

# Party Discipline and Pork-Barrel Politics\*

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## Abstract

Polities differ in the extent to which political parties can pre-commit to carry out promised policy actions if they take power. Commitment problems may arise due to a divergence between the ex ante incentives facing national parties that seek to capture control of the legislature and the ex post incentives facing individual legislators, whose interests may be more parochial. We study how differences in “party discipline” shape fiscal policy choices. In particular, we examine the determinants of national spending on local public goods in a three-stage game of campaign rhetoric, voting, and legislative decision-making. We find that the rhetoric and reality of pork-barrel spending, and also the efficiency of the spending regime, bear a non-monotonic relationship to the degree of party discipline.

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# 1 Introduction

How do political institutions affect economic policy choices? This question frames much recent research in comparative political economics. Whereas political scientists working in comparative politics have long addressed the implications of different political institutions for *political* outcomes—such as the number of political parties, the stability of government, and the representation of minorities—political economists have more recently become interested in the institutional determinants of *policy* outcomes such as income tax rates, national and local public spending, and industry rates of trade protection.

Much of the work on comparative political economy focuses on aspects of fiscal policy. For example, Persson et al. (2000) study the differences between presidential and parliamentary political systems for the provision of local public goods and the redistribution of income via transfer programs. Lizzeri and Persico (2001), Persson and Tabellini (2001, ch. 8), and Milesi-Ferreti et al. (2002) compare taxes, spending and transfers in polities with majoritarian and proportionally representative (PR) electoral rules. Austen-Smith (2000) examines how tax and spending policies vary with the number of political parties represented in the law-making body.

We too are interested in the forces that shape fiscal policy, but we focus on a different political institutional feature. We note that polities differ in the extent to which political parties can pre-commit before elections to carry out certain policy actions if they take power. Commitment problems arise due to a divergence between *ex ante* and *ex post* incentives, which may reflect (among other things) a difference in the objectives of national parties that seek to capture control of the legislature and thereby implement their ideological agendas and the objectives of individual legislators, whose interests may be more parochial. At one extreme, as in the “Downsian” world, a party may be able to announce a policy platform to which its members will be fully committed if elected. At the opposite extreme, as with the “citizen-candidates” of Osborne and Slivinski (1996) and Besley and Coate (1997), the campaign promises of the political parties may be wholly non-binding. In between these extremes, the extent to which the political parties can tie the hands of the politicians who are subsequently elected to office will depend on institutional characteristics of the political regime, such as the role of the national party in financing regional campaigns, in allocating the perquisites of election, and in choosing candidates for higher office.

For lack of a better term, we shall refer to the institutional variation that is of interest here as differences in “party discipline.” We acknowledge that party discipline most often is used by political scientists and others to mean the extent to which parties (or the leaders of a legislative delegation) can induce members to toe the *current* party line.<sup>1</sup> With strict party discipline, party leaders can eliminate the scope for independent expression of opinions

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<sup>1</sup>See, for example, McGillivray (1997), Snyder and Groseclose (2000) and McCarty et al. (2001).

and interests by their fellow party members in the course of policy making. Here we identify strict discipline with a party's ability to induce ex post adherence to a pre-announced position. Parties have an ex ante incentive to make campaign announcements in order to further their electoral objectives, but the effectiveness of these announcements will reflect their ability to ensure compliance. Thus, the parties will want to use what tools they have at their disposal to induce the elected politicians to honor the party's promises. We might have referred to our institutional variable as "the extent of commitment to party platforms," but we felt that this alternative terminology would be too cumbersome.

In this and a companion paper (Grossman and Helpman, 2004) we develop a new model of majoritarian elections and legislative policymaking that we hope will hold independent interest and prove useful for examining a variety of political-economic issues. In our model, winner-take-all elections occur in single-member legislative districts. The two political parties move first by announcing their policy platforms, with the aim of maximizing their chances of taking control of the legislature. Next, the heterogeneous voters in each district vote for the local candidate of one or the other party, with the goal of maximizing their personal expected welfare in the face of uncertainty about the relative popularity of the two parties in districts other than their own. Finally, the elected members of the legislature set policy to further the interests of their constituents, but in recognition of the political penalties that their national party will impose if they fail to deliver on the party's campaign promises. We introduce a parameter that measures the cost to the legislators of deviating from the party platform and so captures the "extent of commitment to party platforms" or what we call party discipline. At one extreme value of this parameter, the legislators are fully committed; at the other, they behave like citizen candidates.

We use the model to examine pork-barrel spending; i.e., projects that are financed by broad-based taxation but provide benefits that are geographically limited in scope.<sup>2</sup> We consider a polity with three districts that are symmetric ex ante. There are three public goods, each of which provides benefits to residents in one of the districts. Benefit functions are identical, as are the costs of the public goods and the distributions of political preference among voters in the districts. Ex post, spending on the three public goods depends on the outcomes of the three regional elections. If, for example, the same political party wins the election in all three districts, then spending in every district will be the same. The spending levels typically will diverge from the efficient levels, however, because the parties will have made earlier promises that will affect the legislators' ex post choices. Depending on the degree of party discipline, the ex post spending in each district when the same party wins the election in all three can exceed or fall short of the efficient level.

When one party wins in two districts but loses in the third, the legislature will concentrate

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<sup>2</sup>In Grossman and Helpman (2004) we use a similar model to study the determination of trade protection when industries are geographically concentrated.

pork in the districts represented in the majority delegation, to the relative neglect of the district whose representative is a member of the minority party. Thus, there will be ex post inequality in spite of the ex ante symmetry—a kind of tyranny of the majority. Spending in a minority district need not be zero, because the elected representatives may be partially bound by prior promises; but it will always be inefficiently small. Spending in the two majority districts may be socially excessive or deficient, again depending on the extent of party discipline.

An interesting implication of our analysis is that both the rhetoric and reality of pork-barrel spending bears a non-monotonic relationship to the parameter that represents the ability of parties to commit to a campaign platform. The promised level of per district spending is very high when party discipline is low, but falls as discipline rises as long as the anticipated spending in a minority district remains at zero. Once the parameter representing discipline reaches a critical level, however, the majority delegation of legislators will feel compelled to deliver positive pork even to a district they do not represent. Thereafter, further increases in discipline result in rising campaign promises and increased spending levels. Actual spending in a district that is represented in a two-member majority delegation also falls and then rises as a function of the parameter measuring the extent of pre-commitment possibilities. Our analysis suggests, therefore, that the cross-sectional effects of political institutions cannot always be captured by simple correlations.

It is noteworthy too that the aggregate efficiency of fiscal policy bears a non-monotonic relationship to the degree of party discipline. When discipline is lax, the parties make extravagant promises and actual spending in districts represented in a majority delegation is socially excessive. In fact, the lavish spending in these districts may leave a typical voter's expected welfare below what it would be were national spending on local public goods to be constitutionally prohibited. As discipline rises from these very low levels, the strong negative response of spending in districts represented in a two-member majority is sufficient to raise expected welfare. At the opposite extreme, when discipline is quite strict, spending in every district falls below the efficient level, which means that the extra spending that results from an increase in discipline again enhances expected welfare. But, for intermediate levels of discipline, each party promises pork at the highest level consistent with ex post spending of zero in a district represented by a member of the minority party. Then spending in districts represented in the majority falls monotonically with discipline from levels that are socially excessive to levels that are socially deficient. Expected welfare rises then falls as party discipline varies in this range.

The paper is organized as follows. In the next section we describe the three stages—campaign, election, and policy—of our political game. We seek a subgame perfect equilibrium of the electoral game between political parties, so we describe the legislative deliberations first, the equilibrium voting behavior second, and the platform choices last. In Section 3, we derive

the equilibrium platforms and spending levels as a function of the parameter representing the extent of party discipline. We refer to these respectively as the *rhetoric* and *reality* of pork-barrel policy. Then, in Section 4, we study how the announcements and policies vary with the political environment. We also examine the relationship between ex ante expected welfare and the degree of party discipline. Section 5 concludes.

## 2 A Model of Pork-Barrel Spending

We study how party discipline affects pork-barrel spending in a majoritarian political system. Our model of public spending is a simple and familiar one—a central government can provide public goods that benefit citizens in specific geographic areas with funds raised by lump-sum levies on a national tax base.<sup>3</sup> In the political game, the national parties move first by announcing positions on the pork-barrel projects, with the goal of maximizing their chances of winning a majority in the national legislature. Then, the ideologically diverse voters elect representatives to the legislature. Finally, the members of the majority delegation in the legislature adopt a spending program to serve their constituents conditioned by the disciplines imposed by their national party. The legislators need not enact the projects endorsed by their party; thus, the political *rhetoric* may differ from the political *reality*.

Consider a polity with three geographic districts and two political parties. Citizens derive utility from consumption of private goods, consumption of a local public good, and from other policies enacted by the party in power. A resident  $i$  of district  $j$  has the quasi-linear preferences

$$u_{ij} = c_{ij} + H(g_j) + \beta_{ij}^K + \nu_j^K,$$

where  $c_{ij}$  denotes the individual's consumption of private goods,  $g_j$  is the size of a public project that yields benefits (only) to residents of district  $j$ , and  $\beta_{ij}^K + \nu_j^K$  represents utility that the individual derives from other policies that will come into effect if party  $K$  captures a majority in the legislature. The function  $H(\cdot)$  is increasing and concave.

