Factions and Political Competition*

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Abstract

This paper presents a new model of political competition where candidates belong to factions. Before elections, factions compete to direct local public goods to their local constituencies. Voters view the public goods as a credible signal that their local candidate is in the right (i.e., powerful) faction. The model of factional competition delivers a rich set of implications relating the internal organization of the party to the allocation of resources. Several key theoretical predictions of the model find a counterpart in our empirical analysis of newly coded data on the provision of water services in Mexico.

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1 Introduction

This paper introduces a model of political competition where candidates belong to party factions.

Starting with the median voter model (Black 1948), a vast formal literature has investigated the connection between elections and the size and allocation of public spending.[1] Virtually all of this literature treats competing political agents (candidates) as singletons. This focus on the individual is often reductive. In many political systems, the power to deliver resources resides largely outside the individual candidate or formal office-holder, and specifically in party factions and/or at the higher echelons of the party. In Italy, for example, the *correnti* for many years determined the allocation of local public goods,[2] as did the *camarillas* in Mexico.[3] In Japan, the power to direct public goods also resides in powerful party factions.[4] Factionalism, as the phenomenon is called in political science, is the object of a sizable descriptive and empirical literature but, to our knowledge, there is no formal model of political competition that incorporates party factions and their power.[5] This is a serious shortcoming because in many political systems the power of the faction, i.e., its ability to deliver for constituents, importantly affects the allocation of resources.

While party factions affect allocations, it is also true that the power of factions is affected by the allocation of resources. Indeed, the purpose of distributing pork is often to shore up the power of certain party factions. In this sense, the power of the faction is *endogenous*. So, a satisfactory model of factional politics must allow for an interplay between the power of factions and the allocation of resources.

In our model, factions are aggregates, or networks, of politicians who share the same career fate: when intra-party reshufflings occur and posts are assigned, either (all) faction members are promoted or they are (all) passed over. The size of a faction, and hence its power, evolves over time: a faction expands only if it wins elections—otherwise, it becomes

[1] This literature includes models with commitment by candidates—in one policy dimension (median voter, see Black 1948) or in many dimensions (redistributive politics, see Lindbeck and Weibull 1987)—and models without commitment (citizen candidates, see Osborne and Slivinski 1996, Besley and Coate 1997). There are also political agency models (Barro 1973, Persson, Roland and Tabellini 1997) and signaling models (the political cycle, Rogoff 1990), just to mention a few.

[2] Sartori (1976) and Zuckerman (1979) are classic references on Italian factions. See Golden and Picci (2005) for a recent paper showing that districts represented by politically more powerful deputies within the governing parties received higher amounts of infrastructure investments.

[3] Extensive references provided in Section 8 below.

[4] See, e.g., Cox and Rosenbluth (1993) on the Liberal Democratic Party (LDP) factions. McCubbins and Thies (1997), show that the allocation of pork-barrel and public good spending is correlated with which LDP factions have agenda-setting power. Cox et al. (1999, 2000) study the incentives to join factions as a function of Japanese electoral rules.

[5] General theories of party factions are discussed in Belloni and Beller (1976) and Kato and Mershon (2006).

marginalized within the party. At election time, then, all faction members have an interest in working to direct pork to the constituents of their faction's candidate. Thus larger factions are better able to deliver pork.

The model is simple, but it delivers a rich set of implications. Over time, as a faction becomes more powerful and more able to deliver pork, we find that voters become increasingly reluctant to vote it out of office. Thus a party may come to enjoy an incumbency advantage even though its representatives are ever-changing, undistinguished, and indeed patently corrupt. Relatedly, factions in our model are most cohesive when the party is dominant, i.e., when the party is relatively insulated from political competition. The components of a factional model of competition can be discerned, to varying degrees, in most political systems. In the U.S., elements of the factional model are especially clear in the politics of the South in the first half of the 20th century[6] and in the *machine politics* of several northern U.S. cities.[7]

The factional model also makes distinctive predictions about the allocation of public expenditure; it predicts that public resources will tend to go to constituencies whose representatives are members of powerful factions, rather than to politically swing constituencies, as standard models would predict.[8] On the one hand, this allocation entails a clear electoral cost for the party as resources are drawn away from politically competitive districts—a recurrent theme in the literature on factionalism. On the other hand, in our model factions also play a useful role for the party, (a) by aligning the interests of large sections of the party on catering to voters, and (b) by providing voters with the opportunity to "invest" in long-lived political power even when individual politicians have short-term incentives; factions thus create "loyal" constituencies for the party. These positive incentive effects of factions are not highlighted in the factionalism literature.

Perhaps the most interesting aspect of the factional model is that it presents a distinctive view of the institutional structure of the party – a view that may apply to other, non-political organizations. The model shows how internal party rules function as a system of "career incentives for teams." We find, for example, that the power to recruit new candidates for office is key to the survival of the faction: limiting the power to recruit chokes the dynamics of the faction and makes it irrelevant to policy. Relatedly, in our model the faction exists because advancement to high party posts requires the support of the rank and file of the party: when advancement does not require that support, the faction becomes irrelevant. Thus, institutional features of party organization determine the strength of factions and

[6] The classic treatment is V. O. Key (1949).

[7] In today's national politics, the party is weak relative to the individual politicians, so the factional model is less relevant.

[8] Glaeser et al. (2005) develops a model which also predicts that parties will appear to tailor policy to please "safe" constituencies. The mechanism in their model, based on differences in how well voters are informed about policy, is quite different, however, from the factional model presented here.

thus the allocation of public spending.[9]

When the power of a faction is not perfectly observed by voters, public spending becomes a means for politicians to signal the power of their faction; so our factional model of political competition generates a political budget cycle. Indeed, our model can properly be viewed as a model of the political cycle.[10] Relative to existing models of the cycle, our's delivers distinctive testable implications. It predicts that the political cycle is being generated by large factions, and thus should correlate with future political advancement of the outgoing candidate (a primary purpose of the faction), but not necessarily with particular personal abilities of the candidate (other than loyalty to the faction, perhaps). Nor should the cycle correlate with "swing states," which might have weak factions. We illustrate our model with a case study of political budget cycles in Mexico.

The evidence for our case study comes from newly coded panel data on the public provision of water services in 463 Mexican municipalities between 1994 and 2001. The data display a strong political cycle associated with state governor elections. Consistent with our modeling environment, powerful factions (in Mexico called *camarillas*) within the Partido Revolucionario Institucional (PRI) controlled political advancement within the party and public spending. In addition, the Mexican constitution bars office-holders from being re-elected, which attenuates the incumbent's motives for generating a political cycle.[11] These institutional features suggest that factions must largely be responsible for the political cycle in Mexico. Moreover, our analysis reveals no association between the political cycle and the outgoing governor's own vote-getting ability, but a strong association with "political career" variable coding the outgoing governor's later success in the party. Also, we find that the cycle is essentially unrelated to "electoral" variables such as the levels of local political competition and voter turnout. We view this evidence as supportive of our factional model of competition.

The paper develops as follows. Section 2 presents our model of factions and political competition. Sections 3 and 4 solve for the equilibrium and discuss its predictions. Sections 5 and 6 discuss certain benefits and drawbacks generated by factional competition. Section 7 discusses a number of extensions and comparative statics on the basic model. Section 8 presents the Mexico case study. Section 9 concludes.

[9] These themes, of the importance of recruiting and advancement, are central to the literature on the roles of political parties. See, e.g., Hennessy (1968), Lawson (1980), Camp (1995) and Norris (2006).

[10] See, e.g., Rogoff (1990), Eslava and Drazen (2006), Persson and Tabellin (2000), Shi and Svensson (2006).

[11] Rogoff (1990) and Rogoff and Sibert (1988) argue that parties, rather than candidates, might also be signaling their competence. We will argue below that this channel cannot explain our empirical findings.

2 Model

We first exposit the model as simply as possible. Because the model has some non-standard elements, we devote the final subsection to discussing its assumptions.

2.1 Citizens

There is a number of identical citizens who live in several states. There is also a central, or federal, government with the power to direct a local public good (pork) to each state. The public good is scarce and so, as we shall see, politicians will compete to direct pork to the state at the base of their support.

Citizens live for two periods. Before voting in each period, citizens of a state may, or may not, receive a unit of local public good $g \in \{0, 1\}$. Because the public good is provided before the vote, when young citizens vote they are concerned only with the probability of receiving the public good when old. Insofar as they are influenced by the public good received when young, it is as a signal of the probability of receiving g when old. Young citizens also care about the appeal of the opposition candidate in period t, denoted by a_t (the appeal of the incumbent party's candidate in each period is normalized to zero). That appeal is unknown until just before the vote, and is assumed to be drawn from a continuous cdf F.

Old citizens are cynical and do not care about the candidates' appeal. They only enjoy the public good, if it is provided to them.

2.2 Parties and Elections

There are two parties, which we call "the ruling party" (or, often, simply "the party") and "the opposition." Our analysis will focus mainly on the internal workings of "the party."

The two parties each field a candidate in every state election in every period. The ruling party controls the federal bureaucracy, so only politicians belonging to the ruling party have an influence on the allocation of the public good. The key function of parties is to select and promote politicians, as detailed in the next section.

2.3 Factions, Recruiting, and Promotions

State s at time t has a *faction* of size $S_t \geq 0$, which is composed of past governors from state s who have gone on to occupy higher elected office or a high post in the federal bureaucracy. Faction members are assigned to occupy a position i in the faction where, to fix ideas, we may assume that position $i + 1$ is senior to position i. In each period, $i = 1$ denotes the outgoing governor—in our model, the lowest rung of the faction.

The party's candidate in state s and period t is assumed to belong to the faction. In other words, the faction has power over recruiting.

Promotions are made at the end of period t. Members of the faction share the same fate in terms of promotion. They are promoted and will rise in the period $t+1$ ranks if and only if the party's candidate for governor in state s is elected in period t. A bureaucrat who was in position i and gets promoted at time t moves up to $i+1$ at $t+1$ (an up-or-out system).

This promotion system is given an interpretation in Section 2.7.2. Note that in this up-our-out system, officials cannot be re-elected. This requirement is imposed partly to match the institutional structure of our case study in Mexico, and partly because it simplifies the exposition. In Section 7.1 we show that the analysis is essentially unchanged when we allow for re-election.

The promotion rule links the evolution of S_t to the outcome of the election. If the party is confirmed in t, then $S_{t+1} = S_t + 1$ (the increase in the size of the faction reflects the fact that a new elected official, the incoming governor, has entered the party). If the party is defeated then $S_{t+1} = 0$. If the party wins when state s was previously controlled by the opposition then $S_{t+1} = 1$.

The faction members' objective function is simply to be promoted in period t (myopic).

2.4 Public Good

We model the within-party competition for resources as a tournament among a large number of factions. N factions compete for qN prizes (units of the public good) where $q < 1$. We allow a faction to be as small as a single member. Whether a faction k receives the public good depends on both effort and luck; specifically, the qN factions with the greatest influence I_k receive the public good, where

$$I_k = u_k + \frac{1-\alpha}{\alpha} \sum_{i=1}^{S_t} \alpha^i e_{it}.$$

Here u_k is the luck element, the realization from a uniform distribution U with support $[-1, +1]$. The effort element is represented by the discounted sum of the e_{it}. The element $e_{it} \geq 0$ represents the effort put in by state-k faction member i at time t. For the interpretation of the effort levels e_i we have in mind a process by which faction members work to gain influence, or favor, with the upper echelons, or decision makers, of the party; this is in the spirit of the literature on "beauty contests" (see e.g. Fullerton and McAfee 1999).

Putting in effort e_i costs the faction member $c(e_i)$. The cost function $c(\cdot)$ is assumed to be convex. To ensure that individual effort e_{it} does not exceed 1, we impose the Inada condition $c'(1) = +\infty$. To ensure that the discounted sum of efforts does not exceed 1, we normalize total effort with the discount factor $\alpha < 1$. This discount factor represents how much more important is the effort of faction member i relative to faction member $i+1$.

Faction k wins the public good if and only if I_k exceeds the q-th quantile of the empirical distribution of the equilibrium I's. The q-th quantile is a random variable. However, since the realizations u_k are uncorrelated across factions, as $N \to \infty$ this quantile converges in probability to a number which we denote by $\underline{I}$. In the limit when the number of factions grows, faction k wins a public good if and only if $I_k \geq \underline{I}$. Now,

$$\begin{aligned} \Pr\left(I_k \geq \underline{I}\right) &= \Pr\left(U \geq \underline{I} - \frac{1-\alpha}{\alpha}\sum_{i=1}^{S_t}\alpha^i e_{it}\right) \\ &= \frac{3}{2} - \frac{\underline{I} - \frac{1-\alpha}{\alpha}\sum_{i=1}^{S_t}\alpha^i e_{it}}{2}. \end{aligned}$$

To be exact, the second equality holds only when the numerator of the fraction is within the support of U, which must necessarily be the case in equilibrium since no faction would want to exert more effort than it takes to win for sure. Then, in equilibrium the probability that the public good is provided to state k is given by

$$\Pr\left(g_t = 1\right) = K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t}\alpha^i e_{it}, \tag{1}$$

where $K = \left(3 - \underline{I}\right)/2$. We see that a large faction finds it easier to provide the public good to its constituents.

For future reference we note that, if we let $\boldsymbol{\pi}$ denote a distribution over S_t, the size of factions in our population, then the resource constraint dictates

$$\begin{aligned} q &= E_\pi\left[\Pr\left(U \geq \underline{I} - \frac{1-\alpha}{\alpha}\sum_{i=1}^{S_t}\alpha^i e_{it}\right)\right] \\ &= E_\pi\left[K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t}\alpha^i e_{it}\right]. \end{aligned} \tag{2}$$

We can augment the model to account for a special member of a faction, which we could call "the president." We develop this variant of the model in Section 7.2.

2.5 Information

Faction members know exactly the size S_t of their faction. However, S_t is not known to voters who, at the beginning of period t, share a prior probability $\pi_t\left(s\right)$ that $S_t = s$.

We assume that young citizens (the only citizens who vote) have no information about their faction except that they can observe whether the party has an outgoing governor. That piece of information is the only state variable that voters can condition on. There will therefore be two sets of beliefs for young voters. When young voters see an outgoing

governor from the opposition at t, then they know that $S_t = 0$. When young voters see an outgoing governor from the party, their prior beliefs at the beginning of time t are described by π_t.

