubbins 1986; Weingast and Marshall 1988; Evans 1994; Balla et al. 2002; Lee 2003). But most theories about the allocation of funds focus on earmarks or "pork barrel" spending, which, at its peak in 2006, only accounted for $29 billion of federal funding. Unlike earmarks, which allocate funding to specific places, grants-in-aid are primarily distributed based on formulas written by Congress. And, while there have been some studies showing the politics of formula grants is similar to that of earmarks (e.g., Martin 2018), this research focuses on how the structure of formulas constrains legislators rather than how political and institutional factors shape which formula is enacted. As a result, little is known about how Congress designs grants-in-aid and who

1. See, for example, the debates surrounding Title I-A of the Elementary and Secondary Education Act as summarized by Skinner and Rosenstiel (2017).

benefits most from these programs.

In this paper, I formalize a theory of congressional bargaining over allocation formulas for grants-in-aid, and provide empirical evidence consistent with the theory. I model bargaining over allocation formulas as a modified divide-the-dollar game in which legislators attempt to maximize grant funding for their states. The theory incorporates three important characteristics of allocation formulas: (1) legislators must allocate grants based on a set of observable attributes (e.g., population, poverty) as opposed to directly specifying the payoff for each state; (2) legislators can set a minimum grant amount that each state must receive; and (3) if Congress does not change the formula then grants will be allocated based on the status quo policy. I find that legislators design grant programs to procure additional funding for their states but are constrained by congressional rules as well as the structure of formulas. I formally show how the formula Congress enacts is shaped by the distribution of population, poverty, and other factors across states. Further, I show that it is not always the same states that benefit from grant programs. Rather, the formula enacted, and thus who benefits, is shaped by the status quo policy and the makeup of the congressional committee with jurisdiction over the program.

I test the theory empirically using an original dataset of proposed and enacted amendments to allocation formulas. First, I test the underlying assumption in the model that legislators care about maximizing funding for their states by examining roll call votes on formula grant amendments. I show that whether an amendment increases a state's grant amount is a significant predictor of how the legislator representing that state will vote on the amendment. Second, I use a within-state design to examine the relationship between the status quo and winning coalition membership. Consistent with theoretical predictions, I find that states receiving relatively small amounts of funding under the status quo are more likely to be included in the winning coalition when formula grant programs are amended. Finally, to examine the role of committees, I use a matched differences-in-differences design to estimate the committee advantage when formula grant programs are reauthorized. In line with the assumption that committees have proposal power in Congress, I find evidence that states represented by committee members, and particularly committee chairs, receive more grant funding.

Understanding how Congress designs and amends the formulas used to allocate grants and which states benefit from these formulas has important implications for the effectiveness of grant programs as well as our understanding of the federal policymaking process. In this paper, I show that how efficiently a program targets funding toward areas with the greatest need depends on the distribution of need across states, the makeup of congressional committees, and the status quo policy. In particular, committees with high need try to improve allocation formulas that do a poor job of targeting and protect formulas that target well. However, depending on the status quo and the distribution of need, the committee may not always be able to do this.

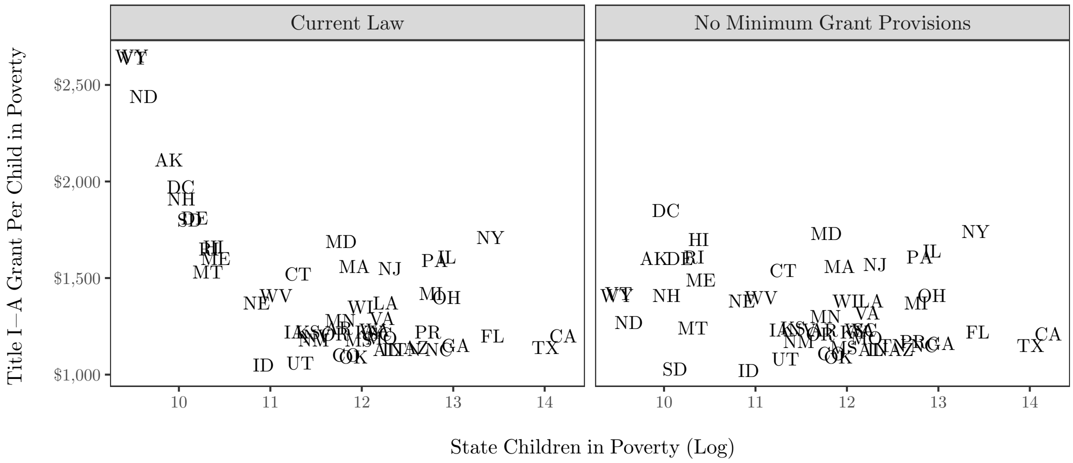
The remainder of the paper proceeds as follows. I begin by offering background on formula grant programs and briefly review the related literature. I then present a theory of congressional bargaining over the distribution of grants. Next, I empirically test the theory by looking at roll call voting and winning coalition membership. I then empirically test the role that committees play in the design of formula grant programs. The final section offers concluding remarks and discusses the implications of the theory for how effectively grant programs allocate funding to areas with the highest need.

2 Grant Allocation Formulas

Legislators have the ability to direct additional grant funding to their states and districts because, in many cases, Congress writes the grant allocation formula. These formulas generally allocate funds based on a set of observable attributes or "formula factors" (e.g., population, poverty, per capita income), subject to available appropriations. For example, a formula might specify that grants be allocated proportionally to population. A program targeting poverty might include a count of people living below the poverty line in a state. It may also include a factor related to a state's tax base to capture a state's fiscal capacity. For example, consider the Title I-A program in the Elementary and Secondary Education Act. The purpose of the Title I-A program is to provide "financial assistance to local educational agencies (LEAs) and schools with high numbers or high percentages of children from low-income families" ("Title I, Part A Program" 2015). Grants under Title I-A are primarily allocated in proportion to the number of children in families living in poverty multiplied by state average per pupil expenditures. As a result, states with higher education spending receive more Title I-A funding.

Formulas often include minimum grant provisions to ensure that grantees have enough funding to run a program and to prevent large losses in grant amounts from year to year. Minimum grant provisions can ensure that each grantee receives a specific dollar amount or percentage of available appropriations. Additionally, some minimum grant provisions (commonly referred to as "hold harmless provisions") stipulate that each grantee receive a percentage of their grant amount from a prior year. Other provisions, often referred to as "foundation grants" or "base guarantees," allocate each grantee a set dollar amount and then distribute the remaining funds based on formula factors. The Title I-A program includes minimum grant provisions that guarantee each state a certain percentage of available appropriations and ensure no school district receives less than 85% of the funding it received in the prior year. One consequence of these minimum grant provisions is that smaller states receive more per capita funding than larger states. Figure 1 shows the Title I-A grant per child in poverty compared to the logged number of children in poverty in a given state under current law and if the formula contained no minimum grant provisions. Under current law, states with fewer children in poverty receive substantially more per child than states with higher numbers of children in poverty. When the minimum grant provisions are removed, this relationship goes away.

Figure 1: Title I-A Grant Amounts Per Child in Poverty (FY2016)



Source: Data from the Congressional Research Service (CRS Report R45141)

3 Related Literature

Scholars have long been interested in how the federal government distributes funding, particularly the role of congressional committees. Distributive theories explain spending as the result of electorally motivated legislators (e.g., Ferejohn 1974; Mayhew 1974; Shepsle and Weingast 1981; Evans 2011; Weingast and Marshall 1988). That is, legislators can increase their chances of reelection by bringing funding back to their states or districts. And, this process is facilitated by the congressional committee system. Through their agenda-setting power (Knight 2005), veto power (Shepsle and Weingast 1987), and makeup of preference outliers or high demanders (Weingast and Marshall 1988), committee members are able to procure a disproportionate share of benefits for their states and districts.

Distributive theories have received substantial empirical testing. There is evidence that members of key committees and subcommittees able to procure more transportation funding for their districts (Evans 1994; Lee 2003; Knight 2005), research funding for universities in their states (Payne 2003), and military construction funding for military bases in their states and districts (Hammond and Rosenstiel 2020). Looking across multiple policy areas, Clemens, Crespin, and Finocchiaro (2015) find members of Appropriations subcommittees are able to procure more earmarks for their districts. Grimmer and Powell (2013) find that members on certain committees get an electoral subsidy from being on those committees. There is also evidence that it is committee status (e.g., being committee chair), not committee membership, that matters (Berry and Fowler 2018).[2]

Alternative explanations for federal spending have also been proposed. Under Krehbiel's (1991) informational model, committees provide a division of labor and means for specialization as opposed to facilitating the distribution of pork. Conversely, under partisan theories, party leaders use their agenda-setting power to achieve party goals and legislators can increase their reelection chances by improving the party's reputation or brand (e.g., Cox and McCubbins 1986, 1993, 2005).

In this paper, I formalize and test a distributive theory of bargaining over grants. In doing so, I join a large literature that builds on the divide-the-dollar game of Baron and Ferejohn (1989) and its generalization by Banks and Duggan (2006). In the game, legislators bargain over how to allocate a fixed budget. Baron and Ferejohn show that, in equilibrium, the legislator with proposal power receives a disproportionate share of funds. Further, funds are only distributed to legislators that vote for the proposal (the winning coalition). And, when proposals are brought up under a closed rule, the size of the winning coalition is minimal (i.e., proposals pass by a bare majority).[3] Lee (2000) argues that an implication of the Baron and Ferejohn (1989) model is smaller states should benefit more from formula grant programs. This is because states with smaller populations need smaller grant amounts, which leaves more funding available for the proposer. By incorporating minimum grant provisions into a divide-the-dollar model, I provide an alternate explanation for why smaller states benefit: there are a few states with very high populations (e.g., New York, Texas, California), but most states have relatively low populations. As a result, some small states will need to be included in the winning coalition, and, as the theory illustrates, the "cheapest" way to do this is often to include minimum grant provisions.

2. Berry and Fowler (2016) test distributive theory using formula grant outlays and find no relationship between committee membership and formula spending. However, this null result may be because the authors do not examine program reauthorizations.

3. When proposals are brought up under an open rule, there are larger-than-minimal winning coalitions. The size of the winning coalition is determined by the size of the legislature and the discount factor.

While much of the theory on federal spending focuses on earmarks, one notable exception is the extension of the Baron and Ferejohn (1989) divide-the-dollar model by Martin (2018). Martin shows that when bargaining over the weights placed on a small number of formula factors, legislators have relatively little latitude in targeting funds to specific districts. Further, unlike the Baron and Ferejohn game, the theory predicts oversized winning coalitions, positive distributions outside of the winning coalition, and stable voting blocs. These finding highlight the importance of incorporating the additional constraints of bargaining over a formula in the divide-the-dollar model. Like Martin, I model bargaining over grants as a divide-the-dollar game in which legislators place weights on formula factors. Additionally, I incorporate a status quo policy, minimum grant provisions, and fix the number of formula factors in order to extract predictions about what formula is enacted and which states benefit.

4 A Theory of Congressional Bargaining Over Grants

While existing theories of distributive politics may shed some light on how Congress designs grant programs, they miss the additional constraints formulas impose. To address this gap in the literature, I model congressional bargaining over formula grants as a divide-the-dollar game in which legislators attempt to adjust grant programs to bring as much funding as possible to their states. Though this is not the first attempt to model bargaining over formulas (e.g., Martin 2018), this theory is the first to incorporate a status quo policy and minimum grant provisions.

Similar to Martin (2018), legislators bargain over the weights placed on formula factors. That is, given a formula based on population and poverty, legislators decide the share of funding allocated based on population and the share of funding allocated based on poverty. In line with distributive theories, I endow committee chairs with proposal power. I also consider an extension in which a majority of committee members must support a proposal for it to pass. I conceptualize minimum grant provisions as an additional formula factor that provides an equal amount of funding for all states. I first consider a one-period game in which the committee chair proposes a formula and all legislators vote on the committee proposal. If the proposal is enacted, grants are allocated based on this new formula. If the proposal fails, grants are allocated based on the status quo policy. However, in practice, bargaining does not follow this take-it-or-leave-it structure. I therefore also consider an infinite horizon model where legislators bargain until agreement is reached and a new proposer is drawn in each period.

What formula gets enacted depends on which legislator is chair, the status quo formula, and the distribution of formula factors across states. As the proposer, committee chairs are often able to modify formulas to bring additional funding to their states. However, as in Martin (2018), funding is distributed outside of the winning coalition. The model also yields new predictions related to the status quo policy. First, there are cases in which the committee chair retains the status quo formula. And, in the repeated game, if the status quo is very favorable to the chair then there are cases when delay can occur in equilibrium yet ultimately a new policy is passed. Second, states doing poorly under the status quo are "cheaper" to include in the winning coalition and thus benefit from formula changes. Third, the winning coalition may be minimal sized or larger-than-minimal sized. The size of the winning coalition depends, in part, on the grants each legislator is receiving under the status quo.