Let the populations of the three districts be equal and normalize each to one. Funds raised by the tax system (in units of the private good) can be converted one-for-one into units of any of the three local public goods. Since the government levies lump-sum taxes, a program  $\mathbf{g} = (g_1, g_2, g_3)$  requires a per capita levy of  $\frac{1}{3} \sum_{j=1}^3 g_j$ . Thus, resident  $i$  of district  $j$ , who has (exogenous) income  $I_{ij}$ , would consume  $c_{ij}^K = I_{ij} - \frac{1}{3} \sum_{j=1}^3 g_j^K$  units of private goods if party  $K$  were to gain power and enact the spending program  $\mathbf{g}^K = (g_1^K, g_2^K, g_3^K)$ .

We distinguish the political objectives of the national parties from those of the individual politicians who are elected to office. The national party has an ideological agenda, which is

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<sup>3</sup>This is the same model of local public goods that was used extensively in Persson and Tabellini (2000) to address a variety of political-economic questions.

reflected in the “other” policies it will enact (besides the pork barrel spending) if elected. In order to pursue this agenda, the party must capture a majority of seats in the legislature. We assume, therefore, that a party’s objective is to do just that; i.e., to maximize the probability that it will win at least two of the district elections. The legislators, on the other hand, are beholden to their constituents. We do not model a sequence of elections and so cannot derive the politicians’ objective functions endogenously. Instead, we assume that elected legislators pursue the interests of district residents, but bear a political cost for any departures from party discipline. The legislators’ objective functions are described in greater detail below.

We seek a sub-game perfect equilibrium of a three-stage game in which the parties  $A$  and  $B$  announce the spending programs  $\mathbf{g}^A$  and  $\mathbf{g}^B$ , respectively, in the first stage, the voters in each district elect a single representative to the national legislature in the second stage, and the elected representatives supply the public goods  $\mathbf{g}_L^K$  in the third stage, where  $K$  indicates the party that controls the legislature and  $L$  indicates the set of districts in which the candidates from party  $K$  garner a majority of votes.

## 2.1 The Policy Stage

Let us begin with the final, policy stage. At this stage, the majority delegation from party  $K$  comprises the representatives of two or three districts. Party  $K$  has previously announced a position  $\mathbf{g}^K$  on the set of pork-barrel projects. The party sought competitive advantage by announcing its position and it hopes to be able to use similar tactics in subsequent elections. Accordingly, it imposes such penalties as it can on elected party members when they deviate from the party’s announced position. How much the party can penalize its members for pursuing their parochial objectives depends upon the institutional setting. If, for example, regional campaigns are financed by the national party, or if the party controls other resources such as committee assignments and patronage positions, then the party will have ample “sticks and carrots” with which to induce compliant behavior. We do not explicitly model the instruments of party discipline, but rather attempt to capture them in reduced form with a parameter  $\delta$ . If the legislators from majority party  $K$  enact a pork-barrel program  $\mathbf{g}$  after their party has announced a position  $\mathbf{g}^K$ , then collectively they bear a political cost  $\frac{\delta}{2} \sum_{j=1}^3 (g_j - g_j^K)^2$ . If, for example,  $\delta = 0$ , then discipline is lacking, and the legislators are free to serve their local constituents with complete impunity. As  $\delta \rightarrow \infty$ , a party has the wherewithal to keep its individual politicians fully in line. Then the party can commit to actions that its candidates surely will take if they are elected.

We assume that each legislator has as his objective to maximize the aggregate welfare of the residents of his district net of costs he will bear for failing to deliver on his party’s promises. We also assume that members of a given political party have the ability to transfer (political) utility among themselves, for example by sharing patronage benefits. In contrast, members of

different political parties lack the means to effect such transfers.<sup>4</sup> Then a majority delegation of party  $K$  comprising representatives from the set of districts  $L$  will choose a spending program to maximize their joint political welfare given by

$$\sum_{j \in L} \left[ I_j + H(g_j) - \frac{g_1 + g_2 + g_3}{3} \right] - \frac{\delta}{2} \sum_{m=1}^3 (g_m - g_m^K)^2 ,$$

where  $I_j$  is aggregate income in district  $j$ . The interests of those residing in districts represented by legislators in the minority party are neglected in the process of distributing pork.

We can now link the policy outcomes to the composition of the legislature and the announced positions of the majority party. If party  $K$  captures all three seats in the legislature, then

$$g_{\{1,2,3\},j}^K = \arg \max_{g_j \geq 0} H(g_j) - g_j - \frac{\delta}{2} (g_j - g_j^K)^2 \quad (1)$$

where  $g_{L,j}^K$  denotes spending on the public project in district  $j$  when party  $K$  holds a majority comprising the set of districts  $L$ . If party  $K$  captures the seats in districts  $j$  and  $k$ , but not in  $\ell$ , then

$$g_{\{j,k\},j}^K = \arg \max_{g_j \geq 0} H(g_j) - \frac{2}{3}g_j - \frac{\delta}{2} (g_j - g_j^K)^2 \quad (2)$$

and

$$g_{\{j,k\},\ell}^K = \arg \max_{g_\ell \geq 0} -\frac{2}{3}g_\ell - \frac{\delta}{2} (g_\ell - g_\ell^K)^2 . \quad (3)$$

## 2.2 The Election Stage

Citizens enter the voting booth knowing the announced positions of each party. They anticipate the links between possible election outcomes and policy choices, as described in (1), (2), and (3). However, they are imperfectly informed about the average voter preferences in districts other than their own. Each individual votes for the candidate who, if elected in her district, would offer her the highest level of expected utility. This is a weakly dominant strategy for the voter.

Voters differ in their tastes for the parties' ideological positions, as noted above. The taste disparities have idiosyncratic and regional components. We define  $\beta_{ij} = \beta_{ij}^B - \beta_{ij}^A$  as the idiosyncratic component of the relative preference of voter  $i$  in district  $j$  for the ideological positions and other characteristics of party  $B$  compared to party  $A$ . Similarly,  $\nu_j = \nu_j^B - \nu_j^A$  represents the relative preference for the positions of party  $B$  (positive or negative) shared by all residents of district  $j$ . We assume that  $\beta_{ij}$  has mean zero in every district  $j$  and that it is distributed uniformly on values ranging from  $-1/2h$  to  $1/2h$ . The parameter  $h$  measures

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<sup>4</sup>Of course, this is just an extreme case of a less controversial claim, that members of a political party have better means to transfer utility among themselves than do members of opposing parties.

(inversely) the extent of preference diversity among citizens in any district. The residents of a district know their own preferences, of course, by the time they enter the voting booth, but they are not sure of the mean preferences of those residing in other districts. Each voter in district  $j$  views  $\nu_k$  and  $\nu_\ell$  as independent random variables drawn from a common, cumulative distribution function  $F(\cdot)$ . To preserve the symmetry of the two parties in the eyes of the (average) voter, we take the density function associated with  $F(\cdot)$  to be single-peaked and symmetric about  $\nu = 0$ .

Consider the problem facing voter  $i$  in district 1. If the candidate for party  $A$  wins in district 1, her utility will depend on the election results in districts 2 and 3 and on the positions previously announced by the two parties (since these will affect the subsequent legislative deliberations). Let  $V_j(\mathbf{g}^K) = H(g_j^K) - (g_1^K + g_2^K + g_3^K) / 3$  be the common component of utility for any individual in district  $j$  that arises from the spending program  $\mathbf{g}^K$ . Using this notation, the expected utility for voter  $i$  conditional on a victory by party  $A$  in district 1 can be written as

$$U_{i1}^A = I_{i1} + \rho_2 \rho_3 \left[ V_1 \left( \mathbf{g}_{\{1,2,3\}}^A \right) + \beta_{i1}^A + \nu_1^A \right] + \rho_2 (1 - \rho_3) \left[ V_1 \left( \mathbf{g}_{\{1,2\}}^A \right) + \beta_{i1}^A + \nu_1^A \right] \\ + (1 - \rho_2) \rho_3 \left[ V_1 \left( \mathbf{g}_{\{1,3\}}^A \right) + \beta_{i1}^A + \nu_1^A \right] + (1 - \rho_2) (1 - \rho_3) \left[ V_1 \left( \mathbf{g}_{\{2,3\}}^B \right) + \beta_{i1}^B + \nu_1^B \right] ,$$

where  $\rho_j$  is the probability that party  $A$  will win in district  $j$  as perceived by a voter outside that district. Here, the term in the first square brackets is the utility that voter  $i$  in district 1 would derive from all of the policy actions (pork barrel and “other”) that would be enacted by party  $A$  were it to win in all three districts. This is multiplied by the probability that party  $A$  will win in both districts 2 and 3, since we are conditioning on the event of a victory by party  $A$  in district 1. The other terms in the expression for  $U_{i1}^A$  can be understood similarly. Note especially the last term, which represents the probability of a victory by party  $B$  in districts 2 and 3 multiplied by the voter’s evaluation of the policies that would be enacted by party  $B$  (*not* party  $A$ ) in this eventuality.

