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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. 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 presents a new model of political competition where candidates belong to intra-party factions. Before elections, hierarchical networks of party officials (factions) compete to direct local public goods to their constituencies and thereby win votes and advance their careers within the party. The model delivers a rich set of implications linking the allocation of public resources to the internal organization of the party. In doing so, the model provides a unified explanation of two prominent features of public resource allocations: the tendency of public spending to favor incumbent party strongholds and the persistence of (possibly inefficient) policies. We illustrate the model with analysis of data on the provision of water services in Mexico and find empirical support for many of the model’s key predictions.

A vast formal literature has investigated the connection between elections and the size and allocation of public spending.<sup>1</sup> Virtually all of this literature treats competing political agents as singletons, be they candidates or parties, vested with the power to deliver or promise resources. This view is often oversimplified. In reality, the power to deliver public resources to a constituency is often *dispersed* among (networks of) party and government officials. To illustrate, consider the well-documented case of Lyndon Johnson and his successful efforts as a first-term U.S. Congressman to bring a massive federal dam project to his district in Texas.<sup>2</sup> Johnson needed to secure land rights, mobilize local support, obtain Congressional and regulatory approvals, and ensure both the appropriation of funds and their timely disbursement. Each of these processes was complex and fraught with political and legal obstacles. To achieve all this, Johnson tapped a network of contacts in the Democratic party for help with each step. This network, or faction, ranged from the party rank and file in Texas, to Congressional leaders, to White House officials, each with an incentive to assist Johnson and his constituents. By this account, and others like it (see Section 2, below), the political allocation of resources results from a team effort: it depends on the size and power of the party faction available to each local representative.

What are party factions? How do they form and persist? What purposes (if any) do factions serve for political parties? How do factions affect the allocation of public resources, across constituencies and through time? To answer these questions, we construct a simple model of network formation and exchange among party officials – a model informed by a large descriptive literature on intra-party factions.

In the model, each of many districts holds an election in which a party office-holder competes

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

<sup>2</sup>A vivid account is provided in Caro (1983, pp. 370-385 and 459-468).

against a challenger from an opposition party. To win, it helps the office-holder to deliver local public goods before the election; and this delivery requires the assistance of fellow party officers. If it is in their interest, these fellow officers can work to help bring public resources to a district. The objective of party officers is to advance their careers (maintain their elected offices, or improve their positions within the party); and for this, we assume they need the support of other party members. Thus the opportunity for a quid-pro-quo emerges: party officers need support for promotion and in return for such support they can offer assistance in securing public resources. We call this exchange the *patron-client relationship*. In our model, we study the formation and persistence of *networks* of patron-client relationships. Echoing a literature in political science, we call durable networks of patron-client relationships *factions of interest*. While factions of interest have been the subject of a large descriptive literature, to our knowledge, there is no formal model either of the formation of party factions or of their effect on public spending. Understanding the dynamics of intra-party networks is important because of their impact on resource allocation.

Regarding faction formation, our analysis suggests that two organizational features — promotion that depends on other officers’ support, and dispersed power to influence the allocation of resources — generate strong incentives for the formation of patron-client relationships. These organizational features, and their associated quid pro quo, appear to be common among political parties. Consistent with this view, factions of interest are found in a variety of political systems. We discuss a few prominent examples in Section 2.

Regarding the effect of party factions on the allocation of resources, our analysis also has novel implications. Among these is an explanation for the tendency of public spending to favor incumbent party strongholds. In the standard, static models of distributive politics (Lindbeck and Weibull 1987, for example), a given public budget is allocated across localities to maximize the sum of the probabilities of winning. In these models, “swing” districts are the focus of pork spending as their votes are the most responsive to public largesse; localities (or groups) that are loyal to the party, or “party strongholds,” are predicted to receive relatively little. Tests of the standard models have produced mixed results. A number of studies, of many different countries, either find little evidence that spending is directed to swing constituencies or that ruling party strongholds benefit disproportionately from public expenditures.<sup>3</sup> The factional model accounts for this “stronghold premium.” In the model, the premium arises because party strongholds tend to elect the party’s candidate, and so over time their factions become over-represented within the party’s hierarchy.<sup>4</sup>

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<sup>3</sup>This literature is discussed in Section 1.1. Motivated in part by evidence of stronghold spending, Cox and McCubbins (1986) offer a prominent alternative to the “swing-voter” models, in which incumbent strongholds or “core-voters” are favored by pork spending because they are more responsive than opposition voters and not as risky as swing voters.

<sup>4</sup>We do not contend that factions are the only source of the “stronghold premium.” There may be other features of party organization that confer special advantage to strongholds.

At the same time, the model offers a novel explanation for the persistence of policies. Leading models of policy persistence have emphasized forces that are outside the parties—either vested interests facing switching costs (Coate and Morris 1999), or voters who are uncertain of the gains from reform (Fernandez and Rodrik 1991). The factional model identifies an additional source of persistence—the persistence of factions within the party hierarchy. Powerful factions take time to build, but once built, they are resilient—they become durable reservoirs of power for special interests (geographic or otherwise). The model predicts persistence even if the individuals that compose factions or hold offices turn over. Such is the case in Mexico, for example, where by law office-holders cannot be re-elected and yet those districts blessed with powerful factions enjoy durable largesse.<sup>5</sup> Factional politics also links public spending to political careers, so patterns of party promotions should have explanatory power for the allocation of funds. These and other predictions, that trace out the importance of faction power for the allocation of public expenditure, are not captured by existing political economy models.

We illustrate the model’s predictions with a case study of the provision of water services in Mexico, where party factions (called *camarillas*) have long played a prominent role. Using newly coded panel data on water infrastructure spending in more than 450 Mexican municipalities, we first document a substantial spike in public expenditure in the year of a state governor’s election, a “political budget cycle.” We then examine the cross-sectional distribution of this cycle for evidence of persistence in the allocation of expenditure, the party stronghold premium, and links between public spending and political careers. Our findings support several of the important predictions of the factional model.

## 1.1 Related literature

There is a large descriptive literature in political science on party factions. Much of that literature addresses themes that are central to our model—the forces that generate factions, the effect of factions on the allocation of public spending. General theories of party factions are discussed in Belloni and Beller (1976) and Kato and Mershon (2006). See our section 2 below for more from the political science literature.

Our paper also relates to a literature in economics on collusion in hierarchies. See e.g. Tirole (1986), or Carrillo (2000). Strictly speaking, our’s is not a model of corruption or even collusion; indeed, the patron-client relationship has benefits for the party because it motivates patrons to exert effort on behalf of clients. Nevertheless, our paper can be seen as a first effort to apply some themes from that literature to political parties. Dal Bó *et al.*

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<sup>5</sup>Lyndon Johnson’s faction, discussed above, was also persistent despite turnover. Johnson largely inherited it from James P. Buchanan, the 12-term Congressman whose death in 1937 left open the seat that Johnson then won.

(2007) on familial legacies in the U.S. Congress is a related paper with an empirical focus.

The factional model opens the black box of internal party organization. There is a small literature on platform competition in a non-unitary party, and on the effect of party charters on platforms. See Caillaud and Tirole (2002), Testa (2003), Castanheira *et al.* (2005).

Finally, our paper also relates to two strands of a literature concerned with the distribution of public expenditure. The first strand, discussed in the introduction, seeks to understand the persistence of inefficient policies.<sup>6</sup> The second strand is a literature that has tested the standard model of distributive politics using data on public expenditures. Larcinese, Rizzo and Testa (2006) and Larcinese, Snyder and Testa (2006) are recent examples and provide thorough reviews. The results in this literature are mixed and often show that spending favors party strongholds. In the U.S. context, for example, Ansolabehere and Snyder (2006) find that counties with the highest vote shares for the governing party of a state receive the most state transfers. Stronghold spending has been found in a number of non-U.S. contexts as well. Examples include Joanis (2007) on Canadian provincial governments, Barkan and Chege (1989) on Kenya, Estevez, *et al.* (2002) on Mexico, and Dasgupta *et al.* (2004) on India. These findings echo some of the results of our analysis of Mexican water spending.

## 1.2 Plan of the paper

The paper proceeds as follows. In Section 2 we describe several examples of factions from a variety political systems and identify key features that they share. In Section 3 we set up the model. Section 4 shows that our model nests the familiar model of distributive politics as a special case, the case where the power to deliver public expenditure is not distributed among the party hierarchy. In Section 5 we study the equilibrium networks formed from patron-client links. We provide conditions under which persistent networks will form; that is, when networks will consist of party officers who support each other in every period. We call these persistent networks factions. In every period, faction members are tempted to defect to other, more powerful factions. An equilibrium where members resist this temptation is called a “factional equilibrium” and is characterized by stable factions. In Section 6 we study the resource allocation in a factional equilibrium. In Section 7 we further discuss and extend the model. Section 8 applies the model to evidence from Mexico. Section 9 concludes.

## 2 Facts About Factions

In this section we briefly discuss factions as they arise in several political systems. The goal is to familiarize the reader with this phenomenon, and to show that factions share

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<sup>6</sup>In addition the papers cited above, see Hassler et al (2003), and Michell and Moro (2006).

common traits. We will cover factions in Italy’s Christian Democratic Party (DC), Japan’s Liberal Democratic Party (LDP), Mexico’s Institutional Revolutionary Party (PRI), China’s Communist Party (CCP), and politics in Chicago’s “Daley machine.” In each of these cases, we will highlight certain key features. First, the hierarchical nature of relationships inside a faction; second, the nature of the exchange between patrons and clients; and third, the effects of factions on public expenditures.

## 2.1 What are Factions?

We begin with a broad definition taken from Zuckerman’s (1975) study of Italian factions.

I define a political party faction as a structured group within a political party which seeks, at a minimum, to control authoritative decision-making positions of the party. It is a “structured group” in that there are established patterns of behavior and interaction for the faction members over time. Thus, party factions are to be distinguished from groups that coalesce around a specific or temporarily limited issue and then dissolve [...] (Zuckerman, 1975, p. 20).

This definition, which highlights the durability of factions, refers to “factions of interest” and indicates that these groups should be distinguished from “factions of principle” – distinguished, that is, from (intra-party) lobbies organized around particular policy agendas.<sup>7</sup> Factions of interest, like the Italian *correnti* studied by Zuckerman (see more below), are less idealistic aggregations that pursue their own power, more than general-interest policies. Bettcher (2005 pp. 343-4) offers a more precise definition of factions of interest, though he calls them clientele.

Clienteles have a pyramidal structure built up from patron–client relationships. In a political party, clientele organize vertical relations among elected politicians and party officers, and these relations may extend outward and downward into different levels of government and party organization. The relationships – and thus the overall structure – are maintained through exchanges among individuals at different levels. Lower members (clients) deliver votes to their superiors (patrons), and in exchange receive selective incentives such as money, jobs, and services. In other words, members join and remain in the clientele for particularistic, self-interested reasons. Continued membership in the clientele also depends on an ongoing relationship with a particular patron. Consequently, clientele are not firmly organized and become vulnerable to collapse if key patrons are lost.

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<sup>7</sup>The terms “factions of interest” and “factions of principle” are borrowed from Bettcher (2005). Factions of principle appear prominently in U.K. and U.S. parties, for example.

Our paper is concerned with factions of interest.

## 2.2 Factions in Italy's DC

The DC Party dominated Italian government from the post-war period until the mid 1990s and its factions, *correnti*, were quite formal organizations. Bettcher (2005, p. 351) reports:

Each faction acquired a common identity and common resources. The factions possessed well-developed organizational features, including: 'formalized faction names, more or less distinct memberships, leadership cadres and chains of command, faction headquarters, communications networks including press organs, and faction finances' (Belloni, 1978: 93). As of 1986, the factions all had offices clustered in historic Rome (Panorama, 15 June 1986: 49–50). Meetings and conventions were held regularly at various levels at least through the 1980s (L'Espresso, 19 February 1989: 8).

Faction members are described by Zuckerman (1975, p. 40) as following three rules:

- 1) Seek to control cabinet positions. Strive to occupy more and "better" positions than previously held and to defend those already controlled.
- 2) Seek to further the career of the leader. Support him in his effort to achieve "better" positions.
- 3) Seek to obtain goods of value to those who are not faction members only when the persistence of the faction or the strength of the Christian Democrat Party is at stake.

DC factions were typical in that they were not organized around ideology or broad-based policy goals. One longtime factional leader and cabinet minister contended:

"The number of factions has now grown to nine. This is due to personal power games within the party. When a new faction forms, such as the Tavianeis, or the Morotei, it must justify itself in ideological terms, but this is artificial. The factions are power groups." (Quoted in Zuckerman, 1975, p. 26.)