4.1 Model Setup

Let $N = \{1, ..., n\}$ be a set of n legislators bargaining over how to allocate a budget. To avoid complications that may arise from ties, I assume n is odd. One of the legislators, the committee chair, is endowed with proposal power. I denote the committee chair with c.

Formula grants, unlike earmarks, are based on formula factors as well as minimum grant provisions. To incorporate this into the model, I allow legislators to bargain over weights placed on formula factors and the minimum grant amount. Each legislator i has two quantifiable attributes or formula factors, $x_i > 0$ and $z_i > 0$. For simplicity, x_i and z_i are measured in share. A legislator's allocation is a function of the weights placed on

x and z, η and γ, as well as a fixed amount or minimum that each legislator receives, α:

$$y_i = \eta x_i + \gamma z_i + \alpha \frac{1}{n} \tag{1}$$

where $\eta, \gamma, \alpha \geq 0$.

For example, consider a formula based on population (x) and poverty (z) levels. If a state made up 10% of the total national population and had 25% of the national population living in poverty then $x_i = 0.1$ and $z_i = 0.25$. Further if $\eta = 0.5$, $\gamma = 0.5$, and $\alpha = 0$, then half of the funding would be based on population and the other half would be based on poverty. Under this formula, state i would receive 17.5% of the budget.[4]

What formula can be enacted is constrained by the funding level for the program. That is, legislators bargain over how to divide a budget among themselves but cannot increase the size of the budget. As in other zero-sum games, this budget constraint always binds in equilibrium. For simplicity, I fix the budget to 1. As a result, a legislator's grant amount y_i can be thought of as the share of available funding that her state receives. For an allocation $\mathbf{y} = (y_i)_{i=1}^n$ to be feasible, it must satisfy $\sum_{i=1}^n y_i \leq 1$. And because x_i and z_i are measured in share, then $\sum_{i=1}^n y_i \leq 1$ implies that $\eta + \gamma + \alpha \leq 1$. I denote all feasible combinations of (η, γ, α) with χ where

$$\chi = \{\eta, \gamma, \alpha \in [0,1] \,|\eta + \gamma + \alpha \leq 1\} \tag{2}$$

In practice, a formula typically remains in effect until it is amended. That is, formula grant provisions generally do not sunset. To incorporate this into the model, I include an exogenously determined status quo policy $(\eta_q, \gamma_q, \alpha_q) \in \chi$. This status quo remains in effect if no formula change is passed. During a program's initial enactment, the status quo formula is $(0, 0, 0)$. I denote legislator i's grant allocated under the status quo policy with q_i.

The sequence of play is as follows. At the start of the game, the committee chair makes a proposal $(\eta, \gamma, \alpha) \in \chi$ and the chamber floor then takes an up-or-down on the

4. $0.5 \times 0.10 + 0.5 \times 0.25 = 17.5\%$

committee proposal. If $(n+1)/2$ legislators vote for the proposal (i.e., majority rule), grants are allocated based on the new formula. If the proposal fails, the status quo policy remains in effect. Utilities are then realized and the game ends.

A player's utility is the allocation they receive from a formula. If a proposal (η, γ, α) is enacted, then the utility for legislator i is

$$u_i = \eta x_i + \gamma z_i + \alpha \frac{1}{n} \tag{3}$$

The largest grant amount a state can receive is equal to its largest formula factor. Let $f_i^1 > f_i^2 > f_i^3$ represent legislator i's rank ordering of x_i, z_i, and $1/n$.[5] When $f_i^1 = x_i$ (i.e., $x_i \geq z_i$ and $x_i \geq 1/n$) then the largest grant i can receive is x_i. And, this allocation occurs when $\eta = 1, \gamma = 0, \alpha = 0$. The intuition for this result is relatively straightforward: a legislator receives the largest grant when all of the weight is placed on her largest formula factor. I refer to legislators whose largest factor is x_i as legislators whose preferred weight is η. I refer to legislators whose largest factors are z_i and $1/n$ as legislators whose preferred weights are γ and α, respectively. Note that because x and z are measured as shares of the total, the mean of x is $1/n$ and the mean of z is $1/n$.[6] Thus, when a formula is based on population (x) and poverty (z), a state with below average population and poverty levels prefers α. If a state has above average population and its population share is higher than its poverty share, the state prefers η. Otherwise, the state prefers γ.

4.2 Equilibrium Analysis

I focus on equilibria in which the chair proposes an acceptable allocation and no legislator uses a weakly dominated voting strategy. That is, the chair proposes an allocation that defeats the status quo and legislators vote yes if and only if their utility from the proposal not passing is less than their utility from the proposal.[7]

5. For example, if $x_i > z_i > 1/n$ then $f_i^1 = x_i$, $f_i^2 = z_i$, and $f_i^3 = 1/n$.

6. $\frac{\sum_{i=1}^n x_i}{n} = \frac{1}{n}$ because, by definition, $\sum_{i=1}^n x_i = 1$.

7. These restrictions rule out uninteresting equilibria in which proposals are best responses solely because they would not pass and voting decisions are best responses solely because a single vote does

The question for the committee chair is which of the proposals that can pass the floor maximize her grant amount. A standard result of divide-the-dollar games is that the budget constraint always binds in equilibrium.[8] Because of this, the chair's grant is equal to the following:

$$y_c = 1 - \sum_{i \in N-c} y_i \tag{4}$$

Therefore, for the chair to maximize her own grant she should minimize the grants to other legislators provided that a winning coalition (at least $(n-1)/2$ legislators) would vote for the proposal. Let $A_i \subseteq \chi$ be the set of proposals that i would accept. As the alternative to a proposal is the status quo, all legislators accept any proposal that gives them at least their grant amount under the status quo. Thus the set of proposals acceptable to a given winning coalition W is

$$A_W = \bigcap_{i \in W} A_i = \left\{ (\eta, \gamma, \alpha) \in \chi \,\middle|\, \eta x_i + \gamma z_i + \frac{\alpha}{n} \geq q_i \ \forall i \in W \right\} \tag{5}$$

and the social acceptance set is the following set of all proposals that could pass:

$$A = \bigcup_{W \in \mathcal{D}} A_W \tag{6}$$

where $\mathcal{D}$ is the set of all winning coalitions. Thus, the committee chair solves the following:

$$\begin{aligned} \min_{\eta,\gamma,\alpha} \sum_{j \in N-c} \eta x_j + \gamma z_j + \alpha\frac{1}{n} & \\ \text{s.t. } (\eta, \gamma, \alpha) \in A & \\ \text{s.t. } \eta + \gamma + \alpha = 1 & \end{aligned} \tag{7}$$

Due to her proposal power, the chair always weakly benefits when Congress considers revising a formula.[9] That is, if the chair were to ever lose funding from a formula change, she would retain the status quo. And, in many cases the chair is able to increase her grant amount. In particular, whenever the status quo policy does not allocate the entire

not change the outcome.

8. I show this result for this model in Lemma 1 in the appendix.

9. $y_c \geq q_c$.

budget, the chair is always able to increase her grant amount. This is because, at the very least, the chair can increase her most preferred weight, which strictly increases the grant amounts for all legislators. However, when the budget constraint does bind under the status quo then to increase her own grant amount the chair needs to decrease the grant amount for at least one other legislator. And, it is always possible for the chair to do this when the chair and the majority of legislators are receiving less under the status quo than they would if all of the funding were allocated based on either their second-most preferred weight or the chair's preferred weight. Proposition 1 summarizes this result.

Proposition 1. There exists a Nash equilibrium in which the chair makes an acceptable proposal. Further, let g_i be the grant legislator i receives when the committee chair sets her preferred weight to 1, G be the set of all legislators for whom $g_i \geq q_i$, and $|G|$ be the number of legislators in G. If (i) $\sum_{i \in N} q_i < 1$; (ii) $q_i < f_i^2$ for the majority of legislators and the chair; or (iii) $|G| \geq (n+1)/2$ and $q_i < g_c$ then there exists a Nash equilibrium in which a formula is enacted that increases the chair's grant amount.

One implication of Proposition 1 is that when the status quo formula concentrates funding in just a few states, the chair will generally be able to alter the formula to increase her grant amount. However, if the majority of states are doing well under the status quo, then the chair may not be able to change the formula.

The underlying logic for this result is that when a legislator is not receiving her maximum grant amount then there is another formula in addition to the status quo formula that provides the legislator at least what she is receiving under the status quo. Thus, except in the case where the chair is receiving her maximum grant under the status quo or when requirements (i), (ii), and (iii) are violated, it is always possible for the chair to construct a formula that provides a majority of legislators at least what they were receiving under the status quo and increases her own grant.[10]

If possible the chair sets her preferred weight to 1 as this provides her state its maximum grant amount. And, it is be possible for the chair to enact this formula when

10. If the chair is receiving her maximum grant under the status quo then she retains the status quo policy as this is already maximizing her utility.

it provides a majority of states at least what they are receiving under the status quo formula. As a result, when the chair sets her preferred weight to 1, there may be an over-sized winning coalition. For example, if the chair prefers η and a majority of legislators are receiving grants under the status quo less than or equal to x_i then the size of the winning coalition is equal to the number of states for which $q_i \leq x_i$. However, if the chair is not able to set her preferred weight equal to 1 then any formula change has a winning coalition that is minimal sized. That is, under majority rule, the winning coalition size is $(n+1)/2$. Corollary 1 states this result more formally.

Corollary 1. If $|G| \geq (n+1)/2$ then there exists a Nash equilibrium in which the winning coalition size is $|G|$. If $|G| < (n+1)/2$, then any formula change enacted in equilibrium has a minimal winning coalition.

Notice that if the committee chair prefers the same weight as the majority of legislators then, in equilibrium, the chair always sets her preferred weight to 1. Additionally, when the status quo formula is $(0,0,0)$, as would be the case when a program is initially enacted, then the chair sets her preferred weight to 1.

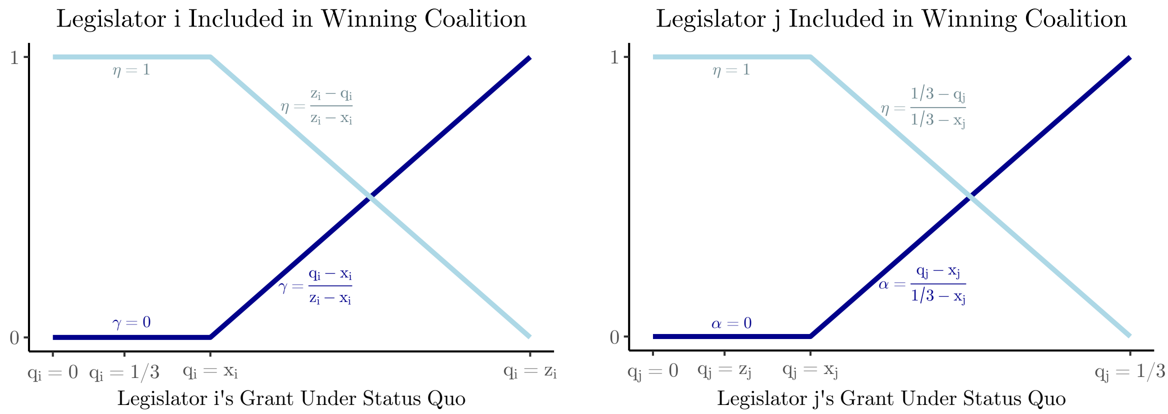
There are, however, cases where there exists an equilibrium in which the committee chair retains the status quo. For example, consider the case where a majority of legislators prefer α and the status quo policy is $(\eta_q, \gamma_q, \alpha_q) = (0,0,1)$. In this case all legislators are receiving grants equal to $1/n$, which is the maximum possible grant for the majority of legislators. Thus, any formula change would result in the majority of legislators losing funds. As a result, no matter which legislator is the committee chair, no formula change is enacted in equilibrium.

When proposing a formula, the chair forms the cheapest winning coalition. As equation 7 indicates, the cheapest members of the winning coalition are those that have the lowest status quo grants and those whose inclusion results in the smallest amount of funding being distributed to legislators other than the committee chair.