2.6 Timeline

At time t,

- the S_t members of the state s faction choose effort e_{it},
- the public good g_t is realized according to the probability distribution (1)
- voters update their prior probability $\boldsymbol{\pi}_t$ and vote in the governor's election, choosing between a new candidate for the party and a new opposition candidate
- at the end of the period, promotions are made and S_{t+1} is determined.

2.7 Discussion of Modeling Assumptions

2.7.1 The Faction

We made several stark assumptions concerning the faction. First, we tied the faction to a state. Second, we made it a purely vertical (and exclusive) network, in the sense that only past governors can be part of the faction. Third, factions are non-overlapping—a politician cannot belong to more than one faction. Fourth, the lowest member of the faction is the governor. These assumptions were made for simplicity of exposition. In reality, for example, a faction includes many figures who are not past governors but who are bureaucrats and/or hold other political office. It should be clear that these assumptions could be relaxed considerably. We have also assumed that politicians are assigned to a faction once and for all. In reality, presumably politicians may "jump" from one faction to another at critical times. It would be interesting to understand the forces that shape the faction's membership. Unfortunately, to our knowledge, there is as yet little systematic information, beyond anecdotal evidence, about the life of factions that would allow us to build a sensible model. As such, we have decided not to pursue the issue of endogenous choice of faction membership. In general, we could have presented a more complex model. To the extent that allowing greater complexity increases the citizen's uncertainty about faction's power, the signalling motive at the heart of the model will only be enhanced.

A key assumption is that the size of the faction is not observed by voters but it is observed by politicians. We think this assumption is descriptively accurate in the sense that the median voter will not know who within the party organization will put in effort for their

state, nor the extent of their influence. Politicians are clearly much better placed to obtain such information.

The assumption of a large number of factions yields the mathematically convenient property that the decision problem of a faction at time t is independent of the fortunes of any other single faction. In Section 7.7 we study the polar opposite case where the number of factions is two, and show that the logic of the model with many factions carries over.

2.7.2 Recruiting and Promotion Rules

The specific promotion rule we chose, in which the governor's election plays a central role, can be interpreted as capturing the requirement that party members need the support of the lower echelons in order to be promoted. To see why, suppose that in order to be promoted to level i, a faction member needs support of the member at level $i-1$. Suppose further that promotions in each period t are made sequentially, starting from the lowest level in each faction. Then it is seen by induction that faction members at all levels need the lowest level in their faction to be promoted (in our stylized model, the outgoing governor of their state). But by rule, that faction member himself needs the support of the incoming governor to be promoted, and that is going to happen only if the ruling party's candidate is elected. Thus, the advancement of all faction members turns on the outcome of the gubernatorial election.

The promotion rule we chose is deterministic, that is, either the size of the faction grows by one if its candidate for governor is elected, or the faction effectively disappears. This is obviously a stark simplification, but not an essential one. To the extent that the evolution of the faction is not deterministic, voters are less likely to be able to guess its size and so the signalling motive that generates the political cycle will become even stronger.

By tying a faction to a state, our model implicitly assigns the faction the power to nominate a candidate in the state that it controls. If the faction were unable to recruit in this manner, there would be no place for factions in our model (see Section 5.2).

2.7.3 Other Means of Signaling

It is natural ask whether a candidate might find other ways to signal the power of his faction, such as presidential visits to his state, public endorsements, etc. To this question we have two answers. First, candidates may well signal in multiple ways—we do not claim that the signal appears in only in the provision of public expenditure. Second, however, we point out that in order for the signaling to be sustained in equilibrium, at least part of the signaling must be by means of material benefit to voters. Otherwise, if signaling is only costly to candidates but is not materially beneficial to voters, there is no incentive for voters to support the candidate, since the future reward for the support would only be more materially useless signaling. This point is developed formally in Section 7.6.

2.7.4 Information

In our model voters have very limited knowledge of history: they only know whether the outgoing governor is from the ruling party. This assumption reduces the state space of the voter's decision problem. If we relaxed this assumption and allowed young voters to know the result of a given number of past elections, for example, then the decisions of all agents in the model would depend on a richer set of state variables. This would complicate the analysis, but it would not eliminate the basic force that generates the budget cycle. As long as voters do not perfectly know the power of their faction, politicians will signal by providing local public goods.

2.7.5 Public Good

In our model, the power to provide public goods is partly, but not fully, vested into elected office. Indeed, if an opposition candidate or a candidate with a small faction gets elected, they find it more difficult to provide public goods.

3 Equilibrium

In this section we look for a stationary (time invariant) equilibrium of the game.[12] In such an equilibrium, young voters enter each period with a belief $\boldsymbol{\pi}_t = \boldsymbol{\pi}$ about their faction's strength. This belief is stationary and thus is not subscripted by t. We require that equilibrium beliefs be correct, in the sense that the probability distribution $\boldsymbol{\pi}_{t+1}$ must be consistent with $\boldsymbol{\pi}_t$ and the promotion probabilities induced by the equilibrium effort of party members. In such a stationary equilibrium, a faction member at position i exerts the same level of effort in every period (that level is not the same, of course, across faction members).

3.1 Effort choice by faction members

If the time-t outgoing governor in state s is from the opposition then there is no faction from state s at t. Assume therefore that there is an outgoing party governor in period t. Then faction members maximize the probability of being promoted. Given the promotion rule, this amounts to maximizing the probability that the party candidate for governor is elected. Whether a majority votes for the party candidate depends on what voters expect to receive in the future. That expectation in turn depends on their information at the time of the vote,

[12] Existence of a stationary equilibrium is addressed later in this section.

which at a stationary equilibrium is summarized by $(\boldsymbol{\pi}, g_t)$. If we denote

$$\begin{aligned} B &= \Pr{}_{\pi}\left(\text{majority votes for party at } t \mid g_t = 1\right) \\ b &= \Pr{}_{\pi}\left(\text{majority votes for party at } t \mid g_t = 0\right), \end{aligned}$$

then member i of the faction solves

$$\begin{aligned} & \max_{e_i} b + (B-b)\Pr\left(g_t = 1\right) - c\left(e_i\right) \\ = & \max_{e_i} b + (B-b)\left[K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t}\alpha^i e_i\right] - c\left(e_i\right). \end{aligned}$$

Assume that $B \geq b$ (we will verify later that this is the case). The equilibrium level of effort e_{it}^* solves

$$c'\left(e_i^*\right) = (B-b)\frac{1-\alpha}{2\alpha}\alpha^i. \tag{3}$$

This equation does not depend on S_t, so, member i of the faction will put in e_{it}^* independent of how many members are included in his camarilla. Therefore, the total amount of effort is increasing in S_t.

Proposition 1 *In a stationary equilibrium, the total effort exerted by a faction and the probability that its constituents receive the public good are increasing in the size of the faction.*

3.2 Voter Behavior

Until now, voter behavior has been summarized by B and b. We now explain how these two statistics are determined in equilibrium, with particular attention to the question of whether $B > b$, i.e., whether (and why) voters are swayed by the pre-electoral provision of public goods.

Old voters in period t have no reason to vote, so we will have them abstain.[13]

Young voters are responsive to g_t insofar as it portends the future realization of g_{t+1}. A young citizen votes as if he were pivotal. If he elects the party candidate then his future payoff is $E_{\boldsymbol{\pi}_t}\left(g_{t+1} | g_t, \text{party gov. wins at } t\right)$. If he votes for the opposition he gets a_t.[14] At

[13] We could just as well have them vote in a fixed proportion for the party candidate. The important thing for our purposes is that they are not responsive to g_t.

[14] There is no public good in period $t+1$ because we have assumed that the opposition cannot provide the public good, and the party has no state s faction at $t+1$. Even if we allowed the opposition to provide some public good to state s, that state's faction *within the opposition party* is of size 1 in period $t+1$, and thus much smaller than the expected value of the party's faction. This would lead voters to discount heavily the monetary return from defeating the party candidate.

the stationary equilibrium $\boldsymbol{\pi}_t = \boldsymbol{\pi}$ and so a voter chooses the party if

$$\begin{aligned} a_t &\leq E_{\boldsymbol{\pi}}\left(g_{t+1}|g_t, \text{party candidate wins at } t\right) \\ &= \Pr{}_{\boldsymbol{\pi}}\left(g_{t+1}=1|g_t, \text{party candidate wins at } t\right) \\ &= K + E_{\boldsymbol{\pi}}\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^*|g_t\right) \end{aligned}$$

B represents the probability that voters vote for the party candidate after the realization $g_t = 1$ is known, but before a_t is known. Thus,

$$\begin{aligned} B &= \Pr\left[a_t \leq E_\pi\left(g_{t+1}|g_t=1, \text{party candidate wins at } t\right)\right] \\ &= F\left(K + E_\pi\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^*|g_t=1\right)\right). \end{aligned} \tag{4}$$

Analogously,

$$b = F\left(K + E_\pi\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^*|g_t=0\right)\right). \tag{5}$$

It is now intuitive that $B \geq b$: the event $g_t = 1$ is more likely when S_t is large, so conditioning on that event increases the likelihood that S_t is large. In the appendix we prove formally that $B \geq b$.

3.3 Equilibrium

Consider a stationary equilibrium where the effort levels chosen by the faction members are collected in the vector $\{e_i\}$, and the probabilities that the party's candidate is elected are B following $g_t = 1$ and b following $g_t = 0$. Then the probability of being of size $S_t + 1$ in period $t+1$ is the probability of being size S_t in period t times the transition probability. Formally,

$$\pi_{t+1}(s+1) = \pi_t(s) \cdot \left[b + (B-b)\left(K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{s}\alpha^i e_i\right)\right].$$

At a stationary equilibrium $\pi_t(\cdot) = \pi(\cdot)$, so we obtain the following characterization of the stationary distribution:

$$\begin{aligned} \pi(s+1) &= \pi(s) \cdot \left[b + (B-b)\left(K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{s}\alpha^i e_i\right)\right], \\ \pi(0) &= 1 - \sum_{s=1}^{\infty}\pi(s). \end{aligned} \tag{6}$$

Definition: A stationary equilibrium is a quintuple $(K^*, \mathbf{e}^*, B^*, b^*, \boldsymbol{\pi}^*)$ that solves (2), (3), (4), (5), and (6).

A trivial stationary equilibrium always exists where no effort is undertaken. More important, we show in the appendix that, for given F, there are stationary equilibria with positive effort levels if $c(e)$ is sufficiently convex around $e = 0$; for example, if $c(e) = e^{\gamma}$, then choosing γ large enough guarantees existence of a stationary equilibrium with positive effort levels.

Proposition 2 *If $c(e)$ is sufficiently convex, a stationary equilibrium exists where all factions exert positive effort.*

4 Testable Implications

Despite its simplicity, the model presented in the previous section has a number of empirical implications many of which will find a counterpart in the Mexico case study. Some of the implications are immediate and are collected in the next proposition. Others require more discussion and are developed in the subsections that follow.

Proposition 3 *In equilibrium, voters are swayed by the pre-electoral distribution of public goods. This is true even though politicians cannot be re-elected. Moreover, states with opposition governors are least likely to receive the public good.*

The fact that in our model states with opposition governors are least likely to receive the public good may seem unremarkable, but it is a point where our model differs from a "unitary actor" model of the party. If the party acted as one agent, the same signaling motives that induce it to direct benefits to own-governed states may well induce it to give resources to states governed by opposition governors, especially if these are seen as "battleground" states (provided of course that the beneficiaries interpret the signal correctly). Thus, models of the party as a unitary actor may produce unconventional implications in the cross-section.

4.1 Public Goods and Future Political Success

Our model of factional competition also makes sharp predictions about the relationship between public good allocations and the career paths of politicians. We derive here an implication of the model which we will later confirm in the Mexico case study.

Proposition 4 *The probability that an outgoing governor's state receives public goods is predicted by his future success within the party.*

Proof: Denote

$$P_\tau = (\text{party wins at } t+1, ..., \tau | \text{party wins at } t).$$

Then we can write

$$\begin{aligned}
& \Pr(g_t = 1 | \text{outgoing governor at } t \text{ promoted through } \tau) \\
= \; & \Pr(g_t = 1 | \text{party wins at } t, t+1, ..., \tau) \\
= \; & \frac{\Pr(\text{party wins at } t, t+1, ..., \tau | g_t = 1) \cdot \Pr(g_t = 1)}{\Pr(\text{party wins at } t, t+1, ..., \tau)} \\
= \; & \frac{P_\tau \cdot \Pr(\text{party wins at } t | g_t = 1) \cdot \Pr(g_t = 1)}{P_\tau \cdot \Pr(\text{party wins at } t)} \\
= \; & \frac{B \Pr(g_t = 1)}{B \Pr(g_t = 1) + b \Pr(g_t = 0)} \\
> \; & \frac{[(1-B) + B(1-P_\tau)] \Pr(g_t = 1)}{[(1-B) + B(1-P_\tau)] \Pr(g_t = 1) + [(1-b) + b(1-P_\tau)] \Pr(g_t = 0)} \\
= \; & \Pr(g_t = 1 | \text{outgoing governor at } t \text{ not promoted through } \tau) \qquad (7)
\end{aligned}$$

The algebra that justifies the inequality is reported in appendix section B.3. ■

This proposition shows that the distribution of public goods is predicted by later intra-party success of the outgoing politician.

4.2 Public Goods and Vote-Getting Ability

Within the same party, we can rank two candidates by their vote getting ability. We say candidate 1 is a better vote-getter than candidate 2 if candidate 1 faces a distribution $F_1(a)$ that is smaller, in the sense of first-order stochastic dominance, than the distribution $F_2(a)$ faced by candidate 2. In the context of our model, this implies that at every total effort level put forth by the faction, a better vote-getter will be more likely to get elected. This does not necessarily guarantee that, in equilibrium, the better vote-getter will be elected more often—the faction might decide to shirk when a good vote-getter is selected—but it does imply that the faction prefers to field better vote-getting candidates.

Regardless of whether the politician was a good vote-getter when running for office, conditional on having been elected, in our model his vote getting ability is irrelevant for his future role in the life of the faction. In particular, the state of a governor that barely managed to get elected is just as likely to receive public goods as one of a governor that was elected by a large margin.