While not primarily motivated by policy, DC factions had a major impact on the distribution of public resources. Bettcher (2005, pp. 351-2) reports that



Christian Democratic factions competed vigorously on behalf of their members for seats in the cabinet and the party's National Council. [...] The factions also procured and distributed a much broader range of patronage, including public jobs at all levels. They colonized the state thoroughly and diverted its resources for their purposes [...]. The Italian regime was infamous for *partitocrazia*, a system in which political parties held preponderance over all aspects of government and society. The DC received the lion's share of ministries, especially the most coveted ones (for example, Agriculture, Post and Telecommunications, and State Holdings) (Leonardi and Wertman, 1989: 225–36). [...] At the local level, from Palermo and Naples to Genoa and the Veneto, DC factions divided up and governed hospitals, welfare agencies, public utilities, credit agencies, housing and construction agencies, chambers of commerce, cooperatives, industrial associations, and professional associations (Caciagli, 1977: Ch. 6; Tamburrano, 1974: 111–16). Public entities proliferated to meet the expanding needs of the DC and its factions.

## 2.3 Factions in Japan's LDP

The LDP has led the Japanese national government almost continuously since the party's formation in 1955. The great majority of LDP politicians have been long-term members of factions.<sup>8</sup> These factions were called *shidan* (divisions) or *gundan* (army corps). Like Italian factions, they were formal, hierarchical organizations. Bettcher (2005, p. 346) writes:

Offices proliferated within the largest factions as they matured. These offices had regular functions and procedures, which became standardized across the different factions (Ishikawa and Hirose, 1989: 212). The first of these was the faction secretary-general (*jimu socho*), analogous to the secretary-general of the party (in both the faction and the party the secretary-general was a different person from the leader). The secretary-general of each faction was entrusted with the daily business of his faction, including keeping order in the faction and handling relations with other factions. [...] Next was the standing secretariat (*jonin kanjikai*), which determined a faction's management policies. It met prior to weekly faction meetings and then obtained approval of its decisions from the full faction (Iseri, 1988: 30–2, 34–5; Ishikawa and Hirose, 1989: 213). Under the standing secretariat were one or more bureaus (*kyoku*), charged with executing

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<sup>8</sup>Turnover in factional membership decreased from the 1960s to the 1980s as the vast majority of the LDP's lower-house politicians became identified with a single faction. Defections from factions almost ceased after 1972. Once a politician was elected and joined a faction, his fate was usually tied to the same faction until he died or retired. Bettcher (2005 p. 345)

its internal policies. Some factions had specialized bureaus for handling policy issues or elections. The secretariats and the bureaus were specialized, permanent, hierarchical structures within the faction, governed by a set of written faction rules. They curtailed the influence of the leader and diminished the impact of his individual characteristics on the faction (Iseri, 1988: 32–5).

As in Italy, Japanese factions were based on mutual dependence between patrons and clients. This is illustrated by Cox *et al.* (2000, p. 116).

[F]action bosses [...] helped members get three crucial aids to re-election: the party endorsement, financial backing, and party and governmental posts. In return, the bosses received his follower’s support in the LDP presidential election, which he could use either to pursue the party presidency himself or to trade for other positions.

As in the Italian case, LDP factions have had an important influence on the distribution of public expenditures. According to Scheiner (2005), p. 807-8, pork barrel spending is targeted to the constituents of strong LDP factions.

[...] funding for local projects is often clearly targeted to LDP Diet members’ financial and political supporters, especially local politicians who deliver the vote for the Diet members (Curtis, 1971; Mulgan, 2000, p. 81; Park, 1998a, 1998b).

## 2.4 Factions in Mexico’s PRI

Factions in Mexico are called “camarillas.” They are less formal than Italian or Japanese party factions, but they have been highly influential in the PRI, the party that dominated Mexican politics from 1930-2000. Camarillas are based on personal ties of trust across hierarchical levels, and members often share some element of their formative or professional life.<sup>9</sup> Camp (2003, p. 104) enumerates “Fifteen characteristics of Mexican Camarillas;” we select the seven most relevant to our analysis.

1. The structural basis of the camarilla system is a mentor-disciple relationship
2. Successful politicians initiate their own camarillas simultaneously with membership in mentor’s camarillas

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<sup>9</sup>They might share a university advisor, or have been colleagues in a previous position, etc. See Smith (1979) for a wonderfully detailed study of *camarillas*.

3. Every major national figure is the “political child,” “grandchild,” or “great grandchild” of an earlier, nationally known figure.
4. Politicians with kinship camarillas have advantages over peers without them.
5. The larger the camarilla, the more influential its leader and, likewise, his disciples.
6. Personal qualities generally determine disciples’ ties to a mentor.
7. It is acceptable to shift loyalties when the upward ascendancy of the political mentor is frozen.

The two-way ties between patrons and clients in a camarilla are well-illustrated in the following description of the activities at CONASUPO, a public agricultural support agency.<sup>10</sup> Grindle (1977) writes:

Through a number of high-level appointments, the director of CONASUPO made friends among the leadership of the peasant and middle-class sectors of the party, obligated a number of state governors, developed a following among university students, and established friendships with officials in key government agencies. The extent of the political support he accumulated in this manner made him a valuable member of a political faction whose importance increased as it attempted to influence the selection of the presidential candidate for 1976. If successful in this maneuver, the director could expect to become a close collaborator of the new president. His subordinates were aware of the advantages of “winning” for their own careers. “If he becomes a minister,” commented one respondent, “then his entire equipito will follow him and we’ll all have positions in the Ministry.”

## 2.5 Factions in China’s CCP

The preceding examples are from well-developed democracies. Intra-party factions also operate in systems with weaker democratic institutions. For example, in China’s CCP where party politics is largely informal,<sup>11</sup> factions play an important role. The Shanghai faction, for example, associated with former president Jang Zemin, was (in)famous for its ability to

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<sup>10</sup>CONASUPO had a broad mandate. See Yunez-Naude (2007, pp. 4-6).

<sup>11</sup>“Unlike most Western countries, where formal politics is clearly dominant over informal politics [...] the Chinese informal sector has been historically dominant, with formal politics often providing no more than a facade. Informal politics plays an important part in every organization at every level, but the higher the organization the more important it becomes. [...] This informal sphere is distinguished from relations within the host organization as a whole by its more frequent contacts, greater degree of goal consensus, loyalty to the informal group, and ability to work together.” Cited from Dittmer (1995, pp. 16-17).

secure state resources and party posts.<sup>12</sup> It is not surprising, therefore, that a large literature in Chinese politics studies factions.<sup>13</sup> This literature invariably identifies factions as key for understanding political power. Huang (2000, p. 77) writes:

A leader's power is essentially based on the strength of his factional networks.  
The leaders who have the most access to factional networks dominate

Chinese factions share many traits with their counterparts in Italy, Japan and Mexico. Huang (2000, p. 76), identifies the following six characteristics of factional links in the CCP, many of which resemble those of DC, LDP and PRI factions.

1. A factional linkage is secured by common political interests.
2. Its crux is the exchange of political obligations that concern the well-being of both participants in a hierarchic context.
3. It is equally coercive on both participants. Abrogation by either of them can bring about damage or even disaster to both participants.
4. Each participant holds a position of authority at a given level. But direct relations usually exist only between the superior and his immediate inferiors.
5. A factional linkage is not inclusive. Although a leader can develop such linkages with other followers so as to maximize his support, it will be disastrous for a follower to seek multiple linkages with more than one leader. This would give a leader enough reason to suspect his loyalty and hence to withdraw his protection.
6. It can be extended: both ends can be linked to the next higher or lower level of authority in the same fashion.

The goods exchanged across CCP factional linkages are also similar to those from the preceding examples. The superior (patron) rewards the inferior (client) with security/advancement, and is repaid with support.

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<sup>12</sup>“A joke circulating throughout China since the late 1990s also reflects public resentment of favoritism in elite promotion. Whenever a line formed to get on a train or bus, people often teased: ‘Let comrades from Shanghai aboard first.’” Li (2002).

<sup>13</sup>Cf. Huang (2000, p.1) who writes “Factionalism, a politics in which informal groups, formed on personal ties, compete for dominance within their parent organization, is a well-observed phenomenon in Chinese politics.”

The prime basis for factions among cadres is the search for career security and the protection of power ... Thus the strength of the Chinese faction is the personal relationship of individuals who, operating in a hierarchical context, create linkage networks that extend upwards in support of particular leaders who are, in turn, looking to their followers to ensure their power. Pye (1981, pp. 7-8)

Like factions of interest elsewhere, CCP factions seek rents from the central state administration and are thought to affect the distribution of public expenditures. Shanghai, for example, is widely believed to have received a disproportionate share of central government spending during the 1990's as a result of factional imperatives. While systematic evidence is difficult to obtain, at least one study documents this effect. Shih (2004) collected proxies for the factional ties among Chinese politicians and tested for the impact of factional ties on the distribution of distribution of bank loans in reform-era China and finds that factional ties have an effect on the distribution of bank loans.

## 2.6 Factions in Chicago's "Daley Machine"

The Democratic Party in Chicago under mayor and party chairman Richard J. Daley (1955-1976) is a well-studied example of factions operating inside a U.S. party "machine." During the Daley era, the Chicago Democrats were organized along the administrative lines of the city in hierarchical networks of clients and patrons. Chicago was divided into 50 wards, each consisting of 50-60 voting precincts, with each precinct containing 400-600 registered voters. Daley was the party's chief executive. Beneath him were party committeemen, and beneath them, with some overlap, were alderman – each representing a ward of the city. Committeemen were party, not government, officials and each appointed a cadre of precinct captains who reported to him. In addition, factional networks extended into the city government bureaucracy through a vast number of patronage jobs tightly controlled by the party. (Guterbock, 1980)

As in the previous examples, party members in Chicago made exchanges across patron-client links; clients at lower ranks delivered votes for their patrons in exchange for personal promotion and jobs for themselves and their constituents. Ultimately, a faction's power depended on its vote-getting ability and its influence with the highest echelons of the party:

"In the heyday of the machine during the Daley years ... jobs were allocated to ward and township committeemen in proportion to the individual committeeman's influence and the number of votes his ward delivered for machine candidates. [...] Generally, the committeemen parceled out the jobs they "owned" to their precinct captains on the basis of the captains' ability to garner votes.

If a captain failed to deliver his precinct, he could be “viced” or fired from his job. If his failure were less serious, he might only lose some of the jobs under his control.” Cited from Freedman (1994, p. 39).

In another example, Guterbock (1980, p. 27) describes the intra-party competition this way:

“The ward committeeman has control over some 150 patronage jobs, and if he continues to produce favorable election results, his patronage power will rise. However, the ethnic identification of the [local party organization] limits its power. The committeeman, alderman, ... and most of the leading precinct captains are Jewish. Their ethnicity prevents their wholehearted acceptance into the inner circle of citywide party leaders, almost all of whom are Irish.”

In addition to patronage jobs, party factions directed public resources to themselves and their constituents by means of their control over city and county bureaucracies. One alderman described the services offered by his network as follows:

“Anybody in the 25th [ward] needs something, needs help with his garbage, needs his street fixed, needs a lawyer for his kid who’s in trouble, he goes first to the precinct captain. . . . If the captain can’t deliver, that man can come to me. My house is open every day to him.<sup>14</sup>”

In another example, a City attorney and precinct captain explained how, in exchange for votes, he worked to provide better public services, and indeed lower taxes for his constituents.

“I consider myself a social worker for my precinct. I help my people get relief and driveway permits. I help them on unfair parking fines and property assessments. The last is most effective in my neighborhood [middle class]. “The only return I ask is that they register and vote. ... I never take leaflets or mention issues or conduct rallies in my precinct. After all, this is a question of personal friendship between me and my neighbors...<sup>15</sup>”

Overall, the party and its internal politics, more than the formal offices of government, determined public spending:

“It was through [Daley’s] control of the party, not his elective office, that he gained complete control of the city council ... Thus the mayor, not the council, decided the budget; the mayor, not the council, really decided on the legislation that ran the city.” Allswang (1986, p. 143).

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<sup>14</sup>25th Ward Alderman Vito Marzullo, quoted in “Ald. Vito Marzullo: Dispenser of Jobs,” *Chicago Daily News*, February 7, 1967.

<sup>15</sup>Quoted in Allswang (1986), page 141.

## 2.7 Summary: Defining Traits of Factions of Interest

These examples of factions present several common traits upon which our model is based:

1. Factions of interest are hierarchical networks of party members.
2. A faction member transacts mostly with his direct hierarchical superior (patron-client relationship). The patron expects to be supported in his ascent to power. In return, the patron gives the client resources that help advance (or at least secure) the client's position in the hierarchy.
3. Factions of interest do not typically coalesce around ideological or policy positions. Instead, they are devoted primarily to the capture of public resources.
4. The existence of factions results in an allocation of resources that follows a factional logic, not necessarily the welfare of the party as a whole, or any efficiency criterion.