Similarly, we can evaluate the expected utility for voter  $i$  in district 1 conditional on an electoral victory by the candidate from party  $B$  in this district, which is

$$U_{i1}^B = I_{i1} + \rho_2 \rho_3 \left[ V_1 \left( \mathbf{g}_{\{2,3\}}^A \right) + \beta_{i1}^A + \nu_1^A \right] + \rho_2 (1 - \rho_3) \left[ V_1 \left( \mathbf{g}_{\{1,3\}}^B \right) + \beta_{i1}^B + \nu_1^B \right] \\ + (1 - \rho_2) \rho_3 \left[ V_1 \left( \mathbf{g}_{\{1,2\}}^B \right) + \beta_{i1}^B + \nu_1^B \right] + (1 - \rho_2) (1 - \rho_3) \left[ V_1 \left( \mathbf{g}_{\{1,2,3\}}^B \right) + \beta_{i1}^B + \nu_1^B \right] .$$

Voter  $i$  casts her ballot for the candidate from party  $A$  if and only if  $U_{i1}^A \geq U_{i1}^B$ ; i.e., if and only if

$$\beta_{i1} \leq \frac{\Delta_1}{\theta_1} - \nu_1, \tag{4}$$

where

$$\begin{aligned} \Delta_1 = & \rho_2\rho_3 \left[ V_1 \left( \mathbf{g}_{\{1,2,3\}}^A \right) - V_1 \left( \mathbf{g}_{\{2,3\}}^A \right) \right] + \rho_2(1-\rho_3) \left[ V_1 \left( \mathbf{g}_{\{1,2\}}^A \right) - V_1 \left( \mathbf{g}_{\{1,3\}}^B \right) \right] \\ & + (1-\rho_2)\rho_3 \left[ V_1 \left( \mathbf{g}_{\{1,3\}}^A \right) - V_1 \left( \mathbf{g}_{\{1,2\}}^B \right) \right] + (1-\rho_2)(1-\rho_3) \left[ V_1 \left( \mathbf{g}_{\{2,3\}}^B \right) - V_1 \left( \mathbf{g}_{\{1,2,3\}}^B \right) \right] \end{aligned}$$

and

$$\theta_1 = \rho_2(1-\rho_3) + \rho_3(1-\rho_2) .$$

Inequality (4) gives the upper bound on a voter's idiosyncratic relative preference for the ideological positions of party  $B$  such that she nonetheless votes for the candidate from party  $A$ . This bound depends on the relative preference of voters in district 1 for the announced spending program of party  $A$ , the district-wide average preference among voters in district 1 for the ideological positions of party  $B$ , and the probability  $\theta_1$  that district 1 will prove to be pivotal in determining which party controls a majority in the legislature.

Considering that  $\beta_{i1}$  is distributed uniformly on  $[-1/2h, 1/2h]$ , the fraction of votes that party  $A$  will capture in district 1 (as a function of  $\nu_1$  and the announced platforms) is given by  $s_1 = 1/2 + h\Delta_1/\theta_1 - h\nu_1$ . The probability that party  $A$  will capture the seat in district 1 (as viewed from outside the district) is the probability that  $s_1 \geq 1/2$ , or the probability that  $\nu_1 \leq \Delta_1/\theta_1$ . Thus,  $\rho_1 = F(\Delta_1/\theta_1)$ . More generally, we can write

$$\rho_j = F(\Delta_j/\theta_j) \tag{5}$$

where  $\Delta_j$  and  $\theta_j$  are defined analogously to  $\Delta_1$  and  $\theta_1$ , respectively, with  $j$  in place of 1,  $k$  in place of 2, and  $\ell$  in place of 3,  $j \neq k$ ,  $j \neq \ell$ , and  $k \neq \ell$ .

### 2.3 Campaign Stage

We turn to the initial stage of the political game, when the parties announce their positions on the pork-barrel projects. At this stage, the party leaders are uncertain about the relative popularity of the two parties among voters in the three districts. The leaders regard each  $\nu_j$  as randomly and independently distributed with distribution  $F(\cdot)$ . Thus, each party sees a link between the pair of announcements  $\mathbf{g}^A$  and  $\mathbf{g}^B$  and the probability of a victory by party  $A$  in district  $j$  such as is given in equation (5). Party  $A$  chooses its positions on the pork-barrel projects to maximize the probability that it will win in at least two districts, which is

$$\rho = \rho_1\rho_2\rho_3 + \rho_1\rho_2(1-\rho_3) + \rho_1(1-\rho_2)\rho_3 + (1-\rho_1)\rho_2\rho_3 .$$

Party  $B$  seeks to minimize  $\rho$ .

Consider the choice of  $g_1^A$ , which is the proposal by party  $A$  for spending on projects in

district 1. The party's first-order condition for maximizing  $\rho$  is<sup>5</sup>

$$\frac{\partial \rho}{\partial g_1^A} = \sum_{j=1}^3 \theta_j \frac{\partial \rho_j}{\partial g_1^A} = 0 . \quad (6)$$

Party  $B$  has an analogous first-order condition for minimizing  $\rho$ .

Since the parties have the same average popularity among voters and similar incentives in regard to pork-barrel spending, it is natural to focus on a symmetric equilibrium. In a symmetric equilibrium, the parties announce identical positions, i.e.,  $\mathbf{g}^A = \mathbf{g}^B = \mathbf{g}$ . Then, the economic platforms of the two parties have equal appeal to voters, and thus  $\Delta_j = 0$  for all  $j$ . In the event, each party has a fifty percent chance of winning in each district; i.e.,  $\rho_j = F(0) = 1/2$  for all  $j$ . But then the first-order condition (6) can be written more simply as

$$\sum_{j=1}^3 \frac{\partial \Delta_j}{\partial g_1^A} = 0 . \quad (7)$$

We shall also describe an equilibrium in which the parties treat the three districts similarly. It may seem natural that they should do so, inasmuch as the three districts have equal populations of voters, similar distributions of ideological preferences, and similar tastes for the local public goods. However, Myerson (1993) has shown in a different but related context that candidates might prefer to target “goodies” to a subset of otherwise similar voters. In his model, there exists no pure-strategy equilibrium in which voters are treated symmetrically. Our setting differs from his, because voters have preferences for one party or the other apart from their evaluation of the goodies they are promised in the course of the electoral competition. We find that the parties have strong incentives to concentrate their promises of public spending in only two districts when  $F'(0)$  is large (the density of the regional popularity shock is high at zero), but that they prefer to treat the districts similarly when  $F'(0)$  is small.<sup>6</sup> In what follows, we focus on the latter case.

Let  $g$  denote the level of pork-barrel spending promised by both parties to every district in a symmetric equilibrium. Note that  $g$  is just rhetoric, while the reality of public spending varies with the composition of the elected legislature. The spending on a particular project will depend on whether the elected representative from the district is a member of the majority party or not, and if so, whether the majority delegation comprises two or three legislators.

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<sup>5</sup>More formally, a maximum requires  $\partial \rho / \partial g_1^A \geq 0$  for a small downward deviation in  $g_1^A$  from the equilibrium value and  $\partial \rho / \partial g_1^A \leq 0$  for a small upward deviation in  $g_1^A$  from the equilibrium value. This detail will become important for certain parameter values, as  $\partial \rho / \partial g_1^A$  is not everywhere continuous.

<sup>6</sup>More specifically, we have used numerical methods to evaluate the best response by party  $A$  when party  $B$  chooses a spending program that satisfies the first-order condition in (7). We find in numerous such examples that the second-order conditions for maximizing  $\rho$  are violated when  $F'(0)$  is large, but that they are satisfied when  $F'(0)$  is sufficiently small. In these latter cases, the platform that satisfies (7) is a (global) best response for party  $A$ .

In the symmetric environment we describe, the spending is the same in each of the two districts included in a two-member majority no matter which two districts happen to be in the majority, and the spending in a district represented by a minority legislator is the same no matter which district that is. We denote by  $\bar{g}_3$  the actual spending in each district when the majority delegation comprises three legislators, by  $\bar{g}_2$  the actual spending in a district included in a two-member majority delegation, and by  $\bar{g}_0$  the spending in a district excluded from the majority delegation.

We can now use the definitions of  $\Delta_j$  and  $V_j$  to rewrite the first-order condition (7) for party  $A$ 's choice of promised spending in district 1 as

$$\frac{1}{4} [H'(\bar{g}_3) - 1] \frac{\partial g_{\{1,2,3\},1}^A}{\partial g_1^A} + \frac{1}{2} \left[ H'(\bar{g}_2) - \frac{1}{3} \right] \frac{\partial g_{\{1,2\},1}^A}{\partial g_1^A} - \frac{1}{4} \left[ H'(\bar{g}_0) + \frac{1}{3} \right] \frac{\partial g_{\{2,3\},1}^A}{\partial g_1^A} = 0 . \quad (8)$$

The three terms in the expression on the left-hand side give the marginal effect of a change in  $g_1^A$  on the electoral prospects of party  $A$  via the induced changes in spending in district 1 in the event that this district is included in a three-member majority, included in a two-member majority, and excluded from the majority, respectively. The impact on the party's prospects come not only from the marginal effect on voters in district 1 who are affected by these changes, but also from the marginal effect on voters in districts 2 and 3, who must share in the cost of providing public goods to district 1. Finally, note that the solution to (8) gives not only the optimal choice of  $g_1^A$ , but also the Nash equilibrium value of  $g$ , since the parties behave similarly in the symmetric equilibrium and they treat all districts the same.