Proposition 5 *The vote-getting ability of an outgoing governor is uncorrelated with the probability that his constituents receive public goods and with his future success within the party.*

This stark no-correlation result is a consequence of the assumption that governors never again run for office. Were we to allow for the possibility of an outgoing governor running for office in the future, we would likely observe some correlation. Interestingly, however, we will see this lack of correlation in the Mexican case study where re-election is precluded. One interpretation of this finding is that, in Mexico, the vote-getting ability of politicians plays a secondary role in their political careers after the governorship.

4.3 Voter Loyalty

In a stationary equilibrium, conditional on reaching size s, the faction is more likely to survive and thrive when s is large (formally, this is because the bracketed term in expression (6) increases in s). This is a feature of the equilibrium—it depends on the fact that the equilibrium effort level increases with the size of the faction, see Proposition 1—and it means that in our model old (and therefore large) factions are better able to sway voters than small ones.

Proposition 6 *The expected vote share of the dominant party in a state is increasing in the length of the spell of uninterrupted electoral success in that state.*

An external observer might mistakenly interpret the correlation between the age of a faction and its electoral success as evidence of voter loyalty, whereas in reality the correlation would disappear if we conditioned on g_t. While voters appear to become attached to the party, in reality they simply become more prone to invest in the "durable political good" which the faction represents.

Related to this observation, in the equilibrium of our model areas with uninterrupted histories of support for the party have larger factions and are thus more likely to receive public goods. In the Mexican data on water services, we see faint traces of a positive relationship between past support and the size of the cycle in the coefficients of Table 3, columns 5 and 6. These coefficients are imprecisely estimated, but they indicate that in states where the party has held the governorship for long periods, cycle spending is especially large.

5 Benefits of Factional Organization: Factions As Incentive Scheme

In this section we investigate whether there is a functional rationale for the internal party organization we have studied; namely, a party divided into long-lived factions that thrive with electoral success. We will find that there are advantages (measured in terms of votes gained) for the party to such an organization. These advantages ultimately derive from the

intertemporal commitment ability that long-lived factions give the party – an ability that individual candidates may not be able to provide.

5.1 Promotion Policy and the No-Faction Case

In our model, party rules condition the promotion of faction members on the advancement of the lower echelons of that faction. This rule creates incentive effects that benefit the party. To see this, let us analyze the polar opposite case in which promotions do not depend at all on the advancement of the lower rungs of the faction. As we shall see, in this alternative case faction members no longer work toward party objectives, and the faction becomes inconsequential.

Suppose the promotion of faction member i does not depend on $i-1$'s backing, because the party's protocols do not require internal support for promotions.[15] Then the link between promotions and electoral success is severed. For simplicity, let us imagine that the promotion policy is completely unrelated to electoral success. Then, even if the bureaucracy is persistent over time, bureaucrats at any point have no incentive to signal the strength of their faction to the voters and thus $e_i^* = 0$ for all i. Since at any point in time voters anticipate zero probability of receiving public goods in the future, the probability that the party wins the election in state s would be $F(0)$. This probability is lower than

$$E_\pi \left[F\left(b + (B-b)\left(K + \frac{1-\alpha}{2\alpha} \sum_{i=1}^{S} \alpha^i e_i^* \right) \right) \right],$$

the expected probability of wining when promotions depend on electoral success.

In a sense, this is a world where factions do not exist in equilibrium. Alternatively, we can think of this as a world in which factions might well grow and be persistent over time, but time-t voters do not care because the size of the faction at $t+1$ will not increase the likelihood of receiving the public good.

Proposition 7 ***(Value of the faction).*** *If the promotion of faction member i does not depend on $i-1$'s support, or equivalently, if promotions are independent of the electoral outcome, then faction members will not exert any effort and the party will be less successful in elections.*

This proposition shows that in our model the rule that links promotions to electoral success serves as an incentive scheme aligning the bureaucrats' incentives with the party's. It also shows that in a world with no factions the party is less successful. This observation speaks to a general point. The long life enjoyed by factions supplies a useful (for the

[15] The promotion and enlargement of a faction might depend, say, on the whim of a president who may value personal favors, or practice nepotism, rather than rewarding electoral success.

party) political good that individual candidates may not be able to provide: intertemporal commitment to constituents.

5.2 Recruitment and the Growth of the Faction

The long life of factions is predicated on their ability to grow by recruiting new candidates for governor. This power to recruit could, of course, be checked by internal party rules. In our model, that would mean limiting the faction's ability to select gubernatorial candidates. Such an organizational check would, however, imply a cost to the party since, as we will show, voters would be less responsive to public good provision. This would, in turn, lead to lower effort by faction members and the party will be less successful in elections.

To explore this point, let us consider the effect of an unanticipated one-time shock in period t that makes the faction unable to recruit the new candidate governor in period t only. We can think of this candidate as being imposed by the highest echelons of the party and thus as having no allegiance to the faction. Conditional on the candidate being elected in period t, the equilibrium evolves from period $t+1$ on just as described in Section 3 except that the faction has not grown from period t to $t+1$. Thus, from a voter's viewpoint, $e_{i,t+1} = e_i^*$. Let voters be aware that period-t candidate is not a faction candidate. For period t only, expressions (4) and (5) are amended to:

$$\begin{aligned} \underline{B} &= F\left(K + E_\pi\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t}\alpha^i e_i^* | g_t = 1\right)\right) \\ \underline{b} &= F\left(K + E_\pi\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t}\alpha^i e_i^* | g_t = 0\right)\right) \end{aligned}$$

(note the lack of "+1" in the upper limit of the summation). Assume that $|\underline{B} - \underline{b}| < |B - b|$ (this is the case if F is convex, for example). Then voters are less responsive to public good provision when the faction cannot recruit. Period-t efforts are given by the equation

$$c'\left(e_{i,t}^*\right) = \left(\underline{B} - \underline{b}\right)\frac{1-\alpha}{2\alpha}\alpha^i.$$

Since $c(\cdot)$ is assumed to be convex, equilibrium effort is positively correlated with the size of $|\underline{B} - \underline{b}|$, and so effort is less intense, when the faction cannot recruit. Moreover, since $F(\cdot)$ is increasing, $\underline{B} < B$ and $\underline{b} < b$, and so the faction is less likely to survive the elections in period t when the faction cannot recruit.

Proposition 8 ***(Advantages of letting the faction recruit).*** *Suppose F is convex. Then if the faction cannot recruit, voters are less responsive to the provision of public goods and faction members put in less effort. In equilibrium, the faction is less likely to win elections when the faction cannot recruit.*

This proposition highlights the advantage to the party of a rule that "rewards success" by letting the successful camarilla grow by recruiting.

6 Cost of Factional Organization: Loss of Flexibility

We now augment the model and allow for state heterogeneity in the responsiveness to local public goods. This will highlight a drawback of factions, which is that the party loses some flexibility in allocating resources across states.

Up to now, the only characteristic that differentiates states at time t is the size of their faction. At the time of voting, of course, states are heterogeneous due to the different values taken by a_t, but this heterogeneity of candidate quality does not translate into heterogeneity of effort because the realization a_t is unknown to the faction members at the time they make their choices. We introduce an additional source of heterogeneity by allowing the *distribution* of a_t to depend on the realization of a random variable ε_t. We assume ε_t to be i.i.d. across states and time periods. The parameter ε_t will capture the degree to which the voting population is likely to respond to promises of future benefits. To this end, we introduce the following definition.

Definition: $F(a|\varepsilon')$ is tighter than $F(a|\varepsilon)$ if $f(a|\varepsilon') \geq f(a|\varepsilon)$ for all $a \in [0,1]$.

When $F(a|\varepsilon')$ is tighter than $F(a|\varepsilon)$ then its derivative with respect to a is greater, and so in our model voters are more responsive to the promise of future benefits.[16]

Before we proceed, we need to make clear what agents know about ε_t. We assume that time-t party members know the realization of ε_t before they choose their effort level. Voters, in contrast, are assumed not to know ε_t (although of course they know the realization a_t).[17] Thus, politicians know $F(a|\varepsilon_t)$, but voters only know $E_{\varepsilon_t}[F(a|\varepsilon_t)]$. As a consequence of this assumption, voters at time t are unsure whether to attribute a positive realization $g_t = 1$ to a large faction (which they care about for its future implications) or to the realization of ε_t (which they do not care about). Because we assume that ε_t is i.i.d over time, tightness is not persistent and is thus not a source of any political cycle.[18]

In this model a stationary equilibrium exists and is characterized by the following equations

$$c'(e_i^*(\varepsilon_t)) = [B^*(\varepsilon_t) - b^*(\varepsilon_t)] \frac{(1-\alpha)}{2} \alpha^{i-1}. \tag{8}$$

[16] Incorporating heterogeneity in this way is very much in the spirit of Lindbeck and Weibull (1987).

[17] Eslava and Drazen (2006) work with a similar assumption about the voters' lack of knowledge about the electorate's sensitivity to public good provision.

[18] Eslava and Drazen (2006) make a similar assumption.

$$B^*(\varepsilon_t) = F\left(K^* + E_{\pi,\varepsilon_t}\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i E_{\varepsilon_{t+1}}\left[e_i^*(\varepsilon_{t+1})\right]|g_t=1\right)|\varepsilon_t\right) \quad (9)$$

$$b^*(\varepsilon_t) = F\left(K^* + E_{\pi,\varepsilon_t}\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i E_{\varepsilon_{t+1}}\left[e_i^*(\varepsilon_{t+1})\right]|g_t=0\right)|\varepsilon_t\right) \quad (10)$$

$$\pi^*(s+1) = \pi^*(s)\cdot E_{\varepsilon_t}\left[b^*(\varepsilon_t) + \left[B(\varepsilon_t^*) - b^*(\varepsilon_t)\right]\left(K^* + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{s}\alpha^i e_i^*(\varepsilon_t)\right)\right],$$

$$\pi^*(0) = 1 - \sum_{s=1}^{\infty}\pi^*(s).$$

Now $e_i^*(\varepsilon_t)$ is a random process whose realization depends on ε_t but, like in our original model, its distribution is stationary—it does not depend on S_t. Therefore, states with larger factions still receive the public good with higher probability. We now want to compare equilibrium efforts under two different realizations ε_t and ε_t'. Note that the expectation terms in equations (9) and (10) do not depend on the realization ε_t. Therefore, if $F(a|\varepsilon')$ is tighter than $F(a|\varepsilon)$ then $B^*(\varepsilon') - b^*(\varepsilon') \geq B^*(\varepsilon) - b^*(\varepsilon)$. Therefore by equation (8) we have $e_i^*(\varepsilon') \geq e_i^*(\varepsilon)$ for all i.

Proposition 9 ***(Drawback of factional politics)***. *Given two states with the same faction size, the state that is more responsive to local public goods (i.e., has a tighter F) is more likely to receive the public good. However, the probability that a state receives the public good also depends on the size of the faction, and that is suboptimal for the party as a whole.*

This proposition highlights a source of inefficiency inherent to the presence of factions: resource allocation responds to intra-party considerations ahead of electoral considerations. This inefficiency presumably has a real cost for the party in terms of vote share.

In most models, including ours, closeness of the election is thought to proxy for responsiveness. In the Mexican data, closeness of the election is not a good predictor of the budget cycle, suggesting that considerations related to heterogeneity across states are trumped by intra-party considerations. We interpret these results as supporting a model that shifts focus toward intra-party incentives for public good provision.

7 Extensions and Comparative Statics

7.1 Re-election

We have assumed until now that politicians cannot be re-elected. This assumption simplifies our exposition and matches the institutions in Mexico, which will be discussed later.

However, the analysis of the model does not hinge on this assumption. We now show that extending the framework to allow for re-election leaves the equilibrium unchanged.

The game is the same as the one in Section 2, except that we allow a governor to run for re-election $N-1$ consecutive times. An incumbent politician who wins re-election gets the same payoff he got from winning the first election; set this payoff to 1. If he loses, he gets zero. As for the faction, we suppose that it grows by 1 whenever the incumbent wins re-election, and it drops to zero when the incumbent does not. At the end of the incumbent's period in office, a new candidate is chosen for the ruling party.

The analysis of this model is essentially the same as in Section 3. The only difference is that young voters at period t can now see whether the ruling party candidate is the incumbent politician or a new one, but this makes no difference to voters. Therefore, the equilibrium is unchanged.

Proposition 10 *The equilibria of our game are unchanged if we allow governors to be re-elected.*

In light of this result, our analysis can be interpreted to strike a note of caution about the existing literature on the political cycle: as a driver of the political cycle, the possibility of re-election may have been overemphasized.

7.2 The President

In many cases, decision-making power in party factions is concentrated in the party's upper echelons. In Mexico, for example, the president has extensive powers. It is not difficult to modify the model to accommodate the power of the president (or of high echelons of the party).

Suppose that, in every period, with some probability the faction includes the president. In keeping with the idea that faction membership is opaque, we assume that voters do not know to which faction the president belongs. To keep things simple, let us assume that the probability a faction includes the president can be written as an increasing function $\phi(S_t)$ of the faction's power.[19] The presence of the president among the faction members does not affect the promotion mechanism for that or any other faction.

The president contributes effort to his faction. Let us assume for simplicity that in every period the president puts in effort $\frac{1}{2}$.[20] To accommodate the presence of the president, it is

[19] A fully rigorous model would also allow ϕ to depend on the size of all other factions. One could also imagine that $\phi(S_t)$ is a function of which faction the president belonged to in $t-1$. Simplifying as we do is appropriate for the purpose of this section, which is merely to outline the broad features of a model.

[20] By fixing the president's effort, we are side-stepping the issue of the president's incentives except to assume that he wants to help his faction.

necessary to renormalize the production function of the public good, which now satisfies

$$\Pr\left(g_t = 1\right) = K + \frac{1}{2}\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t}\alpha^i e_{it}\right) + \phi\left(S_t\right)\frac{1}{2}.$$

This function represents the expected probability that the public good is provided given the effort of the regular faction members and given that, with probability $\phi\left(S_t\right)$, the faction will include the president. This expression can be used to obtain close counterparts to expressions (4) and (5), namely

$$\begin{aligned} B' &= F\left(K + E_\pi\left(\frac{1}{2}\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e^*_{it}\right) + \phi\left(S_t\right)\frac{1}{2}|g_t = 1\right)\right) \\ b' &= F\left(K + E_\pi\left(\frac{1}{2}\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e^*_{it}\right) + \phi\left(S_t\right)\frac{1}{2}|g_t = 0\right)\right). \end{aligned}$$

With these expressions, equilibrium is characterized exactly as in Section 3. In equilibrium voters will now take into account the possibility that one of their faction members, now and/or in the future, might be the president.