To illustrate what formula is enacted and which legislators are included in the winning coalition consider a case with three legislators c, i, j where $x_c > 1/3 > z_c$, $z_i > x_i > 1/3$, and $1/3 > x_j > z_j$. Thus, c prefers η, i prefer γ, and j prefers α. Note that when there are only three legislators, the committee chair just needs one other legislator to weakly prefer the committee proposal to the status quo for it to pass.

Figure 2 shows what c would propose to include either i or j in the winning coalition, depending on the status quo policy. Notice that the smaller a legislator's grant is under the status quo, the larger η is in chair's proposed formula. And because the chair prefers η, the smaller a legislator's grant is under the status quo, the larger the chair's grant is under the proposal.

Figure 2: Proposals By Status Quo Grant



When deciding whether to include i or j in the winning coalition, c chooses whichever formula gives her state the larger grant amount. The solution to this is shown in Figure 3 below. Because η is smaller the larger a state's grant is under the status quo, when a state is receiving less under the status quo it is cheaper to include in the winning coalition.[11] Specifically, when $x_i \geq q_i$ then legislator i is included in the winning coalition. When $x_j \geq q_j$ then legislator j is included in the winning coalition. And, when both $q_i > x_i$ and $q_j > x_j$ then i is included in the winning coalition when the following is true:

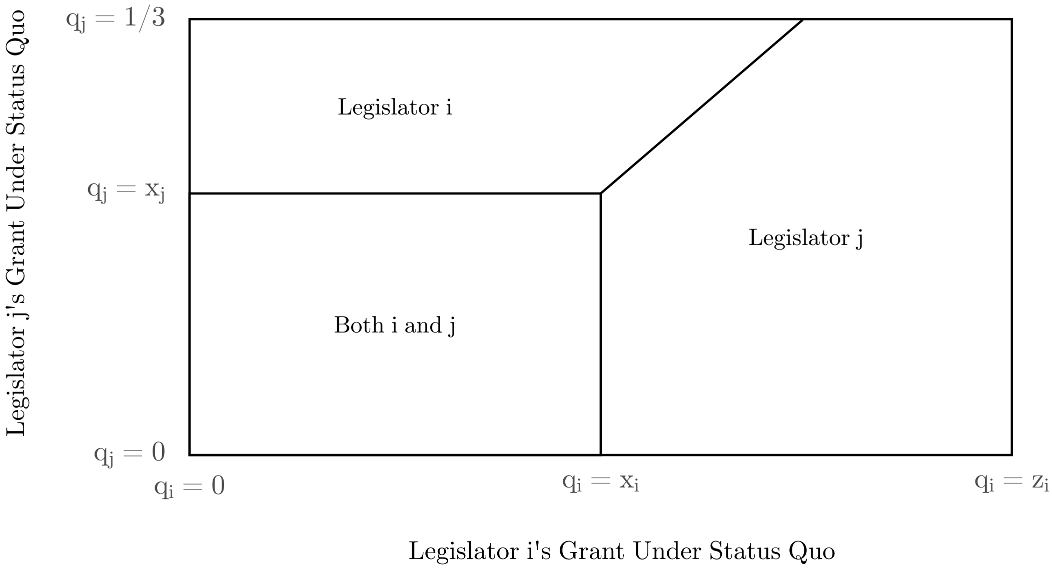
$$\frac{z_i - x_i}{x_c - z_c}(q_j - x_j) \geq \frac{1/3 - x_j}{x_c - 1/3}(q_i - x_i) \tag{8}$$

When equation 8 does not hold and $q_i > x_i$ then j is included in the winning coalition. Thus, as q_i increases, legislator i becomes more expensive to include in the winning

11. It is worth noting that evaluating how a state is doing under the status quo is relative. In this example, j's grant under the status quo is always smaller than i's grant. This is because $z_i > x_i > 1/3 > x_j > z_j$. However, there are times when the chair is better off including i in the winning coalition than j.

coalition.

Figure 3: Legislator Included in the Winning Coalition



Notice that the formula enacted in equilibrium distributes funding outside of the winning coalition. Unlike the Baron and Ferejohn (1989) model, any formula where at least one of the weights is non-zero provides some funding to every state. The reason for this is that $x_i > 0$ and $z_i > 0$. That is, for example, a formula that allocates funding based on population will provide some funding to every state as every state has a population greater than 0.

This example also illustrates how bargaining over a formula reduces the benefit for the proposer, which in this case is the committee chair. In the Baron and Ferejohn (1989) game, the funds distributed outside of the winning coalition would go to the proposer. Further, in the case where either $q_i < x_i$ or $q_j < x_i$ then the proposer's benefit is further reduced. This is because the chair sets $\eta = 1$, which increases the grant for i and/or j. However, in the Baron and Ferejohn game, the proposer would merely make i or j indifferent rather than increasing their grant amount. And, in equilibrium, the proposer would never include both i and j in the winning coalition.

4.3 Role of Committees

For a committee to report a bill to the floor, it must first be passed in committee. That is, a majority of committee members must vote for the proposal. To incorporate this feature of the bargaining process into the model, I consider a game where the winning coalition must include a majority of the committee members. Specifically, let $H = \{1, ..., h\}$ be a set of h legislators who are members of the committee with jurisdiction over the formula such that $H \subseteq N$.[12] To avoid complications that may arise from ties, I assume that h is odd.

The sequence of play is as follows. At the start of the game, the committee chair $c \in H$ makes a proposal $(\eta, \gamma, \alpha) \in \chi$ and legislators take an up-or-down on the proposal. If $(n+1)/2$ legislators and $(h+1)/2$ committee members vote for the proposal, grants are allocated based on the new formula. If the proposal fails, the status quo policy remains in effect. Utilities are then realized and the game ends.

The effect of requiring the winning coalition to include a majority of committee members is that committee members disproportionately benefit from formula grants. However, it is not necessarily the case that a given committee member's grant increases compared to the base model. In fact, some committee members may do worse compared to the base model. Instead, the effect of this constraint is that more committee members will be included in the winning coalition. Proposition 2 summarizes this result.

Proposition 2. When the winning coalition must include a majority of committee members, the number of non-committee members included in the winning coalition weakly decreases and the number of committee members included in the winning coalition weakly increases.

It is worth noting that this additional constraint weakly decreases the committee chair's grant amount compared to the base model. That is, if the proposal that maximizes the chair's grant amount in base model has a winning coalition that includes a majority of committee members, then the chair would make the same proposal. However, if the

12. Notice that when $h = n$ this is the same as the base model.

winning coalition does not include a majority of committee members then the chair must enact a formula that provides her less funding.

4.4 Effect of Multiple Proposers

In practice, bargaining does not typically follow this take-it-or-leave-it structure. If the committee proposal is not accepted, other legislators can offer alternate proposals. To investigate the effect of this bargaining, I consider an infinite horizon game where a new proposer is randomly selected and payoffs are realized in each period. Specifically, the bargaining protocol is as follows. In the first period, the committee chair makes a proposal $(\eta, \gamma, \alpha) \in \chi$ and the chamber floor then takes an up-or-down on the committee proposal. If $(n+1)/2$ legislators vote for the proposal (i.e., majority rule), then utilities based on the committee proposal are realized in the current period and in every subsequent period. Otherwise grants are allocated based on the status quo policy $(\eta_q, \gamma_q, \alpha_q) \in \chi$ for the current period, a new proposer is selected, and the game repeats. Legislator i is selected as the proposer with probability ρ_i. Legislators discount future payoffs with a common discount rate $\delta \in [0, 1)$. Note that when $\delta = 0$ this is the same as the one-period game.

Following Banks and Duggan (2006), I focus on no-delay stationary equilibria.[13] More formally, I require that legislators' proposals satisfy sequential rationality and that their acceptance sets satisfy weak dominance. In such equilibria, legislators have a continuation value

$$v_i = \sum_{j=1}^{n} \rho_j \int_p y_i(p) \pi_j dp \tag{9}$$

where $y_i(p)$ is legislator i's grant from proposal p and π_j puts probability one on socially acceptable proposals that maximize j's utility and zero otherwise.

As in the one-period model, the question for the committee chair is which of the proposals that can pass the floor maximize her grant amount. From equation 4 it follows that for the chair to maximize her own grant she should minimize the grants to other

13. No delay implies that a proposal p is in A.

legislators provided that legislators in the winning coalition W receive a grant at least equal to what they would if they rejected the proposal. If proposal $p = (\eta, \gamma, \alpha)$ is accepted, each player i receives a payoff in the current period equal to $y_i = \eta x_i + \gamma z_i + \alpha \frac{1}{n}$ and a dynamic payoff equal to $\frac{y_i}{1-\delta}$. Therefore, player i supports any proposal that provides her a grant y_i weakly greater than $(1-\delta)q_i + \delta v_i$ and the set of proposals acceptable to a given winning coalition is

$$A_W = \left\{ (\eta, \gamma, \alpha) \in \chi \,\middle|\, \eta x_i + \gamma z_i + \frac{\alpha}{n} \geq (1-\delta)q_i + \delta v_i \ \forall i \in W \right\} \tag{10}$$

The cheapest members of the winning coalition again are the legislators with the lowest grants under the status quo and that allow the chair to distribute the smallest amount of funding to other legislators. However, in addition, a legislator's cheapness is also a function of her continuation value and thus the probability that she becomes the proposer in the future.

As with most divide-the-dollar games, this model can be formulated as a special case of Banks and Duggan (2006). From Theorem 1 of Banks and Duggan I get the following existence result:

Proposition 3. There exists a stationary equilibrium with immediate agreement.

And this result holds even though the status quo policy may be favorable to some legislators. However, for certain values of q_c and distributions of x and z there also exist stationary equilibria with delay. I provide an example of one such scenario in the Appendix.

5 Roll Call Voting and Winning Coalitions

In this section, I test the theory using using data on amendments to allocation formulas in the Senate. First, the underlying assumption of the model is that legislators want to procure additional formula funding for their states. As a result, Senators should vote for proposals that increase funding for their states and against those that do not. Consistent with the theory, I find that how much a proposal changes a state's grant amount is a significant predictor of whether a Senator will vote for that amendment.

Second, the theory predicts that formula grant proposals will benefit states doing worse under the status quo. To test this prediction, I examine the relationship between a state's grant amount under the status quo formula and whether that state is included in the winning coalition. Consistent with this prediction, I find that states doing worse under the status quo are more likely to benefit from a formula change.

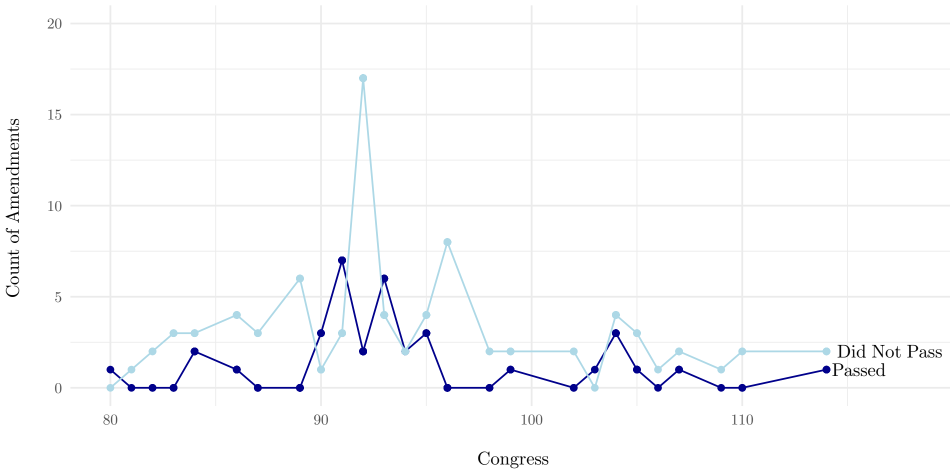
5.1 Data

To test the theory, I use an original dataset of Senate amendments to formula grant programs. Specifically, I collected estimates of state grant amounts under amendments to allocation formulas from the Congressional Record. For each proposal I collected estimates of state grants under the proposal and the status quo policy, what bill the amendment is amending, and which committee had jurisdiction over that bill.[14] I also recorded which member proposed the amendment and I match these data to roll call votes from Lewis et al.'s (2017) Voteview database.[15] I also match each proposal to Stewart and Woon's (2017) and Nelson's (1993) congressional databases to determine party membership, committee membership, party leadership, and seniority. The dataset spans the 80th Congress to the 114th Congress (1947–2016). Figure 4 shows the number of amendments in the dataset in each congress by amendment status.

14. Grant estimates are generally produced by the government agency that administers the program or by the Congressional Research Service.

