ESSAYS ON THE POLITICAL ECONOMY OF THE CENTRALIZED PROVISION OF LOCAL PUBLIC GOODS

by

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This thesis explores the political economy aspects of the provision of local public goods by higher levels of government.

Chapter 1 focuses on local public goods as instruments for special interest politics at the supra-local level, with an emphasis on public infrastructure. To capture the implications of long-run relationships between political parties and their loyal supporters, I set out a dynamic probabilistic voting model which predicts that the geographic pattern of spending depends on the way the government balances long-run 'machine politics' considerations with the more immediate concern to win over swing voters. To assess the empirical relevance of both forces, I analyse rich data on road spending from a panel of electoral districts in Québec. Empirical results exploiting the province’s linguistic fragmentation provide robust evidence that partisan loyalty is a key driver of the geographic allocation of spending.

Chapter 2 proposes a theoretical framework to analyse the coexistence of multiple tiers of government in local public good provision. I study the effects of such partial decentralization on accountability using a two-period political agency model, in which two levels of government are involved in public good provision and voters are imperfectly
informed about each government’s contribution to the public good. The model predicts that the net effect of a departure from complete centralization (or decentralization) balances the benefits of vertical complementarity against the loss of accountability following from imperfect information and detrimental vertical interactions.

Chapter 3 investigates the impact of partial decentralization on local electoral accountability in the context of California’s school finance system. I exploit the peculiarities California’s school finance system and the federal No Child Left Behind Act of 2001 to estimate the extent to which politicians are punished or rewarded for observed policy outcomes, and how this channel is affected by the degree of centralization. Results show that voters are responsive to differences in dropout rates and pupil-teacher ratios, and that incumbents are less likely to be reelected when a district’s degree of centralization is high. Increased federal involvement after 2001 is associated with sharper local electoral accountability.
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Introduction: The Political Economy of the Centralized Provision of Local Public Goods

The classic theoretical treatment of pure public goods abstracts from politics: a Samuelsonian social planner makes allocation decisions dispassionately pursuing the social optimum. Similarly, Tiebout’s (1956) efficiency result on local public goods provision, which follows from mobility across local jurisdictions, is derived in a ‘politics-free’ framework.

However, most public goods do not correspond to the polar cases studied by Samuelson (1954) or Tiebout. For example, public infrastructures such as roads generate localized benefits (in contrast with Samuelson) but are generally not provided by local governments (in contrast with Tiebout). Similarly, public education is a local public good in which higher levels of government, such as provinces or states, tend to be heavily involved. As opposed to the canonical example of national defence, a centrally-provided pure public good, public infrastructure and public education are best described as ‘centrally-provided local public goods.’

While the local provision of local public goods may be fruitfully studied in a Tiebout-style politics-free framework, the centralized provision of local public goods cannot. To
study centrally-provided local public goods, one necessarily needs to take the political process seriously.\textsuperscript{1} In the case of centralized provision, mobility across local jurisdictions is not sufficient to achieve efficient provision. Central governments face inescapable political constraints that impinge on the decision process.

Understanding how political considerations affect policymaking lies at the heart of the ‘new political economy’ research agenda, with governments’ incentives to select policies that target specific groups – often defined along geographic or ethnic lines – for political purposes attracting particular interest.\textsuperscript{2} This thesis contributes to this literature, both theoretically and empirically, by studying the joint consequences of two key features of the centralized provision of local public goods:

1. Local public goods are a privileged instrument for special interest politics at the central level; and

2. Local public goods are typically provided by a hierarchy of political offices.

Chapter 1 focuses on the first of these features, abstracting from the role of multiple political offices. It studies how electoral considerations may distort the geographic allocation of centrally-provided local public goods. The chapter’s theoretical contribution is to introduce a dynamic component in a simple distributive politics model with probabilistic voting and office-seeking politicians, in order to capture the role that local public goods play in fostering long-run partisan loyalties between politicians and voters. In a nutshell, Chapter 1 seeks to answer the following question: Does the “road to power” involve catering to swing districts, or nurturing long-run relationships in loyal districts?

Still within the framework of a dynamic political economy model, Chapter 2 introduces a second level of government also involved in the provision of the local public good.

\textsuperscript{1}See Knight (2004) for an excellent discussion.

\textsuperscript{2}See Besley (2007) and Persson and Tabellini (2000) for discussions of the field’s contours.
Both office-seeking and rent-seeking governments are considered, in the context of probabilistic and ‘deterministic’ elections alternately. The so-called ‘political agency’ model of this chapter highlights the potential costs and benefits of shared responsibility among levels of government in the provision of local public goods. On the costs side, ‘electoral accountability’ in such a context presents voters with the complex task of assessing the respective role of each level of government in the policy outcomes that they observe. On the benefits side, shared responsibility allows the public sector to exploit complementar-\-\-\-ies in the production function. Chapter 2 asks the following question: What are the net welfare consequences of an “intertwined federalism” system characterized by shared expenditure responsibility in local public good provision?

In the context of a hierarchy of political offices, Chapter 3 focuses on the electoral accountability channel outlined in Chapter 2. While the distributive politics model of Chapter 1 is essentially concerned with the causal link flowing from electoral considerations to policy outcomes, Chapter 3 studies the opposite causal relationship – with policy outcomes shaping electoral outcomes. Electoral accountability relies on the electorate’s ability to attribute the responsibility of policy outcomes to the politicians they are called upon to reelect, a channel likely to be affected by the intensity of the involvement of higher tiers of government in a given policy area. While the analysis of Chapter 2 suggests that electoral accountability should be stronger when responsibilities are clearly assigned to one political office, the involvement of higher tiers of government is often associated with policies specifically designed to improve local accountability (one instance of beneficial complementarity in local public goods production). The analysis of this last chapter revolves around the following question: Are politicians at all levels of government “sharing the blame” for bad policy outcomes?

The argument of this thesis is supplemented by two empirical applications. Chapter
1 presents an empirical application to public spending on roads, the canonical example of a centrally-provided local public good. Because they yield durable and visible benefits to voters, public infrastructure expenditures are an attractive instrument for politicians to build enduring electoral support in their constituencies. In this particular application, road spending in the Canadian province with the largest land mass, Québec, is under the sole responsibility of the provincial government. By contrast, spending on K-12 education in California – the second empirical application, introduced in Chapter 3 – exhibits shared responsibility between school boards, the State and the federal government. The fact that school districts are single-purpose governments makes public education a unique laboratory to study electoral accountability in the context of a hierarchy of political offices.

Together, the results from these two empirical applications lend support to the central claim of this thesis: politics plays a central part in the centralized provision of local public goods. And as a consequence, politics belongs at the heart of the new economic theory of public goods.
Chapter 1

The Road to Power: Partisan Loyalty and the Centralized Provision of Local Infrastructure

“... the new road turns from pavement into gravel

(‘Must’ve elected the wrong guy last time around,’ David says...)”
– Margaret Atwood, *Surfacing*, 1972, p. 18

1.1 Introduction

Public infrastructure is at the forefront of the public debate in many countries. This is especially true in North America, where the United States and Canada recently experienced tragic events that have put aging infrastructure under the spotlight. Following the deadly Minneapolis bridge collapse in the summer of 2007 and a similar event in Canada a year before, the popular press has been quick to make accusations about electoral
misallocation of road spending.\textsuperscript{1}

The main goal of this chapter is to examine whether the geographic allocation of infrastructure spending by higher tiers of government (e.g. provinces or states) is indeed distorted by electoral politics. Public infrastructures such as roads and bridges are durable and highly visible, two characteristics that are especially desirable from the point of view of politicians interested in securing the enduring support of their constituencies. Yet even though vote-catching behaviour is a recurring topic in the popular press, relatively little is known about the extent to which political considerations actually influence the allocation of infrastructure spending.

The existing theoretical literature on distributive politics (or special-interest politics), rooted in the Downsian modelling tradition, has focused largely on the incentive for politicians to favour pivotal voters, groups or regions.\textsuperscript{2} As shown by the considerable interest in ‘swing states’ during U.S. presidential campaigns, pivotal regions clearly attract a disproportionate share of political attention, and the empirical evidence suggests that this is indeed accompanied by a disproportionate share of campaign resources.\textsuperscript{3} It seems natural to expect that pivotal regions should also attract a disproportionate share of government resources more generally. However, evidence from the empirical literature on the geographic allocation of public spending is somewhat mixed in finding spending patterns that conform to the ‘swing voter’ view.\textsuperscript{4}

\textsuperscript{1}Thirteen people died on August 1, 2007, when a bridge of the Interstate 35W highway over the Mississippi River collapsed in Minneapolis, Minnesota (USA). On September 30, 2006, five motorists were killed in Laval, Québec (Canada), when a bridge over Highway 19 collapsed. Both events sparked debates about the politicization of infrastructure spending.

\textsuperscript{2}Following Downs’ (1957) seminal voting model, a series of ‘median voter theorems’ have been formulated, drawing attention to the decisive influence of the pivotal (or swing) voter on policy decisions. Similarly, a ‘swing voter’ view of pork-barrel politics has emerged as a standard prediction in formal models of distributive politics – see Lindbeck and Weibull (1987, 1993) for perhaps the most influential treatment.

\textsuperscript{3}See, for example, Strömberg (2008) on campaign spending in the United States.

\textsuperscript{4}While Cadot et al. (2006), Milligan and Smart (2005), Dahlberg and Johansson (2002), Schady (2000), and Stein and Bickers (1994) report evidence of swing voter patterns, others such as Francia and
Despite its intuitive appeal, the swing voter view overlooks one of the most enduring features of modern democratic societies, namely the fact that political parties engage in long-run relationships with their core supporters. For example, two-thirds of the U.S. population consider themselves to be either Democrat or Republican, and these partisan loyalties are known to evolve only slowly over time (see Green et al., 2002). Such stable electoral bases are crucial for major political parties to remain credible contenders in upcoming elections. For that reason, parties typically devote ongoing attention to their core supporters.

Since the core supporters of a political party are almost never pivotal voters – those who, by definition, tend to be close to indifferent between parties – political parties face a trade-off in the allocation of political favours. Although politicians have an incentive to direct spending towards electoral districts in which the marginal dollar spent is most likely to make a difference in terms of immediate electoral outcomes (i.e. in swing districts), the existence of long-term relationships between parties and constituencies provides an incentive for forward-looking incumbents to favour the districts that constitute their traditional electoral base, so as to secure their support in the future.