### 3 Equilibrium Platforms and Policies

To simplify the exposition, we adopt a quadratic form for the (per capita and aggregate) benefits from the local public goods. We assume that  $H(g) = \alpha g - \beta g^2/2$  for  $g \leq \alpha/\beta$  and  $H(g) = \alpha^2/2\beta$  for  $g \geq \alpha/\beta$ . Concavity requires  $\beta > 0$ . We also take  $\alpha > 1$ , so that a social planner would provide a positive amount  $(\alpha - 1)/\beta$  of each public good.

Suppose that some party has announced the platform  $\mathbf{g} = (g, g, g)$  and now it wins the election in all three districts. Then, by (1), the legislature will spend an amount  $\bar{g}_3(g)$  in each district, where

$$\bar{g}_3(g) = \begin{cases} \frac{1}{\beta + \delta} (\alpha + \delta g - 1) & \text{for } g \leq \frac{1}{\delta} + \frac{\alpha}{\beta} \\ g - \frac{1}{\delta} & \text{for } g \geq \frac{1}{\delta} + \frac{\alpha}{\beta} \end{cases} . \quad (9)$$

The chosen spending level equates the marginal benefit from spending,  $\alpha - \beta \bar{g}_3$  (if  $\bar{g}_3 < \alpha/\beta$ ) to the marginal cost,  $1 + \delta(\bar{g}_3 - g)$ , where the latter includes not only the unit cost of the goods, but also the (marginal) political cost to the legislators of deviating from the promised

spending level,  $g$ .

If the party wins instead in only two districts, it will spend

$$\bar{g}_2(g) = \begin{cases} \frac{1}{\beta+\delta} (\alpha + \delta g - \frac{2}{3}) & \text{for } g \leq \frac{2}{3\delta} + \frac{\alpha}{\beta} \\ g - \frac{2}{3\delta} & \text{for } g \geq \frac{2}{3\delta} + \frac{\alpha}{\beta} \end{cases} \quad (10)$$

in each of the two districts represented by a member of the majority delegation and

$$\bar{g}_0(g) = \begin{cases} 0 & \text{for } g \leq \frac{2}{3\delta} \\ g - \frac{2}{3\delta} & \text{for } g \geq \frac{2}{3\delta} \end{cases} \quad (11)$$

in the remaining district. Notice that  $\bar{g}_2 > \bar{g}_3$  for all finite  $\delta$  and all  $g$ . The perceived benefits from spending in a district are the same no matter how many districts are represented in the majority delegation, but the perceived costs of the spending are smaller when the taxes borne by residents of one district are neglected in the policy-making calculus; the unit cost of 1 that appears in the formula for  $\bar{g}_3$  is replaced by  $2/3$  in the formula for  $\bar{g}_2$ . Also,  $\bar{g}_0 = 0$  unless  $g$  is sufficiently large; i.e., unless  $g > 2/3\delta$ . The majority delegation perceives no political benefit from delivering pork to a district represented by a member of the minority party. It will undertake spending in such a district only if the party had promised some reasonably high level of public goods and if the political cost of neglecting that promise is sufficiently great. Finally, note that all spending levels are strictly increasing in the announcement,  $g$ , except when  $g$  is small so that  $\bar{g}_0 = 0$ .

Equations (9), (10) and (11) relate the various possible policy outcomes to the policy announcement. We can now use these equations to find the announcement that satisfies the first-order condition, (8). In so doing, we recognize that symmetry implies  $g_{\{1,2,3\},1}^A = \bar{g}_3(g)$ ,  $g_{\{1,2\},1}^A = \bar{g}_2$ ,  $g_{\{2,3\},1}^A = \bar{g}_0$ , and  $g_1^A = g$ . We note that  $H'(\bar{g}) = \alpha - \beta\bar{g}$  if  $\bar{g} < \alpha/\beta$  and that  $H'(\bar{g}) = 0$  otherwise. Also,  $\partial\bar{g}_3/\partial g = \delta/(\beta + \delta)$  for  $g < 1/\delta + \alpha/\beta$  and  $\partial\bar{g}_2/\partial g = \delta/(\beta + \delta)$  for  $g < 2/3\delta + \alpha/\beta$ . For  $g > 2/3\delta + \alpha/\beta$ ,  $\partial\bar{g}_2/\partial g = 1$  and for  $g > 1/\delta + \alpha/\beta$ ,  $\partial\bar{g}_3/\partial g = 1$ . The change in responsiveness of local spending in a district to changes in the campaign promise is due to the assumed satiation of voters when the quantity of their local public good reaches  $\alpha/\beta$ . Finally, note that  $\partial\bar{g}_0/\partial g = 0$  for  $g < 2/3\delta$ , while  $\partial\bar{g}_0/\partial g = 1$  for  $g > 2/3\delta$ . This fact, which will prove to be important for understanding our findings below, reflects that a district not represented in the majority delegation receives no pork whatsoever for low levels of the announcement, but spending there rises one-for-one with the announcement once  $g$  is so high that the legislators provide pork even to this district to mitigate the costs of renegeing on their party's promise.

Let  $\Gamma(g)$  denote the left-hand side of (8); i.e. (a positive multiple of) the marginal electoral benefit to a party from increasing the size of its campaign promise to a typical district. There are four segments of  $\Gamma(g)$  according to whether the supply of public goods to

a minority district responds to a change in the campaign promise or not, and whether the response of the supply to represented districts reflects a positive marginal value of the good in the district or just the positive marginal cost of deviating from the party's promise. For  $g < 2/3\delta$ ,  $\bar{g}_0$  does not respond to  $g$ . For  $2/3\delta < g < 2/3\delta + \alpha/\beta$ ,  $\bar{g}_0$  responds, but only as a reflection of party discipline. For  $2/3\delta + \alpha/\beta < g < 1/\delta + \alpha/\beta$ ,  $\bar{g}_0$  and  $\bar{g}_2$  respond only for disciplinary reasons, and for  $g > 1/\delta + \alpha/\beta$ ,  $\bar{g}_0$ ,  $\bar{g}_2$ , and  $\bar{g}_3$  all respond only because the legislators wish to mitigate the rising discipline costs. Substituting the relevant expressions into (8), we find

$$\Gamma(g) = \begin{cases} \frac{\delta}{3(\beta+\delta)^2} [2\beta + 9\delta(\alpha - \beta g) - 5\delta] & \text{for } g < \frac{2}{3\delta} \\ \frac{\delta}{3(\beta+\delta)^2} [2\beta + 9\delta(\alpha - \beta g) - 5\delta] - \left(\frac{2\beta}{3\delta} + \alpha - \beta g + \frac{1}{3}\right) & \text{for } \frac{2}{3\delta} < g < \frac{2}{3\delta} + \frac{\alpha}{\beta} \\ \frac{\delta^2}{(\beta+\delta)^2} (\alpha - \beta g - 1) - 1 & \text{for } \frac{2}{3\delta} + \frac{\alpha}{\beta} < g < \frac{1}{\delta} + \frac{\alpha}{\beta} \\ -2 & \text{for } g > \frac{1}{\delta} + \frac{\alpha}{\beta} \end{cases} .$$

Figure 1 depicts  $\Gamma(g)$  for a polity with little party discipline; i.e.,  $\delta < 4\beta/(9\alpha - 5)$ . Note that  $\Gamma(0) > 0$  and that  $\Gamma(g)$  declines linearly with  $g$  for  $g < 2/3\delta$  and for  $2/3\delta + \alpha/\beta < g < 1/\delta + \alpha/\beta$ . For  $\delta < 4\beta/(9\alpha - 5)$ ,  $\Gamma(g)$  rises linearly with  $g$  for  $2/3\delta < g < 2/3\delta + \alpha/\beta$ . Finally, for  $g > 1/\delta + \alpha/\beta$ ,  $\Gamma(g)$  is flat and equal to  $-2$ . It is easy to show that the curve jumps downward at  $g = 2/3\delta$ , again at  $2/3\delta + \alpha/\beta$ , and again at  $g = 1/\delta + \alpha/\beta$ . For this case of low discipline,  $\Gamma(g) < 0$  for  $g$  slightly below  $2/3\delta$  and  $\Gamma(g) < 0$  for all  $g > 2/3\delta$ . Therefore, there is a unique equilibrium announcement, which is

$$g = \frac{2}{9\delta} + \frac{9\alpha - 5}{9\beta} \quad \text{for } \delta \leq \frac{4\beta}{9\alpha - 5} . \quad (12)$$

Next suppose that party discipline is “moderate”; i.e. that  $4\beta/(9\alpha - 5) < \delta \leq \beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2})/(6\alpha - 6)$ . In this case,  $\Gamma(g)$  takes the form shown in Figure 2. This figure is qualitatively similar to Figure 1, except that  $\Gamma(g)$  is positive for  $g$  slightly to the left of  $2/3\delta$  while  $g$  is negative for  $g$  slightly to the right of  $2/3\delta$ , for  $\delta$  in this range. It follows that each party has an electoral incentive to increase its promises of local public spending for all  $g < 2/3\delta$ , but an incentive to decrease its promises of local public spending for all  $g > 2/3\delta$ . Evidently, the equilibrium announcement is

$$g = \frac{2}{3\delta} \quad \text{for } \frac{4\beta}{9\alpha - 5} < \delta \leq \frac{\beta \left( 3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2} \right)}{6(\alpha - 1)} . \quad (13)$$