15. Forty percent of the floor amendments in my dataset received a roll call vote.

Figure 4: Amendments to Formula Grant Programs Over Time



For each proposal, I consider the status quo policy to be the formula that would be in effect if the proposal did not pass. The status quo is usually the formula in current law, under the bill as reported by committee, or under changes passed by the House. Figure 5 shows what the data generally look like in the Congressional Record. In this example, grants under Senator Bellmon's amendment were compared to grants under H.R. 3434.

Figure 5: 125 Cong. Rec. (1979) 29936

FEDERAL FOSTER CARE FUNDING

[In millions of dollars]

	Fiscal year 1978	Fiscal year 1980		
		H.R. 3434	Bellmon amendment	Change
U.S. total	211.95	278.14	279.84	+1.70
Alabama	1.30	1.80	2.21	+0.41
Alaska	.70	.84	.80	−.04
Arizona	(1)	1.10	1.57	+.47
Arkansas	.40	1.00	1.27	+.27
California	29.30	35.16	35.16	(2)
Colorado	1.20	1.44	1.44	(2)
Connecticut	1.60	1.92	1.92	(2)
Delaware	.40	.48	.49	+.01
District of Columbia	.40	.48	.58	+.10
Florida	1.10	3.50	4.15	+.65
Georgia	2.20	2.64	2.99	+.35
Hawaii	(1)	.40	.62	+.22
Idaho	.30	.40	.40	(2)
Illinois	3.20	5.30	5.37	+.07
Indiana	1.20	2.60	3.31	+.71
Iowa	1.10	1.32	1.32	(2)
Kansas	2.40	2.88	2.75	−.13
Kentucky	1.90	2.28	2.42	+.14
Louisiana	2.60	3.12	3.12	(2)
Maine	1.70	2.04	1.95	−.09
Maryland	3.00	3.60	3.60	(2)
Massachusetts	.60	2.50	2.50	(2)
Michigan	10.20	12.24	12.24	(2)
Minnesota	3.20	3.84	3.76	−.08
Mississippi	.80	1.30	1.50	+.20
Missouri	1.50	2.20	2.68	+.48
Montana	.50	.60	.57	−.01
Nebraska	.60	.72	.72	(2)
Nevada	.30	.36	.34	−.02
New Hampshire	.50	.60	.57	−.03
New Jersey	.30	3.30	4.65	+1.35
New Mexico	.08	.60	.85	+.25
New York	109.20	131.04	125.09	−5.95
North Carolina	.70	2.60	3.01	+.41
North Dakota	.40	.48	.46	−.02
Ohio	2.50	5.00	6.22	+1.22
Oklahoma	.60	1.30	1.58	+.28
Oregon	3.70	4.44	4.24	−.20
Pennsylvania	6.80	8.16	8.16	(2)
Rhode Island	.20	.40	.41	+.01
South Carolina	.50	1.40	1.79	+.39
South Dakota	.30	.36	.41	+.05
Tennessee	2.10	2.52	2.80	+.28
Texas	1.00	6.30	6.30	(2)
Utah	.40	.70	.73	+.03
Vermont	.50	.60	.57	−.03
Virginia	2.60	3.12	2.98	−.14
Washington	2.10	2.52	2.52	(2)
West Virginia	.80	.96	1.04	+.08
Wisconsin	2.90	3.48	3.48	(2)
Wyoming	.07	.20	.20	(2)

1 Less than $0.05 million.

2 No change.

As these data are at the state level, I focus my analysis on the Senate. While there is nothing particular to the theory that applies to the Senate but not the House, there is reason to suspect that senators are more likely to try and alter grant programs to bring more funding to their states than House members. Specifically, because formulas do not allocate grants to congressional districts it is difficult for House members to claim credit for formula changes and know how a formula change will affect funding for their district

(Lee 2003, 2004). However, because most formula grants allocate funding to states or entities that are nested within states, these same issues do not affect Senators.

The advantage of these data are that they allow me to isolate formula changes. That is, by looking at individual amendments rather than entire bills, I can examine how legislators voted when the only issue being considered is the allocation formula. Further, these data allow me to easily quantify both the status quo policy and the proposal policy. However, it is worth noting that these data do not reflect the universe of all proposed amendments to formula grant programs. For example, during consideration of the Every Student Succeeds Act (ESSA) in 2016, 17 amendments to allocation formulas were proposed on the Senate floor. Of those amendments, 3 are included in the data I collected from the Congressional Record. The amendments included are those that make larger and more contentious formula changes. That is, these amendments resulted in more debate on the Senate floor. To account for this sample selection issue, I reestimate the winning coalition membership analysis using a dataset that encompasses the universe of enacted changes to formulas administered by the U.S. Department of Education and find similar results. This analysis is included in the Appendix.

5.2 Methodology

To examine roll call voting and winning coalition membership, I estimate the probability of a legislator voting for an amendment and of a legislator being included in the winning coalition. I discuss the methodology for each analysis in more detail below.

5.2.1 Roll Call Votes

The theory assumes that legislators want to increase funding for their states. As a result, Senators should vote for amendments that increase funding for their states and against amendments that do not. To test this, I predict the probability of legislator j voting for amendment p with a linear model of the following form:[16]

$$Pr(Yea_{jp}|y_{jp}, q_{jp}, X_{jp}, \delta_j, \omega_p) = \beta_1 GrantIncrease_{jp} + \beta_2 X_{jp} + \delta_j + \omega_p + \epsilon_{jp} \qquad (11)$$

where y_{jp} is legislator j's state's grant under the proposal, q_{jp} is j's grant under the status quo, ω_p are proposal fixed effects, δ_j are legislator fixed effects, and X_{jp} is a vector of other covariates: whether proposal p was offered by a copartisan, committee membership, party leadership, seniority, majority party membership, and whether the state is represented by the amendment sponsor.[17] I measure whether a state's grant increased by comparing its grant amount under the proposal to its grant amount under the status quo. Specifically, I use following four measures of whether a state's grant increased: (i) the change in grant share, (ii) a binary indicator for whether a state's grant share increased; (iii) the change in logged grant amounts; and (iv) a binary indicator for whether a state's grant amount increased. As linear probability models suffer from heteroskedasticity, I use robust standard errors.[18]

5.2.2 Winning Coalition Membership

To examine the relationship between status quo grants and winning coalition membership, I compare whether a state was included in the winning coalition under amendments proposed in the same congress. That is, I compare whether a state was included in the winning coalition when it was doing poorly under the status quo to winning coalition membership when it was doing well under the status quo within a two-year span.

I use two measures for whether a state is included in the winning coalition: (1) a binary indicator for whether the state's grant increased and (2) whether the state's Senators voted for the proposal. To measure whether a state is doing poorly under the

16. I estimate this with a linear probability model rather than a logistic regression due to the inclusion of fixed effects. Estimating the model without fixed effects and using a logit do not substantially change the results. I include these analyses in the Appendix.

17. This analysis includes votes to table and these votes are reverse coded. I exclude the majority leader to account for votes to recommit.

18. I calculate White (1980) heteroskedasticity-consistent standard errors using the `sandwich` package in R (Zeileis 2004).

status quo, I take the log of a state's grant under the status quo.[19] Because funding levels vary by program, I also include a covariate for the funding level for the program. Specifically, I estimate the probability of being included in the winning coalition with the following linear model:[20]

$$Pr(WinningCoalition_{ipt}|q_{ipt}, \omega_{it}) = \beta_1 \log(q_{ipt}) + \beta_2 Appropriations_{pt} + \omega_{it} + \epsilon_{ipt} \quad (12)$$

where y_{ip} is state i's grant under proposal p in congress t; q_{ip} is state i's grant under the status quo; $Appropriations_{pt}$ is the funding level for the program amended by p under the status quo; ω_{it} is a state-congress fixed effect; and ϵ_{ipt} is an error term. As in the previous analysis, I use robust standard errors to account for heteroskedasticity. As roll call votes are measured at the Senator level the analysis using roll call votes as the dependent variable is done at the legislator level.[21] Similarly, because grant amounts vary by state, the analysis using grant amounts as the dependent variable is done at the state level.

The advantage of this design is that it accounts for state characteristics. As the theory illustrates, whether a state is included in the winning coalition depends on state characteristics (e.g., population), which can vary over time. And, these factors may also be related to a state's grant under the status quo. Including state-congress fixed effects holds state characteristics constant. This allows me to isolate the effect of how a state is doing under the status quo.

5.3 Results

Table 1 examines the relationship between how Senators vote on amendments to allocation formulas and how those amendment change their states' grant amounts. This analysis indicates that Senators are more likely to vote for formula changes that increase the funding their state receives. This is in line with the theory, which assumes that leg-

19. As status quo grants are measured in log dollars, this analysis estimates the relationship between the percentage change in a state's status quo grant on its probability of being included in the winning coalition. In the Appendix I reestimate the model using share and find similar results.

20. I fit a linear probability model rather than a logistic regression due to the inclusion of fixed effects. In the appendix, I fit a conditional logistic regression and get similar results.

21. This analysis excludes the majority party leader due to votes to recommit.

islators modify formulas to increase funding for their states. Additionally, the analysis indicates that committee members vote against floor amendments to allocation formulas. As these are floor amendments, it may be the case that committee members prefer the bill reported out of committee and thus vote against proposed changes on the floor. Lastly, this analysis indicates that legislators are more likely to vote for amendments proposed by copartisans.

Table 1: Senate Voting on Proposed Formula Amendments

	Dependent variable:			
	Vote For Amendment			
Change in Grant Share	0.032^{**}			
	(0.011)			
Change in Grant Share ≥ 0		0.282^{***}		
		(0.014)		
Change in Logged Grant			0.027^{***}	
			(0.004)	
Change in Grant ≥ 0				0.392^{***}
				(0.016)
Proposed by Copartisan	0.302^{***}	0.299^{***}	0.304^{***}	0.297^{***}
	(0.014)	(0.014)	(0.014)	(0.013)
Amendment Sponsor	0.394^{***}	0.321^{***}	0.398^{***}	0.325^{***}
	(0.031)	(0.031)	(0.030)	(0.032)
On Committee	-0.087^{***}	-0.077^{***}	-0.086^{***}	-0.084^{***}
	(0.015)	(0.014)	(0.015)	(0.014)
Party Leadership	-0.006	0.005	-0.007	0.023
	(0.036)	(0.035)	(0.036)	(0.035)
Seniority	0.004^{**}	0.005^{**}	0.004^{*}	0.004^{**}
	(0.002)	(0.002)	(0.002)	(0.002)
Senator Fixed Effects	✓	✓	✓	✓
Amendment Fixed Effects	✓	✓	✓	✓
Count of Amendments	47	47	47	47
Observations	4,274	4,274	4,274	4,274
Adjusted R^2	0.323	0.385	0.319	0.405
Note:	*p<0.05; **p<0.01; ***p<0.001			
	Robust standard errors in parentheses			

Table 2 examines the relationship between a state's grant under the status quo and winning coalition membership when an allocation formula is amended. In line with theoretical predictions, when a state is doing worse under the status quo it is more likely to be included in the winning coalition. If legislators are attempting to allocate funding based solely on need, then a state's grant under the status quo should have no relationship to whether it is included in the winning coalition. These results are more consistent with legislators trying to maximize grants for their states by forming the cheapest winning coalitions. However, this is not to say that other political and institutional factors do not play a role in the distribution of grants. Rather, these results should be taken to mean that at least some of the patterns in grant allocations can be explained by legislators trying to increase their grant amounts.

Table 2: Winning Coalition Membership

	Dependent variable:	
	Grant Increase	Vote For Amendment
Status Quo Grant (Log)	-0.035^{***}	-0.045^{***}
	(0.002)	(0.009)
Program Funding Level (Log)	0.036^{***}	0.003
	(0.004)	(0.010)
State-Congress Fixed Effects	✓	✓
Count of Amendments	117	47
Observations	5,772	4,274
Adjusted R^2	0.093	0.344
Note:		$^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$ Robust standard errors in parentheses

6 Role of Congressional Committees

In this section, I examine the role that authorizing committees play in the design of allocation formulas. If legislators want to procure additional funding and committees have proposal power then the state represented by the committee chair should benefit more from formula changes. I test this prediction using data on education grant programs.

Specifically, I use a matched difference-in-differences design to estimate how much formula funding committee members and chairs are able to procure for their states. Consistent with the theory, I find evidence that both committee members and committee chairs are able to procure additional formula funding for their states when programs under their jurisdiction are reauthorized.