7.3 Politicians' Loyalty to the Faction

We saw in section 5.2 that the ability to recruit politicians is the foundation of a faction's power. What qualities would we expect the factional system to select for? It seems natural that factions would try to recruit and retain loyal and vote-getting politicians. In Section 4.2 we showed that whether an outgoing governor is a relatively good vote-getter does not affect either the probability that his constituency receives public goods or his future success within the party. In this section we show, however, that loyalty does.

We model loyalty as a politician's propensity to support his direct superior in the faction. Formally, we can imagine that with probability $(1-\lambda)$ in every period the politician decides to undercut his direct superior, so that everyone above him in the faction loses his job. Assume further, to fix ideas, that the faction breaks up completely when this happens.

Assume that a signal x of this probability is revealed during a governor's term in office, and then only to his fellow faction members—not to voters. After the governor's term in office, a faction member's posterior on his loyalty is $\lambda\left(x\right)$.

When an outgoing governor's loyalty is low, his superiors have reduced incentives to put in effort because, even if the party's candidate is elected, he is only promoted with probability $\lambda\left(x\right)$. Moreover, the effect of possible disloyalty throughout the faction needs to be taken into account. Denote by λ_i the loyalty of member i to the faction. Then the probability that

the faction survives into the next period is only

$$\left\{ b + (B - b) \left[K + \frac{1-\alpha}{2\alpha} \sum_{i=1}^{S_t} \alpha^i e_i \right] \right\} \cdot \prod_{i=1}^{S_t} \lambda_i.$$

Denote

$$\Lambda(S_t) = \prod_{i=1}^{S_t} \lambda_i.$$

Then the first order conditions that determine effort of the faction members are

$$c'(e_{it}^*) = \Lambda(S_t) \cdot (B - b) \frac{1-\alpha}{2\alpha} \alpha^i.$$

Clearly, in any equilibrium effort is higher when $\Lambda(S_t)$ is higher. So factions where loyalty is greater produce more effort and are more likely to survive. Thus we have the following proposition.

Proposition 11 *The outgoing governor's loyalty to his faction is positively correlated with the probability that his constituents receive public goods and with his future success within the party.*

This result suggests that, to the extent possible, factions will attempt to recruit loyal members and to expel disloyal ones.

7.4 Endogenous Promotion Policies, the President's Role, and Cyclicality

As it stands, the model does not allow for non-election years and, as such, it cannot formally be viewed as a model of the political budget cycle.[21] However, it is not difficult to extend the model and build cyclicality into it. We can do this by having elections in years t that are, as in Mexico, multiples of 6. In the remaining years there is no election. Let us imagine that in every non-election year, τ, faction members choose two forms of effort $e_{i\tau}$ (which influences provision of the public good in period τ) and $\tilde{e}_{i\tau}$ (party service). Party service may mean raising funds, campaigning for party officers, and generally promoting and following the president's directions. The president cares about the party's electoral welfare but also about the bureaucrat's contribution to the party. Formally, the president cares about achieving a

[21] Martinez (2005) points to this as limitation of most models of the cycle that are based on signaling motives. That paper explicitly builds off-election years into the model and shows that politicians may well have an incentive to signal in those years as well. The standard reply to this concern is that the object of the signaling (ability or, in our case, size of the camarilla) evolves through the off-election years and so it pays to wait until just before the election to signal.

given mix of $\sum_{i,\tau} e_{i\tau}$ and $\sum_{i,\tau} \tilde{e}_{i\tau}$. The president's problem is how to provide incentives to contribute to the party's general welfare.

The president's instrument to this end is the power to promote party members to higher office. In other words, the promotion policy is now more complicated than what we assumed in Section 2. The president can use this power directly to give incentives for party or presidential service by setting up a tournament stretching through the non-election years where camarillas compete for the right to play the game of Section 2 by putting forth party service effort $\sum_{i,\tau} \tilde{e}_{i\tau}$. The rules of the tournament can be made very competitive, so that in non-election years party members opt to focus *all* their efforts on party service. Another, simpler, bargaining protocol is for the president to make each faction a take-it-or-leave-it offer whereby the president promises to allow the faction to play the game of Section 2 in exchange for a stipulated amount of party service. In either case, effort is induced via the promise of a seat at the table in the game of Section 2. Thus, party service in years 1 through 5 is the "price to pay;" the efforts at $t = 6$ towards public good provision are part of the "reward." Because the reward naturally follows the effort, in this extension public good provision is cyclical and tends to arise in election years.

It should be noted that this extension also closes the model in that it gives the president rents. To the extent that promotion allows a party member to become president in the future, this extension explains why party officers desire promotion.

7.5 Party Dominance and a Coat-Tail Effect

Until now we have assumed that, even though the party may suffer electoral defeats at the local level, the party is dominant at the national level and is not subject to the risk of losing national elections. A dominant party can guarantee its members that public goods will flow to the well-connected within the party, which is important for dynamic considerations. Specifically, voters may hesitate to vote for the party at the local level if they fear that it might lose at the national level (in the presidential elections) and thus jeopardize the future flow of public goods to their district.[22]

In our model we may represent a non-dominant party as a party that, with probability $(1 - \nu)$, fails in the time-t national elections and thus is unable to deliver any public goods

[22] Dominance at the national level matters for another reason, too. Dominance is typically associated with a commingling between party roles and the (nominally apolitical) federal and state bureaucracies. In Italy, the practice of doling out bureaucratic jobs to party members was called *lottizzazione*. Such practices extend the boundaries of the party into a broad organization with significant administrative powers. When this is so, factions also swell beyond the formal boundaries of the party to include positions in the public administration. When a party is not dominant, in contrast, and we have alternation in power, the bureaucracy is typically less aligned with the party. In those cases, the levers of power are fewer for party members to operate, and so the degree to which public spending responds to intra-party incentives will necessarily be lower.

in period $t+1$. In such a model, voters are less inclined to vote for the party when ν is low, because the faction offers no special advantages if the party fails in the national elections. Let us consider the effect of an unanticipated one-time shock in period t that makes the party less dominant, so that $\nu < 1$ in period t only. Conditional on the faction being elected in period t and on the party retaining national power in period t, the equilibrium evolves from period $t+1$ on just as described in Section 3. Thus, from a voter's viewpoint, $e_{i,t+1} = e_i^*$. Thus, for period t only, expressions (4) and (5) are amended to:

$$\begin{aligned} B(\nu) &= F\left(\nu E_\pi\left(K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^* | g_t = 1\right)\right) \\ b(\nu) &= F\left(\nu E_\pi\left(K + \frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^* | g_t = 0\right)\right). \end{aligned}$$

Period-t efforts are given by the equation

$$c'\left(e_{i,t}^*\right) = \left(B(v) - b(v)\right)\frac{1-\alpha}{2\alpha}\alpha^i.$$

Since $c(\cdot)$ is assumed to be convex, equilibrium effort is positively correlated with the term $|B(\nu) - b(\nu)|$. Assume that $B(\nu) - b(\nu) < B(\nu') - b(\nu')$ for $\nu < \nu'$ (this is the case if F is convex, for example). Then effort is less intense when the party is less dominant. Moreover, since $B(\nu)$ and $b(\nu)$ are monotone, the faction is less likely to survive the elections in period t when the party is less dominant. This effect can be interpreted as a coat-tail effect.

Proposition 12 ***(Coat-Tail Effect)***. *Suppose F is convex. Then in a period when the party is less dominant, voters are less responsive to the provision of public goods and camarilla members put in less effort. In equilibrium, the faction is less likely to win elections when the party is less dominant.*

7.6 Local Public Goods With Deferred Benefits and Network Effects

In our model the provision of public goods plays a dual role. First, because it is costly to bureaucrats, it serves as a signal of faction size. Second, the public good is valuable to voters. In this section we explore a variant of our model in which the two roles are separated. We study public goods that have a deferred benefit, or whose benefits are subject to a network effect, even as public good provision fully retains its signaling value. As we shall see, these types of public goods are less likely to be provided in equilibrium. This implies that the signaling value alone is not enough to trigger provision of public goods; for public goods to be provided, they must also yield narrowly tailored benefits.

We shall say that a public good g' has *deferred benefits* if expenditure at time t affects the consumption of the public good at time $\tau > t$. One way to think about g' is as an investment in a public good the bulk of whose benefits are realized with substantial delay. Think for example of water outlets (i.e., connections to a public sewer network), whose benefits—mainly decreased probability of morbidity and epidemics—may be small in the near future but large (probabilistically) in the medium to long term.[23] For simplicity and to fix ideas, let us consider a public good g'_t that is produced in period $t-1$ and consumed in period t,

$$\Pr\left(g'_t = 1\right) = K + \frac{1-\alpha}{2\alpha} \sum_{i=1}^{S_{t-1}} \alpha^i e_{i,t-1}.$$

We assume that the realization of g'_t is known before the election at time $t-1$. This assumption allows g' to play the signalling role previously played by g.

Consider the problem of a young voter at time t who just before the election learns that $g'_{t+1} = 1$. The voter updates his prior probability about the size of his faction at t, but that is immaterial to him, since his public good consumption at time $t+1$ (the only thing that his vote can affect) has already been determined. Thus the young voter at time t does not respond to the results of his faction's efforts at time t. This, in turn, eliminates the incentive for the faction to work: no effort is provided in equilibrium.

Proposition 13 *Local public goods with deferred benefits are not provided in equilibrium.*

This result suggests an explanation for why one might see a political budget cycle in water inlets spending but not in water outlets, or other forms of public spending whose benefits are largely delayed. To the extent that the benefits to voters of inlets are relatively immediate, cycle spending should be directed to this service rather than to outlets. As we will see, this is consistent with evidence from Mexico, where outlets do not exhibit a cycle.[24]

The same argument applies, *a fortiori*, to signals that are not beneficial at all to voters; such a signal would not be employed in equilibrium. Thus, in our model providing public goods is more than visibly burning money. Unlike the famous signaling model by Spence, wasteful signals and signals whose benefits are skewed towards the future are less likely to be employed in equilibrium.

[23] To illustrate, consider a simple model of an epidemic as a disastrous but rare event which absent sanitation (outlets) is i.i.d. in each period. The benefits of sanitation in terms of avoiding epidemics are most likely to be felt in the future. In our simple model such a future is beyond the voters' time horizon. In a more sophisticated model, the benefits of outlets are back-loaded relative to the benefits of inlets, so long-lived but impatient voters would discount the benefits of sanitation.

[24] The extreme no-provision result relies on the voters' short time horizon. If we extended the time horizon of voters, diffuse public goods would become somewhat valuable, but public goods with narrowly tailored benefits would still be provided more often, because a larger fraction of their intertemporal benefit profile would be enjoyed by the current voters.

To continue with the example, the benefits of sanitation (outlets) differ from those of piped water (inlets) in another dimension. The benefits of piped water are not subject to *network effects*: insofar as piped water saves trips to a common well or dependence on an unreliable cistern, piped water is essentially a private good. The benefits of sanitation in contrast (chiefly decreased morbidity and mortality) are more subject to a network effect: the benefits to a family depend critically on the fraction of families in their geographic vicinity who have sanitation. Formally, the return to investment in sewers is very nonlinear in the spatial saturation. Let us take an extreme case. Consider a number of houses around a lake in which children bathe, and suppose epidemics are controlled only if *every* house around the lake has a sewer. Then the promise of small increments in sewer connections are not of interest to voters. Only the prospect of *every* house being connected could sway them. Thus a political cycle in network goods (if there is one) ought to take a lumpy form: universal coverage in selected communities. But if a community receives the benefits of sewers at time t then there is nothing further that it needs in terms of sewer connections at $t+1$—there is no promise of future benefits of this form that can entice them to vote for the incumbent at time t. Thus, from the perspective of a politician, goods with strong network effects seem ill-suited to the purpose of fueling a political cycle.

Proposition 14 *Local public goods with strong network effects are less likely to be provided as part of a political cycle.*

7.7 A 2-Faction Model

In modeling the factions' competition for resources, we made use of the simplifying assumption that the number of factions is large. This assumption allowed us to ignore the strategic effects among factions. We also assumed that the "noise" in the beauty contest among factions is uniformly distributed, an assumption that yielded linearity of the faction's payoff function. In this section we briefly look at a model that relaxes both assumptions.

We seek to replace the public good production function in equation (1) with a form derived from the Nash equilibrium of an explicit tournament between a small number factions. The main property of equilibrium we are interested in is whether larger factions are more likely to deliver the public good.[25] When this property holds, we are guaranteed that $B > b$ and then the rest of the analysis follows along the lines of Section 3. So in the remainder of this section, after outlining the model of competition for scarce resources, we focus on the question of whether larger factions are more likely to provide the public good.

[25] This property seems natural, and indeed it could have been derived through a reduced-form approach by imposing properties such as strategic substitutability of the efforts of different factions. However, the production function which we derive from the equilibrium of our orignal game does not exhibit these properties of strategic substitutability.

Let us assume for ease of analysis that there are just two factions, and that they vie for one indivisible unit of the public good. Let S_k denote the size of faction $k = 1, 2$, and let e_{ik} denote the effort level exerted by member i of faction k. At our level of generality it is difficult to be specific about the technology that transforms effort into public good, but again we have in mind a process by which faction members try to gain influence with the upper echelons, or decision makers, of the party. We thus continue to adopt a "beauty contests" approach and assume that effort e_{ik} means that member i will draw e_{ik} independent realizations from a random variable X. (We ignore hereafter the issues associated with the fact that e_{ik} need not be an integer). We assume that a faction "wins" the public good if the maximum among all the draws provided by its members exceeds the maximum of all the draws provided by members of the opposing faction.