Along some dimensions, we see variation across the examples. The formality of the faction, for example, ranges from high (Italy, Japan) to low (China). The system of factional competition may be operated centrally almost as an incentive scheme (Chicago, by Daley), or it may be the result of informal self-organization of competing groups (Mexico). The model in the following sections is sufficiently general that it need not take a stand on these dimensions.

## 3 A Model of Intra-Party Allegiances

In this section we present the model. It is designed to accomplish, with a minimal amount of complexity, two tasks:

1. Provide a framework to study the endogenous formation of factions: why party officers belong to them, and why factions may persist over time.
2. Study the impact of factions on the allocation of resources.

To study of faction formation, we allow party officers to choose their factional partners. To study persistence, we have this choice repeated in every period. It is important for the existence of factions that the power to deliver public resources is distributed across the party. We model this power as effort, and it is one of two elements of the *quid-pro-quo* that links patron and client. The other element is support for promotion. To get at this second side of the exchange, the model specifies a party charter that sets promotion rules.

### 3.1 Setup

Time is discrete and indexed by  $t$ . There are  $S$  states (localities), indexed by  $s$ ; in each of them an election takes place in every period. Two national parties compete in each election. We focus on the internal workings of one of these parties, the party of the office-holder. The workings of the opposition party will be sketched only sparsely.<sup>16</sup>

### 3.2 Party and Party Officers

A party is a series of positions that party officers wish to hold. Positions are characterized by their rank. Rank  $r + 1$  is senior to rank  $r$ , and  $r = 0$  denotes the lowest possible rank.<sup>17</sup> The number of positions of each rank is determined by the party charter, modeled below.

The main actors in our model are party officers. The party officers' objective function is myopic: they simply derive a given amount of utility (which we normalize to 1) from being promoted to the next rank at the end of each period. Officers can exert effort  $e$  in favor of a state of their choice, which increases the probability that state receives a unit of a public project. Also, officers can support one another for promotion according to the rules specified in the party charter. These actions are detailed next.

### 3.3 Allegiances and Effort: The Patron-Client Link

At the beginning of the period, officers make two sets of choices. First, officers declare one state for which they will work and a set of patrons whom they will support for promotion. After all allegiances are so determined, officers choose an effort level  $e$  that increases the probability that a public project is provided to the state they declared.

**Client's support of patron** The declaration process takes place sequentially in order of rank, starting from the highest. When it is their turn, each party officer  $i$  of rank  $r \geq 0$  simultaneously declares a state  $s$  for whom he will work, and each announces a distribution  $p_i^j$ , where  $\sum_j p_i^j \leq 1$ , which represents the probability that  $i$  will *support* officer  $j$  for promotion. All officers supported with positive probability by  $i$  must (a) have rank  $r + 1$ , and (b) have declared the same state as  $i$ .

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<sup>16</sup>The analysis could be symmetrically extended to the opposition party. We do not do so because we think little would be gained in terms of economic insight.

<sup>17</sup>The positions may be in the party, or they could be positions in the government bureaucracy, for example, if the party has power of patronage. The different ranks need not be formal, with distinct titles and authorities. Rather, the ranking is meant to capture, more broadly, the path by which an officer's career advances.



We call officer  $i$  the “client” and the officers he commits to support with positive probability his “patrons.” Conditions (a) and (b) make analysis of the strategic formation of patron-client networks tractable. Condition (a) says that clients can only support patrons one rank above them; condition (b) requires clients to devote their effort to the state chosen by their patrons.

**Patron’s support of client** Next, each party officer simultaneously picks an effort level  $e \in [0, 1]$  that increases the probability that a public project is provided to the state he has declared. Putting in effort  $e$  costs the faction member  $c(e)$ . The cost function  $c(\cdot)$  is assumed to be convex, and  $c(0) = c'(0) = 0$ .

Effort has several interpretations, not mutually exclusive. First, effort may represent investment in a lobbying process by which faction members compete to divert public resources toward their chosen state. Second, effort may represent fund raising activity on the part of faction members. Finally, effort may capture the degree to which the officer resists the temptation to skim public funds allocated to state  $s$ . As we will see, in equilibrium the patron’s effort helps the client, and so represents the *pro quo* that is given in exchange for the *quid* (support).

### 3.4 Elections and Public Projects

In each state and in every period there is an election in which the party candidate (who is the rank-0 officer recruited into the party) runs against an opposition candidate. We abstract from the details of this election for the moment and simply assume that the dominant party candidate is more likely to win the election if his state is assigned an indivisible public project.<sup>18</sup> In each region the probability of electing the dominant party candidate increases from  $b_s$  to  $b_s + \Delta_s$  when the public project is provided.

The probability that the public project is provided to state  $s$  depends on the sum of efforts devoted by party officers to that state. Let  $\mathbf{e}_r$  denote the sum of all efforts directed by officers of rank  $r$  to region  $s$ . Then region  $s$  receives a public project with probability

$$\Pr(g = 1) = (1 - \alpha) \sum_{r=0}^{\infty} (\alpha)^r \mathbf{e}_r \tag{1}$$

or 1, whichever is smaller. The scalar  $\alpha$  is assumed to be smaller than 1. This assumption is for technical convenience, it ensures that the summation converges. The assumption  $\alpha < 1$  also implies that the effort of higher-ranking officers has less impact on the provision of public resources. In Section 7.3 we discuss how to extend the analysis to the case where  $\alpha > 1$ .

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<sup>18</sup>Behind this assumption is a model, sketched in Section 7.5 and detailed in Appendix C, of rational voters who interpret the pre-electoral receipt of the public project as a signal.

We need not take a stand here on whether the effort exerted in favor of state  $s$  is *rival* to that exerted for other states. The public resources, denoted by  $g$ , may come from a fixed pot that could be allocated to any state (effort is rival), or they may come from a pot that is only available to state  $s$  (effort is non-rival).<sup>19</sup>

States with high  $b_s$  are referred to as party “strongholds,” and states with high  $\Delta_s$  as “swing” states. We assume for convenience that  $b_s + \Delta_s < 1$ ; that is, the party can never be assured of winning the election.

### 3.5 Party Charter: Recruitment, Promotions, and Exit

The party charter regulates recruitment, promotions, and exit from party cadres. Recruitment occurs early in the period, promotions and exit at the end. We now offer a simple model of a charter.

**Recruitment** Recruitment takes place while allegiances are being declared. In each state, the power to recruit in state  $s$  is granted to the highest-ranked officer who declared for state  $s$ , provided that this officer won election in  $s$  at some point in the past. In this case, the officer submits a new recruit, a rank-0 candidate that will represent the dominant party in an election against the opposition in state  $s$ . If the highest-ranking officer never won election in state  $s$  then he is not allowed to recruit and the election is lost by default.

**Promotions** Promotions are made at the end of each period, sequentially by rank starting from the lowest. An officer who holds rank 0 is promoted to rank 1 if he won the election in his state. An officer who held rank  $r > 0$  in period  $t$  is promoted to rank  $r + 1$  if he is *supported* by at least one officer who held rank  $r - 1$  during  $t$  and who was himself promoted at the end of period  $t$ .

**Exit** Officers who are not promoted lose their officer status forever (up or out).

This charter requires the recruiting officer for state  $s$  to have held elected office in that state. One interpretation of this requirement is that successful politicians in state  $s$  are better able to pick a candidate that is a good fit for state  $s$ . An important implication of this

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<sup>19</sup>One might be concerned that the interpretation of rival effort is not proper here, because probability (1) does not depend on the effort towards states other than  $s$ ; but the rival interpretation *is* proper. Expression (1) can be recovered as the limit probability of winning a prize in a tournament in which  $N$  factions compete for  $qN$  prizes ( $q < 1$ ), when the number of competing factions  $N$  becomes large. So expression (1) does not preclude the interpretation of factions competing for a fixed amount of public spending. For the details of this argument see Appendix A. This interpretation notwithstanding, when a party officer works on behalf of another, that effort undoubtedly results in a net gain of resources commanded by the party as a whole.

assumption, as we shall see, is that in equilibrium the head of the faction attached to state  $s$  will need to have been elected in state  $s$ .

The promotion rules imply, for example, that officer  $i$  of rank 2 can be promoted only if a rank-0 officer is elected who supported an officer of rank 1 who, in turn, supports officer  $i$ . Note that the party cadres necessarily have a pyramidal structure: there are fewer officers at higher ranks, because every officer who gets promoted can propel up at most one other officer of rank immediately superior. The charter can thus be seen as a rough approximation of a process of *representative democracy* within the party, where officers are selected for assemblies of different ranks, and the selectorate of the rank  $r$  assembly is rank  $r - 1$  assembly. Alternatively, the promotion rule can capture an informal process in which officers require the support of the other officers (in our case, the cadres just below them) in order to maintain or increase their position within the party. We view this assumption as factually uncontroversial, since in reality promotions are typically determined by party assemblies and/or simply by informal support within party ranks.

### 3.6 Timeline

At time  $t$ :

- Sequentially, starting from the highest rank, party officers declare the state that they will work for and whom they support for promotion.
- A (rank-0) candidate is recruited in each state.
- Party officers simultaneously choose the effort devoted to procuring public resources.
- The public project is realized in each state according to the distribution (1).
- In every state, elections take place between the ruling party and the opposition.
- Promotions are made sequentially in order of rank, starting from the lowest.

## 4 Unitary Party Benchmark

In the standard, unitary-party model, a given budget is allocated across localities to maximize the sum of the probabilities of winning.<sup>20</sup> (See e.g. Lindbeck and Weibull 1987). Our analysis nests as a special case the allocation implemented in that model.

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<sup>20</sup>Considering other objectives for the party, such as winning a majority of the districts, would not qualitatively change the results.

We obtain the standard allocation by restricting  $\alpha = 0$ . In this case, power is not distributed across the party hierarchy: only the effort exerted by rank-0 officers matters for procuring public resources. Let us therefore focus on the behavior of these officers. The rank-0 officer in state  $s$  chooses  $e$  to maximize the probability of winning the election minus the cost of effort,

$$\max_e b_s + \Delta_s \cdot e - c(e).$$

The optimal effort level  $e_s^*$  therefore solves

$$c'(e_s^*) = \Delta_s.$$

In this allocation, swing localities receive resources in proportion to their responsiveness ( $\Delta_s$ ); and the baseline level of support for the party ( $b_s$ ) does not affect the allocation. These properties of the resource allocation are the hallmarks standard models of distributive politics.

In our specific setup, the unitary party paradigm has even stronger predictions, because the return to allocating resources to a locality is linear (with slope  $\Delta_s$ ). This implies that, in a unitary party, resources would be allocated maximally ( $e = 1$ ) to all localities with  $\Delta_s$  larger than a threshold, and no resources would go to the other localities. This allocation, too, can be achieved in our model by restricting the cost function  $c(\cdot)$  to be linear.<sup>21</sup>

Thus we see that our analysis nests as a special case the allocation that is implemented in the conventional unitary-party models of distributive politics. In this special case  $\alpha = 0$ ; that is, power is not distributed vertically in the party organization. In what follows we study the case when power is distributed vertically, that is,  $\alpha > 0$ .

## 5 Determining the Allegiance Network

The model described above is a dynamic network formation game. In this section we characterize the equilibrium of this game. In equilibrium, support is proffered between officers of adjacent ranks, giving rise to *networks* of mutual support. When these networks of support hold fast across periods we call them *factions*. The results of this section provide formal answers to some of the questions we raised in the introduction: What are party factions, how do they form, and how do they persist despite the incentives for officers from weaker factions to defect into more powerful ones?

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<sup>21</sup>The slope of the linear function  $c(\cdot)$  corresponds to the shadow price of resources in the optimal allocation for the unitary party model.

## 5.1 Networks: Preliminaries

We start by defining a network. A network is a group of officers linked by bonds of support.

**Definition 1** *Two officers  $i$  and  $j$  are **linked** if  $p_i^j > 0$ . A **network** is a set of party officers (network members) each of whom is linked to another member, none of whom is linked to a non-member, and which does not contain any other network.*

This definition partitions the set of party officers into distinct networks.<sup>22</sup> We now characterize certain features of equilibrium networks.