To formalize these conflicting incentives, this chapter extends a distributive politics model with probabilistic voting, an approach pioneered by Lindbeck and Weibull (1987, 1993), to account for the existence of long-run relationships between the incumbent government and loyal regions. In contrast with the static models typically used in the existing literature, I set up a two-period probabilistic voting model in which partisan loyalty exhibits some intertemporal persistence. In equilibrium, the allocation of spend-
ing is affected by two conflicting forces – the intensity of political competition in the short-run and the existence of long-run loyalty relationships – and the standard swing voter prediction may be reversed as long as future electoral support receives sufficient weight in the incumbent government’s decisions. Thus, the model predicts that both swing voter outcomes and what has been referred to in the literature as ‘machine politics’ outcomes can be observed in equilibrium. This implies that the expected geographic pattern of politically-driven public spending is essentially an empirical matter.

I assess the empirical relevance of both swing voter and machine politics forces by exploiting a rich data set on road expenditure by the provincial government in Québec, the Canadian province with the largest land mass. These data are disaggregated at the electoral district level and cover a ten-year period in the 1980s and 1990s. The empirical analysis contributes to a small but growing empirical literature interested in measuring the effect of local political competition on the geographic allocation of centrally-provided local public goods. I follow this literature in using a measure of election closeness to proxy for the intensity of local political competition. However, my empirical strategy also accounts for long-run partisan loyalties, a non-negligible side effect being the attenuation of a potential omitted variable bias in estimates of the effect of election closeness on expenditures. To capture the long-run dimension of partisan loyalty, I propose a novel way to identify safe districts as those that repeatedly vote for a given party.

The empirical strategy involves regressing policy outcomes on electoral outcomes, which gives rise to well-known endogeneity problems. The main identification challenge

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5See, for example, Dixit and Londregan (1996). Others, such as Larcinese, Snyder and Testa (2006), refer to machine politics outcomes as ‘partisan supporters’ outcomes.

6The recent contributions by Milligan and Smart (2005), Larcinese, Rizzo and Testa (2006) and Larcinese, Snyder and Testa (2006) are the closest, in many respects, to the present paper.

7Larcinese, Rizzo and Testa (2006), Larcinese, Snyder and Testa (2006) and Case (2001) are also interested in the role played by safe districts in the allocation of spending. However, their measures of ‘safeness’ do not exploit the dynamic nature of partisan loyalties.
is to disentangle the role of pork-barrel politics from the numerous non-electoral consider-
erations that drive the geographic allocation of government spending. To address this challenge, I exploit the linguistic fragmentation of the political environment in Québec, in addition to the time structure of the data.

A first opportunity to control for the potential endogeneity of political variables is provided by the distinctive linguistic pattern associated with partisan loyalty in Québec. A former French, then British colony, Québec is a linguistically divided society. Since the integration of the Province of Québec in the British Empire, linguistic divisions have had profound consequences for the political landscape. Local partisan loyalties today are still strongly correlated with the linguistic composition of local populations. When all differences between French and English regions that are relevant to the allocation of road spending are controlled for, the linguistic composition of electoral districts is plausibly exogenous to spending decisions and therefore can be used as an instrument for partisan loyalty.

In controlling for endogeneity, a second desirable feature of the data is its panel structure. Thus the empirical strategy can account for fixed, unchanging geographic determinants of government spending. The time structure of the Québec data also makes it possible to apply a difference-in-differences strategy, based on a change in government that occurred in 1994, comparing spending in loyal and non-loyal districts before and after that election. Previous studies had typically relied on cross-sectional data.\footnote{While Milligan and Smart (2005) and Larcinese, Rizzo and Testa (2006) use panel data, most existing studies rely on cross-sectional data – e.g. Stein and Bickers (1994), Case (2001), Dahlberg and Johansson (2002).}

The analysis provides robust evidence that partisan loyalty has played a key role in the geographic allocation of road spending in Québec in the 1980s and 1990s. The chapter’s main result is that road spending tended to favour electoral districts that are...
loyal to the party in power, especially close to elections. There is no consistent evidence that the parties in power have favoured swing districts.\textsuperscript{9} This indicates that machine politics spending patterns are a significant by-product of electoral politics – even more so, in this instance, than the swing voter patterns that have been the main focus of the existing empirical literature.\textsuperscript{10} That machine politics patterns dominate in the allocation of road spending is consistent with roads’ long-lasting character – arguably a desirable feature from the point of view of politicians who are interested in cementing long-run loyalty relationships with voters. Previous studies have tended to use data on either campaign spending or relatively small transfer programs – for example, Peru’s Social Fund in Schady (2000) or Sweden’s environmental grants to municipalities in Dahlberg and Johansson (2002).\textsuperscript{11} Unlike road spending, it is plausible to think that politicians would not perceive these expenditures to have sufficient long-term significance to be appropriate instruments for building enduring political support.

The chapter is organized as follows: In Section 1.2, I discuss the implications of a simple model of distributive politics which nests the swing voter and the machine politics views of distributive politics (the details of the formal model are presented in the Appendix). Section 1.3 describes the data used in the analysis and provides summary statistics. Section 1.4 reports some descriptive evidence. Baseline regression results are

\textsuperscript{9}The empirical strategy also sheds light on an alternative view of distributive politics which, in the legislative bargaining modelling tradition, highlights the ability of powerful politicians to bias the legislative agenda towards their own constituency. Empirical results do not support the prediction that cabinet ministers should attract a disproportionate share of spending.

\textsuperscript{10}Exceptions are the recent studies by Larcinese, Rizzo and Testa (2006), Larcinese, Snyder and Testa (2006) and Francia and Levine (2006), who find support for the machine politics view using aggregate state-level data to study the role of presidential politics in the geographic allocation of the US federal budget. Case (2001) also finds evidence of machine politics patterns in Albanian social spending.

\textsuperscript{11}Milligan and Smart (2005) study the allocation of regional development grants by the Canadian federal government. Although a portion of these grants are directed to local infrastructure projects, they serve a variety of other purposes, including transfers to businesses and operating subsidies to local development agencies. Thus, the fact that Milligan and Smart do not find evidence of strong machine politics patterns associated with these grants should not be unduly surprising.
presented in Section 1.5, with instrumental variables (IV) and difference-in-differences results presented in Section 1.6, and Section 1.7 concludes.

1.2 A Dynamic Model of Distributive Politics

In this section, I analyse the role of partisan loyalty in the context of a two-period probabilistic voting model.\footnote{Probabilistic voting models, in which voters are assumed to react ‘smoothly’ to government policies, are simple and convenient for studying government behaviour under electoral constraints. As a result, their use has become standard in the political economy literature and, more directly relevant to this paper, in models of distributive politics. Important contributions include Cox and McCubbins (1986), Lindbeck and Weibull (1987, 1993) and Dixit and Londregan (1996). For an extensive discussion of probabilistic voting models, see Persson and Tabellini (2000).} While existing models of distributive politics have typically been static, the long-run loyalty relationships that this chapter is concerned with are inherently dynamic. For this reason, I first extend to two periods a simple probabilistic voting model of distributive politics. I then use this dynamic framework to derive some implications of one particular form of district heterogeneity for the allocation of public spending across districts, namely their degree of loyalty to the ruling party. The predictions of this model shape the empirical strategy pursued in the remainder of the chapter.

1.2.1 The Two-District Case

Consider a simple model in which an incumbent government can affect its electoral prospects by allocating a fixed budget between two districts. For expositional purposes, one of the districts will be referred to as the ‘swing’ district (labeled with superscript \( j = s \)) and the other, as the ‘loyal’ district (labeled with superscript \( j = l \)). It is relatively straightforward to extend the analysis to more than two districts.\footnote{See Appendix 1.A.2 for a generalization of the model to a large finite number of districts.}

The model captures two key differences between swing and loyal districts. First, the
incumbent benefits from an ‘initial electoral advantage’ (which will be governed by the parameter $\gamma$) over its potential challengers in the loyal district; however, in the swing district, the incumbent has no advantage and the playing field is level. Second, any electoral advantage favouring the incumbent persists over time in the loyal district but not in the swing district (intertemporal persistence will be governed by the ‘persistence factor’ $\delta$). These two differences between the districts are captured formally by the following assumptions.$^{14}$

**Assumption 1:** $\gamma^l = \gamma \geq 0$ and $\gamma^s = 0$.

**Assumption 2:** $\delta^l = \delta \in (0, 1]$ and $\delta^s = 0$.

I consider the following timing of events:

1. At the beginning of period 1, the government allocates spending between the two districts such that
   
   $$e^l + e^s = \bar{e}, \text{ with } e^l, e^s \geq 0.$$ 

2. At the end of period 1, an election is held.

3. In period 2, a second election is held.$^{15}$

Public spending ($e^l$) and initial electoral advantage ($\gamma^l$) affect the incumbent’s prob-

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$^{14}$The results derived hereafter do not depend on $\gamma^s$ and $\delta^s$ being set to zero but rather on $\gamma^l \geq \gamma^s$ and $\delta^l \geq \delta^s$. However, $\gamma^s = \delta^s = 0$ is a convenient normalization. The positive correlation between $\gamma^l$ and $\delta^l$ implied by Assumptions 1 and 2 captures in a simple way the idea that a safe district today is also a district that is likely to deliver repeated victories in the future. This creates an incentive for the incumbent to invest in these districts to boost its future electoral fortunes. Appendix 1.A.2 provides a more flexible model in which $\gamma^l$ and $\delta^l$ may not be positively correlated.

$^{15}$Note that spending takes place only once, i.e. before election 1, and that the entire budget is assumed to be distributed in period 1. However, the spending allocation will have impacts in both periods through the political process. Any subsequent budget to be allocated in the future is abstracted from to simplify the analysis.
ability of being reelected in the period-1 election \( p^j_1 \) in district \( j \) in the following way:\(^{16}\)

\[
p^j_1 = \frac{1}{2} + F(\gamma^j + e^j) \quad \text{for} \quad j \in \{s,l\},
\]

where \( \gamma^j \geq 0, F' > 0, F'' < 0, 0 \leq F(e) \leq \frac{1}{2} \forall e \text{ and } F(0) = 0.\(^{17}\) In such a framework, the initial electoral advantage \( (\gamma^j) \) lends itself to an intuitive interpretation in terms of political competition. If \( \gamma^j \) is high, the incumbent benefits from having a strong advantage over her challengers, which corresponds to a situation involving low political competition. Conversely, if \( \gamma^j \) is low, the incumbent’s advantage is low, which leads to a high degree of political competition.\(^{18}\) Given the concavity of \( F \), the marginal effect of an increase in \( e^j \) is decreasing in \( \gamma^j \).

In the period-2 election, the probability of winning is determined as in (1.2), with the exception that the electoral advantage derived from \( \gamma^j \) and \( e^j \) is subject to some ‘depreciation’ over time:

\[
p^j_2 = \frac{1}{2} + \delta^j F(\gamma^j + e^j) \quad \text{for} \quad j \in \{s,l\},
\]

\(^{16}\)Obviously, factors other than the initial electoral advantage and public spending may affect reelection probabilities: for example, individual characteristics of politicians, characteristics of the local population, etc. Such undoubtedly important influences on local politics are abstracted from here in order to keep the exposition as simple as possible, but will be introduced in the empirics. See Appendix 1.A.2 for a discussion of the empirical implementation.