Finally, suppose that party discipline is strict; i.e.,  $\delta > \beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2})/(6\alpha -$

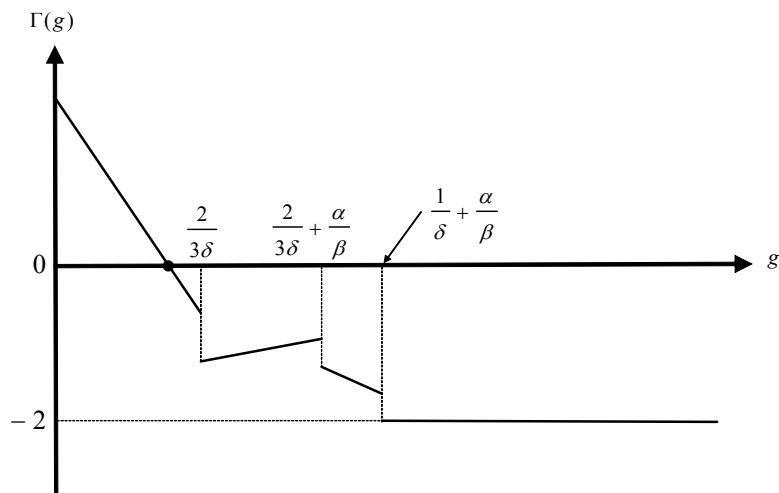


Figure 1: Equilibrium announcement when party discipline is low

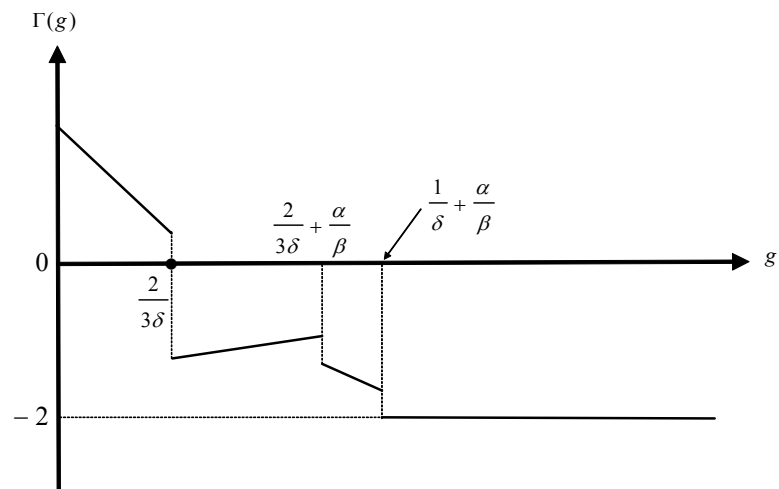


Figure 2: Equilibrium announcement when party discipline is moderate

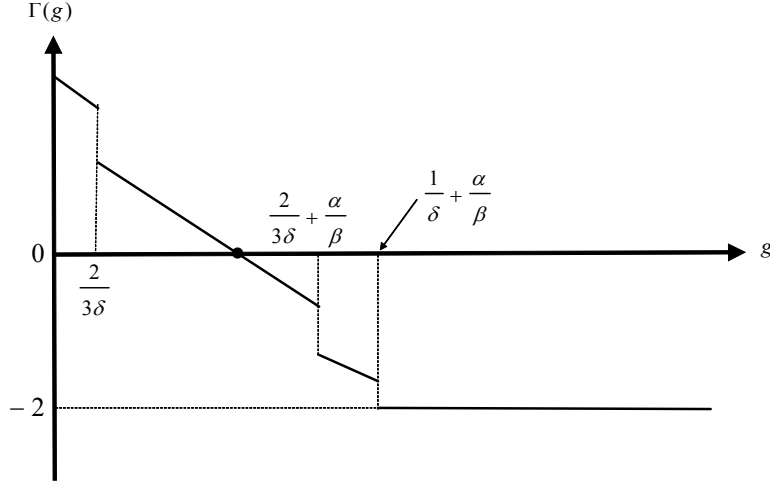


Figure 3: Equilibrium announcement when party discipline is high

6). In this case,  $\Gamma(g)$  appears as in Figure 3. For such high values of  $\delta$ ,  $\Gamma(g)$  is downward sloping in every region except when  $g > 1/\delta + \alpha/\beta$ , where it is flat. We find that  $\Gamma(g) > 0$  for all  $g < 2/3\delta$  and  $\Gamma(g) < 0$  for all  $g > 2/3\delta + \alpha/\beta$ . The unique equilibrium falls between these values, where

$$g = \frac{6\delta^3(\alpha - 1) - 2\delta^2\beta(1 + 3\alpha) - \delta\beta^2(5 + 3\alpha) - 2\beta^3}{3\delta\beta(2\delta^2 - 2\beta\delta - \beta^2)} \text{ for } \delta > \frac{\beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2})}{6(\alpha - 1)}. \quad (14)$$

We can substitute the equilibrium values of  $g$  into (9), (10), and (11) to solve for the equilibrium spending in a district whose elected representative is a member of a three-member majority delegation, a two-member majority, and a minority delegation, respectively. We study the relationship between party discipline and pork-barrel spending in the section that follows.

## 4 Party Discipline and Pork-Barrel Spending

### 4.1 Policy Rhetoric

We use (12), (13) and (14) to plot the relationship between the level of spending on local public goods that each party announces in a Nash equilibrium and the parameter that measures the strength of party discipline. We do so in Figure 4 for the case of  $\alpha = 2$  and  $\beta = 1$ . As we shall now explain, the qualitative features of the figure—including the apparent non-monotonicity in the relationship between the size of the announcement and  $\delta$ —hold for all values of  $\alpha > 1$  and  $\beta > 0$ .

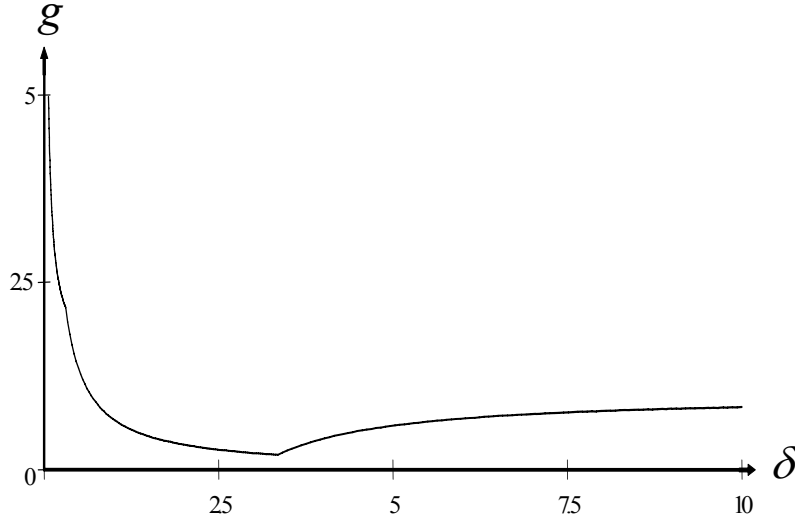


Figure 4: Equilibrium platform as a function of party discipline for  $\alpha = 2$  and  $\beta = 1$

When party discipline is lax, the political rhetoric is shrill. Each party promises extravagant spending on local public goods, with  $g \rightarrow \infty$  as  $\delta \rightarrow 0$ . But voters recognize that the promises will not be fully honored. Indeed, the modest penalties for deviating from the platform will allow elected legislators to turn their backs entirely on a district that is not included in the majority ( $\bar{g}_0 = 0$ ). Nonetheless, anticipated pork-barrel spending in a district that does end up represented in a majority—be it a two-district majority or a three-district majority—is quite lavish. We shall find in the next section that, for  $\delta$  small,  $\bar{g}_3$  exceeds the efficient level of spending and  $\bar{g}_2$  exceeds the level of spending that maximizes the well-being of residents of the two districts that comprise a two-member majority. In other words, the promises induce the legislators to opt for greater pork-barrel spending than even their own constituents would like. Why would the parties make such extravagant promises? The answer is that each party chooses  $g_j$  not only to make the anticipated spending attractive to residents of district  $j$ , but also to make it unattractive for voters in other districts to elect the candidate of the opposing party. An increase in party  $A$ 's promised spending in district 1, for example, raises the expected tax bill and thus lowers welfare for voters in district 2 in the event that the candidates from party  $A$  win in districts 1 and 3 but not their own.

In the region of lax discipline, (12) implies that promised spending in each district is a decreasing function of  $\delta$ . In such circumstances, the parties and voters recognize that a district whose representative is not included in a majority delegation will be allocated no pork-barrel spending. Thus, a change in  $\delta$  has no effect on  $\bar{g}_0$  in this range. Since

$\partial \bar{g}_3 / \partial g = \partial \bar{g}_2 / \partial g = \delta / (\beta + \delta) > 0$  for  $g < 2/3\delta$ , the first-order condition (8) is satisfied if and only if  $H'(\bar{g}_3) - 1 + 2[H'(\bar{g}_2) - 1/3] = 0$ . But an increase in  $\delta$  causes both  $\bar{g}_3$  and  $\bar{g}_2$  to rise at constant  $g$ . This reduces both  $H'(\bar{g}_3)$  and  $H'(\bar{g}_2)$ , and so it shifts downward the first segment of  $\Gamma(g)$  in Figure 1. The result is a lower equilibrium value of  $g$ .