### **Lemma 1** (*Characterization of networks*)

- a. A network contains officers of every rank between the minimum and the maximum rank in the network.*
- b. All members of a network must exert effort for the same state.*
- c. In equilibrium, a network will contain at most one rank-0 member of that state; only members of the network including the rank-0 member have a positive probability of being promoted.*
- d. If the network survives into the next period, in equilibrium at most one network member of each rank is actually promoted.*

**Proof.** Part a. Suppose the network had members of rank greater and smaller than  $r$ , but no members of rank  $r$ . Then we could partition it into two smaller networks, a violation of the definition that a network may not contain another network.

Part b. follows because all members in a network are linked.

To prove the first statement in c., suppose a network comprised two rank-0 members. Then one of the two rank-0 members is not able to work for his state (by definition no two network members can work for different states), which means his chance of being promoted is  $b_s$ . But then he would be better off by splitting off and forming a single-member network, because then he would be able to work and increase his probability of promotion. To prove the second statement in c., observe that in equilibrium the rank-0 officer for state  $s$  can only belong to one network  $\varphi$ . Consider any other network  $\varphi'$  that works for state  $s$ . At promotion time in period  $t$ , the lowest ranked officer(s) in network  $\varphi'$  have rank greater than zero and will not be supported by anyone, so by party charter they cannot be promoted. But then nobody above them in network  $\varphi'$  can be promoted.

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<sup>22</sup>In the network literature, what we call network is usually called a *component*.

Part d. follows from c. and the rules in the party charter. ■

By Lemma 1, any network that has a positive probability of survival can be uniquely identified by the state for which its members work. Conversely, every state has a network, albeit possibly a very small one (of size 1).

We now introduce a result that, while straightforward, offers insight as it highlights the force that drives the formation of patron-client links, and thus of networks. The result roughly says that if a client supports a set of patrons at all, he will offer his support completely.

**Lemma 2 (*Power of clientele fully expended*)** *If there is at least one officer of a rank one above  $i$ 's who works for the same state as  $i$ , then in any equilibrium  $\sum_j p_i^j = 1$ .*

**Proof.** Consider rank-1 officer  $i$  in a network which includes a rank-0 member. If officer  $i$  is supported in equilibrium by the rank-0 member, that is in part because the rank-0 member values the support that member  $i$  provides to rank-2 members. So officer  $i$  cannot decrease the support he receives from the rank-0 member by scaling up his  $p_i^j$ 's proportionally until their sum equals 1. At the same time, by scaling up the  $p_i^j$ 's, officer  $i$  increases the effort exerted by rank-2 members and thus increases the probability that the whole network survives. For both reasons, then, scaling up the  $p_i^j$ 's is a dominant strategy. The same reasoning applies to every officer of rank  $i > 1$ . ■

The intuition for this result is straightforward: by offering his support to a patron, the client makes himself valuable both to the patron and to his own clients. This increases the patron's incentives to exert effort on his behalf, and leads his own clients to support him more strongly. This result suggests that the incentive to create patron-client networks is pervasive in our model.<sup>23</sup>

## 5.2 Patterns of Allegiance and Effort Maximization

Now, with a basic understanding of the characteristics of equilibrium networks, we turn to investigate further questions of network structure. In this subsection, we are concerned with the network structure that maximizes effort by its members, and the payoffs to current network members from adding a new member. The answers to these questions will, ultimately, explain the stability of various networks and thus how factions form and persist.

If a network has more than one officer per rank, allegiance could be distributed in many ways among these officers. All members of that rank could be supported equally, for example,

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<sup>23</sup>This result does not mean that all officers need be clients of some patron, because the putative client may wish to exert effort on behalf of a state for which a patron is not available. In that case, the putative client may opt instead to start his own network.

or only one could be supported. How support is distributed obviously influences effort; if, for example, officer  $j$  is not supported by any network member, then he has no chance of promotion and so will exert no effort. In this section we ask how to allocate the available support in order to maximize the total effort produced by the network.

**Lemma 3** *Consider a network and vary only the distribution of support among its rank- $r$  members. If  $c''' < 0$ , then total effort produced by all its rank- $r$  members is maximal when just one rank- $r$  member is supported. If  $c''' > 0$ , then total effort produced by all its rank- $r$  members is maximal when all rank- $r$  members are supported with the equal probability.*

**Proof.** Suppose there are  $J$  network members of rank  $r$ , and let  $e^j$  denote the effort put forth by the  $j$ -th network member (we omit the index  $r$  because it is constant throughout the proof). Let  $\sigma^j$  denote the support that the  $j$ -th network member receives, i.e., the probability that the member is promoted conditional on the election in his state being won. We are looking for the constellation of  $\sigma^j$ 's that maximizes total effort  $\sum_j e^j$  under the constraint that  $\sum_j \sigma^j = 1$ . The constraint reflects the total amount of support that emanates from rank  $r - 1$ . Start by observing that  $e^j$  solves

$$\max_{e^j} \sigma^j [b + \Delta Pr (g = 1)] - c(e^j).$$

Substituting from (1) and taking first order conditions,  $e^j$  solves

$$\Delta (1 - \alpha) (\alpha)^r \sigma^j = c'(e^j). \quad (2)$$

Summing over all  $j$ 's yields

$$\Delta (1 - \alpha) (\alpha)^r = \sum_j c'(e^j),$$

where we have used the fact that  $\sum_j \sigma^j = 1$ . Write

$$h(e^1, \dots, e^J) = \frac{1}{\Delta (1 - \alpha) (\alpha)^r} \sum_j c'(e^j).$$

We can then write an ancillary version of our problem as follows.

$$\max_{\{e^j\}} \sum_j e^j \quad \text{s.t.} \quad \begin{aligned} h(e^1, \dots, e^J) &= 1 \\ e^j &\geq 0 \end{aligned}$$

The function  $h$  is symmetric and so is the objective function, thus the solution depends on the Hessian of  $h$ . If its Hessian is negative definite then the function  $h$  is concave; since  $h$  is an increasing function, the solutions to our problem are extremal points, i.e., all but one  $e^j$  are zero. This allocation can be achieved by setting all  $\sigma^j$ 's to zero but one; that is, by supporting only one network member. The Hessian is negative definite when  $c''' < 0$ .

If instead  $c''' > 0$  then the Hessian of  $h$  is positive definite, and the function  $h$  is convex. In this case, the objective function is maximized when all  $e^j$ 's are positive and equal. This allocation can be achieved by setting all  $\sigma^j$ 's equal to  $1/J$ , that is, by supporting all network members equally. ■

This result suggests that within-rank competition increases total effort only when  $c''' > 0$ . If instead  $c''' < 0$ , then job security is more effective. Although the previous result is a “partial equilibrium” result because it characterizes only the effort produced within a given rank, the result helps characterize the effort-maximizing structure for the entire network.

**Proposition 1 (*Effort-maximizing network structure*).** *If  $c''' < 0$ , then among all networks covering the same ranks, total effort is maximal in the network with one member per rank. If  $c''' > 0$ , then total effort is increasing in the number of members per rank.*

**Proof.** Due to the linearity of expression (1), the equilibrium effort of network members of rank  $r$  does not depend on the effort of network members of different rank. Thus, the incentive design problem can be solved rank by rank. The result then follows from the previous Lemma. ■

While within-rank competition is sometimes effort-maximizing, not all network members will appreciate the competition. Indeed, we now show that network members always dislike competition *within their own rank*.

**Lemma 4** *Consider a network and vary only the number  $J$  of its rank- $r$  members. Assume all rank  $r$  members are supported with equal probability. Then the payoff of a rank  $r$  member is decreasing in  $J$ .*

**Proof.** Since the two networks are identical at ranks different from  $r$ , the total effort put forth by ranks different from  $r$  is unchanged as  $J$  varies. We can therefore restrict attention to that portion of payoffs that reflects the effort put forth by rank  $r$  members. For a member of rank  $r$ , that portion is given by

$$R^J(e, e^{J*}) = (1 - \alpha)(\alpha)^r \Delta \frac{1}{J} [e + (J - 1)e^{J*}] - c(e),$$

where  $1/J$  is the support enjoyed by each rank- $r$  member, and  $e^{J*}$  denotes the equilibrium effort put forth by every other member of rank  $r$ ,

$$e^{J*} = \arg \max_e R^J(e, e^{J*}).$$

Observe for future reference that  $e^{J+1*} < e^{J*}$ . The equilibrium payoff of the  $j$ -th member is given by

$$R^J(e^{J*}, e^{J*}).$$



Note that, by construction, for any  $e$  we have  $R^J(e, e) = R^{J+1}(e, e)$ . Note further that for any  $e \neq e^{1*}$  we have

$$R^1(e^{1*}) > R^1(e) = R^J(e, e).$$

Since  $R^J(e, e)$  is concave in  $e$ , and is maximized at  $e^{1*}$ , it follows from  $e^{J+1*} < e^{J*}$  that

$$R^J(e^{J+1*}, e^{J+1*}) < R^J(e^{J*}, e^{J*}).$$

■

This results suggests that no member would want to enlarge his network by admitting a new member at his own rank. When  $c''' > 0$ , however, members would like to enlarge the network by admitting new members at all ranks *but their own*.

### 5.3 Permanent Allegiances: Factions and Factional Equilibrium

Networks need not be stable over time. For example, one network might offer so high a survival prospect that in every period members from all other networks would like to defect into it. In this subsection we introduce a notion of stable networks, factions. Factions are cohesive networks of officers that support each other period after period, until their network's demise. When all networks are stable, we call it a factional equilibrium. In the results that follow we provide conditions for the existence and uniqueness of a factional equilibrium. In this way, we provide a formal answer to the question: why do factions persist despite the incentives for officers from weaker factions to defect?

**Definition 2** *A **faction** is a network in which officers always exert effort for the same state and no officer ever alters his links. A **factional equilibrium** is an equilibrium in which all networks are factions.*

The structure of factions can be immediately characterized as a corollary of Lemmas 1 and 2.

**Corollary 1** *In any factional equilibrium, after the first period:*

- a. all factions will have exactly 1 member per rank.*
- b. in every faction and in every period each client fully supports the same patron.*
- c. in each period all factions either grow by one member or else they collapse.*

Figure 1 depicts an example of the evolution of factions between period  $t$  and  $t + 1$ . In this example the faction in state 3 collapses, while the others survive (and grow by 1 member).

To ensure that a factional equilibrium exists, we need to check that there are no incentives for officers to defect from their faction.

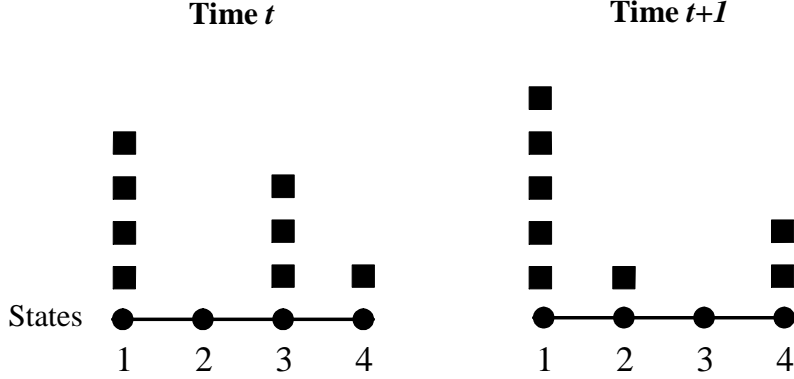


Figure 1: Evolution of factions between periods.

**Definition 3** A *defector* is an officer who, in a given period, switches the faction for which he works.

Obviously, a factional equilibrium admits no defectors. The temptation to defect is stronger for members of small factions, who face a relatively low probability of winning the election. A member of a small faction may wish to increase his probability of promotion by defecting to a larger one. In addition, members will be tempted to defect to particularly “safe” states, if they exist. When neither of these temptations is too strong, a factional equilibrium exists. Moreover, a defector may not necessarily be allowed into a different faction. Then again, a factional equilibrium exists.

**Proposition 2** A factional equilibrium exists under the following conditions:

- a. if  $c''' < 0$ ; because then defectors will not be accepted.
- b. if  $\alpha$  is sufficiently small, all the  $b_s$  are sufficiently similar, and all the  $\Delta_s$  are sufficiently similar; because then no faction member will wish to defect to another faction.