\(^{17}\)Similar concavity assumptions are adopted by Cox and McCubbins (1986), Lindbeck and Weibull (1993), and Dixit and Londregan (1996).

\(^{18}\)To simplify the exposition, the model does not consider districts in which challengers benefit from an electoral advantage (and such districts that are loyal to an opposition party). The reason for this omission is that the key trade-off of interest highlighted by the model is a consequence of some districts being loyal to the incumbent. From the point of view of the incumbent, the existence of districts being loyal to the opposition (i.e. sure losers) creates incentives that, if anything, reinforce the incentives associated with a high electoral advantage in favour of challengers. Introducing districts in which the electoral advantage favours challengers could be done in a relatively straightforward manner by allowing \( \gamma^j \) to take negative values and by altering equation (1.2) as follows:

\[
p^j_1 = \begin{cases} 
\frac{1}{2} + F(\gamma^j + e^j) & \text{if } \gamma^j + e^j \geq 0 \\
\frac{1}{2} - F(|\gamma^j + e^j|) & \text{if } \gamma^j + e^j < 0
\end{cases}.
\]
Consider an incumbent government that maximizes the expected number of seats that it holds, over the two periods (technical details on the incumbent’s problem can be found in Appendix 1.A.1). Assuming that the problem has an interior solution, spending in the swing district is given by the following first-order condition (spending in the loyal district is obtained residually):

\[ F'(e^s) = (1 + \beta \delta) F'(\gamma + \bar{e} - e^s) \]

where \( \delta \) is a discount factor \((0 \leq \delta \leq 1)\). The left-hand side of the equation is the marginal benefit of the last unit spent in district \( s \), and the right-hand side is the marginal benefit of spending in district \( l \) (which has a period-1 and a period-2 component) or, alternatively, the marginal opportunity cost of spending in district \( s \). In equilibrium, these two quantities must be equal.

### 1.2.2 Predictions

The key issue concerns which of the two districts should be expected to get more funding. The basic mechanism at work involves diminishing returns to spending, which follow from the concavity of \( F \). Because of diminishing returns, public spending is less productive in terms of period-1 marginal political support in the loyal district than in the swing district. Thus, the incumbent government has an incentive to direct more spending to the swing district – this captures, in a simple way, the standard ‘political competition effect’ that has been the focus of the prior literature, and is consistent with the swing voter view of distributive politics. This incentive is stronger the higher the initial electoral


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\[ \text{Box-Steffensmeier and Smith (1996) find empirical support for such a ‘law of motion’ for electoral support. Their estimates of } \delta^j (\text{in my notation}) \text{ are in the order of .7-.8, which is consistent with the interpretation of } \delta^j \text{ as a depreciation factor.} \]
advantage in the loyal district ($\gamma$). Proposition 1 formalizes this idea.

**Proposition 1 (political competition effect):** In a two-district setting, an increase in the initial electoral advantage of the incumbent government in the loyal district ($\gamma$) unambiguously increases equilibrium spending in the swing district (and decreases spending in the loyal district).

*Proof.* See Appendix 1.A.1.

The fact that political support persists over time in the loyal district leads to a second, opposing incentive for the incumbent government. As long as $\beta > 0$, the incumbent cares about the election to be held in period 2 and therefore values the support of the loyal district in the future. Spending in the loyal district is more valuable to the incumbent the higher the persistence factor in that district ($\delta$). *Ceteris paribus*, this ‘loyalty effect’ (formalized by Proposition 2) leads to more spending in the loyal district, consistent with the machine politics view of distributive politics:

**Proposition 2 (loyalty effect):** In a two-district setting, an increase in the persistence of political support in the loyal district ($\delta$) unambiguously reduces equilibrium spending in the swing district (and increases spending in the loyal district).

*Proof.* See Appendix 1.A.1.

Thus spending in the swing district is decreasing in the intertemporal link between elections in the loyal district (governed by $\beta$ and $\delta$) and increasing in the initial electoral advantage favouring the incumbent in the loyal district (governed by $\gamma$). For a more detailed discussion, see Appendix 1.A.1.
**Proposition 3:** Depending on the values taken by $\delta$, $\gamma$ and $\beta$, the two-district model has three types of equilibria:

(i) **Swing voter** equilibria: $e^{ss} > \frac{e}{2} > e^{ls}$

(ii) **Machine politics** equilibria: $e^{ls} > \frac{e}{2} > e^{ss}$

(iii) **An equal distribution** equilibrium: $e^{ss} = e^{ls} = \frac{e}{2}$.

**Proof.** See Appendix 1.A.1.

Spending will be higher in the swing district if the persistence of political support (in the loyal district) is relatively low and the initial electoral advantage (also in the loyal district) is relatively high, leading to the first type of equilibria. However, the standard swing voter view of distributive politics is reversed here if the government cares sufficiently about the future and if electoral support is sufficiently persistent in the loyal district, leading to the second type of equilibria. Note that the ambiguous result in Proposition 3 is a direct consequence of the time component in the government’s optimization problem: in the static case, i.e. the case in which $\beta = 0$, only the political competition effect is present and the swing district is always favoured.

### 1.2.3 Relation to the Previous Literature

Relative to existing theories, the main theoretical contribution of the chapter is the adoption of a dynamic perspective of distributive politics to study the role of partisan loyalty.\textsuperscript{21} The model shows that both swing voter and machine politics equilibria can

\textsuperscript{21}The dominance of static models in the political economy literature is reflected in the extensive survey by Persson and Tabellini (1999), which restricts attention to such models. However, at least since Alesina (1988), there is widespread acceptance of the idea that electoral politics is best thought of in a dynamic framework. More recently, influential dynamic political economy models have been developed by Besley and Coate (1998), explicitly extending the standard probabilistic voting model to a dynamic
arise in a dynamic context, whereas the static version of the model allows only for the former type of equilibrium.

This chapter is not the first attempt to rationalize both machine politics and swing voter equilibria in a probabilistic voting framework. Dixit and Londregan (1996) provide a static model in which both types of equilibria are possible. The feature that plays a central role in triggering machine politics equilibria in the Dixit and Londregan model is the lower cost that political parties face when delivering favours to their own support groups. This arises because the government has an informational advantage in loyal constituencies, for example because politicians know their supporters’ preferences better than those of citizens who are less loyal. While this assumption is plausible, a different route is followed here: the key effect of partisan loyalty is instead captured by loyal districts delivering enduring benefits to the incumbent government (vs. short-run benefits for swing districts).

Cox and McCubbins (1986) also propose a static probabilistic voting model in which machine politics equilibria can arise, but not swing voter equilibria. Their model predicts that spending in loyal constituencies is a less risky strategy to secure winning coalitions than spending in swing constituencies, and that loyal constituencies should therefore be favoured by risk-averse politicians. Studying loyalty building strategies in a dynamic framework permits the relaxation of this risk-aversion assumption. Machine politics outcomes can also arise if party leaders maximize not only their own welfare, as is typically assumed in this literature, but also their party members’ welfare. Adopting this perspective, the models developed in Besley (2005) and Besley and Preston (2007) environment, and by Persson et al. (2000), setting out a model of politics and public finance, mainly intended to study the role of different political institutions on public finance outcomes. The case for adopting a dynamic perspective in the analysis of the “theory of political failure” has recently been convincingly reasserted by Battaglini and Coate (2007), this time within the framework of a legislative bargaining model.
deal with the implications of a heterogeneous population of loyal and swing voters. In these models, the party in power maximizes the welfare of its members, leading to a bias in favour of core supporters. Spending targeted towards swing voters arises as an electorally-driven deviation from this pattern, whereas spending benefiting the loyal voters is not directly driven by an electoral motive. The model developed in this chapter differs in that it assumes a purely opportunistic (but forward-looking) government.\(^{22}\)

Although the empirical analysis that follows does not directly test for the relevance of one modelling approach over the others, the results presented hereafter support the theoretical perspective adopted in this section, drawing attention to the key role of long-lasting partisan loyalties.

### 1.3 Data and Summary Statistics

To assess the empirical relevance of the swing voter and the machine politics outcomes described in the previous section, I exploit rich data on the Québec government’s road expenditures in each of the province’s electoral districts. The expenditure data cover fiscal years 1986 to 1996, with the exception of 1991, when the data were not compiled by the Department of Transportation.\(^{23}\) There were 122 (provincial) districts before 1989,

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\(^{22}\)Theory suggests other mechanisms through which the centralized provision of local public goods might lead to inefficiencies. For example, legislative bargaining models such as the one proposed by Milligan and Smart (2005) draw attention to the role of politicians’ individual characteristics in their ability to attract public projects to their own constituency. Knight (2004) highlights the conflicting incentives of individual legislators to increase own-district spending and restrain the own-district tax burden, while Cadot et al. (2006) focus on the link between the productivity of public capital and influence activities by corporate lobby groups. For a comprehensive survey of the previous literature, see Persson and Tabellini (1999, 2000).

\(^{23}\)These figures have been produced using administrative data, internal to the Department of Transportation – Béland (various years). Aggregate figures may not match public accounts data. I refer to fiscal years as if they were calendar years, e.g. 1986 refers to the 1986-87 fiscal year. Publication of these data stopped after 1996.
and there has been 125 since then. The expenditure data set is merged with two other sources of data, used to construct district-level covariates. The first of these sources provides demographic and economic data on each electoral district. The second source of district-level data consists of official election results covering six general elections (1981, 1985, 1989, 1994, 1998 and 2003). Summary statistics on the variables used in the analysis are provided in tables 1.1 and 1.2, which I now discuss in detail.

### 1.3.1 Expenditure Data (Dependent Variable)

Table 1.1 documents the road expenditure data, which are used to construct the dependent variable in all empirical specifications. The average per district road expenditure was $4.84 million in 1986 (in 1992 Canadian dollars) and reached a peak of $5.85 million in 1992. In 1996, average expenditure had declined to $5.22 million. The maximum spending received by a single district varied from $20.75 million (in 1986) to $29.69 million (in 1987). Each year, a fraction of the ‘ridings’ – Canadian electoral districts – received zero or almost zero expenditure. The expenditure figures include direct expenditure by the Department of Transportation on the construction and maintenance of roads under its direct jurisdiction and transfers to municipal governments for road improvement. On average, construction expenditure represents 42% of total expenditure (with a low of 37% in 1987 and a high of 52% in 1995), the remainder being accounted

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24 Over the period covered by this study, some redistricting occurred but most changes to district boundaries have been minor. In these cases, it is straightforward to link old and new districts and no further adjustment to the data has been made. However, in some cases, either districts have been split or new districts have been created from existing districts. Thus, the number of cases varies from year to year. Another source of variation in the number of cases has to do with missing data points in the official publications, which generally relate to urban districts where expenditure is very small.