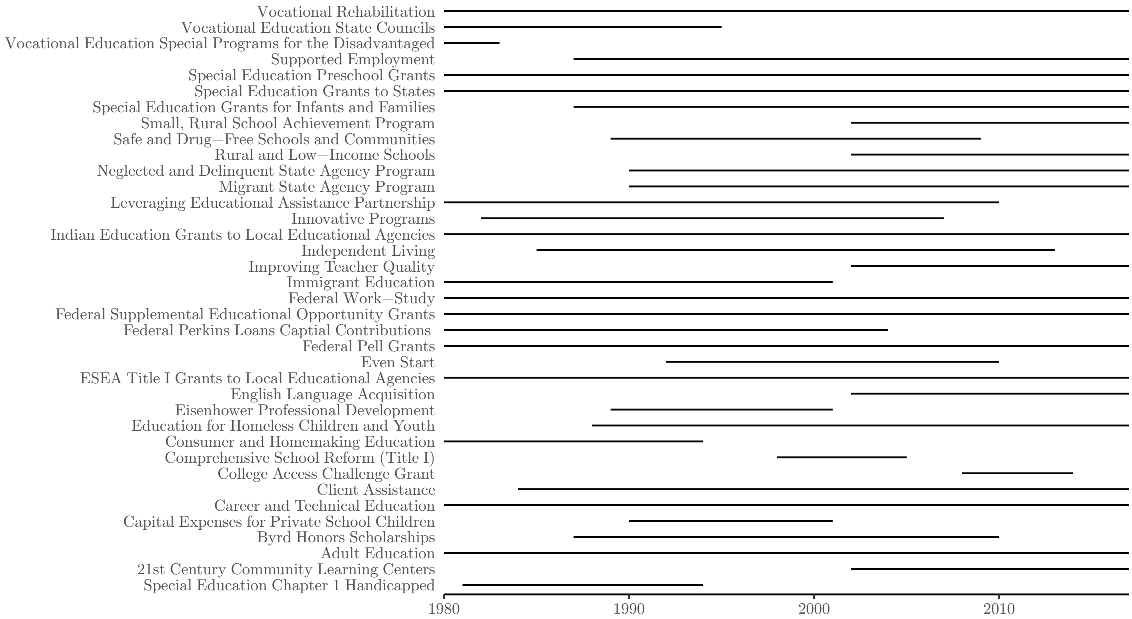
6.1 Data

To test examine the role of congressional committees, I examine the distribution of grants to states for education. I compile a data set of grant amounts for each state in each year going back to FY1980 for all formula grant programs administered by the Department of Education.[22] For each program in each year, I hand code when the program was last reauthorized. I then match each reauthorization to Stewart and Woon's (2017) and Nelson's (1993) congressional databases to determine authorizing committee membership. As all of the programs in the data set are education programs, they all fall under the jurisdiction of the Health Education Labor and Pensions (HELP) Committee.[23] Figure 6 summarizes which programs are funded in each year in this dataset. As in the previous analyses, these data are at the state level. As a result, I focus my analysis on the Senate.

22. Data on state grant amounts are available on the Department of Education's website. I exclude the Impact Aid program from this analysis because it has been reauthorized by bills reported out of the Health Education Labor and Pensions Committee and the Armed Services Committee. Thus, it is sometimes unclear what bill last reauthorized the program and who the committee members are.

23. During this time period the HELP Committee was also called the Human Resources Committee and the Labor and Human Resources Committee.

Figure 6: Formula Grants Administered by ED, FY1980 to FY2017



6.2 Methodology

To estimate the committee and committee chair effects, I use a difference-in-differences design that compares state grant amounts within the same year under education programs that have and have not been reauthorized. Specifically, I exploit the fact that programs do not come up for reauthorization at the same time. That is, at the beginning of a legislator's tenure as chair there will be some programs that she has reauthorized (and thus had the ability to change the formulas) and others she has not. Therefore, I can compare how a state does under a program that the current chair has reauthorized to a similar program that has yet to come up for reauthorization. Put differently, each treated observation has its own control set made up of grant amounts in the same year for the same state under similar programs. For example, Senator Ted Kennedy (MA) became chair of the HELP committee in 2007. In 2008, Congress reauthorized the Higher Education Act (HEA), which is under the jurisdiction of the HELP committee. However, the Workforce Investment Act (WIA), which is also under HELP's jurisdiction, had yet to be reauthorized while Senator Kennedy was chair. To estimate the additional formula funding Senator Kennedy was able to bring to Massachusetts, I compare the change in Massachusetts's HEA grant amounts between 2008 and 2009 to the change in Massachusetts's WIA grant amounts over the same time period.[24]

As formula changes are often phased in over time, I estimate the effect of joining committee and becoming chair immediately following a formula change and for each of the three subsequent years.[25] Let $D_{ipt} \in \{0, 1\}$ represent the treatment status of state i for program p at time t. I compare the change in a committee member/chair's grant amount following reauthorization at time t to a counterfactual of never being reauthorized over the same period. Thus, the vector $\mathbf{D}$ for the treatment (T) and control (C) groups is the following:

	$t-3$	$t-2$	$t-1$	t	$t+1$	$t+2$	$t+3$
D_T	0	0	0	1	1	1	1
D_C	0	0	0	0	0	0	0

To estimate the treatment effect j years after reauthorization, I compare the change in each treated observation's logged grant amount between $t-1$ and $t+j$ to that of its matched control set. To account for the fact that the same observation may be used in the control group for multiple observations in the treatment group (matching with replacement), I estimate standard errors using a weighted bootstrap (Otsu and Rai 2017). I discuss the estimation of effect sizes and standard errors further in the appendix.

This differences-in-differences design overcomes two potential issues for estimation. First, as the model illustrates, a state's grant amount depends on it's formula factors or observable attributes. As discussed previously, comparing the same state in the same year holds state attributes, such as population and poverty, constant. Second, as others

24. This analysis assumes that chairs do not select which programs to reauthorize based on which formulas they most want to change. This assumption seems reasonable given that a single statute contains multiple formula grant programs as well as other policies. Thus, whether a program gets reauthorized depends on more than just its allocation formula. To test this assumption I compare the chair's state's grant under the status quo under programs reauthorized and not reauthorized in a given year and find no significant difference. Further, this analysis assumes that a state's grant amounts under reauthorized programs would have followed the same trends as non-reauthorized programs had those programs not been reauthorized. To test this assumption, I examine the pre-reauthorization trends in state grant amounts and find the reauthorized and not reauthorized grants are similar. I include these analyses in the appendix.

25. Thus, I only include observations in the treatment group in year t where the treatment status does not change prior to year $t+4$. I also only include observations that remained untreated for at least three years prior to reauthorization.

have noted, a challenge in measuring the committee advantage is constructing the counterfactual as certain legislators may be more likely than others to select onto a committee (e.g., Grimmer and Powell 2013; Berry and Fowler 2016). Thus I cannot compare a committee member's state to all other states. This design sidesteps this issue by exploiting the plausibly exogenous variation in program reauthorizations, as opposed to which state is represented by the chair, to make within-state comparisons.

6.3 Results

Table 3 presents estimates of the of the committee advantage and the committee chair advantage. The analysis suggests that states represented by committee members receive more formula grant funding. Further, there is an additional benefit of becoming the committee chair on top of committee membership.[26] In the first year following a reauthorization, committee members' states receive about 24% more education funding and committee chairs' states receive an additional 5.5%.[27] These results are consistent with the prediction of the theory that committee members benefit more from formula changes and this benefit is not just due to committee members being high demanders. These results are also somewhat in line with work by Berry and Fowler (2018) that argues that legislators see an increase in power when they become committee chairs. However, unlike Berry and Fowler, I find a substantial effect of committee membership as well as being the committee chair.

26. The control group includes programs that have yet to be reauthorized since a legislator became chair. Because committee chairs were on committee prior to being chair, the committee chair effect is primarily comparing how a state does when it was represented by a committee member to when it is represented by the committee chair.

27. As grants are measured in log dollars, $100 \times (\epsilon^{\beta} - 1)$ reflects the percentage change in funding in a legislator's state when that legislator is on committee or is the chair. For small values of β, this can be approximated by $100 \times \beta$.

Table 3: Effect of Committee Position on Formula Grants, Diff-in-Diff Estimates

	DV: Grant Amount (Log)			
	t	$t+1$	$t+2$	$t+3$
Committee Chair	0.055*	0.198*	0.106*	0.117
	(0.023)	(0.077)	(0.044)	(0.061)
Committee Member	0.215*	0.1**	0.227***	0.396**
	(0.1)	(0.037)	(0.053)	(0.121)
Observations				
Committee Chair	138	138	138	138
Committee Member	1,014	1,014	1,014	1,014

Note: *p<0.05; **p<0.01; ***p<0.001; standard errors computed based on 1,000 weighted bootstrap samples in parentheses

7 Concluding Discussion

In this paper I show how grant programs are shaped by majority rule, congressional committees, and legislators attempting to maximize the funding their states receive. Consistent with a distributive theory of formula grants, committee members, and particularly the committee chair, are more successful in procuring additional funding because of the role they play in the policymaking process. However, the structure of a formula imposes additional constraints. As in Martin (2018), the advantage to the chair is reduced because funding is distributed outside of the winning coalition, winning coalitions may be oversized, and members of the winning coalition may receive a larger share of funding than is required to make them support a proposal. In this paper, I show that the status quo further constrains the chair, in some cases preventing them from enacting a new formula.

The theory also yields new predictions about which states should most benefit from formula grant programs. States doing worse under the status quo benefit more from formulas because they are cheaper to include in the winning coalition. Consistent with this prediction, I find that the larger a state's grant is under the status quo formula, the less likely that state is to be included in the winning coalition. Additionally, as the Title

I-A example illustrated, smaller states tend to receive more per capita grant funding than larger states (Lee 2000). This result is consistent with the theory as the distribution of population across states is right skewed. In other words, there are a few states with very high populations (e.g., New York, California, Texas) but the majority of states have population levels below the national average. Thus, if a formula were to include population or factors correlated with population (e.g., poverty) then a large number of states would want to have high minimum grants. Because a large number of formulas do include some measure of population, many formulas should end up with higher minimum grant amounts. And, since minimum grants distribute an equal amount of funding to each state, these provisions provide smaller states more per capita funding.

These results have important implications for how efficiently programs distribute funding to areas with the greatest need. What formula gets enacted, and thus which states benefit, depends on the distribution of formula factors across states, the committee chair, and the status quo policy. Committee chairs with high need benefit from efficient formulas. Thus, due to their proposal power, committee chairs with high need typically improve formulas with poor targeting and protect formulas that target effectively. However, for a committee chair to improve the targeting of a formula, she needs to find a majority of legislators who support her proposal. Thus, if the majority of legislators have relatively low need then, depending on the status quo, it may not be possible for the chair to enact a formula that improves targeting.

The chair, status quo, and distribution of need also determine whether a formula is more targeted to one factor over another. Consider again a formula based on population and poverty. If poverty is concentrated in a few states but population is not then population share will be larger than poverty share for a majority of states. Thus, for certain status quos, even if the chair represents a state with a high poverty share then it may not be possible to enact a formula that is only based on poverty. The formula will have to put some weight on population. More generally, if one factor is greater than the other for a majority of legislators then the formula will often place at least some weight on that first factor.

One implication of this theory is that having committee chairs who are high demanders in a certain policy area may actually improve how effectively formulas target need. Weingast and Marshall (1988) show how the committee system in Congress facilitates decision making because it allows for the enforcement of legislative bargains. This is due to both committees' agenda setting power and the fact that committees are made up of high demanders. By a similar argument committee chairs can enact and protect formulas that most benefit their states through their agenda setting power. And, if committee chairs have high need for a program (i.e., they are high demanders) then the formulas they enact and protect are likely to be formulas that target funding toward areas with the greatest need.

References

Balla, Steven J., Eric D. Lawrence, Forrest Maltzman, and Lee Sigelman. 2002. "Partisanship, Blame Avoidance, and the Distribution of Legislative Pork." *American Journal of Political Science* 46 (3): 515–525.

Banks, Jeffrey S., and John Duggan. 2006. "A General Bargaining Model of Legislative Policy-making." *Quarterly Journal of Political Science* 1:49–85.

Baron, David P., and John A. Ferejohn. 1989. "Bargaining in Legislatures." *American Political Science Review* 83 (4): 1181–1206.

Berry, Christopher R., and Anthony Fowler. 2016. "Cardinals or Clerics? Congressional Committees and the Distribution of Pork." *American Journal of Political Science* 60 (3): 692–708.

———. 2018. "Congressional committees, legislative influence, and the hegemony of chairs." *Journal of Public Economics* 158:1–11.

Clemens, Austin, Michael Crespin, and Charles J. Finocchiaro. 2015. "Earmarks and Subcommittee Government in the U.S. Congress." *American Politics Research* 43 (6): 1074–1106.