**Proof.** The effort choice in a factional equilibrium is pinned down by equation (2), since each client only has one patron and  $\sigma^j = 1$ . What remains to be determined is the pattern of allegiance; that is, we need to check if there is incentive for faction members to defect from faction  $\varphi$  of state  $s$  to faction  $\varphi'$  of state  $s'$ . Say faction  $\varphi'$  has maximum rank  $K$ . Then no member of faction  $\varphi$  with rank greater than  $K$  will defect to  $\varphi'$ , because then the highest-ranking member of the faction will not have been elected in state  $s$  and so, by assumption,

will not be able to nominate a rank-0 candidate. We will check for incentives to deviate on the part of members of rank lower than  $K$ .

a. An officer of rank  $r$  in faction  $\varphi$  might consider defecting to faction  $\varphi'$  if he is guaranteed some positive probability of being supported by that faction's  $r - 1$ -rank member. His defection might trigger other defections, possibly all the way down to members of rank 1. Consider then the lowest rank member to defect in any given period. In order for his defection to be profitable, it must be rewarded by a positive probability of being supported by the  $r - 1$  rank member of faction  $\varphi'$ . That faction member will not, however, divide his support between his former patron and the defector, because by Proposition 3 that would decrease the aggregate effort produced by rank  $r$  of the faction, without affecting the effort put forth by any other rank in the faction. Thus,  $r - 1$  rank member's best response towards a defector is either to not support him at all or to fully support him. Let us select the equilibrium in which this indifference is resolved against the defector. Then the defection would be turned down and the potential defector does not defect. Thus there cannot be a lowest-ranked defector, which shows that there is a factional equilibrium.

b. When  $\alpha$  is small, the effort of faction members of ranks 1 or higher has little effect on the probability of delivering the public good. Thus all factions, regardless of their rank, promote with approximately the same probability as a faction of rank 1. If all the  $b_s$  are sufficiently similar and all the  $\Delta_s$  are sufficiently similar, then no officers in faction  $\varphi$  would want to defect to faction  $\varphi'$ , as that would cut their probability of promotion in half. ■

The reason for the conditions in part b. of the above proposition is straightforward. Members of small factions generally have an incentive to switch to large factions in order to free-ride on the effort of the larger group, unless  $\alpha$  is sufficiently small, in which case the effort of ranks higher than 1 has a negligible impact and so faction size, beyond size 2, does not much affect the probability of promotion. The reason why we need the  $b_s$  to be similar is that if, for example,  $b_1 > 2(b_2 + \Delta)$ , the conditions in faction 1 are simply too attractive for a member of faction 2 to resist defecting.<sup>24</sup>

The sufficient conditions provided in Proposition 2 are somewhat restrictive. One reason that they need to be stringent is that we have assumed no barriers to entry into a new faction, save the possibility that the defector may not be supported. In reality, the faction may have the power to screen defectors from other factions. A social choice problem then arises, because faction members might have conflicting views as to whether to accept defectors; indeed Lemma 4 establishes that there is always some member who is against accepting a defector. So, if all faction members have veto power over whether to accept defectors, then no defector will ever be accepted and a factional equilibrium exists.

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<sup>24</sup>We assume here that the defector to faction 1 will receive a utility of at least  $b_1/2$ , as would be the case if, for example,  $c''' > 0$ .

**Proposition 3** *If faction members have veto power over the acceptance of defectors, then a factional equilibrium exists.*

Consistent with the view that factions face a collective decision problem concerning defectors, Cox *et al.* (1999) observe that an informal norm against accepting defectors prevailed in Japan's LDP, precisely to protect the interest of those faction members who would be displaced by the defector.<sup>25</sup> This norm effectively functions as a veto power.

## 5.4 Uniqueness of Factional Equilibrium

Under an additional assumption, the factional equilibrium is unique. The additional assumption needed to prove this result is the following.

**A1** When indifferent between his patrons, the client will support most the one who worked for his current state in the previous period (if available).

This assumption captures mild intertemporal ties between a party officer and other officers who worked for his current state in the previous period. It may not be immediately clear what indifferences Assumption A1 resolves. To understand the content of the assumption, observe that when a client has two patrons, say, he may wish to support one patron with probability 2/3 and the other with probability 1/3; but, he is indifferent as to whom should get the 2/3. Assumption A1 says that the client will resolve this indifference in favor of the patron who worked for the same state in the previous period. In this sense, Assumption A1 resolves indifference on the client's part.

**Proposition 4** *Suppose Assumption A1 holds, and that either of these conditions hold.*

a.  $c''' < 0$

b. *network members have the power to veto member(s) according to the mechanism described in Appendix B.*

*Then the factional equilibrium is the unique equilibrium.*

**Proof.** See Appendix B. ■

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<sup>25</sup> “[S]ince the mid 1960s each faction’s posts have been allocated largely on the basis of seniority. Thus, a prospective faction-jumper would want to ensure that his new faction would honour his seniority. But honouring a new member’s seniority would be a delicate matter, because those further back in the seniority queue might complain.” Cited from Cox *et al.* (1999), p. 38.

## 6 Resource Allocation in Factional Equilibrium

Having described the forces that generate a factional equilibrium, we now want to characterize the allocation of resources that emerges. Towards this end, we begin by establishing some properties of the size and effort of factions in equilibrium. We omit the state index  $s$  when no confusion can arise.

### 6.1 Faction effort for given faction size

In a factional equilibrium, within each state  $s$  at time  $t$  the party has a faction with exactly one member per rank. We may therefore identify a faction member with his rank  $r$ . Let  $R \geq 0$  denote the number of faction members. Member  $r$  solves

$$\begin{aligned} & \max_{e_r} b + \Delta \Pr(g_t = 1) - c(e_r) \\ &= \max_{e_r} b + \Delta \left[ (1 - \alpha) \sum_{r=0}^R \alpha^r e_r \right] - c(e_r). \end{aligned}$$

The equilibrium level of effort  $e_r^*$  solves

$$c'(e_r^*) = \Delta(1 - \alpha)\alpha^r. \quad (3)$$

The effort of a faction member is therefore increasing in  $\Delta$  and does not depend on  $b$ . Also, equation (3) does not depend on  $R$ , so member  $r$  will put in  $e_r^*$  independent of his faction's size. Therefore, the total effort put forth by a faction is increasing in the faction's size. We summarize these observations in the following proposition.

**Proposition 5** *In a factional equilibrium, the effort of a faction member is increasing in  $\Delta$  and does not depend on  $b$ . The total effort of a faction is increasing in its size.*

### 6.2 Steady State Distribution of Faction Size

The equilibrium of our network-formation game depends on the size of factions at time zero. However, the effect of these initial conditions dissipates with time. This makes it possible to avoid the effect of initial conditions and focus on the long-run properties of the equilibrium. In this section we characterize the long-run distribution of faction size.

In a factional equilibrium the probability of a faction being of size  $R + 1$  in period  $t + 1$  equals the probability of being size  $R$  in period  $t$  times the transition probability. Formally,

$$\pi_{t+1}(R + 1) = \pi_t(R) \cdot \left[ b + \Delta(1 - \alpha) \sum_{r=0}^R (\alpha)^r e_r^* \right].$$

At a stationary equilibrium  $\pi_t(\cdot) = \pi(\cdot)$ , so the stationary distribution can be characterized by the following difference equation:

$$\begin{aligned}\pi(R+1) &= \pi(R) \cdot \left[ b + \Delta(1-\alpha) \sum_{r=0}^R (\alpha)^r e_r^* \right] \\ \pi(0) &= 1 - \sum_{k=1}^{\infty} \pi(k).\end{aligned}\tag{4}$$

Since by assumption  $b + \Delta < 1$ , we have that  $\pi(R) < \pi(R+1)$  for all  $R$ . Figure 2 provides a qualitative picture of the stationary distribution of faction size for a given pair  $\Delta, b$ .

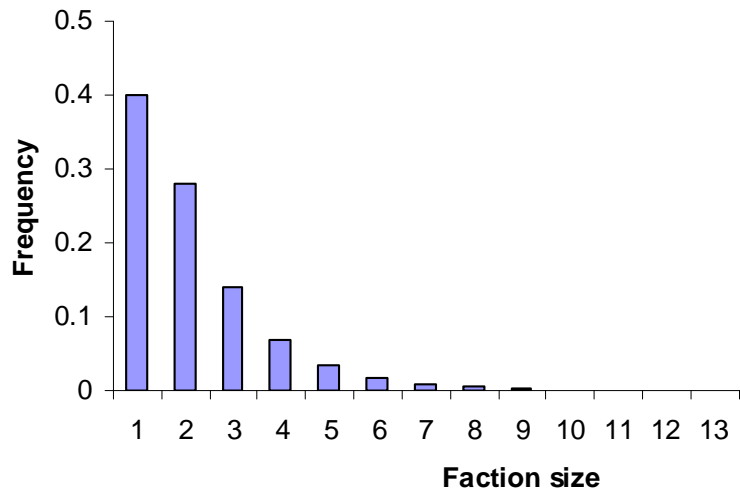


Figure 2: Steady-state distribution  $\pi$  of faction size in state  $s$ .

We now show that swing states, and states with a large base of support for the party, are more likely to have large factions.

**Proposition 6** *Increasing  $\Delta$  and/or  $b$  results in a first-order stochastically dominant shift of the steady-state distribution of faction size.*

**Proof.** Suppose  $\Delta$  increases. Then by equation (3),  $e_r^*$  increases for all  $r$ . From equation (4), then, the new steady-state size distribution  $\pi'$  has the property that

$$\frac{\pi'(R+1)}{\pi'(R)} > \frac{\pi(R+1)}{\pi(R)}.\tag{5}$$

It cannot be that  $\pi'(0) \geq \pi(0)$ , because then we would have  $\pi'(R) > \pi(R)$  for all  $R > 0$  and then both distributions  $\pi$  and  $\pi'$  could not sum to 1. So it must be  $\pi'(0) < \pi(0)$ , and

then equation (5) implies that there is a unique value  $\bar{R}$  such that  $\pi'(R) < \pi(R)$  if and only if  $R < \bar{R}$ . This establishes that  $\pi'$  first-order stochastically dominates  $\pi$ .

If  $b$  increases,  $e_r^*$  does not change for any  $r$ , and equation (5) again holds. The previous reasoning then proves the result. ■

### 6.3 Resource Allocation

This section establishes three main points. First, in a factional equilibrium *the allocation of resources reflects the power of the faction*. Second, and related, there is a systematic *bias in favor of party strongholds*. Third, factions generate *persistence* in the resource allocation. The next proposition makes these points and moreover, in points c.-e., it draws out several additional implications for the allocation of public resources.

**Proposition 7 (*Allocation of resources in factional equilibrium*)** *In a factional equilibrium the probability that a state receives public resources depends on the size of its faction. Through this channel the following results arise in our model:*

- a. In steady state, swing states (higher  $\Delta$ ) and party strongholds (higher  $b$ ) are more likely to receive public resources from the party.*
- b. In steady state, given two states with the same  $b$  and  $\Delta$ , the state with a longer spell of uninterrupted electoral success for the party is more likely to receive public resources from the party.*
- c. The probability that a state receives public resources from the party at time  $t$  is predicted by the future success within the party of the officer who holds rank 0 at time  $t$ .*
- d. Conditional on winning election at time  $t$ , the vote-getting ability of a rank-0 officer is uncorrelated with the probability that his constituents receive public resources from the party in the future.*
- e. Conditioning on faction size at time  $t$  eliminates all the effects described in parts a.-d., except for the effect of  $\Delta$  in part a. States that are dominated by the opposition (faction size at time  $t$  is equal zero) receive no resources from the party at time  $t$ .*

**Proof.** According to Proposition 5, the probability that a state receives the public project given faction size  $R$  is an increasing function of  $R$ . This proves the introductory statement.

Proving of part a. requires averaging out faction size. The probability that a state receives the public project conditional on faction size  $R$  is an increasing function of  $R$ . Taking an average of this function using the steady-state distribution of  $R$  yields the probability that a state receives the public project. By Proposition 6, that distribution is stochastically

increasing in  $b$ . Thus states with higher  $b$  have a higher probability of receiving the public project. The same argument applies to states with larger  $\Delta$ , and in addition factions in those states will exert more effort (Proposition 5), which establishes the result for those states.

Proof of part b. is immediate.

To prove part c., let  $B = b + \Delta$  and

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

Then we can write

$$\begin{aligned} & \Pr(g_t = 1 | \text{outgoing rank-0 officer at } t \text{ promoted through } \tau) \\ = & \Pr(g_t = 1 | \text{party wins at } t, t + 1, \dots, \tau) \\ = & \frac{\Pr(\text{party wins at } t, t + 1, \dots, \tau | g_t = 1) \cdot \Pr(g_t = 1)}{\Pr(\text{party wins at } t, t + 1, \dots, \tau)} \\ = & \frac{P_\tau \cdot \Pr(\text{party wins at } t | g_t = 1) \cdot \Pr(g_t = 1)}{P_\tau \cdot \Pr(\text{party wins at } t)} \\ = & \frac{B \Pr(g_t = 1)}{B \Pr(g_t = 1) + b \Pr(g_t = 0)} \\ > & \frac{[(1 - B) + B(1 - P_\tau)] \Pr(g_t = 1)}{[(1 - B) + B(1 - P_\tau)] \Pr(g_t = 1) + [(1 - b) + b(1 - P_\tau)] \Pr(g_t = 0)} \\ = & \Pr(g_t = 1 | \text{outgoing rank-0 officer at } t \text{ not promoted through } \tau) \end{aligned} \quad (6)$$

The inequality follows from algebraic manipulation.