25 All expenditure and income figures are expressed in 1992 Canadian dollars using provincial CPI (data provided by the Institut de la statistique du Québec).

26 A closer look at the data reveals that, each year, roughly one fourth of the ridings receives essentially no spending. These ridings are typically the smallest urban districts.

27 Most roads in Canada are under provincial/municipal jurisdiction. Any direct federal spending on infrastructure is not included here.
for by maintenance expenditure.

1.3.2 District Characteristics

The following district characteristics are used in the analysis (see Table 1.2): the area covered by the district ($AREA^j$), the size of the population ($POP^j_t$), the share of the population living in urban areas ($URB^j$), the share of the population that is French-speaking ($FRENCH^j_t$), the number of manufacturing firms ($FIRMS^j$), the unemployment rate ($UE^j_t$), and the average household income ($INC^j_t$).\(^{28}\) The $AREA^j$ variable is the only one to which I apply a log transformation in order to account for the wide size discrepancy between some large northern districts and the average district. This transformation conveniently linearizes the relationship between expenditure and district geographic size. Perhaps with the exception of population size, the districts vary widely with respect to these characteristics. Whereas the smallest district was 3 km\(^2\) (an urban district), the largest was 343,390 km\(^2\) (a northern district). The average riding had a population of 52,242 in 1986, 55,237 in 1991 and 57,099 in 1996. The share of the population living in urban areas varies from 10% to 100% and the share of the population whose main language is French (a group which forms more than 80% of the province’s population) ranges between 13% to 99%. The unemployment rate varies between 5.3% and 48.9%, while the average household’s real income is $24,813 in the ‘poorest’ riding (in 1995) and $70,520 in the ‘richest’ (in 1985).

\(^{28}\) I obtained data on district characteristics from the Directeur général des élections du Québec, the body responsible for organizing elections in the province. The source is Directeur général des élections du Québec (various years). Most of these data come from special tabulations from the census and, hence, do not vary every year (see Table 1b for available years). Based on data availability, some of these variables are coded as time-invariant (they are $AREA^j, URB^j$ and $FIRMS^j$).
1.3.3 Election Data

Provincial politics in Québec, which is the focus of this chapter, operates in a first-past-the-post system and was essentially bipartisan over the period of interest: the ‘federalist’ Québec Liberal Party and the ‘independentist’ Parti Québécois (PQ) have alternated in power since 1970. For the period most directly related to the expenditure data (1986-1996), the Liberals were in power from 1985 to 1994, when the PQ took office, only to be replaced in power by the Liberals again in 2003. Table 1.3 provides some summary statistics on the elections held over the 1981-2003 period.

From the electoral data, I construct several ‘political’ variables. The main political variables measure the intensity of political competition and the presence or not of long-run partisan loyalty in each district. To proxy for the intensity of political competition, I construct a standard measure of ‘closeness’ of elections at the riding level ($MAR^j_t$). This variable is defined in a straightforward manner for a particular district $j$ and the last election before year $t$ as

$$MAR^j_t = \frac{v_{j1t} - v_{j2t}}{\sum_{k=1}^{K} v_{jkt}},$$

(1.5)

where $v_{jkt}$ is the number of votes cast for candidate $k$. $K$ is the total number of candidates, and the candidates are ordered in decreasing order of their number of votes, such that $v_{j1t}$ stands for the number of votes for the winning candidate in district $j$, $v_{j2t}$ stands for the number of votes for the second most popular candidate, etc. Thus $MAR^j_t$ captures the margin of the winner over total votes cast and will be used in the empirical

Two other parties have been represented in the National Assembly (N.A.) over the 1981-2003 period: the ‘English-speaking’ Equality Party (four members of the N.A. in 1989) and the ‘conservative’ Action démocratique du Québec (one elected in 1994). I am concerned here with provincial politics. Separate elections are also held at the federal, municipal and school-board levels.

In election years, the previous election is also used. The same convention is adopted by Milligan and Smart (2005), who use a similar measure of election closeness.
analysis to capture the effect of political competition. Summary statistics are provided in Table 1.2. There is wide variation in winning margins across districts. For example, in the 1985 election, winning margins ranged from .23% to 86.93%. The average margin was 20.47% in the 1985 election, 15.81% in the 1989 election, and 21.57% in the 1994 election.

To capture a district’s loyalty to the party in power, I use six closely related measures of partisan loyalty. They exploit the fact that loyal districts repeatedly vote for a given party, often over long periods. All share the same logic: \( \text{LOYAL}_j^t = 1 \) if riding \( j \) repeatedly voted for the incumbent government in a given series of elections, 0 otherwise. The six loyalty variables (labeled L1 to L6) capture different combinations of elections (see Table 1.2 for details). For example, according to L1 a district is classified as ‘loyal to the party in power’ in year \( t \) if it voted for the party currently in power in the 1985, 1989 and 1994 elections.\(^{31}\) Depending on the measure being used, on average between 20% and 35% of districts can be classified as ‘loyal’ to the party in power. This approach to the measurement of partisan loyalty differs from the approaches followed in Case (2001) and Larcinese, Rizzo and Testa (2006). In those studies, vote shares for the incumbent party are used as measures of what Larcinese \(\text{et al.}\) label ‘ideological bias.’\(^{32}\) Since I am particularly interested in the dynamic aspect of partisan loyalty, in the current application I focus on a measure of loyalty that captures the extent of repeated support for the party in power.

Finally, two variables capture the status of individual politicians in the Québec parliament (the National Assembly). The \( \text{GOV}_j^t \) variable takes values 1 if the district is represented by a member of the National Assembly (MNA) from the government party

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\(^{31}\)In an election year, the party forming the incumbent government is deemed the party in power.

\(^{32}\)In a related paper, Larcinese, Snyder and Testa (2006) measure ideological bias using exit polls. Such data are not available in Québec.
and 0 otherwise. In all three elections directly relevant to the expenditure data (1985, 1989 and 1994), majority governments were elected. Consequently, more than 50% of seats in the National Assembly were held by the government party, and as many as 82% following the 1985 election. Within the parliamentary delegation of the party in power, some MNAs are also cabinet members. The $MIN^j_t$ variable equals one if a district’s MNA was a cabinet minister during the previous calendar year, 0 otherwise. On average, one out of five MNAs were cabinet ministers in a given year between 1986 and 1996.

### 1.4 Descriptive Evidence

Before turning to the main regression evidence in Section 1.5, this section explores the link between the political variables and the geographic allocation of road expenditure by examining a series of simple correlations. These correlations suggest, at least on the surface, that machine politics patterns are evident in the allocation of road spending.

The swing voter equilibria derived in Proposition 3 are in line with the predictions of most formal models of distributive politics. The swing voter view predicts that expenditure should be directed to districts likely to change sides (i.e. be pivotal) in the next election. In other words, there should be a positive link between the intensity of local political competition and local spending. In terms of the variables defined in the previous section, this should translate into higher spending in districts where elections tend to be won by tight margins, leading to a negative correlation between the winning margin ($MAR^j_t$) and expenditure variables.

Figures 1.1 and 1.2 provide some preliminary evidence pertaining to the swing voter prediction. In Figure 1.1, government-held ridings are broken down in quintiles of the
winning margin variable. The first quintile contains the closest local elections and the fifth quintile, those that have been won by the widest margins. Somewhat surprisingly (if one’s prior is the standard view), the spending pattern that emerges is the opposite of the pattern that would be consistent with the swing voter prediction. Indeed, spending is increasing in winning margin, with the exception of the fifth quintile (which shows a 4%-decline in average spending compared to the fourth quintile). The gradient is quite steep for low margins: there is a $1.9-million increase (a 51%-increase) in spending between the first and second quintiles and a $0.5-million increase (a 9%-increase) between the second and third quintiles.

![Mean expenditure (M$)](image)

Figure 1.1: District-level road expenditure and quintiles of the margin variable, government districts

While government-held ridings do not seem to conform to the standard swing voter prediction, this prediction seems to describe the situation prevailing in opposition-held ridings better. As shown by Figure 1.2, average spending is generally decreasing in...
winning margin in opposition districts, in accord with the standard view. Spending was almost twice as high in the lowest-margin districts than in the highest-margin districts. This seems broadly consistent with the incumbent government wooing swing districts currently held by the opposition party and somewhat neglecting districts that delivered high margins favoring the opposition party in the previous election.

![Figure 1.2: District-level road expenditure and quintiles of the winning margin variable, opposition districts](image)

The apparent dichotomy observed between government and opposition districts suggests that, within the government party, there exist forces that tend to mitigate, and even reverse, the incentive to favour swing districts. Figures 1.3 and 1.4 reveal that explanations based on both partisan loyalty and cabinet minister status could rationalize the puzzling (based on the swing voter view) positive correlation between spending and winning margin among government-held districts. Indeed, Figure 1.3 shows a strong positive association between loyalty to the government party (based on loyalty measure L2)\(^\text{34}\) and winning margin: while the average winning margin is 30% in loyal districts, it

\(^{34}\)According to L2, a district is coded as loyal to the party currently in power if it elected a candidate
is only 16% in districts that are not loyal to the party in power. Figure 1.4 shows a similar
difference between districts held by cabinet ministers and the remaining government-held
districts.

Figure 1.3: Winning margin and loyalty to the party in power, government districts

A priori consistent with the machine politics equilibria of Proposition 3 (which sug-
gest a positive correlation between loyalty variables and local public expenditure), par-
tisan loyalty seems to pay off: spending was on average 10% higher in loyal districts
than in government-held districts that are classified as ‘not loyal’ by loyalty measure L2
(see Figure 1.5). This difference is significant at the 5% confidence level. It is also note-
worthy that districts represented by a member of the government party in a given year
benefited from higher spending than those represented by a member of an opposition
party. Yearly spending was approximately $0.5-million (or 8%) higher in government-
held districts. Finally, among government-held ridings, those represented by a cabinet
minister enjoyed a $136,000-advantage over those represented by government MNAs not
from that party in all elections included in the dataset.
Although the simple correlations presented in this section summarize interesting stylised facts, they also highlight the limited conclusions that one can draw from them. In particular, it is clear from the discussion of this section that low-margin and high-margin districts tend to differ in systematic ways, complicating the estimation of the effect of local political competition on the pattern of spending. High-margin districts are not only characterized by low political competition at a given point in time but they tend to be involved in long-run relationships with one party (as revealed by Figure 1.3) and they tend to be represented by politicians holding key government positions (as revealed by Figure 1.4). Needless to say, low- and high-margin districts likely differ along other dimensions that may also drive differences in road spending. To address these concerns, the next section analyses the relationship between political factors and expenditure within a regression framework.
Figure 1.5: District-level road expenditure and loyalty to the party in power

Figure 1.6: District-level road expenditure and status of the Members of the National Assembly (MNA)
1.5 Empirical Framework and Main Results

In this section, I study the relative roles played by political competition and partisan loyalty in the geographic allocation of road spending in Québec. The empirical strategy is based on a generalization of the theoretical model presented in Section 1.2, to account for more than two districts and a larger set of district characteristics. The general model – and its empirical implementation – is presented in Appendix 1.A.2.