The rules of this contest are a team version of the "beauty contest" game studied by Fullerton and McAfee (1999), and a similar production function (maximum among n i.i.d. random variables) is often used in the economics literature to model the risky output of innovation. In our context, we may think of the scarce public good being allocated to the faction that works the hardest at gaining influence with party leaders. Fullerton and McAfee (1999) show that, when faction k produces total effort $\sum_{i=1}^{S_k} e_{ik}$, then regardless of the distribution of X, under the rules of the contest the probability that faction k receives the public good is given by

$$\Pr\left(g_k = 1\right) = \frac{\sum_{i=1}^{S_k} e_{ik}}{\sum_{i=1}^{S_1} e_{i1} + \sum_{i=1}^{S_2} e_{i2}} \tag{11}$$

So, the probability that faction k gets the public good is equal to the fraction of total effort that it exerts.[26]

We look for a symmetric equilibrium in which all members of faction k exert the same effort level e_k. The first order conditions at a symmetric equilibrium for a member of faction $k \neq j$ are

$$c'\left(e_k\right) = \left(B - b\right)\left[\frac{1}{S_1 e_1 + S_2 e_2} - \frac{S_k e_k}{\left(S_1 e_1 + S_2 e_2\right)^2}\right] = \left(B - b\right)\frac{S_j e_j}{\left(S_1 e_1 + S_2 e_2\right)^2}.$$

Combining the first order conditions for factions k and j, we learn that the equilibrium effort levels e_k^* satisfy

$$\frac{c'\left(e_1^*\right)}{c'\left(e_2^*\right)} = \frac{S_2 e_2^*}{S_1 e_1^*}$$

Let us assume that the cost function has the form $c\left(e_i\right) = \beta e_i^2$. Then the previous equation yields

$$e_2^* = e_1^* \cdot \sqrt{\frac{S_1}{S_2}}\ .$$

[26] This functional form is sometimes called a "Tullock contest."

Substituting for e_2^* into equation (11) yields the equilibrium probability that faction k receives the public good,

$$= \frac{\frac{S_k e_k^*}{S_k e_k^* + S_j \left(e_k^* \cdot \sqrt{\frac{S_k}{S_j}} \right)}}{1 + \sqrt{\frac{S_j}{Sk}}}.$$

This probability is an increasing function of S_k, which means that for any given size of faction j, the larger the size of faction k, the higher the probability that k's constituents receive the public good. Conversely, when receiving the public good, bayesian updating leads citizens to believe that their faction is larger. Thus, as we wished to show, $B > b$.

8 Case Study: The Political Budget Cycle in Mexico's Water Services

We have studied a model of factional competition which, given that the size of a state's faction is uncertain, also has the following "political cycle" characteristics.

1. A cycle emerges even though candidates cannot be re-elected.
2. Voters are swayed by pre-electoral distributions of public goods.
3. States with opposition governors receive no public good.
4. The distribution of public goods is predicted by later, intra-party success of the outgoing politician, but not by electorally relevant variables.
5. The later success of outgoing governors is uncorrelated with their vote-getting skills.

In this section we turn to evidence from Mexico, and show that it matches these five stylized facts.

Section 8.1 collects qualitative evidence on party structure. The main thrust of this subsection is to show that factions are very important in party life. Section 8.2 reports on our analysis of newly collected data on the political budget cycle in Mexico's water services. The main finding is that the cycle is accounted for not by "electoral" variables (e.g., closeness of the election, voter turnout), but by a "political career" variable (later advancement of the outgoing governor).

8.1 Qualitative Evidence

Three qualitative features of Mexican politics are particularly important to our analysis.

First, during the period of our sample, Mexico had a highly centralized state in which a strong party (the PRI) exercised a great deal of control over expenditures at all levels of government.[27] For example, in our data on water services expenditure, more than 50% of the investment in infrastructure came directly from the central government, with a further 25% from state matching funds.[28] Thus in the case of water services, as was true more generally, the resources to provide public goods were not attached to the office of state governor. Instead, obtaining local public goods required dealing with the federal party structure, presumably in competition with other states.

Second, in order to obtain local public goods, candidates for election needed the support of highly placed party officials. This need encouraged the formation of vertical networks of mutual dependence (factions) within the party. In Mexico these factions are called *camarillas*; they are personal networks with a pyramidal structure based on close friendships and on common background and interests.[29]

Third, while in Mexico the selection of a nominee for a given political post was made by officials of ranks at or above the nominee's proposed position,[30] the power to promote was not absolute. In practice, the approval of the lower levels of the party was useful, if not always necessary.[31] In our model, this constraint explains why party officials not currently running

[27] See Ameringer (1992, pages 408-411) for a summary of the Mexican system, and Diaz-Cayeros, Magaloni and Weingast, (2003) for quantitative evidence of the reliance by local governments on federal support. Samuel Alatorre's study of Mexican fiscal federalism concludes that "[t]he gradual centralization of fiscal authority by the federal government since the 1980s has lead to a fiscal dependency of sub-national governments on the center that is extreme. State and municipal officers have little knowledge or influence in the revenue allocation process, a process widely perceived as a black box."Alatorre (2002, page 90). See Rodríguez (1997, p. 34) for a similar description. The political scientists Richard Fagen and William Touhy state the case even more strongly: "Each successive level of (Mexican) government is weaker, more dependent and more impoverished than the level above [...] An ayuntamiento or municipal government is normally constituted at the pleasure of the state authorities, is in control of few funds, and is limited judirically and politically to caretaker and administrative functions." (Fagen and Touhy, 1972, pages 20-21).

[28] See Table A1, and the accompanying discussion in Appendix A.

[29] The key role of camarillas in Mexican politics has long been noted. See, e.g., Grindle (1977a,b), Smith (1979).

[30] Indeed, for most positions of substantial authority, this selection was made by the President himself. In his study of political recruitment in Mexico, Roderic Camp writes that "recruitment relies heavily on national political leadership, represented in the executive branch, and the institutional recruitment structure is narrow. In effect, incumbent selectors reside within a national, single institution, the executive branch, which is in turn dominated by the presidency." Camp (1995).

[31] The appointment of a minister, vice-minister, party president or general secretary, or director of a state-owned company requires formal approval from party officials at lower ranks. Similar approval from below is required for party nominees to elected posts such as President, Senator or Federal Deputy. See Bailey

for election are willing to work for their camarilla: it is because their political advancement requires the support of their camarilla.[32]

These three features of Mexico's politics suggest that the route to advancement for a Mexican politician lies in continually working to strengthen his camarilla. It is therefore natural to view the election as a political "call to arms" for camarilla members.

8.2 Quantitative Evidence and Interpretation

Using newly coded panel data on the public provision of water services in 463 Mexican municipalities between 1994 and 2001, we estimate an economically and statistically significant cycle associated with state governor elections. (A detailed description of these data, the institutional backdrop, and our econometric methods is provided in Appendix A.)[33]

We estimate regressions of the form:

$$\Delta inl_{i,t} = \alpha_0 + \alpha_1 X_{i,t} + \alpha_2 dI_{i,t} + \gamma_i + \lambda_t + \varepsilon_{i,t}$$

where $\Delta inl_{i,t}$ is the annual change of potable water network connections (inlets) per capita in municipality i in period t; $X_{i,t}$ is a vector of socio-demographic variables including population growth, density of population, and poverty level; $dI_{i,t}$ is a vector of indicator functions that account for state and municipal elections; γ_i is a municipality specific effect, and λ_t is a time-specific effect common to all municipalities. Finally, $\varepsilon_{i,t}$ is the error term.

Column 1 of Table 1 presents evidence of a sharp political cycle in water inlets. The point estimates indicate that years in which only a governor's election is held are associated

(1988) for a summary of the President's dominance over party leadership and promotion before the reform of 1990. According to Ameringer (1992) "the importance of the representation of local and state committees in the PRI's decision-making bodies was increased (with the reform of the party's statues 1990) to give them parity with the sectoral organizations. [...] the new PRI statutes call for the party's presidential candidate to be selected by a National Political Council composed of 150 prominent party members, who will vote by secret ballot. However, the president retains the power to nominate party leaders personally loyal to him as members of the National Political Council, and their votes are likely to reflect his preference. [...] candidates for elective office, except the presidency, must demonstrate the support of a specific percentage of the "directive committees" of PRI-affiliated organizations or of the registered voters in a given district." (Ameringer, 1992).

[32] Camarillas are central to the political recruitment and promotion process. The political scientist Roderic Camp's study of political recruitment in Mexico concludes that "[camarillas] are built around an individual leader whose career affects the potential of the leader's followers ..." (Camp, 1995). Camp later wrote in his 2003 *Politics in Mexico*, "[The camarilla] has determined prior to 2000, more than any other variable discussed, who goes to the top of the political ladder, what paths are taken and the specific posts they are assigned," (page 117).

[33] We collect this information in an appendix in the interest of brevity; while the data are novel, the methods are standard.

with an increase of 100% above the average annual change or approximately $US 35 million in additional expenditure in these municipalities.[34,35]

Substantial differences such as these have motivated theories of political budget cycles, including the seminal model in Rogoff (1990).[36] In that model, an incumbent politician seeking re-election lowers taxes and increases spending in election years in order to signal his competence to voters. In Mexico, there is reason to think that signaling is indeed one purpose of public water expenditure – politicians running for office there pay for billboards publicizing the number of water connections made in the last term of office. But a key question is who is doing the signaling. Since the Constitution of Mexico precludes re-election,[37] an incumbent governor would seem to gain little from signalling his future competence to his current constituents. Furthermore, without re-election the single-crossing property in Rogoff (1990), which relates higher level of competence with higher spending, and which underpins the separating equilibrium, does not hold.[38]

A model of incumbents signalling competence might still explain the evidence if we interpret the incumbent as the party, instead of the politician. However, the PRI had dominated Mexican politics between 1929 and 2000; by the mid 1990s, information about its compe-

[34]These results are also consistent with the findings in Gonzalez (2002) of a sizeable political cycle in infrastructure spending.

[35]Note that Column 2 of Table 1 indicates that there is no cycle in spending on water outlets (connections to a public *sewer* network). See 7.6 for a discussion.

[36]Other contributions to this literature include Persson and Tabellini (2000), and Shi and Svensson (2006), and their "moral hazard" models of the budget cycle. In these models, an incumbent politician takes hidden actions and manipulates policy before an election in order to appear more competent to voters. Leading another prominent strand of the literature, Alberto Alesina's (1987, 1988) "partisan" model was the first to reconcile rational voters and a political *business* cycle, i.e., changes in output, employment and inflation around an election. Alesina's model does not, however, speak to manipulation of policy in the time leading up to an election.

[37]Politicians cannot be immediately re-elected at any level of government; although mayors can be re-elected upon leaving office for at least one term. The principle of no re-election dates to the Mexican Revolution. In 1909, the despotic President Porfirio Díaz broke his promise to retire and end his 35-year rule. Francisco Madero then founded the Anti-Reelectionist Party, lost a farcical election to Díaz, and went on lead the Mexican Revolution. The end of the civil war was followed by the founding of the National Revolutionary Party (PNR) a coalition formed from several fighting factions. The PNR maintained the Revolution's principle of no immediate re-election for any public office, a principle that was encoded in the Constitution of 1917. The PRI which is the third generation of the original PNR, continues to embrace the no re-election principle upon which it was founded.

[38]In Rogoff (1990) the more competent politicians are less reluctant to spend because, while all politicians care about social welfare, only the competent ones can, after being re-elected, mitigate the welfare costs of the profligate and distorted election year policies. Absent re-election, politicians have no opportunity to mitigate their policies. The regression in Table 3, Column 1, provides additional evidence against the single-crossing argument by showing that politicians do not seem to care about social welfare. Interacting the timing of governor's election with the level of poverty in the municipality, our estimates indicate that the size of the cycle is unrelated to the relative wealth of the community.

tence (as opposed to that of a given politician) ought to have been relatively certain. Its incentives for signaling its ability would thus seem to have been relatively low. Moreover, Table 2 reveals a telling pattern: the political budget cycle does not exist in municipalities where the incumbent governor is from the PRI's principal opposition during the period, the right-of-center Partido Acción Nacional (PAN). If the PRI is trying to signal its competence, there is no reason that it should not do so in states that are controlled by the opposition and therefore, in the Mexican context, presumably more likely to be "battleground" states. Thus, the evidence points away from a model of a monolithic party seeking to signal its competence. Instead, a natural interpretation of this evidence is that (a) non-PRI governors lack the clout to deliver public goods; and (b) states that are not represented within the PRI have a hard time commanding resources. Taken together, this evidence suggests a view of the PRI as a collection of politicians fighting for limited resources. This is precisely our model.

The regressions in Table 3, Columns 2-8, probe the explanatory power of models of redistributive politics, where parties allocate public resources where they will maximize either vote share or the probability of winning an election (e.g., Lindbeck and Weibull 1987). We ask whether electoral factors such as historical rates of voter participation or the competitiveness of the election may account for the cycle. The results regarding turnout (Column 2) indicate that the size of the political cycle in water services is unrelated to historical voting rates in the municipality. We next consider several measures to capture the electoral competitiveness in the municipality. In each case, we find that the cycle is actually higher in municipalities that appeared safely pro PRI, though this relationship typically is not precisely estimated. Thus we find no evidence that this political cycle spending is being targeted at states where either voter turnout or electoral competition is relatively high.[39] Once again, the picture that emerges is one of a party that does not allocate resources to maximize votes a la Lindbeck-Weibull (1987): resources are allocated at least partly in pursuit of some other goal.

While the variation in the size of this political cycle was not well accounted for by the factors that standard models of political competition predict should matter, the political cycle in public water services expenditure is strongly associated with incumbent governors who later go on to enjoy success in the party. Table 4 presents the results of regressions where the timing of a governor's election is interacted with an indicator for the later political success of the incumbent PRI governor. Here later success is identified with governors who go on to hold either higher political office or party leadership positions.[40] Column 1 of the top

[39] Schuetz (2006) studies patterns of mortgage lending by state-controlled agencies who effectively monopolized the mortgage market in Mexico. She finds a modest political cycle in these loans but, similar to the pattern of water services spending, finds no evidence that the loans were directed to politically contentious states.