Part d. Regardless of whether the politician was an effective 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 rank-0 officer that barely managed to get elected is just as likely to receive public goods as one with an officer that was elected by a large margin.

Part e. Immediate. ■

Part b. of the above proposition indicates that resource allocation is persistent. States with a longer spell of uninterrupted electoral success for the party are more likely to receive public resources. This is because such states have larger factions. By the same token, failure to receive resources is also persistent, because it makes it more likely that the faction is eliminated.

The stark no-correlation result obtained in Part d. is a consequence of the assumption that party members never again run for office. Were we to allow an outgoing rank-0 officer to run for office again, we would likely observe some correlation. Interestingly, however, we will see some evidence of 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.



## 7 Discussion and Extensions

### 7.1 Obstacles to Factional Politics and the U.S. Case

It is important to point out that national parties in the U.S. do not have notable factions of interest.<sup>26</sup> Why is that? And more generally, what determines the degree to which a party is divided into factions of interest? We shall attempt to answer these questions next.

**Party Dominance** Electorally dominant parties are more likely to develop factions. It is no coincidence that all the parties mentioned in Section 2 have been in power for long spells—many decades. Dominance breeds factions for several related reasons. First, from the point of view of a party officer, holding rank  $r$  is more valuable if a party is now in power, is likely to be in power soon, and is likely to be in power in the future. In this sense, the rewards that induce factional behavior are more powerful in dominant parties. Second, and related, a party that is in office for extended periods is able to penetrate government bureaucracies. In this way, non-political positions in state enterprises, public administration, regulated businesses, etc., become part of the party reward system—ranks, in our terminology. Third, the negative effects of factional organization on resource allocation (as spending is diverted from swing states) are less important if, for some reason, a party does not fear electoral competition.

These observations may partly explain why factions of interest are relatively rare in U.S. national parties, which tend to alternate in power. In contrast, factions can be found in the state Democratic parties in the post-civil-war South (see Key 1949) and in city political machines, both of which continuously held power for extended periods of time.

**Control over Nominations** A key determinant of whether factions are strong or weak is the control that the factions have over nominations. Are factions able to choose new party officers? That depends on both party and legal rules. In this section we introduce the concept of loyalty to the faction, and use it to show the importance of nomination control for faction strength.

**Definition 4** *The **loyalty** of a party officer is the probability  $\lambda$  that the client will keep the commitment to support his patron.*

Until now we have assumed perfect loyalty. When we allow imperfect loyalty, aggregate factional effort becomes a function of loyalty.

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<sup>26</sup>Factions of principle are, however, common within national parties. The Republican Party, for example, is divided into Reagan Republicans, Rockefeller Republicans, the Religious Right, etc.

**Proposition 8** *Aggregate factional effort is monotonic in loyalty: when the loyalty of a rank- $r$  member decreases, equilibrium effort of faction members with rank  $R > r$  decreases.*

**Proof.** Let  $\lambda_r \leq 1$  denote the loyalty of the rank- $r$  officer. Then the support  $\sigma^R$  that the faction member of rank  $R$  receives, i.e., the probability that the member is promoted conditional on the election in his state being won, is given by:

$$\sigma^R = \prod_{r=0}^{R-1} \lambda_r.$$

Expression (3) characterizing equilibrium effort is then amended to

$$c'(e_r^{**}) = \sigma^r \Delta (1 - \alpha) \alpha^r.$$

Clearly, the lower  $\sigma^r$ , the lower  $e_r^{**}$ . ■

Loyalty of 0-rank candidates is highly valued by fellow faction members, because disloyal candidates reduce their likelihood of being promoted. If recruitment is controlled by the faction, then, we should expect high-loyalty candidates to be picked. By the same token, the long-term viability of factions also depends on their ability to control nominations.<sup>27</sup> Consistent with this view, in Italy's DC and Japan's LDP, factions effectively had control over nominations and jealously guarded it.<sup>28</sup> Conversely in the U.S., where nominations are usually decided in primaries, factions are not overly strong.<sup>29</sup>

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<sup>27</sup>If some other entity—the president, or the public—nominates candidates, those candidate are likely to be loyal to those entities. On this point, see Cox et al. (1999).

<sup>28</sup>Regarding Italy's DC, Zuckerman (1975, p. 33) writes:

It would seem that in regions where a national faction leader is present other political patrons or aspiring patrons will associate with his faction. [...] In regions where there are two patrons seeking national prominence, each will associate with a different national faction.

In Japan, particularly before the 1994 reform, nominations were decided in national-level negotiations in Tokyo. Cox et al. (1999, p. 40) write:

The factions competed just as fiercely over endorsements as they did over posts, seeking both to secure nominations for their own non-incumbents and to protect their incumbents from the appearance of endorsed non-incumbents in their districts.

<sup>29</sup>In the US system, due largely to legal constraints, national parties have relatively little say in the nomination for congress. Instead, primaries typically devolve that power to the mass of party members. For all major offices, candidate selection is by primary, with the right to participate as a candidate or as a voter beyond the control of party organization. (Katz and Kolodny 1994, p. 31). Concerning the weakening effect of primaries on party discipline, see generally V. O. Key (1958), Ch. 14.

**The U.S. Case** In U.S. party politics, it is important to distinguish between national parties and state and local party organizations. We mentioned above that neither national party is dominant in the U.S., which makes it less likely that factions would develop in national party organizations. There are other reasons, too. From the perspective of career concerns, national parties are small numerically and relatively influential in the U.S. compared to state parties.<sup>30</sup> This makes them less appealing as a target for politicians intent on building networks. In addition, U.S. national parties have peculiar institutions at the national level whereby committee chairmanships, which confer great power of patronage, are assigned by seniority. Thus, access to these powerful posts does not require politicians to marshal the support of other party members. For all these reasons, factional politics does not develop at the national party level. If we are looking for factions of interest, therefore, we must look in the state parties and at the local level. Again, this is indeed where factions are found, for example in local party machines, or in the state parties of the U.S. south.

## 7.2 Benefits of Factional Politics: Incentivizing Effort

In our model, the party charter conditions promotion on the support of other party members. In a factional equilibrium, this promotion rule gives rise to an incentive system which links the fate of *all* officers to the outcome of elections, including those who are not directly involved. This link has the virtue for the party of incentivizing these officers. To make this point, we now analyze the case of a party charter in which promotions do not depend at all on the support of the lower rungs of the faction. We will find that factions collapse and the party is worse off for that. In this sense, then, factional politics is beneficial for the party.

Suppose the promotion of faction member  $r$  does not depend on  $r - 1$ 's backing, because the party charter does not require internal support for promotions.<sup>31</sup> Then there is no reason why a member of rank  $r > 0$  should exert effort and thus  $e_r^* = 0$ . Then the probability that the party wins the election in state  $s$  is simply  $b_s$ .

**Proposition 9 (*Value of the faction*).** *If the promotion of faction member  $r$  does not depend on  $r - 1$ 's support or, equivalently, if promotions are independent of electoral outcomes, then faction members will exert no effort and the party will be less successful in elections.*

This proposition does not imply that factions are the *optimal* incentive scheme. If promotions could be conditioned explicitly on effort, for example, then the party could achieve better

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<sup>30</sup>In part this may be due to the federal organization of the U.S government.—for example, elected positions at the federal level, while often very important, are only 600, compared to more than 500,000 elected positions at the state and local level (Katz and Kolodny (1994), p. 27.).

<sup>31</sup>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.

results. Some element of factional behavior, however, must be part of the optimal incentive scheme, in the sense that party members must be induced to exert effort *collectively* on behalf of the party in different states.

### 7.3 Power Throughout the Hierarchy

We have assumed in our model that the effort of members of higher rank has less effect on the provision of public projects. In this section we show that this is merely a technical assumption and explain how to do without it.

The assumption we want to relax is that  $\alpha < 1$  in expression (1). The role of that assumption is to ensure that the expression sums to less than 1, and thus can be interpreted as a probability. This assumption can be avoided, at the cost of some slight complication. To see how, suppose we replace expression (1) with the following expression:

$$\Pr(g = 1) = \min \left\{ 1, \frac{1}{T \cdot (\alpha)^T} \sum_{r=0}^T (\alpha)^r \mathbf{e}_r \right\}, \quad (7)$$

where  $\alpha > 1$  and  $T$  is a positive integer of our choice. This expression meets our *desideratum*: the effort exerted by officers of a higher rank counts for more.

This expression is almost as tractable as expression (1) because it is linear in the  $\mathbf{e}_r$  when it is below 1. And, for factions with less than  $T$  members, expression (7) is definitely smaller than 1 (remember that, in a faction,  $\mathbf{e}_r < 1$ ). So the behavior of members of factions with rank smaller than  $T$  is very similar to that described in our model: larger factions exert more aggregate effort and are more likely to survive. Notice that  $T$  can be chosen very large, so that for all of the factions most of the time all our analysis goes through. When the size of the faction exceeds  $T$  it is possible that  $\Pr(g = 1) = 1$ . In that case many combinations of effort among faction members can be an equilibrium, and then the analysis becomes somewhat more cumbersome. But, from the point of view of the evolution of factions, it is not that difficult: factions that exceed a certain number of members get the public project for sure, and so they survive with probability  $b + \Delta$ . Thus, nothing substantial in our analysis hinges on the assumption that  $\alpha < 1$ .

### 7.4 Global Public Goods

If a party is forced by its factions to distribute many local public goods to influence local elections, fewer resources may remain to woo voters with promises of public goods in nationwide elections. Thus, we expect parties with strong factions to promise fewer global public goods; their appeal will be based mostly on their ability to procure local public goods.

To make this point, denote by  $\mathbf{E}$  the total amount of effort put forth by all the party’s factions. Imagine that a fraction  $v$  of this effort results in local public expenditure that could otherwise go toward promising global public goods in national elections (appropriations from a federal budget, say), with the balance  $(1 - v)$  representing resources that could not be used for that purpose (the creation of patronage posts in a local hospital, say). Consider the problem of a party president running for nation-wide office. Let us assume that the party president balances the goals of winning local elections with that of winning national office. From the party president’s point of view, increasing the portion  $(1 - v)\mathbf{E}$  of resources is unambiguously good: these resources help win local elections and do not interfere with nationwide elections. The portion  $v\mathbf{E}$ , on the other hand, has the disadvantage of limiting the party president’s ability to promise global public goods in the national election. If we denote by  $Z$  the size of the federal budget, only

$$\max \{0, Z - v\mathbf{E}\}$$

is available for the party’s president to promise global public good. When the median voter’s ideal point in the nation-wide election exceeds that level, the party president is constrained in his ability to promise enough global public good. When factions are strong,  $\mathbf{E}$  is large and the president is more constrained.

This argument does not necessarily favor parties with weak factions: when  $v$  is small, the incentive effect of factions dominates over the flexibility-reducing effect, and factions play a useful role on balance. Nevertheless, to the extent that electing the party president in the nationwide election is a public good for party officers, this argument indicates that factions exert a negative externality on each other. This is analogous to a common-pool problem, where the common pool of resources is  $Z$ , the size of the federal budget.

## 7.5 Rational Voters and the Political Budget Cycle

We now turn to modeling the behavior of voters, which in the main model was captured by the two numbers  $\Delta$  and  $b$ . Here our principal goal is provide a rational-voter model where  $\Delta$  is endogenous *and positive*. This does not seem a stringent requirement—it is natural that the party should be more likely to be elected if it is successful at providing public projects. The model we offer is a “political budget cycle” model along the lines of Rogoff (1990), in which the public projects are provided *before* the election. We choose this model because we want our results to speak to the allocation of the political budget cycle across municipalities, an allocation we study empirically in Section 8 below.

A detailed description and analysis of the model with strategic voters is deferred to Appendix C. Here we offer just a sketch.

**Sketch of the model** Voters live for two periods in an overlapping generation model. When young, voters are uncertain about the size of the party faction in their state, and so they start out with a prior which, in steady state, is given by equation (4). If they do not receive the public project, voters believe that their faction is not that powerful and thus re-elect the party with probability of only  $b$ . If voters receive the public project, they update positively on the size of their faction, and thus they become more willing to vote for it because they realize that a strong faction is valuable in the future (it will continue to bring in pork). In this case, they re-elect the party with probability  $b + \Delta$ .