Throughout this section, I estimate empirically-relevant versions of the following equation, intended to explain the equilibrium level of road expenditure, \( e^j \), in district \( j \):

\[
e^j = f(j; j) + Z^j + X^j + \varepsilon^j.
\] (1.6)

Equation (1.6) provides a framework for analysing both the political and non-political determinants of local spending. The first two terms in (1.6) pertain to the political sphere: \( f(j; j) \) captures the influence of the theoretical model’s political competition effect (governed by \( \gamma^j \)) and partisan loyalty effect (governed by \( \delta^j \)), while \( Z^j \) stands for other political factors that may affect the allocation of spending (e.g. the role of powerful politicians in attracting spending to their own district). Recall that according to the political competition effect (see Proposition 1 above), one would expect lower levels of expenditure where the intensity of political competition is low, i.e. where winning margins are typically high. The partisan loyalty effect concerns the role that local spending plays in securing the support of loyal districts in the future (see Proposition 2). According to the loyalty effect, one would expect a positive relationship between expenditure and partisan loyalty. Finally, local expenditure will also (and perhaps primarily) be driven by non-political expenditure needs, i.e. various observable district characteristics. These

\[35\text{Note that equation (1.6) corresponds to equation (1.26) in the Appendix, with } f(j; j) = G(\delta^j) - \gamma^j \text{ and } \gamma^j = \gamma(\delta^j) + \varepsilon^j.\]
are captured by the last two terms in (1.6), with $X^j$ and $e^j$ standing for observable and unobservable district characteristics respectively.

This section proceeds as follows: Section 1.5.1 focuses on the effect of political competition. The standard test of the political competition effect in the literature involves regressing expenditure on a measure of election closeness, generally winning margin. As a benchmark, I start by presenting results based on this standard approach, i.e. abstracting from partisan loyalty. Measures of partisan loyalty are introduced in Section 1.5.2. Section 1.5.3 then explores the composition of road expenditure by presenting separate results for construction and maintenance expenditure.

1.5.1 Political Competition

In this subsection, the basic estimating equation relates spending in district $j$ and year $t$ ($EXP^j_t$) – the empirical counterpart of $e^j$ in the theoretical model – to winning margin ($MAR^j_t$) in the previous election, controlling for a series of district characteristics:

$$EXP^j_t = \alpha + \eta_G MAR^j_t * GOV^j_t + \eta_O MAR^j_t * OPP^j_t + \beta Z^j_t + \theta X^j_t + \varphi_t + \phi^j + \epsilon_t,$$

where $\alpha$ is a constant, $OPP^j_t = 1 - GOV^j_t$, $\varphi_t$ is a vector of year effects, and $\phi^j$ is a vector of district fixed effects. The dependent variable is measured as the level of road spending.\footnote{Results are generally insensitive to changes in the definition of the dependent variable. Regressions using as the dependent variable per capita expenditure, budget shares and ratios to the average district yield very similar results, and are available upon request.} $Z^j_t$ includes the political variables $GOV^j_t$ and $MIN^j_t$, and $X^j_t$ includes the following district characteristics: area covered by the district ($AREA^j_t$), population size ($POP^j_t$), urban population share ($URB^j_t$), number of manufacturing firms ($FIRMS^j_t$), unemployment rate ($UE^j_t$) and household income ($INC^j_t$).

Note that this first specification excludes partisan loyalty, which will be introduced
in Section 1.5.2, in order to focus on the correlation between winning margin and expenditure. Equation (1.7) allows the effect of winning margin on expenditure to differ between ridings held by the government (captured by the parameter $\eta_G$) and opposition parties ($\eta_O$). Although the simple theoretical model presented earlier does not yield predictions with respect to the government versus opposition status of districts, there is no a priori reason to expect that the political competition effect should work differently in government and opposition districts. Small winning margins in both government-held and opposition-held districts should therefore be associated with higher spending, i.e. $\eta_G; \eta_O < 0$.

**Benchmark Results**

The results for this benchmark regression are presented in the first two columns of Table 1.4.\(^{37}\) Specification (1) includes the $X^j_t$ vector but no district fixed effects.\(^{38}\) Most ‘economic’ controls enter the regression significantly and with the expected signs. The area and urban population variables are strongly significant, with a positive sign for the former and a negative sign for the latter. The unemployment rate is also significant and enters the regression positively (higher unemployment being associated with more spending), perhaps reflecting the role of transportation infrastructure in regional development policies. While the positive signs on the other two economic variables (income and number of firms) suggest a positive relationship between economic activity and spending, only the number of firms coefficient is statistically significant.\(^{39}\)

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\(^{37}\)Throughout the paper, standard errors are adjusted for clustering. Groups are defined according to the margin variable, which changes only once per electoral cycle in each district.

\(^{38}\)Since some district characteristics are coded as time-invariant, inclusion of fixed effects absorbs them. In specifications (2) to (5), $AREA^j, URB^j$ and $FIRMS^j$ are dropped and fixed effects are included.

\(^{39}\)The number of manufacturing firms is central to the analysis of Cadot et al. (2006), which they interpret as a proxy for lobbying activities. My results corroborate the presence of a significant link between the number of firms and spending.
Turning now to the political variables, the main parameters of interest are $\eta_G$ and $\eta_O$ (respectively the coefficients on $MAR_t^j \times GOV_t^j$ and $MAR_t^j \times OPP_t^j$). The basic empirical test can be thought of as follows: the standard theoretical view (the swing voter view) predicts that both $\eta_G$ and $\eta_O$ should be negative. According to this view, more spending should be directed to ridings with narrow margins regardless of which party currently holds the riding, those ridings being the most likely to be pivotal in the next election. However, Specification (1) displays a strong positive effect of winning margin in government-held ridings ($\hat{\eta}_G > 0$). This result thus seems to sharply contradict the swing voter view of distributive politics and is more in line with the machine politics view. The coefficient on $MAR_t^j \times OPP_t^j$ has the expected negative sign but is not statistically significant. The other two political variables ($GOV_t^j$ and $MIN_t^j$) display insignificant effects.

Specification (2) exploits the panel structure of the data. By including fixed effects, it controls for fixed unchanging district characteristics. The results for Specification (2) show that $\hat{\eta}_G$ and $\hat{\eta}_O$ have the same signs as in Specification (1) but neither of them is statistically significant, with $\hat{\eta}_G$ now much smaller. Again, these results provide very little evidence in favour of the standard theoretical prediction ($\hat{\eta}_G, \hat{\eta}_O < 0$). On the contrary, a positive correlation is still observed between winning margin and expenditure in government-held ridings.

Specification (3) presents the results from a fixed-effects regression on the subsample of districts that were in the first three deciles of the winning margin variable in 1985. The results from this specification provide useful information with respect to a potentially nonlinear effect of the winning margin on expenditure. Indeed, it is for the highest margins that one would expect the swing voter prediction to be the weakest – the swing ridings are, almost by definition, concentrated among the smallest winning margins in
the previous election. Hence, limiting the sample to close races introduces a bias against finding machine politics patterns, which are intuitively expected to be more prevalent for higher margins. Both $\hat{\eta}_G$ and $\hat{\eta}_O$ now have the negative sign predicted by the political competition effect. While the effect is now significant for opposition-held ridings, it is still insignificant for government-held ridings.\(^{40}\)

**Electoral Budget Cycle**

The first three specifications in Table 1.4 make the strong assumption that the impact of political variables such as $MAR_t^j \times GOV_t^j$ are constant over time. Specifications (4) and (5) allow the impact of $MAR_t^j \times GOV_t^j$ to vary over the electoral cycle.\(^{41}\)

In Specification (4), $MAR_t^j \times GOV_t^j$ is interacted with three electoral cycle dummies: $ELEC_t$ (election years: 1989 and 1994), $PREELEC_t$ (pre-election years: 1988 and 1993), and $POSTELEC_t$ (post-election years: 1986, 1990 and 1995). The coefficients on all three interaction terms are positive. However, $MAR_t^j \times GOV_t^j$ is only significant when interacted with the $ELEC_t$ dummy, revealing that a lot of the action is concentrated in election years. Note that the coefficient on $MAR_t^j \times OPP_t^j$ (which is not interacted with electoral cycle dummies here) has the expected negative sign and is

---

\(^{40}\)It may be argued that Specification (3) controls for the potential endogeneity of political variables, at least to some degree. A recent study by Lee et al. (2004) suggests that, by following over time a subgroup of districts where winning margins were initially narrow, it is possible to isolate a group of districts that share similar unobservable characteristics. Unfortunately, given that the variable of interest here is the winning margin, this strategy is obviously not fully satisfactory for my purposes since using margin to split the sample effectively treats it as a control variable. Note also that there is a trade-off here in restricting the sample to closer races, which would arguably reduce the endogeneity bias but also reduce the number of observations and hence the precision of the results. Unreported results show that choosing a lower cutoff does not significantly alter the qualitative pattern of the political variables. For a more comprehensive discussion of endogeneity issues, see Section 1.6.

\(^{41}\)There is a large body of literature on political budget cycles, the well-known phenomenon that aggregate government budget fluctuations are influenced by political dynamics. Brender and Drazen (2005) revisit the evidence on the political budget cycle. In a related paper, Drazen and Eslava (2006) provide a theoretical model of redistributive politics in which swing regions are targeted before the election.
marginally significant. Specification (5) is presented as a robustness test for the positive sign on $MAR^j_t \times GOV^j_t \times ELEC_t$ in Specification (4). Interactions with $PREELEC_t$ and $POSTELEC_t$ are dropped, and year effects are included. The pattern of interest (the positive sign on the estimated coefficient for $MAR^j_t \times GOV^j_t \times ELEC_t$) appears to be robust.

These results indicate that the dynamics in opposition ridings tend to conform to the standard swing voter view but that, in government-held ridings, there is no supporting evidence.\textsuperscript{42} Furthermore, the effect is positive and significant in election years, when electoral competition is expected to be the strongest. On average, government-held ridings with high winning margins in the previous election received higher road spending in election years. The estimated effect is economically significant, a one percentage-point increase in winning margin being associated with $40,000$ worth of spending in election years. In the remainder of this section, I argue that this pattern is largely explained by the positive correlation between winning margin and partisan loyalty.