Cox, Gary W., and Mathew D. McCubbins. 1986. "Electoral Politics as a Redistributive Game." *The Journal of Politics* 48 (2): 370–389.

———. 1993. *Legislative Leviathan: Party Government in the House.* University of California Press.

———. 2005. *Setting the Agenda: Responsible Party Government in the U.S. House of Representatives.* Cambridge University Press, September 26.

Dilger, Robert Jay, and Michael H. Cecire. 2019. *Federal Grants to State and Local Governments: A Historical Perspective on Contemporary Issues* R40638. Congressional Research Service, May 22.

Evans, Diana. 1994. "Policy and Pork: The Use of Pork Barrel Projects to Build Policy Coalitions in the House of Representatives." *American Journal of Political Science* 38 (4): 894–917.

———. 2011. "Pork Barrel Politics." In *The Oxford Handbook of the American Congress,* edited by George C. Edwards III, Frances E. Lee, and Eric Schickler. March.

Fenno, Richard J. 1966. *The Power of the Purse: Appropriations Politics in Congress.* Little Brown & Company, January.

Ferejohn, John A. 1974. *Pork Barrel Politics: Rivers and Harbors Legislation, 1947-1968.* Stanford University Press.

Grimmer, Justin, and Eleanor Neff Powell. 2013. "Congressmen in Exile: The Politics and Consequences of Involuntary Committee Removal." *The Journal of Politics* 75 (4): 907–920.

Hall, Jeremy L. 2010. "The Distribution of Federal Economic Development Grant Funds: A Consideration of Need and the Urban/Rural Divide." *Economic Development Quarterly* 24 (4): 311–324.

Hammond, Ben, and Leah Rosenstiel. 2020. "Measuring the Influence of Political Actors on the Federal Budget." *American Political Science Review* 114 (2): 603–608.

Imai, Kosuke, In Song Kim, and Erik Wang. 2020. "Matching Methods for Causal Inference with Time-Series Cross-Sectional Data." *Working Paper.*

Knight, Brian. 2005. "Estimating the Value of Proposal Power." *The American Economic Review* 95 (5): 1639–1652.

Krehbiel, Keith. 1991. *Information and Legislative Organization.* Ann Arbor: University of Michigan Press.

Larcinese, Valentino, Leonzio Rizzo, and Cecilia Testa. 2013. "Changing Needs, Sticky Budget: Evidence from the Geographic Distritribution of U.S. Federal Grants." *National Tax Journal* 66 (2): 311–341.

Lee, Frances E. 2000. "Senate Representation and Coalition Building in Distributive Politics." *The American Political Science Review* 94 (1): 59–72.

———. 2003. "Geographic Politics in the U.S. House of Representatives: Coalition Building and Distribution of Benefits." *American Journal of Political Science* 47 (4): 714–728.

———. 2004. "Bicameralism and Geographic Politics: Allocating Funds in the House and Senate." *Legislative Studies Quarterly* 29 (2): 185–213.

Lewis, Jeffrey B., Keith Poole, Howard Rosenthal, Aaron Rudkin, and Luke Sonnet. 2017. "Voteview: Congressional Roll-Call Votes Database." `https://voteview.com/`.

Martin, Gregory J. 2018. "Dividing the Dollar with Formulas." *The Journal of Politics* 80 (2): 479–493.

Mayhew, David R. 1974. *Congress: The Electoral Connection.* Yale University Press.

Nelson, Garrison. 1993. *Committees in the U.S. Congress, 1947-1992, Senate.*

Otsu, Taisuke, and Yoshiyasu Rai. 2017. "Bootstrap Inference of Matching Estimators for Average Treatment Effects." *Journal of the American Statistical Association* 112 (520): 1720–1732.

Payne, A. Abigail. 2003. "The Effects of Congressional Appropriation Committee Membership on the Distribution of Federal Research Funding to Universities." *Economic Inquiry* 41 (2): 325–345.

Shepsle, Kenneth A., and Barry R. Weingast. 1981. "Political Preferences for the Pork Barrel: A Generalization." *American Journal of Political Science* 25 (1): 96–111.

———. 1987. "The Institutional Foundations of Committee Power." *The American Political Science Review* 81 (1): 85–104.

Skinner, Rebecca, and Leah Rosenstiel. 2017. *History of theESEATitle I-A Formulas* R44898. Congressional Research Service, July 17.

———. 2018. *Analysis of the Elementary and Secondary Education Act Title I-A Allocation Formulas: Factors, Design Elements, and Allocation Patterns* R45141. Congressional Research Service, March 22.

Stewart III, Charles, and Jonathan Woon. 2017. *Congressional Committee Assignments, 103rd to 115th Congresses, 1993–2017: Senate.*

Szymendera, Scott. 2008. *Vocational Rehabilitation Grants to States and Territories: Overview and Analysis of the Allotment Formula* RL34017. Congressional Research Service, January 29.

Therneau, Terry. 2020. *A Package for Survival Analysis in R.* R package version 3.1-11.

"Title I, Part A Program." U.S. Department of Education. 2015. October 5. Accessed February 19, 2018. https://www2.ed.gov/programs/titleiparta/index.html.

Weingast, Barry R., and William J. Marshall. 1988. "The Industrial Organization of Congress; or, Why Legislatures, Like Firms, Are Not Organized as Markets." *Journal of Political Economy* 96 (1): 132–163.

White, Halbert. 1980. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica* 48 (4): 817–838.

Zeileis, Achim. 2004. "Econometric Computing with HC and HAC Covariance Matrix Estimators." *Journal of Statistical Software* 11 (1): 1–17.

Appendix

A Theory

Maximum Grant Amounts

It is first useful to consider the maximum possible amount each state could receive under a formula. In a typical divide-the-dollar game (e.g., Baron and Ferejohn 1989), the maximum possible allocation for a legislator is 1 (i.e., they take the entire dollar). However, when allocations are constrained by a formula, each type of legislator has a different maximum allocation, which is less than 1 and determined by x_i and z_i. A legislator's "type" is pair $\{x_i, z_i\}$. Thus, legislators with the same values for x_i and z_i are of the same type. Based on these types, legislators fall into the following three categories, which describe their maximum possible allocation and the formula factor from which they most benefit:

1. When $x_i \geq z_i$ and $x_i \geq 1/n$ then $y_i^{\max} = x_i$ and this allocation occurs when $\eta = 1, \gamma = 0, \alpha = 0$. I refer to these legislators as legislators whose preferred weight is η.

2. When $z_i \geq x_i$ and $z_i \geq 1/n$ then $y_i^{\max} = z_i$ and this allocation occurs when $\gamma = 1, \eta = 0, \alpha = 0$. I refer to these legislators as legislators whose preferred weight is γ.

3. When $x_i \leq 1/n$ and $z_i \leq 1/n$ then $y_i^{\max} = 1/n$ and this allocation occurs when $\alpha = 1, \eta = 0, \gamma = 0$. I refer to these legislators as legislators whose preferred weight is α.[28]

The intuition for this result is relatively straightforward: a legislator receives the largest grant when all of the weight is placed on their largest formula factor. More formally,

$$\max_{\eta,\gamma,\alpha} \eta x_i + \gamma z_i + \alpha \frac{1}{n} \tag{13}$$

28. If $x_i = z_i = 1/n$ then that legislator receive their maximum allocation ($1/n$) under any combination of weights so long as $\eta + \gamma + \alpha = 1$.

when $\eta, \gamma, \alpha \geq 0$ and the budget constraint is $\eta + \gamma + \alpha \leq 1$.

In the case where $z_i = x_i = 1/n$, any combination of η, γ, α provides i her maximum grant of $1/n$ so long as $\eta + \gamma + \alpha = 1$. In this case, η, γ, and α are essentially perfect substitutes. However, in all other cases we must consider corner solutions. When $(1, 0, 0)$ is the formula, i receives a grant of x_i. When $(0, 1, 0)$ is the formula, i receives a grant of z_i. When $(0, 0, 1)$ is the formula, i receives a grant of $1/n$. Thus, $(1, 0, 0)$ provides i her maximum grant (equal to x_i) when $x_i > z_i$ and $x_i > 1/n$. That is, when i prefers η. Similarly, $(0, 1, 0)$ and $(0, 0, 1)$ provides i her maximum grant when she prefers γ and α, respectively.

Proof of Proposition 1

Proposition 1. There exists a Nash equilibrium in which the chair makes an acceptable proposal. Further, let g_i be the grant legislator i receives when the committee chair sets her preferred weight to 1, G be the set of all legislators for whom $g_i \geq q_i$, and $|G|$ be the number of legislators in G. If either (i) $\sum_{i \in N} q_i < 1$; (ii) $q_i < f_i^2$ for the majority of legislators and the chair; or (iii) $|G| \geq (n+1)/2$ and $q_i < g_c$ then there exists a Nash equilibrium in which the chair enacts a formula that increases her grant amount.

Proof. By construction, the voting strategy $A_i = \{(\eta, \gamma, \alpha) \in \chi | \eta x_i + \gamma z_i + \alpha/n\}$ satisfies weak dominance. Notice that legislator i's acceptance set A_i contains the status quo formula for all $i \in N$. Thus, A is always nonempty as it will contain the status quo formula. As a result, the chair can always make an acceptable proposal. And, because a non-acceptable proposal results in grants based on the status quo formula, there is always an acceptable proposal that the chair weakly prefers to a non-acceptable proposal. As a result, selecting the proposal in A that maximizes her grant amount, is a best response for the chair. Thus, there exists a Nash equilibrium in which the chair makes an acceptable proposal. □

Define w_i^1, w_i^2, w_i^3 as the value of legislator i's most, second-most, and least preferred weights, respectively, under the status quo.[29]

29. For example, if $f_i^2 = x_i$ then $w_i^2 = \eta_q$

(i) When $\sum_{i \in N} q_i < 1$ this implies $\eta_q + \gamma_q + \alpha_q < 1$. Thus, the proposer can always strictly increase her grant amount and the grant amount for all other legislators by increasing her preferred weight by $1 - \alpha_q - \gamma_q - \eta_q$. $\square$

(ii) Note that when $\eta + \gamma + \alpha = 1$ but legislator i's least preferred weight is 0 then it must be the case that $y_i \geq f_i^2$. Thus, when $q_c < f_c^2$ this implies that $w_c^1 + w_c^2 < 1$. Further, when $q_i < f_i^2$ for the majority of legislators then $w_i^1 + w_i^2 < 1$ for the majority of legislators. Thus the grant for the chair and majority of legislators can be increased by decreasing w_c^3. $\square$

(iii) When $|G| \geq (n+1)/2$ then the formula that sets the chair's preferred weight to 1 is socially acceptable. This is because it provides every legislator with $y_i = g_i$, which weakly increases grants for a majority of legislators. Further, this provides the chair her maximum grant amount ($y_i = y_i^{\max}$), which strictly increases the chair's grant amount provided the chair is not already receiving her maximum. $\square$

Proof of Corollary 1

Let g_i be the grant legislator i receives when the committee chair sets her preferred weight to 1, G be the set of all legislators for whom $g_i > q_i$, and $|G|$ be the number of legislators in G. Further, let A_W^* be the formula in A_W that maximizes the chair's grant amount and $y_i(A_W^*)$ be legislator i's grant amount from this formula.

It is first useful to consider some lemmas to prove the main result. Lemma 1 shows that in equilibrium the budget constraint always binds.

Lemma 1. $\sum_{i \in N} y_i = 1$

Proof. Suppose not and $\sum_{i \in N} y_i < 1$. Note that because $\sum_{i \in N} x_i = 1$ and $\sum_{i \in N} z_i = 1$, then Lemma 1 implies $\eta + \gamma + \alpha = 1$. If it were not to bind then the proposer could always strictly increase her grant amount by increasing her preferred weight by $1 - \alpha - \gamma - \eta$. $\square$

Lemma 2 shows that if the formula proposed in equilibrium does not provide the chair her maximum grant amount then at least one legislator in the winning coalition is indifferent between the proposal and the status quo.

Lemma 2. If $y_c(A^*_W) < y_c^{\max}$ then there exists $i \in W$ such that $y_i(A^*_W) = q_i$.