To understand why the parties temper their promises as discipline increases (for low  $\delta$ ), we note that  $g > \bar{g}_2 > \bar{g}_3$  when  $\delta$  is small. Then, if a party were to hold its promise constant, a tightening of discipline would raise anticipated spending in any majority district for all possible election outcomes. But public goods have diminishing marginal value to voters and constant marginal cost. So, the increase in anticipated spending would reduce the attractiveness of the party's platform in all districts. The party avoids this by moderating its promise.

As  $\delta$  rises and  $g$  falls, the maximum announcement consistent with zero spending in a district not represented in the majority delegation (call it  $\hat{g}$ ) falls even faster than  $g$ . Eventually, a  $\delta$  is reached such that, if a party were to promise a spending level  $g = 2/9\delta + (9\alpha - 5)/9$  as it does for low values of  $\delta$ ,  $\bar{g}_0$  would turn positive. But once  $\bar{g}_0$  is positive and responds to  $g$ , an additional term enters into the marginal electoral effect of a change in the announcement. Thus, we reach the region of “moderate”  $\delta$ , where a cut in a party's campaign promise induces an anticipated change in spending only in districts included in a majority, but an increase in the promise induces an anticipated change in spending in all three districts. This is the region in which Figure 2 applies.

In the region of moderate discipline, the marginal electoral benefit of an increase in  $g$  is strictly positive for  $g < \hat{g}$  and strictly negative for  $g > \hat{g}$  (see Figure 2). Accordingly, each party chooses the largest policy announcement that yields zero spending in a district represented by a member of the minority party. As discipline strengthens in this range, the pressure on an elected legislature to provide positive public goods to a district that is not represented in the majority intensifies as well. The parties must promise ever less to ensure that spending will be zero in an excluded district. In other words,  $g = \hat{g} = 2/3\delta$  falls with  $\delta$  in this region. Thus, the equilibrium campaign promises continue to moderate as party discipline strengthens.

So too do the anticipated levels of spending in majority districts, as we shall see in the next section. Indeed,  $\bar{g}_3$  and  $\bar{g}_2$  fall to levels that are below the efficient levels of spending. Why would a party announce a platform that leads to so little anticipated spending, when it knows that voters in every district would prefer more? Again, the answer has to do with party's desire not only to reward districts that elect its candidates but also to punish those that fail to give their support. An increase in, say, party  $A$ 's promise of spending in district 1 would increase the welfare of voters in that district for those election outcomes in which party  $A$  wins both in district 1 and in at least one other district. But the higher promise would also benefit voters in district 1 if party  $A$  were to capture a majority in the legislature

while losing in district 1. This latter effect reduces the cost to residents of district 1 of voting against party  $A$ , and the party takes this into account when formulating its platform.

Finally, we reach a  $\delta$  large enough such that  $\Gamma > 0$  for  $g$  slightly above  $\hat{g}$ . This is the region of high discipline—illustrated in Figure 3—in which the parties find it optimal to announce a platform that yields positive spending even in a district represented by a legislator in the minority party. In this region, there are conflicting forces at work on the parties' choices of campaign promises in response to changes in  $\delta$ . Recall that  $\Gamma(\delta)$  has three terms;

$$\Gamma(g) = \frac{1}{4} [H'(\bar{g}_3) - 1] \frac{\partial \bar{g}_3}{\partial g} + \frac{1}{2} \left[ H'(\bar{g}_2) - \frac{1}{3} \right] \frac{\partial \bar{g}_2}{\partial g} - \frac{1}{4} \left[ H'(\bar{g}_0) + \frac{1}{3} \right] \frac{\partial \bar{g}_0}{\partial g}.$$

When  $\delta$  is large,  $\partial \bar{g}_3 / \partial g = \partial \bar{g}_2 / \partial g = \delta / (\beta + \delta)$  and  $\partial \bar{g}_0 / \partial g = 1$ . Thus, an increase in  $\delta$  raises the responsiveness of spending in a majority district—be it one that is part of a three-district majority or one that is part of a two-district majority—to changes in the campaign announcement. Since, as we shall see,  $H'(\bar{g}_3) > H'(\bar{g}_2) > 1$  in this range, this tends to raise  $\Gamma(g)$ , the marginal electoral value of the announcement. The actual spending levels,  $\bar{g}_3$ ,  $\bar{g}_2$ , and  $\bar{g}_0$ , all move in the direction of the announcement,  $g$ , as  $\delta$  rises for given  $g$ . But since  $\bar{g}_3$  and  $\bar{g}_2$  may exceed or fall short of the campaign promise for high  $\delta$ , these changes in spending may contribute to an increase or a decrease in  $\Gamma$ . The increase in  $\delta$  unambiguously pulls  $\bar{g}_0$  toward the higher promised level of spending, thereby reducing the marginal valuation  $H'(\bar{g}_0)$ , and thus contributing to a higher value of  $\Gamma$  via an increase in the last term. Despite the conflicting forces on the marginal electoral value of the announcement level, we are able to prove that an increase in  $\delta$  shifts  $\Gamma(g)$  upward at constant  $g$  throughout the region of high party discipline.<sup>7</sup> Thus, promised pork rises with a strengthening of party discipline once party discipline is already sufficiently strict. Likely, the unambiguously positive relationship between  $g$  and  $\delta$  in this range reflects our choice of a quadratic form for the benefit function,  $H$ .

To summarize, we find that the campaign promise of pork-barrel spending in each district bears a non-monotonic relationship to the severity of party discipline. When discipline is lax, the parties anticipate that the elected legislature will provide public goods only to districts represented in the majority. Then, the level of promised spending declines with a strengthening of party discipline. But, at some critical level of  $\delta$ , the party recognizes that the promise far exceeds the zero spending that will actually occur in a minority district. With

<sup>7</sup>We have proved directly that  $dg/d\delta > 0$  for high party discipline, using the formula for  $g$  in equation (14). The derivative of the expression on the right-hand-side of (14) with respect to  $\delta$  equals zero at exactly four points, only one of which is positive, namely,  $\delta = \beta/2$ . Moreover, this expression attains a local minimum at  $\delta = \beta/2$ , because its second derivative, evaluated at this point, is positive. Note also that

$$\frac{\beta}{6(\alpha - 1)} \left( 3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2} \right) > \frac{\beta}{2}$$

for  $\alpha > 1$ . Therefore  $g$  is an increasing function of  $\delta$  when party discipline is high.

yet further increases in party discipline, a majority delegation comprising two legislators will find it too politically costly to withhold all pork-barrel spending from the minority district. Anticipating this, the parties respond to further increases in party discipline by elevating their promises. As  $\delta \rightarrow \infty$ , the parties are able virtually to pre-commit their candidates to a level of pork-barrel spending in each district, regardless of the composition of the elected legislature. Then  $g \rightarrow (\alpha - 1)/\beta$ , the spending level that would be chosen by a social planner. This is in keeping with the findings of Lindbeck and Weibull (1987), who show that parties commit to efficient policies when their campaign promises are fully credible.

## 4.2 Policy Reality

Now we can examine the relationship between party discipline and the pork-barrel spending that results for the different possible election outcomes. For this, we use equations (9), (10), and (11), together with the expressions for the equilibrium value of  $g$ .

Consider first the spending in any district when all three seats in the legislature are captured by the same party. Since the equilibrium announcement  $g$  never exceeds  $2/3\delta + \alpha/\beta$ , (9) implies that per-district spending  $\bar{g}_3$  never reaches the satiation level. Substituting the equilibrium value of  $g$  into (9), we find

$$\bar{g}_3 = \begin{cases} \frac{9\alpha-5}{9\beta} - \frac{2}{9(\beta+\delta)} & \text{for } \delta \leq \frac{4\beta}{9\alpha-5}, \\ \frac{3\alpha-1}{3(\beta+\delta)} & \text{for } \frac{4\beta}{9\alpha-5} < \delta \leq \frac{\beta(3+3\alpha+\sqrt{3+6\alpha+27\alpha^2})}{6(\alpha-1)}, \\ \frac{6(\alpha-1)\delta^3-8\beta\delta^2-(9\alpha-1)\beta^2\delta-\beta^3(3\alpha-1)}{3\beta(2\delta^2-\beta^2-2\beta\delta)(\beta+\delta)} & \text{for } \delta > \frac{\beta(3+3\alpha+\sqrt{3+6\alpha+27\alpha^2})}{6(\alpha-1)}. \end{cases}$$

Figure 5 shows the relationship between per-district spending and party discipline for the case  $\alpha = 2$  and  $\beta = 1$ .