### 1.5.2 Partisan Loyalty

The large positive coefficients on $MAR^j_t$ estimated for government-held ridings in the previous subsection are puzzling if one’s prior is the swing voter view of distributive politics. Why would rational politicians not target swing districts, especially close to an election? I argue that these estimates might suffer from an omitted variable bias related to the role played by partisan loyalty. As was previously noted (see the discussion of Figure 1.3 above), high margins tend to be associated with strong partisan loyalty. And the theoretical model of Section 1.2 develops one rationale as to why loyalty might be a determinant of the allocation of spending across districts. In terms of equation (1.7),

\textsuperscript{42}Milligan and Smart (2005) find a similar dichotomy.
the coefficient on \(MAR_t^j \times GOV_t^j\) will be biased if (i) \(MAR_t^j \times GOV_t^j\) is correlated with partisan loyalty, and (ii) if the error term \(e_t^j\) is also correlated with loyalty.

Regardless of the loyalty measure (L1 to L6) being used, there is indeed a strong positive correlation between \(MAR_t^j\) and \(LOYAL_t^j\) (see the last column of Table 1.5). The coefficient of correlation between these two variables varies from .28 for L4 (loyalty defined over all future elections) to .50 for L3 (loyalty defined over all past elections) and is always significantly different from zero at the 1% confidence level. Omitting loyalty from the regressions will therefore be a concern to the extent that partisan loyalty is in itself a factor in the geographic allocation of spending, as suggested by the machine politics view of distributive politics.

In this subsection, I take this concern seriously and present results based on the following equation:

\[
EXP_t^j = \alpha + \gamma MAR_t^j + \delta LOYAL_t^j + \beta Z_t^j + \theta X_t^j + \varphi_t + \phi^j + \epsilon_t^j. \tag{1.8}
\]

This specification includes the measures of partisan loyalty and provides evidence on the relative influence of political competition and loyalty on the allocation of spending. The main parameters of interest are now \(\gamma\) and \(\delta\). In line with the swing voter view, \(\hat{\gamma}\) is expected to be negative. Consistent with the machine politics view, \(\hat{\delta}\) is expected to be positive.\(^{43}\)

---

\(^{43}\)Since the focus of this subsection is on the partisan loyalty effect, the regressions do not allow the effect of winning margin to differ in government-held and opposition-held districts. However, note that since loyalty to the party in power is taken into account, one should expect much less of a difference in the effect of winning margin in government v.s. opposition ridings. Indeed, the loyalty effect can be expected to play a different role in ridings held by the incumbent government and in ridings held by other parties. In government-held ridings, the loyalty effect and the political competition effect tend to work against each other. However, in districts held by opposition parties, only the standard political competition effect should be present. In fact, loyalty to an opposition party will tend to reinforce the political competition effect in opposition-held ridings, as high margins for the opponent indicate ridings that are sure losers for the incumbent government.
Table 1.5 reports results from regressions with the six loyalty variables, with and without fixed effects. It also reports the results from a benchmark regression excluding $LOYAL_{ij}$ but still including $MAR_{ij}$. Mirroring the results presented above, the coefficient on $MAR_{ij} (\hat{\gamma})$ is positive and significant in the benchmark regression. Regardless of which loyalty measure is being used, the inclusion of $LOYAL_{ij}$ in the regression considerably decreases the coefficient on $MAR_{ij}$. Although it remains positive in most cases, it is never significant. In contrast, the coefficient on $LOYAL_{ij} (\hat{\delta})$ is positive and significant at the 1% confidence level in all specifications but one.

When equation (1.8) is estimated with fixed effects, the coefficient on $LOYAL_{ij}$ is still positive but not significant.\footnote{Table 1.5 presents results for fixed effects regressions only with loyalty measure L2. As shown by results for the six loyalty measures without fixed effects, the results are only slightly sensitive to the definition of $LOYAL_{ij}$.} Note that with fixed effects, the impact of loyalty – essentially a fixed district characteristic – is identified from changes in the loyalty variable. By construction of the loyalty variables used in this study, such changes occur only when there is a change in government. In the current context, this occurred only in 1994. Given this limited variation, these changes are hard to disentangle from changes in the $GOV_{ij}$ variable, many of which correspond to the changes in $LOYAL_{ij}$. The sudden explanatory power of the $GOV_{ij}$ variable when fixed effects and the loyalty variable are introduced is puzzling. It is the only specification in which this variable displays a significant effect. To address this concern, I also provide results from a fixed-effect regression without the $GOV_{ij}$ variable. These results show an estimate of the effect of loyalty that is strongly significant, but smaller in magnitude than in the regressions without fixed effects. This effect is also economically significant: it implies that a loyal district received 17% more spending than the average district.

The results presented in this subsection again illustrate the difficulty of identify-
ing any evidence of the standard swing voter view in the Québec data. I do however find stronger support for the machine politics view. In Section 1.6 below, I show that the overall picture is robust when accounting for the potential endogeneity of political variables.

1.5.3 Construction vs. Maintenance Expenditure

The data allow for a separate analysis of construction and maintenance expenditure, with the former containing major road improvement projects. One might expect maintenance expenditure to be less responsive to political considerations and more responsive to local needs than construction expenditure. This is indeed what the results in the last two lines of Table 1.5 indicate. While partisan loyalty has a positive and strongly significant effect on construction expenditure, the effect is considerably smaller (and not significant) for maintenance expenditure. This result suggests that major projects, presumably those with the biggest long-term value to voters, are being driven by partisan loyalty. The positive coefficient on $MAR_t^j$ in the maintenance expenditure regression (significant at the 10% level) is hard to interpret and once again casts doubt on the presence of a significant political competition effect in the behaviour of Québec governments over the 1986-1996 period.

1.6 Endogeneity

I now assess the robustness of the results presented in Section 1.5 by means of instrumental variables (IV) and difference-in-differences strategies to account for the potential endogeneity of the $LOYAL_t^j$ variable. As suggested by the theory discussion in Section 1.2, partisan loyalty is the product of repeated interaction between parties and voters. Hence, while loyalty can be expected to be a causal factor in the allocation of spending,
it is also likely that causality works in the opposite direction if governments actually spend with the intention to nurture local partisan loyalties. More generally, endogeneity biases will arise if non-observable considerations, e.g. preferences for public goods, are correlated with both electoral outcomes (specifically partisan loyalty) and the geographic allocation of road spending.

To get a sense of the likelihood that partisan loyalty is picking up some unobserved heterogeneity across districts, Table 1.7 compares the 28 districts that were loyal to the Liberal party in all elections between 1981 and 2003 (i.e. according to L2) to the other 97 districts, based on observable characteristics. Suggesting that unobserved heterogeneity might be an issue, ‘Liberal strongholds’ are statistically different from the other districts along three dimensions: loyal districts tend to be slightly smaller, have a lower unemployment rate, and have a much smaller share of French-speakers. The latter is the main observable difference between liberal strongholds and other districts and will form the basis for the IV strategy that follows.

Based on these observations, the direction of the potential OLS bias affecting the $LOYAL_{jt}$ coefficient is unclear. On the one hand, Liberal strongholds tend to be economically dynamic areas (as suggested by the low unemployment rate) and hence can be expected to have a strong need for new or improved roads. If this is true, one should expect the OLS estimates to be upward-biased. On the other hand, Liberal strongholds tend to be small urban districts, which can be expected to be characterized by a low preference for road spending compared to other public spending. This alternative story suggests that OLS estimates might instead be downward-biased.
1.6.1 Instrumental Variables

The IV strategy uses the French-speaking population variable \( FRENCH_i^j \) as an instrument for partisan loyalty. The rationale for this instrument comes from a fundamental characteristic of the political environment in Québec: partisan loyalties and language spoken are strongly correlated. Roughly 80% of the province’s 7-million population are French-speaking, the majority of whom descend from original French settlers and have a Roman Catholic background. The English-speaking population, which forms a majority in Canada as a whole, is the most important linguistic minority in Québec. This British (and usually Protestant) presence in Québec goes as far back as 1760, when New France was integrated in the British Empire. The Parti Québécois, which advocates the province’s independence from Canada, draws almost all of its support from the French-speaking community. In contrast, loyalty to the Liberal Party (in office for most of the period covered by this study) tends to arise in districts where the English-speaking population is concentrated (e.g. Western Montréal). Anecdotal evidence for this is provided by the fact that among the 12 strongest wins for the Liberals in 1985 (the top decile), 11 occurred in Western Montréal ridings.

The validity of the IV strategy relies on the fact that, provided that other relevant factors are controlled for, language is in itself not a direct determinant of the level of transportation expenditure received by a district. Linguistic characteristics are most certainly not suitable bureaucratic criteria for the Ministry of Transportation. If language has an influence on spending patterns, it is taken here to be mediated by the political process (through its influence on partisan loyalty). This is what the first stage regression captures: the linguistic composition of a riding is a key determinant of the nature of partisan loyalty in that riding. In the second stage, partisan loyalty itself (together with the intensity of political competition) captures the ability of politicians
to bias the allocation of spending for electoral purposes.

The bottom panel of Table 1.6 presents first-stage diagnostics documenting the strong correlation between $FRENCH_j^t$ and $LOYAL_j^t$. The correlation between the two variables is strong, ranging from .29 for loyalty variable L1 to .46 for L5. The usual $F$-tests and partial $R^2$ measures confirm that, regardless of which definition of the loyalty variable is used, $FRENCH_j^t$ has strong predictive power in the first-stage regression.

IV results, featured in the top panel of Table 1.6, are qualitatively similar to the previous results. In fact, the effect of partisan loyalty is slightly bigger and still statistically significant in all specifications (except again for maintenance expenditure).\footnote{The fact that the IV estimates tend to be bigger than their OLS counterparts may be due to the fact that the first-stage regression captures the effect of politically powerful English-speaking ridings, hence reinforcing the estimated impact of loyalty on expenditure.} The coefficient on winning margin is negative in most specifications but, as before, is never significantly different from zero. I conclude from the IV results that unobserved heterogeneity is not responsible for the estimated positive correlation between partisan loyalty and expenditure. Furthermore, the exogenous variation provided by the $FRENCH_j^t$ variable indicates that causality is working in the expected direction, i.e. from partisan loyalty to spending.

1.6.2 Difference-in-Differences

Note that $FRENCH_j^t$ is essentially a time-invariant district characteristic and therefore, in this particular application, is not a suitable instrument in the fixed effects regressions (fixed effects are accordingly excluded from the IV regression). However, the fact that there was a change of government in 1994 allows for a different identification strategy which exploits variation over time in the loyalty variable.

The rationale is simple: the extra spending directed to ridings that are loyal to the
Liberals while this party is in power should go away when the PQ takes office in 1994.