Proof. From weak dominance,

$$A_i = \left\{(\eta, \gamma, \alpha) \in \chi \,\middle|\, \eta x_i + \gamma z_i + \frac{\alpha}{n} \geq q_i \right\} \tag{14}$$

If possible, the chair would set her preferred weight to one as it provides her $y_c^{\max}$. Thus, when $y_c(A^*_W) < y_c^{\max}$, it must be the case that $q_i > g_i$ for the majority of legislators. This implies that the majority of legislators do not prefer the same weight as the chair and some of these legislators need to be included in the winning coalition. Further, from Lemma 1, it immediately follows that if the chair cannot set her preferred weight to 1 the formula proposed in equilibrium will put weight on at least one other factor. If $y_i(A^*_W) > q_i$ for all $i \in W$ such that $g_i > q_i$ then the chair can increase her preferred weight and decrease the other weight in the formula, which decreases the grants for these legislators. Further, the chair will continue to do this until $y_i(A^*_W) = q_i$ for at least one legislator. □

Lemma 3 shows that in equilibrium the sum of grants distributed to legislators other then the chair weakly decreases if members are removed from the winning coalition. Further, if the formula proposed in equilibrium does not provide the chair her maximum grant amount then this inequality is strict.

Lemma 3. When $W' \in \mathcal{D}$ and $W' \subset W$ then

1. $\sum_{i \in N-c} y_i(A^*_{W'}) \leq \sum_{i \in N-c} y_i(A^*_W)$
2. If $y_c(A^*_W) < y_c^{\max}$ then $\sum_{i \in N-c} y_i(A^*_{W'}) < \sum_{i \in N-c} y_i(A^*_W)$

Proof. Because the budget constraint binds in equilibrium, the chair's grant is equal to the following:

$$y_c = 1 - \sum_{i \in N-c} y_i \tag{15}$$

Thus for the chair to maximize her grant, she must minimize grants to all other legislators.

As a result,

$$\sum_{i \in N-c} y_i(A^*_{W'}) = \min_{(\eta,\gamma,\alpha)\in A_{W'}} \sum_{i\in N-c} \eta x_i + \gamma z_i + \alpha/n \tag{16}$$

$$\sum_{i \in N-c} y_i(A^*_{W}) = \min_{(\eta,\gamma,\alpha)\in A_{W}} \sum_{i\in N-c} \eta x_i + \gamma z_i + \alpha/n \tag{17}$$

Because $W' \subset W$, it immediately follows that $A_W \subseteq A_{W'}$. As a result, $\sum_{i\in N-c} y_i(A^*_{W'}) \leq \sum_{i\in N-c} y_i(A^*_W)$. As for part 2, note that, from Lemma 2, there exists $j \in W$ such that $y_j(A^*_W) = q_j$. If legislator j is removed from the winning coalition then c can increase her preferred weight and decrease at least one of the other weights. This strictly increases the chair's grant amount, therefore strictly decreasing the sum of grants distributed to other legislators. □

With this, I can now prove the main result.

Corollary 1. If $|G| \geq (n+1)/2$ then the winning coalition size is $|G|$. If $|G| < (n+1)/2$, then any formula change enacted in equilibrium has a minimal winning coalition.

Proof. If possible the chair sets her preferred weight to 1 as this results in her maximum grant amount. It is possible for the chair to enact this formula when a majority of states receive at least what they are receiving under the status quo formula. Thus, the winning coalition size is $|G|$. In all other cases, the winning coalition is minimal sized. Suppose not and c proposes $(\eta, \gamma, \alpha) \in A$ where $y_i > q_i$ for $\hat{n} > (n+1)/2$ legislators. Because, $|G| < (n+1)/2$ the chair cannot set her preferred weight to 1. From Lemma 1 it follows that if the chair cannot set her preferred weight to 1 then in equilibrium at least two weights are non-zero. From Lemma 3, the chair strictly prefers increasing her preferred weight and decreasing at least one of the other weights such that fewer legislators are included in the winning coalition. This results in a minimal winning coalition because if it did not and the other weights could not be decreased any further then this would imply that the chair's preferred weight is 1, which is not possible.[30] And, the chair strictly prefers this formula to (η, γ, α) because it increases the weight on her most preferred factor and weakly decreases the weight on the other two factors. □

30. There are some knifes edge conditions in which two legislators are equally "cheap" to include in the winning coalition and thus, in equilibrium, the chair could have an oversized coalition.

Proof of Proposition 2

Proposition 2. When the winning coalition must include a majority of committee members, (i) the number of non-committee members included in the winning coalition weakly decreases and (ii) the number of committee members included in the winning coalition weakly increases.

First, I show that the size of the winning coalition in this extension is weakly smaller than in the base model. Let A^h be the set of proposals that weakly increase grant amounts for the majority of legislators and a majority of committee members. And, let $|W|$ be the size of the winning coalition in the base model and $|W^h|$ be the size of the winning coalition when it must include a majority of committee members.

Lemma 4. $|W| \geq |W^h|$

Proof. It follows from Corollary 1 that the winning coalition is only oversized when the chair puts all of the weight on her most preferred factor. If this proposal is in A^h then the chair will propose it in both this extension and the base model as it provides the chair her maximum possible grant amount. If this proposal is in A but not A^h then $|W| > |W^h|$. If this proposal is in neither acceptance set then $|W| = |W^h|$ □

With Lemma 4, I now prove the main result.

Proof.

(i) As I show below, the number of committee members included in the winning coalition, weakly increases. Further, Lemma 4 shows that the overall size of the winning coalition weakly decreases. It must therefore be the case that the number of non-committee members included in the winning coalition weakly decreases. □

(ii) If the proposal that maximizes the chair's grant amount in the base model is in A^h then the chair proposes that as $A^h \subset A$. If not then it must be the case that the proposal in the base model would not include a majority of committee members. Thus, the number of committee members in the winning coalition weakly increases. □

Proof of Proposition 3

To apply Theorem 1 of Banks and Duggan (2006) I must verify six technical conditions:

1. Impose the requirement that $\delta \in [0, 1)$ and $\delta_i = \delta \forall i$.

2. The set of possible formulas χ is nonempty, compact, and convex where $\chi = \{\eta, \gamma, \alpha \in [0, 1] | \sum_{i \in N} \eta x_i + \gamma z_i + \alpha 1/n \leq 1\}$. $(0, 0, 0) \in \chi$ so χ is nonempty. Convexity and compactness follow immediately from the linear budget constraint and the non-negativity constraints used to define χ.

3. The status quo policy $(\eta_q, \gamma_q, \alpha_q) \in \chi$. This is true by assumption.

4. Impose the requirement that the recognition probabilities $\rho_1, ..., \rho_n$ are fixed throughout the game. Note that fixing the chair as the proposer in the first period does not conflict with this requirement as we can consider the chair to be the legislator who is chosen as the proposer in the first period.

5. Each legislator's utility u_i is continuous and concave. This is ensured by the linearity of the utility function.

6. Each legislator's utility u_i is strictly quasi-concave and strictly monotonic in the consumption of i's district. Strict quasi-concavity and strict monotonicity follow from the fact that i's utility is strictly increasing in her own district's grant amount.[31]

Example of Delay

Proposition 2 shows that there always exists a stationary equilibrium without delay. However, for certain values of q_c and distributions of x and z there also exist stationary equilibria with delay.[32] In such an equilibrium, legislators have the following continuation value:

31. This condition is needed to ensure that Banks and Duggan's requirement of limited shared weak preferences (LSWP) holds. LSWP is similar to, but weaker than, single-peakedness.

32. Model 6 of Banks and Duggan (2006) provides a similar example of a stationary equilibrium with delay.

$$v_i = \frac{\sum_{j \in N} \rho_j \left(\int_p y_i(p) \pi_j dp + (1-\delta) q_i \pi_j (\chi - A) \right)}{1 - \delta \sum_{j \in N} \rho_j \pi_j (\chi - A)} \tag{18}$$

where $\pi_j(\chi - A)$ is the probability that legislator j makes a proposal that is not accepted.

Consider a case where $1/3 > x_c > z_c$, $x_i > z_i > 1/3$, $x_j > z_j > 1/3$, and $(\eta_q, \gamma_q, \alpha_q) = (0, 0, 1)$. That is, legislator c prefers α, legislators i and j both prefer η, and the status quo formula places all of the weight on α, providing each legislator with a status quo grant of 1/3. I look for stationary equilibria of the following form: $p_c = (0, 0, 1), A_c = \{(\eta, \gamma, \alpha) \in \chi | y_c \geq (1-\delta)1/3 + \delta v_c\}, p_i = p_j = (1, 0, 0), A_i = \{(\eta, \gamma, \alpha) \in \chi | y_i \geq (1-\delta)1/3 + \delta v_i\}$, and $A_j = \{(\eta, \gamma, \alpha) \in \chi | y_j \geq (1-\delta)1/3 + \delta v_j\}$. In such equilibria,

$$\begin{aligned} v_c =& \frac{(\rho_i + \rho_j)x_c + \rho_c \frac{1}{3}(1-\delta)}{1 - \delta\rho_c} \\ v_i =& \frac{(\rho_i + \rho_j)x_i + \rho_c \frac{1}{3}(1-\delta)}{1 - \delta\rho_c} \\ v_j =& \frac{(\rho_i + \rho_j)x_j + \rho_c \frac{1}{3}(1-\delta)}{1 - \delta\rho_c} \end{aligned} \tag{19}$$

Therefore c accepts a proposal when

$$y_c \geq \frac{1}{3} + \frac{\delta(1-\rho_c)(x_c - 1/3)}{1 - \delta\rho_c} \tag{20}$$

i accepts a proposal when

$$y_i \geq \frac{1}{3} + \frac{\delta(1-\rho_c)(x_i - 1/3)}{1 - \delta\rho_c} \tag{21}$$

and j accepts a proposal when

$$y_j \geq \frac{1}{3} + \frac{\delta(1-\rho_c)(x_j - 1/3)}{1 - \delta\rho_c} \tag{22}$$

In this case, i and j always vote to reject c's proposal. And, by construction, all three legislators' acceptance sets satisfy weak dominance. Further, the chair weakly prefers proposing $(0, 0, 1)$ to any other proposal that would get rejected and weakly prefers proposing $(0, 0, 1)$ to making a proposal that either i or j would accept immediately. Thus, c's proposal strategy satisfies sequential rationality. Additionally, as i and j's proposals would both pass and provide them their maximum grant amounts, these strategies also satisfy sequential rationality. Therefore, there exists a stationary equilibrium where delay occurs with probability 1 but after a finite number of periods a proposal other than the status quo is enacted.[33]

B Senate Floor Amendments

Table 4 provides some descriptive statistics on Senate amendments to formula grant programs. Winning coalition size is measured as the number of states whose grant amount would increase under the proposal.

Table 4: Summary of Formula Grants Amendment Data

	All Amendments	Passed Amendments
Grant Under Proposal		
Mean	\$116,373,836	\$56,887,163
St. Dev.	\$560,444,629	\$185,588,104
Status Quo Grant		
Mean	\$103,861,793	\$55,393,051
St. Dev.	\$497,156,091	\$193,021,005
Change in Grant Amt.		
Mean	\$12,512,042	\$1,494,113
St. Dev.	\$102,585,375	\$50,567,361
Proposal Funding Level		
Mean	\$5,741,109,230	\$2,831,355,390
St. Dev.	\$20,118,608,406	\$5,566,692,195
Status Quo Funding Level		
Mean	\$5,123,848,472	\$2,756,991,257
St. Dev.	\$17,856,464,769	\$5,563,743,261
Winning Coalition Size		
Mean	35.35	37.83
St. Dev.	13.85	11.62

33. If the chair were not fixed as the proposer in the first period then delay would occur with probability $\rho_c > 0$.