As the figure illustrates, spending in a district that is part of a three-district majority exceeds the efficient level of  $(\alpha - 1)/\beta$  when  $\delta \rightarrow 0$  and it grows with  $\delta$  when party discipline is low. In this range of low  $\delta$ , a strengthening of discipline causes the parties to moderate their promises ( $g$  falls), but the legislators have greater incentive to deliver on what has been promised. When all three legislators are members of the same party, the latter effect must dominate. To see this, recall that the the first-order condition for the optimal platform requires  $H'(\bar{g}_3) - 1 + 2[H'(\bar{g}_2) - 1/3] = 0$ , because the parties set their platforms in anticipation that the legislature will allocate no pork to a district that ends up outside the ruling coalition. For this condition to be satisfied following an increase in  $\delta$ , exactly one of  $\bar{g}_3$  and  $\bar{g}_2$  must rise and the other must fall. But it is easy to see that  $d\bar{g}_3/d\delta > d\bar{g}_2/d\delta$  when  $\delta$  is small, which

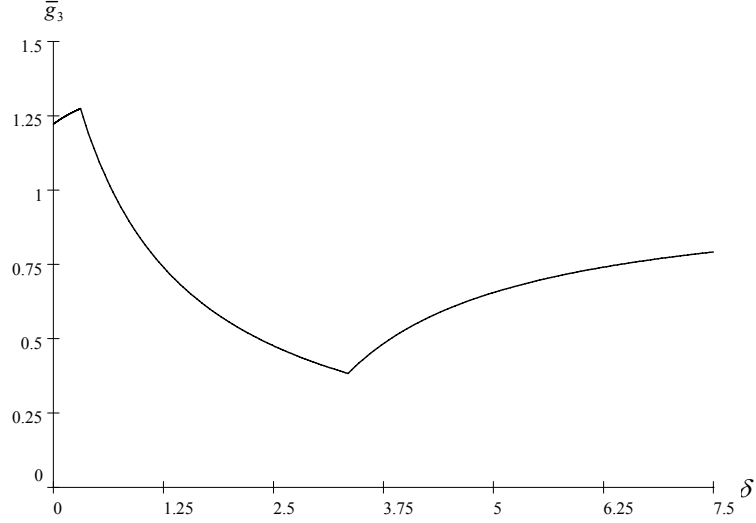


Figure 5: Equilibrium  $\bar{g}_3$  as a function of party discipline for  $\alpha = 2$  and  $\beta = 1$

means that  $d\bar{g}_3/d\delta > 0$ .<sup>8</sup>

When party discipline is in an intermediate range in which the promised level of spending per district is the largest amount consistent with zero ex post spending in a minority district,  $\bar{g}_3$  falls with increases in  $\delta$ . Again, the tightening of discipline causes each party to moderate its promises, but now the decline in  $g$  must result in decreased delivery to majority districts as well. However, when discipline is sufficiently strong that spending in a minority district would be positive, the per-district spending in case of a three-district majority rises with further increases in  $\delta$ . In this case, the campaign promise rises with  $\delta$  as we have seen and even if the legislators are delivering more than what is promised, the net effect of an increase in  $\delta$  will be for  $\bar{g}_3$  to rise.<sup>9</sup>

Using (10), we can derive similarly the relationship between party discipline and public spending in either of the two districts that happen to be included in a two-district majority. When a party wins the local elections in exactly two districts, the legislator allocates pork of  $\bar{g}_2$  to each of those districts, where

<sup>8</sup>From (9) and (10),  $(d\bar{g}_3/d\delta) - (d\bar{g}_2/d\delta) = 1/3(\beta + \delta)^2 > 0$ .

<sup>9</sup>When  $\delta > \beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2})/(6\alpha - 6)$ ,

$$\frac{d\bar{g}_3}{d\delta} = \frac{2(\beta^3 + 4\delta^3 + 6\beta\delta^2 + 6\beta^2\delta)(\beta + 2\delta)}{3(2\delta^2 - \beta^2 - 2\beta\delta)^2(\beta + \delta)^2} > 0.$$

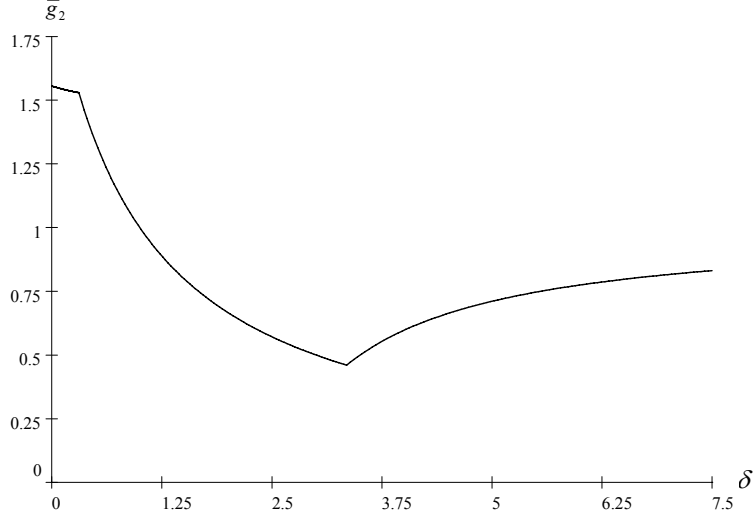


Figure 6: Equilibrium  $\bar{g}_2$  as a function of party discipline for  $\alpha = 2$  and  $\beta = 1$

$$\bar{g}_2 = \begin{cases} \frac{9\alpha-5}{9\beta} + \frac{1}{9(\beta+\delta)} & \text{for } \delta \leq \frac{4\beta}{9\alpha-5}, \\ \frac{\alpha}{\beta+\delta} & \text{for } \frac{4\beta}{9\alpha-5} < \delta \leq \frac{\beta(3+3\alpha+\sqrt{3+6\alpha+27\alpha^2})}{6(\alpha-1)}, \\ \frac{6(\alpha-1)\delta^3-6\beta\delta^2-\beta^2(1+9\alpha)\delta-3\alpha\beta^3}{3\beta(2\delta^2-2\beta\delta-\beta^2)(\beta+\delta)} & \text{for } \delta > \frac{\beta(3+3\alpha+\sqrt{3+6\alpha+27\alpha^2})}{6(\alpha-1)}. \end{cases}$$

Figure 6 depicts the relationship between  $\bar{g}_2$  and  $\delta$  for  $\alpha = 2$  and  $\beta = 1$ ; the qualitative features of the figure apply more generally. Specifically, we see that spending in a majority district falls with  $\delta$  when party discipline is low or moderate, but rises with  $\delta$  once discipline is strong enough that spending in a minority district turns positive.<sup>10</sup> For  $\delta$  near zero,  $\bar{g}_2$  exceeds  $(\alpha - 2/3)/\beta$ , the level of spending that maximizes welfare for the residents of the two districts represented in the majority delegation. Yet when  $\delta$  is in the upper end of the moderate range,  $\bar{g}_2$  falls short of even the socially efficient level of spending,  $(\alpha - 1)/\beta$ .

Finally, we can use (11) to examine pork-barrel spending in a district whose representative is not a member of the majority party. Using (14), we find

<sup>10</sup>When  $\delta > \beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2}) / (6\alpha - 6)$ ,

$$\frac{d\bar{g}_2}{d\delta} = \frac{\beta^4 + 12\delta^4 + 40\beta\delta^3 + 12\beta^3\delta + 36\beta^2\delta^2}{3(2\delta^2 - \beta^2 - 2\beta\delta)^2(\beta + \delta)^2} > 0.$$

$$\bar{g}_0 = \begin{cases} 0 & \text{for } \delta \leq \frac{\beta(3+3\alpha+\sqrt{3+6\alpha+27\alpha^2})}{6(\alpha-1)}, \\ \frac{6(\alpha-1)\delta^2-6\beta(1+\alpha)\delta-\beta^2(1+3\alpha)}{3\beta(2\delta^2-\beta^2-2\beta\delta)} & \text{for } \delta > \frac{\beta(3+3\alpha+\sqrt{3+6\alpha+27\alpha^2})}{6(\alpha-1)}. \end{cases}$$

As we have seen, the legislature does not provide any public goods to a minority district when party discipline is low or moderate. But, when  $\delta$  grows sufficiently large, the legislators will provide pork even to the district that they do not represent in order to moderate the discipline costs. In this range, the allocation of pork to the minority district grows monotonically with the degree of party discipline.<sup>11</sup>

What happens to spending as discipline becomes nearly perfect? We have seen that as  $\delta \rightarrow \infty$ ,  $g \rightarrow (\alpha - 1)/\beta$ , the per-district spending level that would be chosen by a social planner. Moreover, it becomes prohibitively costly for the elected legislature to deviate from what their party has announced. Accordingly, spending in every district approaches the efficient level of  $(\alpha - 1)/\beta$ , irrespective of the election outcome and whether a district's representative is included in the majority or not. The reader can verify that our expressions for  $\bar{g}_3$ ,  $\bar{g}_2$  and  $\bar{g}_0$  all converge to  $(\alpha - 1)/\beta$  as  $\delta$  approaches infinity.