This suggests a difference-in-differences strategy that compares spending in ridings that are loyal to the Liberals (l) to spending in the other ridings (o), before and after the 1994 election. Here, the effect of partisan loyalty is identified as follows:

\[ \hat{\delta} = \overline{EXP_{l}^{86-94}} - \overline{EXP_{l}^{95-96}} - \overline{EXP_{o}^{86-94}} + \overline{EXP_{o}^{95-96}} \]  \hspace{1cm} (1.9)

where the upper bars denote averages. In terms of controlling for the potential endogeneity of partisan loyalty, the main advantage of this approach is that it differences out any fixed systematic difference between ridings that are loyal to the Liberal party and the rest of the province.

Figure 1.7 provides visual evidence corresponding to this identification strategy. Ridings that can be classified as loyal to the Liberals clearly benefited from an advantage in terms of road construction expenditure when that party was in power (between 1985 and 1994). Although that advantage varied from year to year during the two Liberal mandates, it was present in every year for which data are available (remember that the data were not collected in 1991). It was especially large around the 1989 election and again in 1993, a pre-election year. Following the 1994 election, in which the PQ returned to power, Liberal strongholds experienced a sudden drop in road expenditure. Meanwhile, the other ridings (which include those loyal to the PQ) saw their spending level rise importantly in 1996. As a result, in the two years after the 1994 election for which expenditure is available, Liberal strongholds received less construction spending than the other ridings.

Table 1.8 presents the results pertaining to this difference-in-differences exercise. Results are presented for all expenditure and for construction and maintenance expenditure separately. I also present results from a regression with the full set of district charac-
Figure 1.7: Road construction expenditure in Liberal strongholds vs. other ridings
teristics. The first panel of Table 1.8 shows that ridings that were loyal to the Liberals experienced on average a $1.4-million drop in total road expenditure per district after the PQ took office in 1994, two thirds of this drop being attributable to construction expenditure. Meanwhile, the other districts experienced a modest $147,000 increase in total expenditure, which hides a $0.5-million increase in construction expenditure coupled with a $360,000 decrease in maintenance expenditure (see the second panel of Table 1.8). The difference-in-differences estimate is positive and significant for construction expenditure, but again not for maintenance expenditure. This result is robust to the inclusion of the full set of controls. Although the estimated loyalty effect is still positive and of the same magnitude as in other identification strategies presented above, it is not estimated with sufficient precision to be statistically significant for all expenditure. Nevertheless, these results provide additional evidence that loyal ridings have received more road construction expenditure over the 1986-1994 period.

1.7 Conclusion

This chapter has examined an important dimension of government behaviour with respect to the centralized provision of local public goods, namely the geographic patterns of pork-barrel politics. Two opposing predictions dominate the theoretical literature on this issue: the ‘swing voter’ view, following Lindbeck and Weibull (1987, 1993) amongst others, and the ‘machine politics’ view, formalized by Cox and McCubbins (1986). According to the former, public spending is expected to favour districts likely to be pivotal in the next election; according to the latter, spending is instead expected to favour districts that form the traditional electoral base of the incumbent government, namely loyal districts.

The dynamic political economy model laid out in this chapter, in which districts
are heterogeneous with respect to their partisan loyalty, combines the two views of pork-barrel politics in a transparent way, making clear how they follow from incentives pertaining to different time horizons. The model demonstrates that swing voter and machine politics forces can operate at the same time, working against each other to produce an ambiguous short-run relationship between political competition and public spending.

To shed light on the relative importance of these two forces empirically, I exploited a rich data set which documents the allocation of public expenditure on roads amongst electoral districts in Québec. Specifically, I explored the empirical relationship between partisan loyalty, political competition and the geographic distribution of public spending, providing robust evidence that districts which display loyalty to the incumbent government receive disproportionately more spending. The evidence also indicates that the standard swing voter prediction is not the main factor driving the interaction between politics and expenditure allocation in Québec’s recent experience, although there is some evidence of additional spending being directed towards districts held by opposition parties where election outcomes were close. Furthermore, road spending exhibits an electoral cycle, with machine politics patterns especially discernible close to elections. Overall, these results show that, in the case of road spending, long-run political relationships are a key determinant of the allocation of centrally-provided public goods.

One caveat of the analysis of this chapter is that it abstracted from the potential role of other levels of government. While the above empirical application allowed for this simplification, most often local public goods are provided by a hierarchy of political offices. And this reality needs to be an integral part of any general framework intended to study the centralized provision of local public goods. The next chapter takes up this challenge.
1.A Appendix

1.A.1 Two-District Model: Technical Details

Government’s Problem

I assume that the incumbent politician’s period-\( t \) Bernoulli utility function is linear in the number of seats:\(^{46}\)

\[ u_t(n) = n, \quad (1.10) \]

where \( n \in \{0, 1, 2\} \) is the number of seats held. Total expected utility is given by:\(^{47}\)

\[ U = p^t_1 + p^t_2 + \beta(p^t_2 + p^*_2), \quad (1.11) \]

where \( p^t_j \) denotes the probability of winning election \( t \) in district \( j \), and \( \beta \) is a discount factor \( (0 \leq \beta \leq 1) \).

The government maximizes its total expected utility subject to (1.2), (1.3), the resource constraint (1.1) and assumptions 1 and 2 (see Section 1.2.1). This yields the

\(^{46}\)This government objective assumes away the issue of winning a majority of seats. Cox and McCubbins (1986), Dixit and Londregan (1996) and Lindbeck and Weibull (1993) also assume that political parties are merely vote or seat maximizers. A relevant alternative is the maximization of the probability of winning a majority of seats. Lindbeck and Weibull (1987) and Snyder (1989) contrast these two objectives. See Case (2001) for an excellent discussion.

\(^{47}\)In any period, three events can occur: \( u_t(0) = 0 \) with probability \( (1 - p^t_1)(1 - p^*_1) \), \( u_t(1) = 1 \) with probability \( 1 - (1 - p^t_1)(1 - p^*_1) - p^t_1 p^*_1 \), and \( u_t(2) = 2 \) with probability \( p^t_1 p^*_1 \). This yields expected utility in period \( t \):

\[ U_t = 1 - (1 - p^t_1)(1 - p^*_1) - p^t_1 p^*_1 + 2p^t_1 p^*_1, \]

which reduces to:

\[ U_t = p^t_1 + p^*_1. \]
following optimization problem for the government:

\[
\max_{e^l, e^s} \left\{ p^l_1 + p^s_1 + \beta (p^l_2 + p^s_2) \right\} 
\]

\[
\text{s.t. } p^l_1 = \frac{1}{2} + F(\gamma + e^l); \quad p^s_1 = \frac{1}{2} + F(e^s) \\
\frac{1}{2} + \delta F(\gamma + e^l); \quad p^s_2 = \frac{1}{2} \\
e^l + e^s = \bar{e},
\]

which is equivalent to

\[
\max_{e^s} \left\{ F(e^s) + (1 + \beta \delta) F(\gamma + \bar{e} - e^s) \right\}. 
\]

Proofs of Propositions

Proof of Proposition 1. Totally differentiating (1.4) with respect to \(e^s\) and \(\gamma\) yields

\[
\frac{de^{ss}}{d\gamma} = \frac{(1 + \beta \delta) F''(\gamma + \bar{e} - e^{ss})}{F''(e^{ss}) + (1 + \beta \delta) F''(\gamma + \bar{e} - e^{ss})} \geq 0,
\]

which is also signed in a straightforward way by means of the properties of \(F\).

Proof of Proposition 2. Totally differentiating (1.4) with respect to \(e^{ss}\) and \(\delta\) yields

\[
\frac{de^{ss}}{d\delta} = \frac{F'(\gamma + \bar{e} - e^{ss})}{F''(e^{ss}) + (1 + \beta \delta) F''(\gamma + \bar{e} - e^{ss})} \leq 0,
\]

which is signed in a straightforward way by means of the properties of \(F\).

Proof of Proposition 3. First, consider the case where \(e^{ss} = e^{ls} = \frac{\bar{e}}{2}\) (i.e. the two districts receive an equal share of the budget). Condition (1.4) must be sat-

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\(^{48}\)This setting is reminiscent of a durable/nondurable consumption problem or of a consumption/investment trade-off.
is satisfied, so \( F'(0) = (1 + \beta \delta)F'0(\gamma + \frac{e}{2}) \). (a) For a given value of \( \gamma \), denoted \( \tilde{\gamma} \), the latter condition defines the required value of \( \delta \) as a function of \( \tilde{\gamma} \) and \( \bar{e} \):
\[
\delta(\tilde{\gamma}, \bar{e}) = \frac{1}{\beta} \left( \frac{F'(0)}{F'(\tilde{\gamma} + \frac{\bar{e}}{2})} - 1 \right).
\]
Note that to have \( \delta \leq 1 \) it must be the case that \( \tilde{\gamma} \) is not too high. Now consider an increase in \( e^* \) of \( e \) above \( \frac{\bar{e}}{2} \) and, accordingly, a reduction of \( e \) in \( e^* \). This yields:
\[
\delta(\tilde{\gamma}, \bar{e}, e) = \frac{1}{\beta} \left( \frac{F'(0)}{F'(\tilde{\gamma} + \frac{\bar{e} + e}{2} - 1)} \right).
\]
Since \( F'' < 0 \), we have:
\[
\delta(\tilde{\gamma}, \bar{e}, e) \leq \delta(\tilde{\gamma}, \bar{e}, 0).
\]
Hence, for a given value of \( \gamma \), \( e^* \geq \frac{\bar{e}}{2} \geq e^* \) iff \( \delta \) is relatively low and \( e^* \geq \frac{\bar{e}}{2} \geq e^* \) iff \( \delta \) is relatively high. (b) Now, for a given value of \( \delta \), denoted \( \bar{\delta} \), this condition defines the required value of \( \gamma \) as a function of \( \bar{\delta} \) and \( \bar{e} \):
\[
\gamma(\bar{\delta}, \bar{e}, e) = F''^{-1} \left( \frac{F'(0)}{1 + \bar{\delta}e} - \frac{\bar{e}}{2} \right), \quad \text{which must satisfy} \quad \gamma(\bar{\delta}, \bar{e}, 0) \geq 0.
\]
Consider again an increase in \( e^* \) of \( e \) above \( \frac{\bar{e}}{2} \) and a reduction of \( e \) in \( e^* \). This yields:
\[
\gamma(\bar{\delta}, \bar{e}, e) = F''^{-1} \left( \frac{F'(0)}{1 + \bar{\delta}e} - \frac{\bar{e}}{2} \right) + e. \quad \text{Again since} \quad F'' < 0, \quad \text{we have:} \quad \gamma(\bar{\delta}, \bar{e}, e) \geq \gamma(\bar{\delta}, \bar{e}, 0) \quad \text{and} \quad \gamma(\bar{\delta}, \bar{e}, -e) \leq \gamma(\bar{\delta}, \bar{e}, 0).
\]
Thus, for a given value of \( \delta \), \( e^* \geq \frac{\bar{e}}{2} \geq e^* \) iff \( \gamma \) is relatively high, and \( e^* \geq \frac{\bar{e}}{2} \geq e^* \) iff \( \gamma \) is relatively low.