C Estimating the Committee Advantage

To estimate the committee advantage I use a difference-in-differences design where each treated observation is matched with control observations from the same state in the same time period. Let $D_{ipt} \in \{0,1\}$ represent the treatment status (committee member/committee chair) of state i for program p at time t. I estimate the committee advantage j years after a reauthorization for $j \in \{0,1,2,3\}$ using

$$\hat{\tau}_j = \frac{\sum_{i\in S}\sum_{t\in T}\sum_{p\in P} W_{ipt}\left(Y_{ipt+j} - Y_{ipt-1}\right)}{\sum_{i\in S}\sum_{t\in T}\sum_{p\in P} D_{ipt}\times W_{ipt}} \tag{23}$$

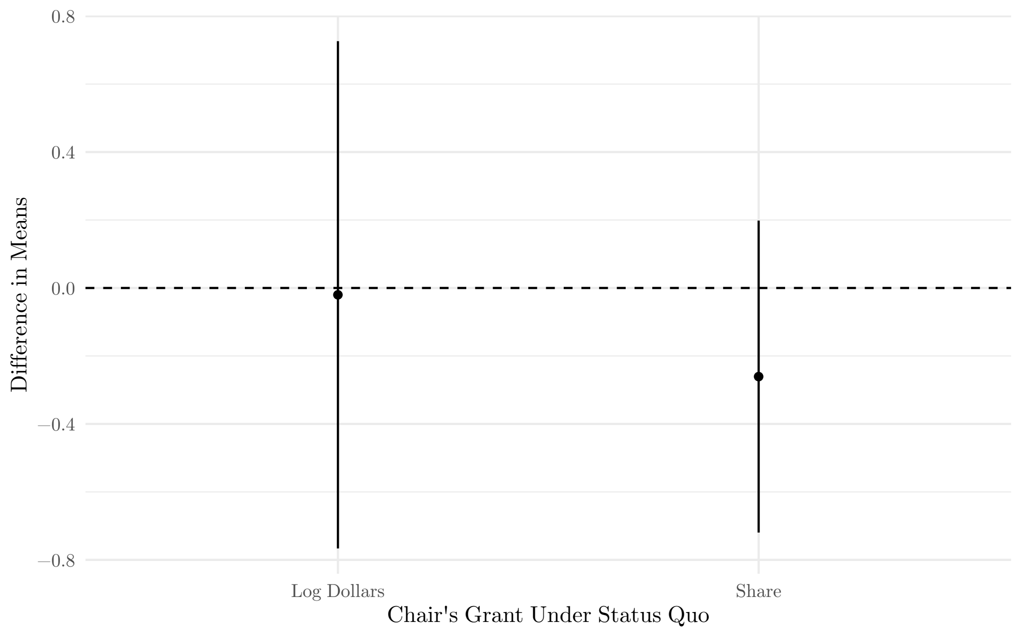
where Y_{ipt+j} is state i's grant amount under program p at time $t+j$; and

$$W_{ipt} = \begin{cases} \frac{-\sum_{p'\in P}\prod_{j'=1}^{3}(1-D_{ip't-j'})\prod_{j'=0}^{3} D_{ip't+j'}}{\sum_{p'\in P}\prod_{j'=-3}^{3}(1-D_{ip't+j'})} & \text{if } D_{ipt+j'} = D_{ipt-j'} = 0 \ \forall\ j' \in \{0,1,2,3\} \\ 1 & \text{if } \prod_{j'=0}^{3} D_{ipt+j'} = \prod_{j'=1}^{3}(1-D_{ipt-j'}) = 1; \\ & \text{ and } \sum_{p'\in P}\prod_{j'=-3}^{3}(1-D_{ip't+j'}) > 0 \\ 0 & \text{Otherwise} \end{cases}$$

Note that τ is the average treatment effect on the treated (ATT). The denominator reflects the number of treated observations that have at least one control observation in their matched sets. The numerator is equivalent to taking the change in a state's grant amount for treated observations that have a matched set and subtracting it from the average change in that state's grant amounts over the same time period for programs that have yet to be reauthorized. To achieve this, treated observations with a matched control set receive a weight (W_{ipt}) of 1 and control observations receive a weight based on the number of treated observations they are matched to and the number of other control observations in the matched set. To estimate standard errors, I use the weighted bootstrap procedure proposed by Otsu and Rai (2017). Specifically, I treat the weights as covariates and do not re-estimate them within each bootstrap iteration. Following Imai, Kim, and Wang (2020), I use a block bootstrap procedure to sample state-program units to accommodate the panel nature of my data.

This analysis relies on two assumptions. First, chairs are not strategically selecting programs to reauthorize based on which formulas they want to change. Second, observations in the treatment and control groups follow common trends. Figure 7 shows the difference in means between the chair's grant under the status quo for the treatment and control groups.[34] I measure the chair's status quo grant using both share and log dollars.[35] There does not appear to be any relationship between the status quo grants and whether programs were reauthorized. This suggests that chairs are not selecting bills to reauthorize based on how much grant funding their states are receiving under programs included in each bill. Figure 8 shows the weighted average grant for the committee chair's state under programs that were reauthorized (treatment group) and not reauthorized (control group).[36] The pre-reauthorization trends for the treatment and control units are similar, which supports the common trends assumption required for identification.

Figure 7: Chair's Status Quo Grant Balance Between Treatment and Control

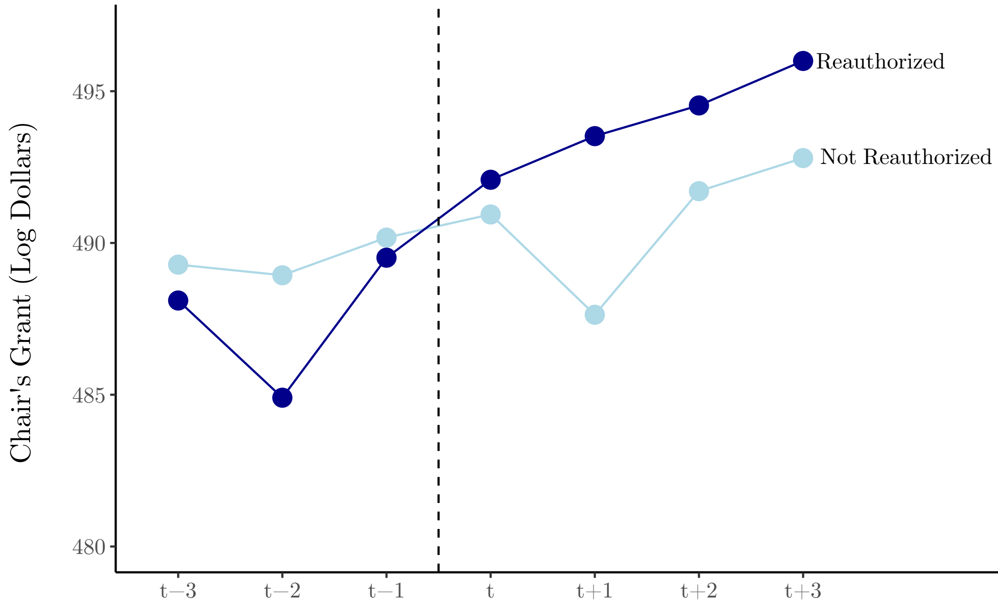


34. The differences in means were weighted using the absolute value of the weights W_{ipt} described above.

35. In order to make the figure easier to read, I multiply share by 100. Thus a share of 15 means that a state is receiving 15% of the funding.

36. Again, I use the absolute value of the weights W_{ipt} described above.

Figure 8: Chair's Grant by Reauthorization Status



D Robustness Checks

Roll Call Voting

Table 5 reestimates the roll call voting analysis without fixed effects, respectively. Again, I find that legislators vote for amendments that increase the grant amounts for their states.

Table 5: Senate Proposed Formula Amendments (OLS)

	Dependent variable:			
	Vote For Amendment			
Change in Grant Share	0.030***			
	(0.008)			
Change in Grant Share ≥ 0		0.296***		
		(0.014)		
Change in Logged Grant			0.002	
			(0.004)	
Change in Grant ≥ 0				0.314***
				(0.014)
Proposed by Copartisan	0.306***	0.299***	0.310***	0.303***
	(0.014)	(0.014)	(0.015)	(0.014)
Amendment Sponsor	0.413***	0.336***	0.424***	0.351***
	(0.023)	(0.025)	(0.023)	(0.024)
On Committee	−0.058***	−0.051***	−0.061***	−0.058***
	(0.015)	(0.014)	(0.015)	(0.014)
Party Leadership	0.065*	0.062*	0.072*	0.076**
	(0.029)	(0.028)	(0.029)	(0.028)
Seniority	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Count of Amendments	47	47	47	47
Observations	4,274	4,274	4,274	4,274
Adjusted R^2	0.129	0.208	0.122	0.207
Note:				*p<0.05; **p<0.01; ***p<0.001
				Robust standard errors in parentheses

Although the roll call voting analysis has a binary outcome, I fit a linear probability model as opposed to a logistic regression due to the inclusion of fixed effects. Table 6 reestimates the roll call voting analysis without fixed effects using a logistic regression. As with the linear model, I find that legislators vote for amendments that increase the grant amounts for their states.

Table 6: Senate Proposed Formula Amendments (Logit)

	Dependent variable:			
	Vote For Amendment			
	logistic			
Change in Grant Share	0.277***			
	(0.039)			
Change in Grant Share ≥ 0		1.400***		
		(0.070)		
Change in Logged Grant			0.011	
			(0.018)	
Change in Grant ≥ 0				1.529***
				(0.078)
Proposed by Copartisan	1.311***	1.419***	1.317***	1.434***
	(0.067)	(0.071)	(0.066)	(0.071)
Amendment Sponsor	3.021***	2.877***	3.106***	2.825***
	(0.464)	(0.472)	(0.463)	(0.466)
On Committee	−0.274***	−0.260***	−0.277***	−0.287***
	(0.068)	(0.071)	(0.068)	(0.071)
Party Leadership	0.266*	0.309*	0.319*	0.381**
	(0.132)	(0.138)	(0.131)	(0.139)
Seniority	0.005	0.008*	0.004	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
Count of Amendments	47	47	47	47
Observations	4,274	4,274	4,274	4,274
Log Likelihood	−2,645.999	−2,464.736	−2,677.690	−2,464.581
Akaike Inf. Crit.	5,305.997	4,943.472	5,369.381	4,943.162
Note:				*p<0.05; **p<0.01; ***p<0.001
				Robust standard errors in parentheses

Winning Coalition Membership

Table 7 reexamines which states are included in the winning coalition using a state's grant share opposed to its grant amount to measure winning coalition membership and grant under the status quo. Similar to using grant amounts, I find that states doing worse under the status quo are more likely to be included in the winning coalition.

Table 7: Winning Coalition Membership

	Dependent variable:	
	Grant Increase	Vote For Amendment
Status Quo Grant Share	-0.040^{***}	-0.018^{***}
	(0.007)	(0.005)
State-Congress Fixed Effects	✓	✓
Count of Amendments	117	47
Observations	5,772	4,274
Adjusted R^2	0.080	0.330
Note:		*p<0.05; **p<0.01; ***p<0.001 Robust standard errors in parentheses

Table 8 reexamines which states are included in the winning coalition using the education grants dataset as opposed to the Senate floor amendments dataset. Winning coalition membership is measured as a state's grant amount increasing. As with the committee analysis, I estimate the probability of being in the winning coalition for each of the first four years following a reauthorization.

Table 8: Winning Coalition Membership, Education Grants (OLS)

	DV: Winning Coalition Member			
	t	$t+1$	$t+2$	$t+3$
Status Quo Grant (Log)	-0.010^{***}	-0.025^{***}	-0.019^{***}	-0.018^{***}
	(0.002)	(0.002)	(0.002)	(0.002)
Funding Level (Log)	0.011^{*}	0.045^{***}	0.047^{***}	0.042^{***}
	(0.005)	(0.004)	(0.004)	(0.004)
State-Congress Fixed Effects	✓	✓	✓	✓
Observations	4,000	4,000	4,000	4,000
Adjusted R^2	0.055	0.079	0.097	0.081
Note:				*p<0.05; **p<0.01; ***p<0.001 Robust standard errors in parentheses

Table **??** reexamines which states are included in the winning coalition using a conditional logistic regression.[37] Again, I find that states doing worse under the status quo

37. Note that table **??** reflects raw logit coefficients. I estimate the model using the `survival` package

are more likely to be included in the winning coalition.

Table 9: Winning Coalition Membership (Logit)

	Dependent variable:	
	Grant Increase	Vote For Amendment
Status Quo Grant (Log)	-1.016^{***}	-0.426^{***}
	(0.074)	(0.099)
Program Funding Level (Log)	1.000^{***}	0.192
	(0.074)	(0.104)
Observations	5,772	4,274
Log Likelihood	$-1{,}637.315$	$-1{,}064.832$
Wald Test (df = 2)	190.450^{***}	63.360^{***}
Note:		*p<0.05; **p<0.01; ***p<0.001
		Robust standard errors in parentheses

Committee Advantage

It is possible that states represented by committee members and the committee chair see an increase in their grant amounts because all states see an increase in their grant amounts following a reauthorization. To account for this, I rerun the analysis for non-committee members and present the results in Table 10. Consistent with the theory, I do not find a significant increase in these states' grant amounts following program reauthorizations.

Table 10: Effect of Committee Position on Formula Grants Placebo Test

	DV: Grant Amount (Log)			
	t	$t+1$	$t+2$	$t+3$
Not On Committee	0.004	0.008	0.037	0.06
	(0.035)	(0.037)	(0.041)	(0.046)
Observations	653	653	653	653

Note: *p<0.05; **p<0.01; ***p<0.001; standard errors computed based on 1,000 weighted bootstrap samples in parentheses

in R (Therneau 2020).