**Brief discussion of the model** The key element of the model is that voters are not perfectly informed about the power of their candidate’s faction. This seems reasonable, since in reality the power of a faction is impermanent and it is determined by opaque intra-party patron-client relationships. Voters are unlikely to know much about this. Anecdotal evidence supports the view that voters are imperfectly informed of the power of the candidate to deliver pork spending. Curtis (1992, p. 228),<sup>32</sup> for example, writes:

“[T]he stress [of the electoral candidate] is on constituency service to convince voters that the candidate has the clout in Tokyo to bring the district new roads and bridges, industrial development, and higher living standards.”

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

### 8.1 Outline

In this section we illustrate predictions of the factional model with a case study of water infrastructure spending in Mexico. We do not observe Mexican factions (*camarillas*) directly. Instead we look for their telltale effects on the allocation of public resources and promotion patterns in the ruling party (at the time, the PRI). Using newly coded panel data on the number of connections to public water grids collected from several hundred Mexican municipalities we estimate regressions to:

#### Document a “political budget cycle”

- There is a substantial spike in the number of new connections to the water grid in governor’s election years.

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<sup>32</sup>Cited from Scheimer (2005), p. 807.

We then study the distribution of this political cycle across municipalities and:

### Find a party stronghold premium

- As predicted by the model, the cycle appears only in municipalities with governors from the ruling PRI. Municipalities represented by governors from opposition parties (and thus are assumed to have no factional power) appear to have no cycle.
- Moreover, the cycle appears only in PRI *strongholds*. The beneficiaries of cycle spending are municipalities that have long supported the PRI and/or elected PRI governors by wide margins.

### Find political careers predict the resource allocation

- Cycle expenditure is positively correlated with measures of *camarilla* strength. As predicted by the model, the cycle disproportionately favors constituencies represented by politicians who are later promoted in the PRI.
- Indeed, we find some evidence that, as predicted by the model, conditioning on this measure of *camarilla* strength “explains” the stronghold premium.

Thus the empirical analysis indicates this budget cycle systematically favors some municipalities over others – and the cross-sectional distribution of the benefits is distinctively consistent with our model of factional competition.

## 8.2 Mexico as a Testbed for the Factional Theory

During the period of our sample, Mexico had several characteristics that make it a natural setting for illustrating our model.

1. Mexico had a highly centralized state with a powerful party (the PRI) that exercised a great deal of control over expenditures by lower levels of government.<sup>33</sup> 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. As there are no opposition parties dispensing funds, the allocation of resources should be expected to have the properties described in Proposition 7.

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<sup>33</sup>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.

2. Support by officials of ranks below the nominee’s proposed position was very important for promotion in the PRI, and often formally required.<sup>34</sup>
3. *Camarillas* were widely understood to be essential to success in politics.<sup>35</sup>

### 8.3 Quantitative Evidence and Interpretation

Our data include a balanced panel of the number of potable water (inlet) and sewage (outlet) connections to public networks in 463 municipalities, collected annually from 1994-2001.<sup>36</sup> To avoid confounding the effects of *camarillas* with other determinants of the number of connections in a municipality, we estimate models of annual changes in connections per capita, and thus difference out fixed municipality effects; we also allow municipality-specific, linear time trends and condition on several demographic variables described below. Finally, we focus on “political budget cycles,” spikes in government expenditure in election years.<sup>37</sup> Concentrating on this form of expenditure has the advantage of isolating the discretionary, pork-barrel spending that is the focus of distributive politics models.

More precisely, our regressions take the following form:

$$\Delta y_{m,t} = \alpha_0 + \alpha_1 E_{m,t} + \alpha_2 E_{m,t} \cdot Z_m + \mathbf{X}_{m,t} \boldsymbol{\alpha}_3 + \gamma_m + \lambda_t + \varepsilon_{m,t}$$

where  $\Delta y_{m,t}$  is the annual change in the number of water network connections per capita in municipality  $m$  in period  $t$ ;  $E_{m,t}$  is an indicator for a state governor’s election;  $\mathbf{X}_{m,t}$  is a vector of time-varying demographic variables;  $\gamma_m$  is a fixed municipality-specific effect,  $\lambda_t$  is a time-specific effect common to all municipalities; and  $\varepsilon_{r,t}$  is the error term. We first document the average budget cycle by showing  $\alpha_1 > 0$ , when  $\alpha_2$  is restricted to equal zero.

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<sup>34</sup>The appointment of a minister, vice-minister, party president or general secretary, or director of a state-owned company required 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. 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 statutes in 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.”

<sup>35</sup>Camp (2003, p. 117) writes, “[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).

<sup>36</sup>Appendix D provides further information about the data and the institutional backdrop in Mexico.

<sup>37</sup>See, e.g., Rogoff (1990), Persson and Tabellini (2000), and Shi and Svensson (2006). Drazen (2000) provides a survey on political cycles.



Variables	(1)	(2)
	Change in inlets per capita	Change in outlets per capita
Governor's election in $t$	0.0072** (0.00311)	0.0022 (0.00304)
Demographic controls	Yes	Yes
Municipality dummies	Yes	Yes
Year dummies	Yes	Yes
No. of Obs.	3,241	3,241
Adjusted $R^2$	0.448	0.233

Table 1: Regression of the Annual Change in Water Connections per Capita on an Indicator for Governor's Election.

NOTE: Dependent variables are, in column (1), the annual change in inlets (potable water connections) per capita and, in column (2), the annual change in outlets (sewage network connections) per capita. Demographic controls are listed in the Data Appendix. Robust standard errors clustered at the municipality level are in parentheses. \*\* denotes significance at 5% level.

Then we study the distribution of the cycle across municipalities by interacting the indicator of an election ( $E_{m,t}$ ) with various (fixed) characteristics of the municipalities,  $Z_m$ .

On average across municipalities, we find an economically and statistically significant cycle in spending associated with state governor elections. The estimates in Column 1 of Table 1 indicate that years in which a governor's election is held, the change in water inlets per capita is, on average, 0.0072 higher. This represents an increase of 125% above the average annual change, or approximately \$US 44 million in additional expenditure in these municipalities.<sup>38</sup> Column 2 of Table 1 presents analogous results for spending on water outlets (connections to a public *sewer* network). We find no evidence of a cycle in this form of infrastructure spending.<sup>39</sup>

To study the distribution of the political cycle, we interact the indicator of a governor's election with (fixed) characteristics of the municipalities. In Table 2, we first allow the relationship between the governor's election and water service provision to depend on the party affiliation of the incumbent governor. Consistent with Proposition 7, part e, the results in column 2 of Table 2 indicate that the political budget cycle in this form of spending appears only in those states where the incumbent governor is from the PRI. In PRI-governed state the election is associated with an additional .0077 inlets per capita. In the states where the

<sup>38</sup>These results are consistent with the findings in Gonzalez (2002) of a sizeable political cycle in infrastructure spending and are robust to the inclusion of controls for municipal and congressional elections, and their interactions. Those estimates are available from the authors upon request.

<sup>39</sup>Anecdotal evidence suggests that outlets hold less appeal for voters (septic fields and outhouses are relatively easy for private owners to construct). Moreover, engineering considerations make the provision of an inlet less expensive and time consuming, on average.

governor is a member of an opposition party,<sup>40</sup> and thus according to the model the district’s faction is size zero, summing the first two coefficients indicates there is no additional spike in spending in the year of the election.

Column’s 3 and 4 of Table 2 evaluate other dimensions of the model’s stronghold spending predictions. Consistent with Proposition 7 part a, the point estimates in these columns indicate that municipalities with higher  $b$ ’s as measured either by uninterrupted support for PRI candidates (column 3) or by wide margins of victory for the PRI (column 4) are most favored by this form of political spending. While, especially in the case of the measure of uninterrupted support, the coefficients are somewhat imprecisely estimated, they imply that indicators of high  $b$ ’s “explain” the previous finding that only municipalities represented by PRI governors benefit from the cycle spending. It isn’t merely that these governors are members of the ruling party it’s that they represent PRI strongholds.

Finally, we allow the relationship between the governor’s election and water service provision to depend on even more direct measures of *camarilla* strength. In columns 5 and 6 of Table 2, we present 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.<sup>41</sup> Consistent with Proposition 7, part c, spending in time  $t$  predicts the later political success of the incumbent governor at time  $t$ . The incumbent PRI governors whose constituents most benefited from cycle spending in the year they left office are the governors who go on to hold higher positions in the party – an indicator of membership in a powerful *camarilla*. Pushing the model’s predictions further still, we find mixed evidence that, consistent with Proposition 7, part e, conditioning on this measure of *camarilla* strength eliminates the party stronghold (large  $b$ ) effect. In column (5), the model’s prediction holds; conditioning on the future success of the incumbent governor “explains” why municipalities with long-standing support for the PRI are favored by political spending. In column (6), controlling for this measure of faction size weakens the positive relationship between the PRI margin of victory and the cycle size, but does not eliminate it.

All of our estimates include controls for the level of poverty in the municipality. Thus, the findings that party strongholds and the constituents of strong *camarillas* benefit from the cycle, do not appear to reflect the relative needs of those municipalities. Similarly, in results not presented here, we find no evidence that the municipalities favored by the political cycle in spending are those with particularly high turnout in governors elections.

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<sup>40</sup>During this period, the opposition is largely from the right-of-center Partido Acción Nacional (PAN). Of the municipalities in our data represented by opposition party governors, 90% (507) are represented by PAN governors, while 10% (54) are represented by a Partido de la Revolución Democrática (PRD) governor.

<sup>41</sup>The positions identified with later success include minister, vice-minister, senator, federal deputy, party 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.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Governor's election in $t$	0.0072** (0.0031)	0.0077** (0.0038)	0.0017 (0.0025)	0.0020 (0.0019)	0.0015 (0.0025)	-0.0041 (0.0026)
Governor's election × opposition in office in $t$		-0.0058 (0.0047)	-0.0006 (0.0034)	-0.0067 (0.0051)	-0.0004 (0.0033)	-0.0001 (0.0033)
Opposition in office in $t$		-0.0011 (0.0040)	-0.0031 (0.0042)	-0.0015 (0.0040)	-0.0033 (0.0042)	-0.0040 (0.0040)
Governor's election × state w/o alternation in $t$			0.0075* (0.0047)		-0.0023 (0.0022)	
Governor's election × non-competitive election in $t$				0.0108** (0.0054)		0.0088** (0.0045)
Governor's election in $t$ × successful PRI governor in $t$					0.0196** (0.0085)	0.0177** (0.0079)
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	3,241	3,241	3,241	3,241	3,241	3,241
Adjusted $R^2$	0.448	0.448	0.448	0.448	0.448	0.449

Table 2: OLS Regression of the Annual Change in Inlets per Capita, by Electoral Factors

NOTE 1: The dependent variable is the annual change in inlets (potable water connections) per capita.

NOTE 2: Variable Defintions: A state has not experienced an alternation in the governorship at  $t$  if the PRI has won all elections up to time  $t$ . A state faced a non-competitive election in  $t$  if the winner-second ratio is larger then the median of our sample (1.28). Demographic controls are described in the Data Appendix. Robust standard errors clustered at the municipality level are in parentheses. \*, \*\* denote significance at 10% and 5% level, respectively.

Variables	(1)	(2)	(3)
Ratio of winner-second voting shares in election $t - 6$	-0.0173 (0.0114)		-0.0132 (0.0126)
Ratio of winner-second voting shares in election $t$		0.3383 (0.2977)	0.2787 (0.3299)
Fraction PRI Municipalities in $t - 1$			-0.1273 (0.6703)
Fraction PRI Municipalities in $t - 7$			-0.1146 (0.3642)
Constant	0.4147*** (0.1034)	-0.1635 (0.4148)	0.1933 (0.8516)
No. of Obs.	31	27	27
$R^2$	0.073	0.049	0.109

Table 3: Linear Probability Model of Governor’s Promotion

NOTE: The dependent variable is an indicator for the future success (promotion) of an incumbent governor. Fraction PRI Municipalities measures the fraction of municipalities in the state with PRI mayors in office. Standard errors, robust to heteroskedasticity, are in parentheses. \*\*\* denotes significance at the 1% level.

Another interpretation of results linking incumbent promotion and the size of the cycle is that is that these 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, Table 3 relates later success in the party to the vote share won by the incumbent himself (in the previous election), and by his successor.<sup>42</sup> 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 Table 3 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. This this finding is unchanged if, as in Column 3, we condition on measures of historical party support in the state (the fraction of municipalities with a PRI mayor in office); we find no evidence that later successful governors were particularly talented vote-getters. This too is consistent with our model of factional competition, particularly with Proposition 7, part d.