[40] The positions identified with later success include minister, vice-minister, senator, federal deputy, party

panel of Table 4 and indicates that the positive political cycle in water services expenditure is associated only with later successful PRI governors. The coefficient on the interaction of the electoral cycle and an indicator of a later successful PRI governor is economically and statistically significant (0.0334, p-value < 0.03). In contrast, there is, as noted above, no evidence of a political cycle in municipalities where the incumbent is a member of the PAN; and municipalities with PRI incumbents who fail to go on to higher office may actually be associated with a *negative* cycle. This evidence is consistent with our account that, in the competition for scarce resources within the party, outgoing governors who are attached to powerful factions get the resources and go on to later success within the party, while localities without powerful agents within the party get no pork.[41]

An alternative possibility is that these later successful governors were unusual political talents and thus better able to marshal resources to benefit the party at election time. Using the limited data available to investigate this possibility, Panel 2 of Table 4 relates later success in the party to the vote share won by the incumbent himself (in the previous election), and by his successor.[42] Despite the limited amount of data, we estimate with considerable statistical confidence that there is no meaningful correlation between a governor's later success and the vote share he won in *his own* election. Indeed the point estimate in Column 1 of the second panel of Table 4 implies that later success is negatively correlated with own vote share; though a relationship either two standard errors larger or smaller would remain qualitatively insubstantial.[43] Thus we find no evidence that later successful governors were particularly talented vote-getters. This is consistent with our model of factional competition (see particularly Section 4.2 on the interaction between political abilities and later political success).

president or general secretary, and general director of a state-owned company. Each of these requires party support, and only some positions of senator and federal deputy require voter approval.

[41] In Columns 2-6 of the top panel of Table 4 we investigate the alternative hypothesis, weakly suggested by the findings in Table 4, that political cycle spending targeted states where the PRI faced relatively little competition. The results in Table 4 indicate, to the contrary, that it is the later success of the incumbent governor that explains the cycle and not the degree of electoral competition in the municipality. Once we condition on the subsequent career of the incumbent governor, the coefficients on (the lack of) electoral competition are substantially diminished in magnitude and are now all statistically insignificant. The negative association between electoral competition and the size of the cycle observed in Table 3 is largely explained by the fact that safely PRI states tend to have incumbent governors that later enjoy success in the party.

[42] These data are limited because there are only 31 incumbent governors during the period we observe water service expenditure. Data from substantially earlier periods would not be informative because political competition was virtually non-existent.

[43] Again, this finding is unchanged if, as in Column 5, we condition on measures of historical party support in the state.

9 Conclusion

We presented a new model of factional political competition, where the allocation of resources is driven by intra-party politics. Despite its simplicity, the model delivers a rich set of implications. A number of these implications found a counterpart in our empirical analysis of newly collected data on the provision of water services in Mexico.

A distinctive feature of the factional model of politics is that the actual power to procure public goods is not vested in elected office: instead, that power resides in the faction. This modeling feature is a good description of political systems with a dominant party, where the power to direct public spending to constituents requires influence within the party. Hence party factions become the source of actual, as opposed to formal, power to procure public goods. When actual and formal power become separated, it is difficult for citizens to assess the actual power of candidates for office—hence the incentive to signal and the political budget cycle. Our analysis prompts an intriguing conjecture—that the observed cross-country variation in intensity of the political cycle may be related to variation across political systems in the degree to which actual power coincides with formal power. This conjecture may represent an avenue for future comparative work.

In our model, elections and the internal party organization are seen to be part of a system of "incentives for (informal) teams" (in our case, factions). Theoretical models of incentives for networks, or informal teams, are rare. However, organizations of all sorts—political parties, firms, governmental agencies, military organizations—are very conscious of the presence of informal employee networks and have evolved ways to manage them. Firms and universities, for example, often require "external" performance evaluations for promotions, as a check against the tendency of informal networks of employees to look after their own. Similarly, the U.S. army rotates its officers frequently across administrative jobs, partly to prevent the formation of collusive networks. In doing so, it forgoes learning by doing. In fighting positions, on the other hand, team spirit is carefully fostered. To our knowledge there is no formal work looking at how organizations manage these inter-worker ties, or bonds. This paper may be seen as an initial attempt to address this question in the context of political parties.

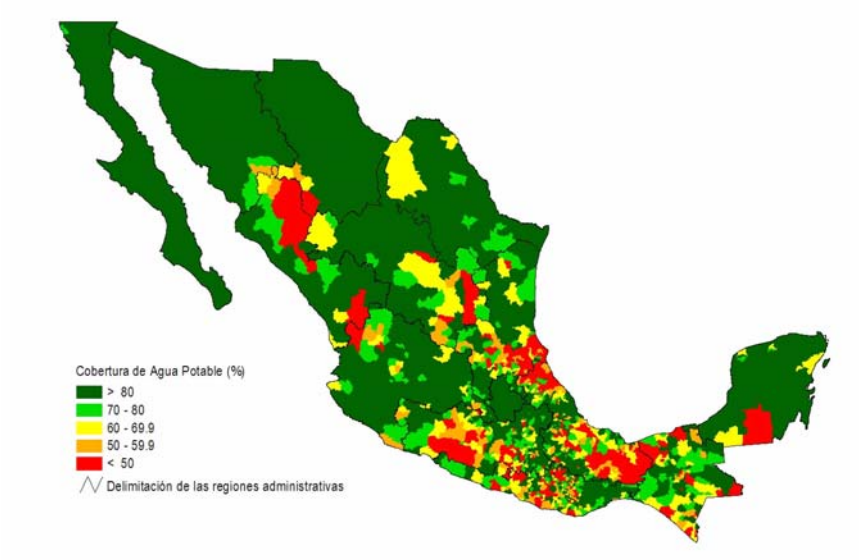

Figure 1: Fraction of the Population with Access to Piped Potable Water Services, 2000

A Empirical Appendix

This appendix provides further background on water services provision in Mexico and details of our data and empirical methods.

A.1 Institutional Backdrop

Water services and infrastructure are central issues in Mexican politics in part because large fractions of the population have no connection to a potable water network (see Figure 1). As a result, water services and infrastructure development are the subjects of considerable public policy.

Since 1983, the provision and development of water services have been the responsibility of municipal governments (rather than federal authorities). Some (30%) state governments have, however, assumed this authority. Under either state or municipal authority, the actual development and provision of services is performed by government-sanctioned water companies. These companies are governed by executive boards composed of members of state/municipal government, public officials appointed by the relevant mayor/governor, members of state Congresses, and in some cases the representatives of private investors.

Investment spending by these companies is substantial and supported largely by Federal and State funds. Table A.1 presents the level and source of funding for water service investment, by year. The table shows that, on average, 76% of water services investment was funded by Federal and State sources between 1991 and 2001. The remainder of the invest-

ment was funded either by loans to the water companies or by municipal governments. The level of total investment ranges from approximately $175 to $391 million in 2001 dollars.

A.2 Data

We use three data sets in our quantitative analysis. The first is newly coded data from National Water Commission (CNA) reports obtained from the Historical Water Archives in Mexico City. It contains annual (calendar year) information on the number of drinking water (inlets) and sewerage connections (outlets), effective price per cubic meter of water, total water supply, and total revenues of 717 (out of 2,443) Mexican municipalities from 1995 to 2001. This is an unbalanced panel. The second data set on electoral results was obtained from the Data Set of Mexican Municipal Electoral Outcomes 1980-1999 created by Alain de Rémes. It contains parties' voting shares and voting turnout for municipal elections held within that period. These data were supplemented with relevant municipal election data for 2000 and 2001, and gubernatorial electoral outcomes from 1994 to 2001 obtained from state electoral institutes. The third data set contains socio-demographic data from the Municipal Data Base System created by the Mexican Census Bureau. We combined these data with cross-sectional municipal data obtained from the National Census for 1990, 1995 and 2000. Data for missing years was filled in using a linear interpolation. After merging these datasets we obtained a balanced panel dataset of 463 municipalities from 1994 to 2001. These municipalities represent each of Mexico's 32 states except Chihuahua and Mexico City's, for which the data are unavailable. The data capture approximately 40% of Mexico's total population; however they represent just 19% of the 2,443 municipalities in Mexico.

A.2.1 Summary Statistics

In the balanced panel, the average annual increase of inlets per capita during electoral years is 0.0058. This represents an average increase of approximately 520 inlets per community, where the mean population size in our data set is 88,900 inhabitants. Using data from the CNA from 1991 to 2001, we estimate the average cost of a water service inlet to be $764 in 2002 pesos or US$73. Assuming the Federal government funds half of this cost, we estimate an average annual total expenditure of $359 million pesos (US $34 million) on water inlets in these municipalities.

Our focus is on the change in water services provision during (governor's) election years. Table A.2. shows the distribution of municipalities, by election type and year. With very few exceptions, gubernatorial elections are held every 6 years; mayoral and local congress elections are held every 3 years. At every level of government, elections tend to be held in the second half of the year with approximately 50% of elections held in the third quarter of the year and 30% in the fourth. As Table A.2 shows, the gubernatorial elections are fairly

evenly distributed across municipalities and years.

Our analysis centers on the budget cycle associated with governors' elections. Table A.3 presents summary statistics of the panel data and a simple comparison of the average change in inlets per capita in and out of governor's election years. The latter indicates a sizeable, but statistically insignificant difference (the p-value of one-sided test is 0.074). The average annual change in inlets per capita is nearly twice as large when the municipality has a governor's election than in other years. Anticipating our discussion of regressions below, it is reassuring that this simple difference in the mean change in inlets per capita is very similar to the one we estimate from regressions with substantial controls for potentially confounding effects of time, municipality-specific trends, and simultaneous elections.

A.3 Estimation Strategy

To more thoroughly evaluate the differences in government water service provision in and out of election years, we estimate regressions of the following form:

$$\Delta inl_{i,t} = \alpha_0 + \alpha_1 X_{i,t} + \alpha_2 dI_{i,t} + \gamma_i + \lambda_t + \varepsilon_{i,t}$$

where $\Delta inl_{i,t}$ is the annual change of inlets per capita in municipality i in period t; $X_{i,t}$ is a vector of socio-demographic variables detailed in table A.4 below; $dI_{i,t}$ is a vector of indicator functions that account for state and municipal elections; γ_i is a municipality specific effect, and λ_t is a time-specific effect common to all municipalities.[44] Finally, $\varepsilon_{i,t}$ is the error term assumed to be distributed independently of the regressors. We accommodate an arbitrary covariance structure of the errors within community by clustering at the level of the municipality.

A.4 Complete Regression Results

The following provides the complete results of the regressions summarized in section 8 of the main text.

Table A.4 presents our basic specification of the association between elections and water service provision. The estimates indicate that in years when only governor's elections are held, the change in water inlets per capita is, on average, a statistically and economically significant 0.0058 higher. The point estimates of interaction terms indicate that this relationship is substantially stronger when there is a coincident mayor's election in the municipality, and substantially weaker when there is a coincident local congressional election. Neither of

[44] We let have the socio-demographic variables enter in levels because a standard model would have capital investment like water infrastructure as function of a state variable measured in levels. Our results are little changed if, instead, we first difference or, indeed, omit, these socio-demographic variables.

these interaction terms is statistically significant, however. Similarly, no other elections have statistically significant basic effects. Regarding outlets per capita, there is no significant effect of political cycles of any kind.

In Table A.5 we present the results of regressions that allow the relationship between the governor's election and water service provision to depend on the party affiliation of the incumbent governor. These estimates indicate that the political budget cycle is statistically significant only in those states where the incumbent governor is from the PRI. The annual increase in inlets per capita during election years in states with PRI incumbent is higher than the average effect (0.0070). The change associated with PAN incumbent governors is no larger than usual.

Table A.6 explores the cross-sectional variation in the size of the budget cycle. The estimates indicate that cycle resources do not go to poorer communities. Similarly, the cycle is not associated with higher turn-out municipalities. Using a variety of measures of political competition, we find no evidence that the cycle is associated with more competitive states, and some evidence that the cycle is larger in municipalities that are safely pro-PRI.

Finally, the results in Table A.7 show that the cycle is strongly associated with incumbent governors who later go on to success in the party. An evaluation of the successful governors shows that the immediate successors enjoy greater (than expected) vote shares. We find no evidence, however, that these later successful governors were, in their own elections, particularly talented vote-getters.

A.5 Robustness

Our results regarding the political budget cycle in water services are robust to several alternative specifications. For example, our estimates are qualitatively similar if we drop demographic and income variables as well as year effects. It is, however, important to include a municipality-specific linear trend. We would expect communities to experience different rates of growth of water infrastructure according to unobserved geographical factors such as altitude, accessibility to natural water sources or closeness to larger cities. If we do not condition on community-specific fixed effects the coefficients on measures of wealth along with most of our year dummies increase their significance while the electoral cycles variables lose it.

The error structure is assumed to be independent across municipalities but not within them. One may be concerned, however, about spatial correlation generated, for example, by state or region-specific shocks or by the effects of inter-municipality competition. To the extent that this spatial correlation reflects longer term trends, we will capture it with municipality specific fixed effects which we allow to be arbitrarily correlated. The estimates of the governor's election budget cycle from a model with state rather than municipality fixed effects is nearly identical.

One may also be concerned about serial correlation in the error terms. In the presence of such correlation, our point estimates and the robust (clustered) standard errors would remain consistent. Our estimates would, however, be inefficient. We explored two specific forms of serial correlation: a fixed-effect first-order autoregressive model and Arellano-Bond method-of-moments estimation that allows past realizations of the dependent variable to affect its current level in a fixed effect environment. The later estimator uses lagged levels of the dependent variable and the predetermined variables and differences of the strictly exogenous variables assuming that there is no second-order autocorrelation of the errors. The point estimate of the relationship between changes in inlets per capita and governor's elections is maintained although its significance is lower under both approaches.

B Proofs

B.1 Proof that, for any π, $B \geq b$

Denote the posterior distribution over S_t upon seeing the public good as $\pi(s|1) = \Pr(S_t = s|g_t = 1)$. We show that $\pi(s|1)$ first order stochastically dominates the prior $\pi(s)$. Let us start with the following expression

$$\begin{aligned}
\pi(s|1) &= \Pr(S_t = s|g_t = 1) \\
&= \frac{\Pr(g_t = 1|S_t = s)\Pr(S_t = s)}{\sum_{j=1}^{\infty}\Pr(g_t = 1|S_t = j)\Pr(S_t = j)} \\
&= \frac{[\sum_{i=1}^{s}\alpha^i e_i^*]\,\pi(s)}{\sum_{j=1}^{\infty}\left[\sum_{i=1}^{j}\alpha^i e_i^*\right]\pi(j)}
\end{aligned}$$

Suppose $\pi(s|1) > \pi(s)$, which from the above equation implies $\frac{\left[\sum_{i=1}^{s}\alpha^i e_i^*\right]}{\sum_{j=1}^{\infty}\left[\sum_{i=1}^{j}\alpha^i e_i^*\right]\pi(j)} > 1$. Then for any $s' > s$ we also have

$$\begin{aligned}
\pi(s'|1) &= \frac{\left[\sum_{i=1}^{s'}\alpha^i e_i^*\right]\pi(s')}{\sum_{j=1}^{\infty}\left[\sum_{i=1}^{j}\alpha^i e_i^*\right]\pi(j)} \\
&> \frac{[\sum_{i=1}^{s}\alpha^i e_i^*]\,\pi(s')}{\sum_{j=1}^{N} j e_i^*\pi(j)} > \pi(s').
\end{aligned}$$

This means that the curve $\pi(s|1)$ lies below the curve $\pi(s)$ if and only if s is smaller than some $\bar{s}$. This means that the c.d.f. of $\pi(s|1)$ lies below that of $\pi(s)$, as we wished to show.