### 4.3 Expected Welfare

We can use our analysis of the equilibrium policy choices for the different possible election outcomes to examine the relationship between party discipline and the efficiency of government spending on local public goods. From an ex ante perspective, each voter has a one-quarter probability that his district will be represented in the legislative delegation of a three-member majority, a one-half probability that his district will be represented in a two-member majority, and a one-quarter probability that his district's elected representative will not be a member of the majority delegation. Thus, the expected welfare from public spending for the typical voter is given by

$$\begin{aligned} EV &= \frac{1}{4} [H(g_3) - g_3] + \frac{1}{2} \left[ H(g_2) - \frac{1}{3} (2g_2 + g_0) \right] + \frac{1}{4} \left[ H(g_0) - \frac{1}{3} (2g_2 + g_0) \right] \\ &= \frac{1}{4} [H(g_3) - g_3] + \frac{1}{2} [H(g_2) - g_2] + \frac{1}{4} [H(g_0) - g_0] . \end{aligned}$$

Figure 7 plots expected welfare as a function of  $\delta$  for  $\alpha = 2$  and  $\beta = 1$ . As the figure shows,

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<sup>11</sup>When  $\delta > \beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2}) / (6\alpha - 6)$ ,

$$\frac{d\bar{g}_0}{d\delta} = \frac{4(4\beta\delta + \beta^2 + 6\delta^2)}{3(2\delta^2 - \beta^2 - 2\beta\delta)^2} > 0.$$

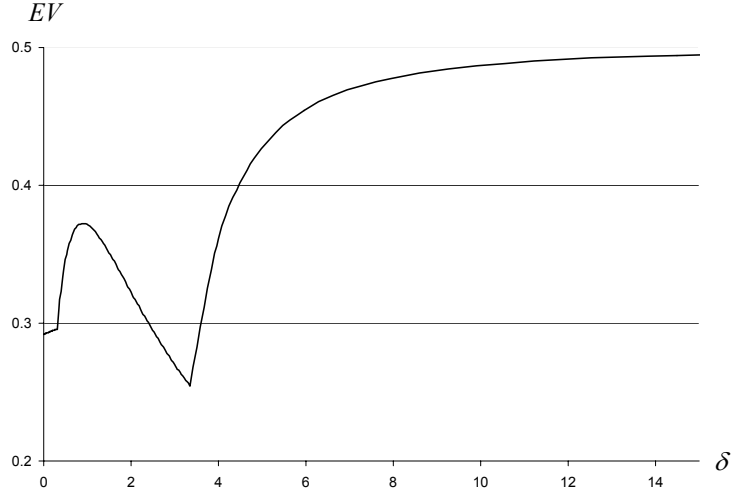


Figure 7: Expected welfare as a function of party discipline for  $\alpha = 2$  and  $\beta = 1$

welfare is quite low when the parties have little ability to commit the spending behavior of the legislators. More generally, as  $\delta \rightarrow 0$ ,  $EV \rightarrow (9\alpha^2 - 18\alpha + 7) / 24\beta$ , which is positive if and only if  $\alpha > 1 + \sqrt{2}/3$ . In other words, if  $\alpha$  is small, a polity with little party discipline delivers lower expected welfare than one that is unable to provide any local public goods whatsoever. The low level of expected welfare results from over-spending in districts that are represented in majority delegations and under-spending in districts that are not represented in the majority.

In the region of low discipline, expected welfare rises monotonically with an increase in party discipline. In this region,  $\bar{g}_3$  and  $\bar{g}_2$  both exceed the efficient level, and the former rises with  $\delta$  while the latter falls. But the net effect is always positive.<sup>12</sup> As  $\delta$  rises into the region of moderate discipline, where the parties' announcements are such as to just keep the level of spending in a minority district just equal to zero, expected welfare continues to rise.<sup>13</sup> Here, both  $\bar{g}_3$  and  $\bar{g}_2$  remain above the efficient level of spending, and both fall when discipline strengthens. But  $\bar{g}_3$  will eventually fall below the efficient level of spending when  $\delta$  passes  $2\beta/[3(\alpha - 1)]$  and even the spending in a district represented in a two-member

<sup>12</sup>It is straightforward to show that

$$\frac{dEV}{d\delta} = \frac{\beta}{54(\beta + \delta)^3} > 0 \quad \text{for } \delta < \frac{4\beta}{9\alpha - 5}.$$

<sup>13</sup>At  $\delta = 4\beta/(9\alpha - 5)$ ,

$$\frac{dEV}{d\delta^+} = \frac{(54\alpha^2 - 9\alpha - 1)\beta}{18(9\alpha - 5)(\beta + \delta)^3} > 0.$$

majority delegation will fall below the efficient level when  $\delta$  exceeds  $2\beta/[3(\alpha - 1)]$ . Both of these values of  $\delta$  fall within the region of moderate discipline, and both  $\bar{g}_3$  and  $\bar{g}_2$  are declining throughout the region. Thus, there must come a critical level of  $\delta$  between  $2\beta/[3(\alpha - 1)]$  and  $\beta/[(\alpha - 1)]$  at which expected welfare reaches a local maximum. Thereafter, further increases in discipline that do not cause spending in a minority district to turn positive must reduce expected welfare. In the figure, expected welfare reaches a local maximum at  $\delta = 46/51$ .<sup>14</sup>

Finally, we reach the region of high  $\delta$ , where discipline is sufficiently strong that the parties' promises induce positive spending even in a district that is not represented in the majority delegation. Throughout this region,  $\bar{g}_3$ ,  $\bar{g}_2$  and  $\bar{g}_0$  all rise monotonically with  $\delta$  from levels that are inefficiently small. Thus, expected welfare must be rising with  $\delta$  in the region of high discipline. As we have noted before, spending levels converge to the efficient levels as  $\delta \rightarrow \infty$ . Thus, expected welfare asymptotes to the first-best.

In short, we find that when political parties have limited ability to pre-commit the actions of elected representatives, the legislature delivers quite inefficient levels of local public goods and the outcome can be worse even than if national spending on district projects were impossible. At the opposite extreme, when the political parties have full ability to pre-commit public spending, then the spending level in each district is efficient. But the relationship between party discipline and expected welfare is not monotonic.

## 5 Conclusions

In this paper, we have developed a three-stage model of political campaigns, voting, and legislative deliberations to study the determinants of national spending on local public goods. The key variable of interest in our analysis is the degree to which political parties can pre-commit the policy actions of their members during the course of the political campaign. We assume that political parties are differentiated by ideology and that the leaders of the two parties seek to gain majority control of the contested legislature in order to pursue their ideological agendas. Electoral competition motivates their promises of pork-barrel spending. After the election, the victorious candidates pursue more parochial concerns, namely to provide goodies to their local constituents. Thus, members of the majority delegation will want to steer pork-barrel spending to the districts they represent, regardless of what their party may have promised. A party's ability to pre-commit to policy reflects its ability to discipline its members when the party succeeds in gaining control of the legislature.

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<sup>14</sup>More generally, the turning point comes at

$$\delta = \frac{2\beta(12\alpha - 1)}{27\alpha^2 - 30\alpha + 3} \in \left( \frac{4\beta}{9\alpha - 5}, \frac{\beta(3 + 3\alpha + \sqrt{3 + 6\alpha + 27\alpha^2})}{6(\alpha - 1)} \right).$$

We conceive of this ability as reflecting political institutions, although we do not model the institutions explicitly. Rather, we represent party discipline by a parameter that measures the size of a penalty that the party imposes on its members if they deviate from the party's campaign platform. We imagine that the party imposes this penalty to preserve its ability to use campaign promises for electoral benefit in future elections. Presumably, the size of the penalty reflects the degree to which the national party controls resources that are valuable to the individual politicians. In future work, it would be desirable to model explicitly the instruments available to the party and their incentives to use them. By doing so, we could endogenize the degree of pre-commitment ability as a function of more primitive features of the political system.

Our reduced-form approach yields a very tractable model and some interesting conclusions. We find that a party's platform, as well as actual spending in districts represented in a majority delegation, bear a non-monotonic relationship to the parameter representing the degree of party discipline. At low levels of discipline, the parties promise lavish pork-barrel spending in every district. If a given party wins in all three districts, the legislature spends more than is optimal in every district. If the majority party controls only two seats, the legislators allocate even more pork to the two districts they represent, but do not spend at all in the third district. As the parameter reflecting party discipline rises from these low levels, initially the qualitative features of the equilibrium remain the same, although the promises moderate and so does spending in a district represented by a legislator in a two-member majority delegation.

As discipline rises, eventually the penalties for deviating from the party platform become sufficiently great that the legislators in a two-member majority delegation would not choose to eschew spending in the remaining district (that they do not represent). For this and higher levels of discipline, public spending is positive in every district, although greater in those represented in a majority delegation than in those that are not. Further increases in discipline cause the parties to raise their campaign promises (from levels that are quite low) and to deliver greater pork to every district for all possible election results. As the penalties for failure to deliver on campaign promises become prohibitive, the promised level of spending per district approaches the socially efficient level, as does the actual spending in every district after any possible election outcome.

We also examined the relationship between parties' ability to pre-commit their fiscal policies and the expected welfare of voters. At low levels of discipline, the excessive spending in districts represented in a majority and the absence of spending in a district that is excluded from the majority result in a highly inefficient fiscal regime. Indeed, expected welfare can be lower due to tyranny of the majority than what would result from a constitutional prohibition on all public spending on local public goods. As discipline strengthens, promises moderate, and so does the inefficiency that results from excessive spending. But further increases in

discipline cause the spending levels to fall to and below the efficient levels, and expected welfare then falls. However, once discipline is so strict that the legislature allocates pork even to a minority district, subsequent increases in discipline cause spending levels to rise again, and expected welfare converges to the first-best.

Our paper fills a gap in the literature between the pre-commitment models in the Downsian tradition and the no-commitment models of Osborne and Slivinski (1996), Besley and Coate (1997), and others. Our findings urge a cautionary note about the use of correlations in comparative political analysis. The relationship between political institutions and policy outcomes can be subtle and complex even in a relatively simple political environment.

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