These results leave open the possibility that some unobserved variable unrelated to factions affects the governor’s ability to deliver resources, and increases his likelihood of promotion, but is unrelated to his vote-getting ability. Overall, however, we view these results on water

<sup>42</sup>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.

infrastructure spending in Mexico as supportive of the factional model. As important, in our view, the preceding analysis offers a template for using the factional model to make novel and testable predictions about readily available data.

## 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, both static and dynamic, about the allocation of local and global public goods. 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 is distributed broadly across the party. In equilibrium, those who hold power coalesce into party factions, which become the sources of *actual*, as opposed to *formal*, power to procure public resources. In our model, elections and the internal party organization are seen as a system of “incentives for (informal) teams” (in our case, factions).

The allocation of resources in a factional equilibrium is different from that obtained in other models of distributive politics. Of particular note is the factional model’s predicted bias in favor of party strongholds, a bias has been reported in many empirical studies of cross-sectional resource allocations. We do not claim that factions are the only source of stronghold premium. Rather, the point is that factions will accentuate that bias, and generally distort the allocation of resources above and beyond the formal rules of the party and the political system.

We view this paper as an initial foray into a promising new field of “political personnel economics.” The premise in this paper is that parties are not unitary actors, but rather aggregations of politicians each using public resources to further his own career. If that is right, then to understand resource allocation it becomes crucial to study intra-party career incentives. Just as personnel economics has delivered important new insights by looking at intra-firm incentive schemes, we expect that the rules of party organization, and the careers of individual political personnel, will prove to be important factors in predicting the allocation of public resources. We hope much work will be done along those lines.

# Appendices (NOT FOR PUBLICATION)

## A Competition among large number of factions

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  $i$  receives the public good depends on both effort and luck; specifically, the  $qN$  factions with the greatest influence  $r_i$  receive the public good, where

$$r_i = u_i + (1 - \alpha) \sum_{r=0}^S (\alpha)^r e_r.$$

Here  $u_i$  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  $e_r$ . The element  $e_r \geq 0$  represents the effort put in by state- $i$  faction member  $r$ .  $S$  is the size of the faction at time  $t$ .

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

$$\begin{aligned} \Pr(r_i \geq \underline{I}) &= \Pr\left(U \geq \underline{I} - (1 - \alpha) \sum_{r=0}^S (\alpha)^r e_r\right) \\ &= \frac{3}{2} - \frac{\underline{I} - (1 - \alpha) \sum_{r=0}^S (\alpha)^r e_r}{2}. \end{aligned}$$

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  $i$  is given by

$$\Pr(g_t = 1) = i + \frac{1 - \alpha}{2} \sum_{r=0}^S (\alpha)^r e_r, \tag{A1}$$

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

## B Uniqueness of factional equilibrium

In this section we provide results about the uniqueness of factional equilibrium. In order to characterize the set of equilibria when network members have veto power (part b. in Proposition 4 below), we need to define formally how veto power is assigned in general networks which may not be factions. To this end, let us append an additional action to our game. We assume that, after party officers of rank  $k$  declare whom they support for promotion, if a member of a state- $s$  network worked for the same state in the previous period, that member has the power to veto each of the other rank- $k$  member(s) of the network (if any). Vetoed members cannot be supported by rank- $(k - 1)$  members.

### Proof of Proposition 4

**a.** In equilibrium, no officer will switch from faction  $\varphi$  to faction  $\varphi'$  if he is going to be the highest ranking member in faction  $\varphi'$ . Consider a putative equilibrium where more than one member of a given rank is supported, and consider the decision problem of a rank-1 officer at the time when all ranks above 1 have pledged their allegiances. Let us compare all the possible networks under the assumption that exactly one rank-1 member joins each. Pick the one that has the highest probability of survival. No member could hope to have a higher level of utility than that afforded by that network. The officer who worked for that network in the previous period, if there is one, can guarantee himself that level of utility by declaring for that network (due to Lemma 3 and Assumption A1). In this case only one officer will declare for that network, and it will be the officer who worked for it in the previous period. If there is no such officer, then that place cannot be occupied by someone who did not work in that state in the previous period because they would not be able to select a rank-0 officer. By induction, we can extend this argument to the second, third, etc. most desirable networks which have an officer of rank 1, and we have shown that in any equilibrium all rank-1 officer in equilibrium will declare for the state they chose in the previous period. By induction, this argument extends to all ranks above 1, and it shows that at every rank every officer will declare for the state they chose in the previous period.

**b.** Consider then the decision problem of a rank-1 officer at the time when all ranks above 1 have pledged their allegiances. In equilibrium, whatever the allocation of rank-1 officers across networks, if a member could veto all others in his network, by Lemma 4 he would do so. Let us compare all the possible networks under the best-case scenario that only one rank-1 member joins each. Pick the one that has the highest probability of survival. No member could hope to have a higher level of utility than that afforded by that network. The officer who worked for that network in the previous period can guarantee himself that level of utility by declaring for that network and vetoing all other members. So only one officer will declare for that network, and it will be the officer who worked for it in the previous period. The rest of the proof follows part a. ■

## C Rational Voters Model

**Dominant party** The dominant party controls the federal bureaucracy, so only politicians belonging to the ruling party can choose to provide public goods to a state.

**Citizens** 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.

**Information** Faction members know 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  $\pi_t(s)$  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  $\pi_t$ .<sup>4344</sup>

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<sup>43</sup>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.

<sup>44</sup>It is natural to 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 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.



## C.1 Voters' Behavior in a Stationary Equilibrium

In this section we look for a stationary (time invariant) equilibrium of the game. In such an equilibrium, young voters enter each period with a belief  $\pi_t = \pi$  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  $\pi_{t+1}$  must be consistent with  $\pi_t$  and the promotion probabilities induced by the equilibrium effort of party members. In such a stationary equilibrium, a faction member at position  $r$  exerts the same level of effort in every period (that level is not the same, of course, across faction members).

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.<sup>45</sup>

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  $E_{\pi_t}(g_{t+1}|g_t, \text{party gov. wins at } t)$ . If he votes for the opposition he gets  $a_t$ .<sup>46</sup> At the stationary equilibrium  $\pi_t = \pi$  and so a voter chooses the party if

$$\begin{aligned} a_t &\leq E_{\pi}(g_{t+1}|g_t, \text{party candidate wins at } t) \\ &= \Pr_{\pi}(g_{t+1} = 1|g_t, \text{party candidate wins at } t) \\ &= E_{\pi}\left((1 - \alpha) \sum_{r=0}^{S_t+1} \alpha^r e_r^* | g_t\right) \end{aligned}$$

$B$  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,

$$\begin{aligned} B &= \Pr[a_t \leq E_{\pi}(g_{t+1}|g_t = 1, \text{party candidate wins at } t)] \\ &= F\left(E_{\pi}\left((1 - \alpha) \sum_{r=0}^{S_t+1} \alpha^r e_r^* | g_t = 1\right)\right). \end{aligned} \tag{C2}$$

Analogously,

$$b = F\left(E_{\pi}\left((1 - \alpha) \sum_{r=0}^{S_t+1} \alpha^r e_r^* | g_t = 0\right)\right). \tag{C3}$$

<sup>45</sup>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  $g_t$ .

<sup>46</sup>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.

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. We now show formally that  $B \geq b$ .

**Lemma 5** *for any  $\pi$ ,  $B \geq b$*

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

$$\begin{aligned} \pi(s|1) &= \Pr(S_t = s|g_t = 1) \\ &= \frac{\Pr(g_t = 1|S_t = s) \Pr(S_t = s)}{\sum_{j=1}^{\infty} \Pr(g_t = 1|S_t = j) \Pr(S_t = j)} \\ &= \frac{[\sum_{r=1}^s \alpha^r e_r^*] \pi(s)}{\sum_{j=1}^{\infty} [\sum_{r=1}^j \alpha^r e_r^*] \pi(j)} \end{aligned}$$

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

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

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

$$\beta(S) = (1 - \alpha) \sum_{r=0}^{S+1} \alpha^r e_r^*.$$

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

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

## C.2 Existence of equilibrium

At any equilibrium of the rational voters game equations (3), (C2) and (C3) must hold. Putting them together yields

$$c'(e_r^*) = \left[ \begin{array}{l} F \left( E \left( (1 - \alpha) \sum_{r=0}^{S_t+1} \alpha^r e_r^* | \pi, g_t = 1 \right) \right) \\ -F \left( E \left( (1 - \alpha) \sum_{r=0}^{S_t+1} \alpha^r e_r^* | \pi, g_t = 0 \right) \right) \end{array} \right] (1 - \alpha) \alpha^r. \quad (\text{C4})$$

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  $r$  we need to find pairs  $(e_r^*, \pi)$  that solve the equation and such that  $\{e_r^*\}$  generates  $\pi$ .

Let us start by showing that for any given vector  $\{e_r\}$ , there exists at least one pair of numbers  $\bar{B}, \bar{b}$  such that the  $\pi$  generated by  $\{e_r\}, \bar{B}, \bar{b}$  solves (C2) and (C3).

Start with arbitrarily chosen  $B_0, b_0$ . Let  $G : [0, 1]^2 \rightarrow \Delta^\infty$  denote the generating process, and denote  $\pi_0 = G(B_0, b_0)$  the probability distribution generated by  $B_0, b_0$ . Now plug  $\pi_0$  into expressions (C2) and (C3); to obtain the pair  $B_1, b_1$ . We can formalize this process as feeding  $\pi_0$  into a function  $H : \Delta^\infty \rightarrow [0, 1]^2$ . 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  $\bar{\pi} = G(\bar{B}, \bar{b})$  solves (C2) and (C3).<sup>47</sup>

Let us call  $\bar{B}(e_1), \bar{b}(e_1)$  the set of fixed points associated with  $\{e_r\}$ . Note that if the vector  $\{e_r\}$  is an equilibrium then it is appropriate to use the first element of the vector only, since the entire vector  $\{e_r\}$  is completely determined through equation(C4) once its first element  $e_1$  is known. Equation (C4).can now be written as

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

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 5). Thus, for  $c(\cdot)$  sufficiently convex we are ensured that an equilibrium with positive effort exists.

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<sup>47</sup>Thanks to Ennio Stacchetti for pointing out the fixed point argument.

## D Empirical Appendix

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

### D.1 Institutional Backdrop

Water services and infrastructure are central issues in Mexican politics. Large fractions of the population have no connection to a potable water network and 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. 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 representatives of private investors.

Investment spending by these companies is substantial and supported largely by Federal and State funds. Data from the National Water Commission (CNA)<sup>48</sup> indicate that, on average, 76% of water services investment was funded by Federal and State sources between 1991 and 2001. The remainder of the investment 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.

### D.2 Data

We use three data sets in our quantitative analysis. The first is newly coded data from CNA reports. It contains annual (calendar year) information on the number of drinking water (inlets) and sewage 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 demographic data from

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<sup>48</sup>National Water Commission, Report on the Situation of Potable Water, Sanitation and Sewerage 2001.

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, for which 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.

### D.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.

We focus on the change in water services provision during governor’s election years. With very few exceptions, governor’s elections are held every 6 years typically in the second half of the year. Governor’s elections are fairly evenly distributed across municipalities and years in our data.<sup>49</sup> Table E.1 presents summary statistics of the panel data. The demographic controls included in our regressions are: population density and its square, the population growth rate, and the fraction of workers earning less than the minimum wage. Table E.1 also presents a simple comparison of the average change in inlets per capita in and out of governor’s election years. There is 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.

## D.3 Robustness of Estimates

Our results regarding the budget cycle in water services are robust to several alternative specifications. For example, our estimates are qualitatively similar if we drop demographic variables and year effects. The same applies if we include controls for mayoral, and congressional elections and their interactions. It is, however, important to include a municipality-specific linear trend. We would expect communities to experience different rates of growth

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<sup>49</sup>We observe a governor’s election in 611 municipalities (with some repeats). This amounts to an average of 76 municipalities voting in a governor’s election, per year in our data with a high of 162 in 1998 and a low of 0 in 1996.

Variables	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	-1.5667	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	442.6	67.1	1563.9	0.8	17772.3	
Winner-second ratio, gov.'s election	539	1.39	1.28	0.31	1.02	2.06	
Party of incumbent gov. PAN=1, PRI=2, PRD=3, Other=4	3704	1.89	2.00	0.39	1.00	4.00	
		Years w/o Gov.'s Elections			Years w/ Gov.'s Elections		
		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 D1: Summary Statistics of the Panel Data, 1994-2001

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 cycle variables lose it.

The errors are assumed to be independent across municipalities but not within them. One may be concerned 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.

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