Now, let us show that $B > b$. Define the function

$$\beta(S) = \frac{1-\alpha}{2\alpha}\sum_{i=1}^{S+1}\alpha^i e_i^*.$$

The function $\beta(S)$ is increasing, and so stochastic dominance implies

$$E(\beta(S)|\pi, g_t = 1) > E(\beta(S)|\pi).$$

Using the following identity

$$E(\beta(S)|\pi) = \Pr(g_t = 1|\pi) \cdot E(\beta(S)|\pi, g_t = 1) + \Pr(g_t = 0|\pi) \cdot E(\beta(S)|\pi, g_t = 0),$$

the previous inequality can be strengthened to yield

$$E(\beta(S)|\pi, g_t = 1) > E(\beta(S)|\pi) > E(\beta(S)|\pi, g_t = 0).$$

Then

$$B = F(K + E(\beta(S)|\pi, g_t = 1)) > F(K + E(\beta(S)|\pi, g_t = 0)) = b.$$

B.2 Existence of equilibrium

At any equilibrium of the signalling game equations (3), (4) and (5) must hold. Putting them together yields

$$c'(e_i^*) = \begin{bmatrix} F\left(K + E\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^*|\pi, g_t = 1\right)\right) \\ -F\left(K + E\left(\frac{1-\alpha}{2\alpha}\sum_{i=1}^{S_t+1}\alpha^i e_i^*|\pi, g_t = 0\right)\right) \end{bmatrix} \frac{(1-\alpha)}{2}\alpha^{i-1}. \tag{B1}$$

We are interested in equilibria in which positive effort is exerted and the public good is provided with positive probability. In these equilibria the right hand side has to be nonzero, which requires that $\pi(s)$ be non-degenerate, i.e., it cannot put mass 1 on a particular s (otherwise conditioning on g_t has no effect). In order to construct such equilibria, for each i we need to find pairs (e_i^*, π) that solve the equation and such that $\{e_i^*\}$ generates π.

Let us start by showing that for any given vector $\{e_i\}$, there exists at least one pair of numbers $\bar{B}, \bar{b}$ such that the π generated by $\{e_i\}, \bar{B}, \bar{b}$ solves (4) and (5).

Start with arbitrarily chosen B_0, b_0. Let $G : [0,1]^2 \to \Delta^\infty$ denote the generating process, and denote $\pi_0 = G(B_0, b_0)$ the probability distribution generated by B_0, b_0. Now plug π_0 into expressions (4) and (5); to obtain the pair B_1, b_1. We can formalize this process as feeding π_0 into a function $H : \Delta^\infty \to [0,1]^2$. We are interested in the properties of the composition $H \circ G$ which takes as its argument a pair B_t, b_t and maps it into a pair B_{t+1}, b_{t+1}. Both G and H are continuous, so the composition is continuous. The composition also maps the square $[0,1]^2$ into itself. By Brouwer's theorem, then, the composition $H \circ G$ must have a fixed point $\bar{B}, \bar{b}$. Then we know that $\bar{\pi} = G\left(\bar{B}, \bar{b}\right)$ solves (4) and (5).[45]

Let us call $\bar{B}(e_1), \bar{b}(e_1)$ the set of fixed points associated with $\{e_i\}$. Note that if the vector $\{e_i\}$ is an equilibrium then it is appropriate to use the first element of the vector

[45] Thanks to Ennio Stacchetti for pointing out the fixed point argument.

only, since the entire vector $\{e_i\}$ is completely determined through equation(B1) once its first element e_1 is known. Equation (B1).can now be written as

$$c'(e_1^*) \in (1-\alpha)\left[F\left(\bar{B}(e_1^*)\right) - F\left(\bar{b}(e_1^*)\right)\right]$$

The RHS might be a correspondence – we have not proved that $\bar{B}(e_1), \bar{b}(e_1)$ is a singleton. Nevertheless, for each $e_1 > 0$ the lower bound of the RHS is positive (see B.1). Thus, for $c(\cdot)$ sufficiently convex we are ensured that an equilibrium with positive effort exists.

B.3 Algebra used in the proof of inequality (7)

We will start from the desired inequality and write a sequence of equivalent inequalities.

$$\begin{aligned}
\frac{B\Pr(g_t=1)}{B\Pr(g_t=1)+b\Pr(g_t=0)} &> \frac{[(1-B)+B(1-P_\tau)]\Pr(g_t=1)}{\left\{\begin{array}{l}[(1-B)+B(1-P_\tau)]\Pr(g_t=1)\\ +[(1-b)+b(1-P_\tau)]\Pr(g_t=0)\end{array}\right\}} \\
\frac{B}{B\Pr(g_t=1)+b\Pr(g_t=0)} &> \frac{[(1-B)+B(1-P_\tau)]}{\left\{\begin{array}{l}[(1-B)+B(1-P_\tau)]\Pr(g_t=1)\\ +[(1-b)+b(1-P_\tau)]\Pr(g_t=0)\end{array}\right\}} \\
\frac{1}{\Pr(g_t=1)+\frac{b}{B}\Pr(g_t=0)} &> \frac{1}{\Pr(g_t=1)+\frac{[(1-b)+b(1-P_\tau)]}{[(1-B)+B(1-P_\tau)]}\Pr(g_t=0)} \\
\frac{b}{B} &< \frac{[(1-b)+b(1-P_\tau)]}{[(1-B)+B(1-P_\tau)]} \\
b[(1-B)+B(1-P_\tau)] &< B[(1-b)+b(1-P_\tau)] \\
b &< B \text{ true!}
\end{aligned}$$

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Table 1. Gubernatorial Cycle in Change in Inlets and Outlets per Capita, 1995-2001

	Change in inlets per capita	Change in outlets per capita
Governor's election in *t*	0.0058*	0.0002
	(0.0026)	(0.0025)
Number of observations	3,241	3,241
Number of municipalities	463	463
R-squared	0.4506	0.2360

Note : Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. A complete list of the regressors and their associated coefficients is presented in Table A4.

Table 2. Gubernatorial Cycle in Inlets per Capita, by Party of Incumbent

	Increment of inlets per capita
Governor's election in *t*	0.0070*
	(0.0031)
Governor's election & PAN in office in *t*	-0.0037
	(0.0040)
Number of observations	3,241
Number of municipalities	463
R-squared	0.4506
Municipality Effects	Yes
Year Effects	Yes

Note: Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. A complete list of the regressors and their associated coefficients is presented in Table A5.

Table 3. Gubernatorial Cycle in Inlets per Capita, by Economic Marginality and Electoral Factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Governor's elections in *t*	0.0056	0.0116	0.0042	-0.0661	0.0019	0.0022	0.0648
	(0.0037)	(0.0217)	(0.0023)	(0.0517)	(0.0034)	(0.0032)	(0.0501)
Governor's election in *t* *Marginality index of municipality	-0.0003						
	(0.0033)						
Governor's election in *t* *Average voting turnout		-0.0121					
		(0.0374)					
Governor's election in *t* *Non-competitive elections			0.0123*				
			(0.0059)				
Governor's election in *t* *Ratio winner-second voting shares				0.1035			
				(0.0733)			
(Governor's election in *t* *Ratio winner-second voting shares)^2				-0.0351			
				(0.0248)			
Governor's election in *t* in state without record of alternation in 2001				.	0.0098		
					(0.0075)		
Governor's election in *t* state with no alternation in *t*						0.0053	
						(0.0049)	
Governor's election*Percentage of PRI Municipalities in *t-1*							-0.2104
							(0.1712)
(Governor's election*Percentage of PRI Municipalities in *t-1)^2*							0.1754
							(0.1384)
Number of observations	3,136	3,241	3,188	3,241	3,241	3,241	2,700
Number of municipalities	448	463	463	463	463	463	450
R-squared	0.1073	0.4506	0.4511	0.4857	0.4509	0.4508	0.1815

Note : Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. A complete list and a description of the regressors and their associated coefficients is presented in Table A6.

Table 4. Gubernatorial Cycle in Inlets per Capita, by Incumbent Governor's Success in The Party

	(1)	(2)	(3)	(4)	(5)	(6)
Governor's election in *t*	-0.0054	-0.0064	-0.0165	-0.0054	-0.0048	0.0543
	(0.0060)	(0.0062)	(0.0309)	(0.0061)	(0.0060)	(0.0437)
Governor's election * PRI in office in *t*	-0.0136*	-0.0108	-0.0263	-0.0137	-0.0066	-0.0102
	(0.0066)	(0.0059)	(0.0138)	(0.0067)	(0.0065)	(0.0065)
Governor's election, PRI in office & successful PRI governor in *t*	0.0334*	0.0311*	0.0234	0.0330*	0.0340*	0.0288
	(0.0163)	(0.0156)	(0.0131)	(0.0156)	(0.0163)	(0.0154)
Governor's election in *t* & Non-competitive elections		0.0049				
		(0.0027)				
Governor's election in *t* *Ratio winner-second voting shares			0.0385			
			(0.0430)			
(Governor's election in *t* *Ratio winner-second voting shares)^2			-0.0154			
			(0.0152)			
Governor's election in *t i* n state without record of alternation in 2001				0.0008		
				(0.0042)		
Governor's election in *t* state with no alternation in *t*					-0.0078	
					(0.0057)	
Governor's election*Percentage of PRI Municipalities in *t-1*						-0.2237
						(0.1738)
(Governor's election*Percentage of PRI Municipalities in *t-1)^2*						0.1842
						(0.1396)
Number of observations	3,241	3,241	3,188	3,241	3,241	2,700
Number of municipalities	463	463	463	463	463	450
R-squared	0.4530	0.4531	0.4866	0.4530	0.4531	0.1862

Linear Probability Model of Successful Governor Within the Party -- Complete Set of Estimates[1]

	(1)	(2)	(3)	(4)	(5)
Ratio winner-second voting shares in election in *t-6*	-0.0173				-0.0132
	(0.0114)				(0.0126)
Ratio winner-second voting shares in election in *t*		0.3383			0.2787
		(0.2977)			(0.3299)
Percentage of PRI Municipalities in *t-1*			-0.1688		-0.1273
			(0.5603)		(0.6703)
Percentage of PRI Municipalities in *t-7*				-0.2649	-0.1146
				(0.2997)	(0.3642)
Constant	0.4147**	-0.1635	0.4605	0.5431**	0.1933
	(0.1034)	(0.4148)	(0.4659)	(0.2637)	(0.8516)
Number of observations	31	27	31	31	27
R-squared	0.0730	0.0491	0.0031	0.0262	0.1091

Note: Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. A complete list and a description of the regressors and their associated coefficients for the top panel is presented in Table A7.

1\ We excluded Oaxaca and years 2000-2001 for lack of data on mayoral outcomes.

Table A1. Investment in Water Infrastructure, by Sources
(Millions of 2001 pesos)

	Subsidized Investment				Non-Subsidized Investment				
Year	**Federation**	**% of total**	**State**	**% of total**	**Loans**	**% of total**	**Municipality**	**% of total**	**Total**
1991	998.0	38.9%	729.0	28.4%	836.0	32.6%	-	-	2,563.0
1992	1,271.0	51.7%	626.0	25.4%	563.0	22.9%	-	-	2,460.0
1993	1,569.0	49.7%	906.0	28.7%	578.0	18.3%	102.0	3.2%	3,155.0
1994	1,424.0	61.1%	427.0	18.3%	352.0	15.1%	127.0	5.5%	2,330.0
1995	545.0	24.3%	672.0	29.9%	595.0	26.5%	432.0	19.3%	2,244.0
1996	1,178.0	67.5%	346.0	19.8%	50.0	2.9%	171.0	9.8%	1,745.0
1997	1,284.0	53.3%	512.0	21.2%	109.0	4.5%	505.0	21.0%	2,410.0
1998	1,708.0	65.4%	453.0	17.4%	206.0	7.9%	243.0	9.3%	2,610.0
1999	1,621.0	59.1%	752.0	27.4%	163.0	5.9%	205.0	7.5%	2,741.0
2000	2,133.0	54.5%	1,327.0	33.9%	344.3	8.8%	106.8	2.7%	3,911.1
2001	1,055.7	38.7%	744.2	27.3%	611.9	22.5%	313.7	11.5%	2,725.5
Average	-	**51.3%**	-	**25.3%**	-	**15.3%**	-	**10.0%**	-

Source: National Water Commission, Report on the Situation of Potable Water, Sanitation and Sewerage 2001.

Table A2. Distribution of Elections, By Election Type and Year, 1994-2001

Year	Presidential elections	Gubernatorial elections*	Local congress elections	Mayoral elections
1994	463	54	128	181
1995	0	55	228	166
1996	0	0	106	104
1997	0	91	158	196
1998	0	162	204	153
1999	0	106	79	77
2000	463	88	185	196
2001	0	55	204	153

Table A3. Summary Statistics of the Panel Data, 1994-2001

	Obs	Mean	Median	Std. Dev.	Min	Max
Inlets per capita	3704	0.221	0.130	0.954	0.003	21.038
Outlets per capita	3704	0.138	0.071	0.660	0.001	15.056
Annual change in inlets per capita	3241	0.0069	0.0018	0.0900	-1.5666	1.9051
Annual change in outlets per capita	3241	0.0041	0.0002	0.0804	-1.4383	2.3249
Fraction of workers earning less than minimum wage	3704	0.32	0.28	0.19	0.04	0.90
Density of population	3704	442.61	67.12	1563.85	0.81	17772.25
State water companies (1=State company)	3241	0.23	0.00	0.42	0.00	1.00
Voting tournout (municipal elections)	867	0.60	0.61	0.13	0.16	2.48
Ratio winner-second for governor	539	1.39	1.28	0.31	1.02	2.06
Ratio winner-second for mayor	866	2.11	1.42	5.62	1.00	158.45
Party in office at state level (1=PAN, 2=PRI, 3=PRD, 4=Other)	3704	1.89	2.00	0.39	1.00	3.00
Party in office at municipal level (1=PAN, 2=PRI, 3=PRD, 4=Other)	3379	1.98	2.00	0.55	1.00	4.00
Infant mortality rate	3704	1.75%	1.56%	1.17%	0.00%	9.21%
Child mortality rate (up to 5 years old)	3704	0.43%	0.39%	0.27%	0.00%	1.95%
Child mortality rate (up to 10 years old)	3704	0.04%	0.03%	0.04%	0.00%	0.67%
Marginality Index by INEGI	3704	-0.618	-0.702	0.812	-2.163	3.051
Illiteracy rate among those 15 years and older	3704	0.12	0.11	0.08	0.01	0.75
Fraction of people at least 15 years old without elementary education	3704	0.37	0.38	0.13	0.08	0.92
Fraction of overcrowded houses	3704	0.50	0.51	0.11	0.21	0.87
Fraction of houses without cement floor	3704	0.19	0.14	0.16	0.00	0.92
Fraction of houses without electricity	3704	0.06	0.04	0.08	0.00	0.73
Fraction of people in working age that receive no salary	3241	0.14	0.11	0.12	0.01	0.83
Municipality expenditure per capita in real pesos 2002	3704	0.93	0.79	0.76	0.00	9.06
National Marginality Ranking	3704	1668.36	1780.00	578.48	2.00	2437.00

	Years Without Governor's Elections			**Governor's Election Years**		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Annual change in inlets per capita	0.0058	0.0016	0.0904	0.0119	0.0024	0.0883
Annual change in outlets per capita	0.0038	0.0002	0.0846	0.0058	0.0004	0.0561

Table A5. Gubernatorial Cycle in Inlets per Capita, by Party of Incumbent
Complete Set of Estimates

Governor's election in *t*	0.0070*
	(0.0031)
Governor's election & PAN in office in *t*	-0.0037
	(0.0040)
Mayor's election in *t*	0.0035
	(0.0047)
Local congress' election in *t*	0.0054
	(0.0036)
Governor's and mayor's elections in *t*	0.0058
	(0.0058)
Mayor's and local congress' elections in *t*	-0.0039
	(0.0069)
Governor's and local congress' elections in *t*	-0.0086
	(0.0058)
PRI in office in *t*	-0.0020
	(0.0040)
PAN in office in *t*	-0.0040
	(0.0028)
% of inhabitants earning 1 minimum wage or less in *t*	0.0045
	(0.1636)
Density of population in *t*	-5.67E-05**
	(1.89E-05)
(Density of population in *t*)^2	4.54E-09***
	(7.79E-10)
Population growth rate in *t*	-0.1303
	(0.1048)
Constant	0.0109
	(0.0513)
Number of observations	3,241
Number of municipalities	463
R-squared	0.4506

Note: Unit of observation is the municipality. Dependent variable is the annual change in water inlets per capita. The specification also includes fixed municipality and year effects. Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. Results are summarized in Table 2.

Table A6. Gubernatorial Cycle in Inlets per Capita, by Economic Marginality and Electoral Factors -- Complete Set of Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Governor's election in *t*	0.0056	0.0116	0.0042	-0.0661	0.0019	0.0022	0.0648
	(0.0037)	(0.0217)	(0.0023)	(0.0517)	(0.0034)	(0.0032)	(0.0501)
Governor's election in *t* *Marginality index of municipality	-0.0003						
	(0.0033)						
Governor's election in *t* *Average voting turnout		-0.0121					
		(0.0374)					
Governor's election in *t* * Non-competitive elections			0.0123*				
			(0.0059)				
Governor's election in *t* *Ratio winner-second voting shares				0.1035			
				(0.0733)			
(Governor's elections in *t* *Ratio winner-second voting shares)^2				-0.0351			
				(0.0248)			
Governor's elections in *t i* n state without record of alternation in 2001				.	0.0098		
					(0.0075)		
Governor's elections in *t* state with no alternation in *t*						0.0053	
						(0.0049)	
Governor's elections*Percentage of PRI Municipalities in *t-1*							-0.2104
							(0.1712)
(Governor's elections*Percentage of PRI Municipalities in *t-1)^2*							0.1754
							(0.1384)
Mayor's elections in *t*	-0.0014	0.0036	0.0035	0.0057	0.0031	0.0034	-4.82E-05
	(0.0028)	(0.0046)	(0.0046)	(0.0046)	(0.0048)	(0.0047)	(0.0024)
Local congress' elections in *t*	0.0032	0.0055	0.0056	0.0065	0.0049	0.0054	0.0051
	(0.0033)	(0.0037)	(0.0037)	(0.0038)	(0.0037)	(0.0036)	(0.0046)
Governor's and mayor's elections in *t*	0.0038	0.0058	0.0103	0.0029	0.0102	0.0080	-0.0030
	(0.0064)	(0.0056)	(0.0070)	(0.0048)	(0.0079)	(0.0065)	(0.0053)
Mayor's and local congress' elections in *t*	0.0021	-0.0042	-0.0040	-0.0071	-0.0034	-0.0037	-0.0012
	(0.0045)	(0.0068)	(0.0068)	(0.0066)	(0.0071)	(0.0068)	(0.0040)
Governor's and local congress' elections in *t*	-0.0053	-0.0073	-0.0175	-0.0093	-0.0123	-0.0090	-0.0062
	(0.0054)	(0.0057)	(0.0090)	(0.0061)	(0.0075)	(0.0062)	(0.0074)
% of inhabitants earning 1 minimum wage or less in *t*	-0.0031	0.0050	0.0082	-0.0321	0.0088	-0.0057	0.0213
	(0.0770)	(0.1630)	(0.1626)	(0.1712)	(0.1636)	(0.1649)	(0.0945)
Density of population in *t*	-5.35E-05**	-5.65E-05**	-5.66E-05**	-5.32E-05**	-5.76E-05**	-5.89E-05**	-1.22E-04**
	(1.57E-05)	(1.87E-05)	(1.84E-05)	(1.92E-05)	(1.86E-05)	(1.91E-05)	(2.21E-05)
(Density of population in *t*)^2	4.41E-09***	4.54E-09***	4.56E-09***	4.39E-09***	4.56E-09***	4.61E-09***	8.50E-09***
	(6.66E-10)	(7.80E-10)	(7.69E-10)	(8.18E-10)	(7.73E-10)	(7.82E-10)	(1.29E-09)
Population growth rate in *t*	0.0379	-0.1228	-0.1157	-0.1346	-0.1304	-0.1732	-0.0326
	(0.0878)	(0.1185)	(0.1175)	(0.1227)	(0.1187)	(0.1075)	(0.1130)
State without record of alternation in *t*						0.0052	
						(0.0042)	
Percentage of PRI Municipalities in *t-1*							-0.0082
							(0.0293)
(Percentage of PRI Municipalities in *t-1)^2*							-0.0008
							(0.0221)
Constant	0.0153	0.0083	0.0069	0.0320	0.0082	0.0140	0.0250
	(0.0250)	(0.0525)	(0.0524)	(0.0532)	(0.0525)	(0.0533)	(0.0321)
Number of observations	3,136	3,241	3,241	3,188	3,241	3,241	2,700
Number of municipalities	448	463	463	463	463	463	450
R-squared	0.1073	0.4506	0.4511	0.4857	0.4509	0.4508	0.1815

Note 1: Unit of observation is the municipality. Dependent variable is the annual change in water inlets per capita. Each specification also includes fixed municipality and year effects. Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. Results are summarized in Table 3. *Note 2* -- Variable Definitions: Competitive gubernatorial elections: A state faced competitive elections in t if the winner-second ratio is smaller than the median of our sample (1.277). Winner-second voting share: The ratio of the voting share of the winner and the second place of gubernatorial elections in t. State without record of alternation in 2001: A state has not exerienced a alternation in the governorship if the PRI has won all elections up to 2001. State without record of alternation in t: A state has not faced alternation if PRI has won all elections up to t, including t. Percentage of PRI municipalities in t-1: This variable reflects the proportion of municipalities that had a PRI mayor in office one year prior to the gubernatorial election.

Table A7. Gubernatorial Cycle in Inlets per Capita, by Incumbent Governor's Success in The Party

	(1)	(2)	(3)	(4)	(5)	(6)
Governor's election in *t*	-0.0054	-0.0064	-0.0165	-0.0054	-0.0048	0.0543
	(0.0060)	(0.0062)	(0.0309)	(0.0061)	(0.0060)	(0.0437)
Governor's election * PRI in office in *t*	-0.0136*	-0.0108	-0.0263	-0.0137	-0.0066	-0.0102
	(0.0066)	(0.0059)	(0.0138)	(0.0067)	(0.0065)	(0.0065)
Governor's election, PRI in office & successful PRI governor in *t*	0.0334*	0.0311*	0.0234	0.0330*	0.0340*	0.0288
	(0.0163)	(0.0156)	(0.0131)	(0.0156)	(0.0163)	(0.0154)
Governor's election in *t* & Non-competitive elections		0.0049				
		(0.0027)				
Governor's elections in *t* *Ratio winner-second voting shares			0.0385			
			(0.0430)			
(Governor's election in *t* *Ratio winner-second voting shares)^2			-0.0154			
			(0.0152)			
Governor's election in *t* in state without record of alternation in 2001				0.0008		
				(0.0042)		
Governor's election in *t* state with no alternation in *t*					-0.0078	
					(0.0057)	
Governor's election*Percentage of PRI Municipalities in *t-1*						-0.2237
						(0.1738)
(Governor's election*Percentage of PRI Municipalities in *t-1)^2*						0.1842
						(0.1396)
Mayor's election in *t*	0.0047	0.0045	0.0054	0.0046	0.0046	0.0003
	(0.0046)	(0.0046)	(0.0047)	(0.0048)	(0.0046)	(0.0021)
Local congress' election in *t*	0.0058	0.0058	0.0061	0.0057	0.0059	0.0057
	(0.0037)	(0.0037)	(0.0037)	(0.0038)	(0.0037)	(0.0048)
Governor's and mayor's elections in *t*	0.0301	0.0302	0.0179	0.0301	0.0302	0.0180
	(0.0164)	(0.0164)	(0.0119)	(0.0164)	(0.0164)	(0.0114)
Mayor's and local congress' elections in *t*	-0.0053	-0.0051	-0.0062	-0.0052	-0.0054	-0.0009
	(0.0067)	(0.0067)	(0.0067)	(0.0070)	(0.0067)	(0.0036)
Governor's and local congress' elections in *t*	-0.0158	-0.0200	-0.0026	-0.0160	-0.0164	-0.0113
	(0.0085)	(0.0099)	(0.0057)	(0.0089)	(0.0087)	(0.0078)
% of inhabitants earning 1 minimum wage or less in *t*	0.0029	0.0037	-0.0301	0.0030	-0.0015	0.0103
	(0.1641)	(0.1640)	(0.1725)	(0.1644)	(0.1660)	(0.1029)
Density of population in *t*	-5.88 E-05**	-5.93 E-05**	-5.25 E-05**	-5.89 E-05**	-5.97 E-05**	-1.30 E-04***
	(1.94 E-05)	(1.95E-05)	(1.98E-05)	(1.96E-05)	(1.95E-05)	(2.45E-05)
(Density of population in *t*)^2	4.60 E-09***	4.63 E-09***	4.34 E-09***	4.60 E-09***	4.64 E-09***	8.82 E-09***
	(7.96 E-10)	(7.97E-10)	(8.35E-10)	(7.98E-10)	(7.94E-10)	(1.37E-09)
Population growth rate in *t*	-0.1663	-0.1617	-0.1710	-0.1681	-0.1725	-0.1099
	(0.1025)	(0.1030)	(0.1048)	(0.1009)	(0.1002)	(0.0981)
PRI in office in *t*	0.0004	0.0009	-0.0001	0.0005	-0.0062	0.0050
	(0.0041)	(0.0043)	(0.0043)	(0.0043)	(0.0062)	(0.0042)
PAN in office in *t*	-0.0049	-0.0044	-0.0051	-0.0049	-0.0060*	-0.0044
	(0.0028)	(0.0028)	(0.0027)	(0.0028)	(0.0025)	(0.0036)
State without record of alternation in *t*					0.0065	
					(0.0059)	
Percentage of PRI Municipalities in *t-1*						0.0133*
						(0.0305)
(Percentage of PRI Municipalities in *t-1)^2*						-0.0187
						(0.0238)
Successful Governor in *t*	-0.0213	-0.0169	-0.0124	-0.0206	-0.0211	-0.0045
	(0.0172)	(0.0167)	(0.0118)	(0.0166)	(0.0171)	(0.0090)
Constant	0.0182	0.0158	0.0369	0.0179	0.0200	0.0239
	(0.0525)	(0.0523)	(0.0523)	(0.0535)	(0.0531)	(0.0318)
Number of observations	3,241	3,241	3,188	3,241	3,241	2,700
Number of municipalities	463	463	463	463	463	450
R-squared	0.4530	0.4531	0.4866	0.4530	0.4531	0.1862

Note 1: Unit of observation is the municipality. Dependent variable is the annual change in water inlets per capita. Each specification also includes fixed municipality and year effects. Standard errors, clustered at the level of the municipality, are in parentheses. Significance at the 5% and 1% level is denoted by * and **, respectively. Results are summarized in the top panel of Table 4. *Note 2* -- Variable Definitions: Competitive gubernatorial elections: A state faced competitive elections in t if the winner-second ratio is smaller than the median of our sample (1.277). Winner-second voting share: The ratio of the voting share of the winner and the second place of gubernatorial elections in t. State without record of alternation in 2001: A state has not exerienced a alternation in the governorship if the PRI has won all elections up to 2001. State without record of alternation in t: A state has not faced alternation if PRI has won all elections up to t, including t. Percentage of PRI municipalities in t-1: This variable reflects the proportion of municipalities that had a PRI mayor in office one year prior to the gubernatorial election.