**Discussion of Propositions**

Proposition 1 is illustrated in Figure 1.8. The figure depicts the marginal benefit of spending in the swing district (decreasing in \( e^* \)) and the marginal opportunity cost of spending in this district (increasing in \( e^* \)). An increase in the initial electoral advantage in the loyal district (from \( \gamma_L \) to \( \gamma_H \)) reduces the marginal opportunity cost of spending in the swing district. This shifts the marginal cost curve down, which leads unambiguously to an increase in equilibrium spending in the swing district (from \( A \) to \( C \) in the picture). As discussed in Section 1.2, \( \gamma \) captures the electoral advantage that the incumbent government holds over its challengers in the loyal district. A higher \( \gamma \) is thus indicative of less intense local political competition, which allows the incumbent government to
focus on the swing district.

Figure 1.9 illustrates the loyalty effect (Proposition 2). An increase in the persistence of political support in the loyal district raises the marginal benefit of spending in that district. In terms of spending in the swing district, a higher $\delta$ raises the marginal opportunity cost of spending, and so by condition (1.4), spending in the swing district must decrease. An increase in $\delta$ (from a low level, $\delta_L$, to a higher level, $\delta_H$) shifts the marginal cost curve in, which leads to an unambiguous decrease in equilibrium spending in the swing district (from point A to point B in the picture).

The intuition for Proposition 3 is again captured by Figures 1.8 and 1.9. Provided that there exist values of $\beta$, $\delta$ and $\gamma$ such that the spending allocation is equal across the two districts ($e^{xs} = e^{ls} = \frac{\bar{e}}{2}$), Proposition 2 implies that an increase in $\delta$ above that level (holding $\gamma$ constant) will yield an allocation that is favourable to the loyal district (Figure 1.9). Conversely, Proposition 1 implies that an increase in $\gamma$ above that
Figure 1.9: Loyalty effect

level (holding δ constant) will yield an allocation that is favourable to the swing district (Figure 1.8).

1.A.2 Generalizing to Multiple Districts

Generalizing, one can think of a large finite number of districts differing by their persistence factor (δi) and their initial electoral advantage (γi). It will be useful to assume a more general specification for the initial electoral advantage, given by:

\[ γ^i = γ(δ^i) + ξ^i, \]  

(1.16)

where \( γ(δ^i) \) captures any systematic correlation between \( γ^i \) and \( δ^i \), and \( ξ^i \) stands for any other factor affecting local political competition. This decomposition of \( γ^i \) accounts for the fact that the intensity of political competition is typically correlated with partisan loyalty, but also influenced by other local and economy-wide political conditions. For ex-
ample, characteristics of local challengers and the national political climate undoubtedly influence the incumbent’s initial advantage in a given district.

**Theoretical Model**

Consider multiple districts, indexed such that \( j \in \{1, \ldots, J\} \). Assuming as before that the incumbent politician’s utility depends linearly on the number of seats held, generalization of the two-district case yields the following problem:

\[
\max_{\{e^j\}_{j=1}^J} \left\{ \sum_{j=1}^J p_1^j + \beta \sum_{j=1}^J p_2^j \right\}
\]

s.t. \( p_1^j = \frac{1}{2} + F(\gamma^j + e^j) \quad \forall j \)

\( p_2^j = \frac{1}{2} + \delta^j F(\gamma^j + e^j) \quad \forall j \)

\( \sum_{j=1}^J e^j = \bar{e}, \)

where \( \gamma^j = \gamma(\delta^j) + \xi^j \). The same restrictions on the parameters as in the two-district model apply here: \( e^j \geq 0, \gamma^j \geq 0, 0 \leq \delta^j \leq 1, 0 \leq \beta \leq 1, F' > 0, F'' < 0, 0 \leq F(e) \leq \frac{1}{2} \quad \forall e \) and \( F(0) = 0 \). Making the appropriate substitutions, the Lagrangian for this problem may be written as

\[
L = \sum_{j=1}^J (1 + \beta \delta^j) F(\gamma^j + e^j) + \lambda \left[ \bar{e} - \sum_{j=1}^J e^j \right],
\]

which yields the first-order conditions (assuming an interior solution)

\[
e^{j*} = F^{t-1} \left( \frac{\lambda}{1 + \beta \delta^j} \right) - \gamma^j = G(\delta^j) - \gamma(\delta^j) - \xi^j, \quad \forall j.
\]
where \( G(\delta^j) \equiv F^{t-1}\left( \frac{\lambda}{1+\beta \delta^j} \right) \).
Summing over all districts yields an implicit expression for the Lagrange multiplier \( \lambda \) in terms of the model parameters:

\[
\bar{e} + \sum_{j=1}^{J} \gamma^j = \sum_{j=1}^{J} F^{t-1}\left( \frac{\lambda}{1+\beta \delta^j} \right) \Rightarrow \lambda \geq 0.
\] (1.20)

Like in the two-district model, two opposite forces affect the allocation of spending across districts. The effect of the initial political advantage on spending is negative (\( \frac{\partial e^j}{\partial \gamma^j} \leq 0 \)).

Provided that \( \gamma^j \) and \( \delta^j \) are not too negatively correlated with each other, the direct effect of loyalty, given \( \gamma^j \), is positive (\( G'(\delta^j) \geq 0 \)). These are formalized in the following assumption and lemmas.

**Assumption 3:** \( \gamma'(\delta^j) \geq \bar{\gamma}' \), where \( \bar{\gamma}' = \lambda \left( \frac{1-\beta}{(1+\beta \delta^j)^2 F''(\gamma^j+e^j)} + \sum_{i \neq j} \frac{1}{(1+\beta \delta^i)^2 F''(\gamma^i+e^i)} \right) \leq 0. \)

**Lemma 1 (political competition effect):** District-\( j \) expenditure is decreasing in the initial electoral advantage in district \( j \).

*Proof.* \( \frac{\partial e^j}{\partial \gamma^j} = -1 \leq 0. \) ■

**Lemma 2 (loyalty effect):** Under Assumption 3, \( G(\delta^j) \) is an increasing function of \( \delta^j \).

*Proof.* Differentiating \( G(\delta^j) = F^{t-1}\left( \frac{\lambda}{1+\beta \delta^j} \right) \) with respect to \( \delta^j \) yields

\[
G'(\delta^j) = \frac{1}{F''(\gamma^j+e^j)} \left( \frac{-\lambda}{(1+\beta \delta^j)^2} + \frac{1}{1+\beta \delta^j} \frac{d \lambda}{d \delta^j} \right). \] (1.21)

Totally differentiating (1.20) with respect to \( \lambda \) and \( \delta^j \) yields

\[
\frac{d \lambda}{d \delta^j} = \frac{\gamma'(\delta^j) + \frac{\lambda \beta}{(1+\beta \delta^j)^2 F''(\gamma^j+e^j)}}{\sum_{j=1}^{J} \frac{1}{(1+\beta \delta^j)^2 F''(\gamma^j+e^j)}}. \] (1.22)
Signing (1.21) involves signing the expression \( \frac{-\lambda}{(1+\beta \delta^j)^2} + \frac{1}{1+\beta \delta^j} \frac{d \lambda}{d \delta^j} \), which is negative if
\[
\frac{d \lambda}{d \delta^j} \leq \frac{\lambda}{1+\beta \delta^j}.
\] (1.23)

For this condition to hold, we need
\[
\gamma'(%(\delta^j)) \geq \lambda \left( \frac{1 - \beta}{(1 + \beta \delta^j)^2 F^u(\gamma^j + e^{j*})} + \sum_{i \neq j} \frac{1}{(1 + \beta \delta^i)^2 F^u(\gamma^i + e^{i*})} \right),
\] (1.24)

which is true by Assumption 3.

Proposition 4 summarizes the trade-off that the government faces in the allocation of \( \bar{e} \) across districts.

**Proposition 4:** In the multiple district model, district-\( j \) expenditure increases (decreases) with loyalty (\( \delta^j \)) as long as the loyalty effect dominates (is dominated by) the political competition effect associated with an increase in \( \delta^j \).

**Proof.** Differentiating (1.19) with respect to \( \delta^j \) yields
\[
\frac{\partial e^{j*}}{\partial \delta^j} = G'(\delta^j) - \gamma'(\delta^j) \geq 0.
\] (1.25)

\( G'(\delta^j) \) is positive by Lemma 2 and \( \gamma'(\delta^j) \) is bounded below by \( \bar{\gamma}' \leq 0 \) (Assumption 3).

**Empirical Implementation**

Equilibrium condition (1.19) forms the basis of my empirical strategy. For estimation purposes, I extend this condition to include other observable political and non-political
determinants of public spending, that are assumed to enter the equation linearly:

$$e^j = G(\delta^j) - (\gamma(\delta^j) + \xi^j) + \beta Z^j + \theta X^j + \epsilon^j,$$

(1.26)

where $G(\delta^j)$ is an increasing function of $\delta^j$ (by Lemma 2), $Z^j$ stands for other political factors that may affect the allocation of spending, and $X^j$ and $\epsilon^j$ are observable and unobservable district characteristics respectively.

Note that, according to Proposition 4, the sign of the relationship between partisan loyalty and expenditure (i.e. the sign of $\partial e^j / \partial \delta^j$) depends crucially on the sign of the correlation between loyalty and political competition (i.e. the sign of the derivative $\gamma'(\delta^j)$). For the incumbent government, there is a trade-off if high loyalty districts tend to display high values for both $\gamma^j$ and $\delta^j$, that is if $\gamma'(\delta^j) \geq 0$. In this case (for which this chapter provides empirical evidence), the model predicts an ambiguous relationship between district expenditure and the degree of loyalty, depending on which of the political competition or loyalty effect dominates. \(^{49}\) A dominant loyalty effect would be consistent with the machine politics view of distributive politics, whereas a dominant political competition effect would be consistent with the swing voter view.

\(^{49}\)Note that this case is a natural extension of the two-district model, in which such a positive correlation between $\gamma^j$ and $\delta^j$ was implicitly assumed (see assumptions 1 and 2).
Table 1.1 Summary statistics: Expenditure data (dependent variable)

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Notes: Standard deviations in paratheses. 1992 Canadian dollars ('000$).
### Table 1.2 Summary statistics: District characteristics and political variables

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Table 1.3 Summary statistics: Provincial general election results, Québec, 1981-2003

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Legend:
QLP: Québec Liberal Party
PQ: Parti Québécois
ADQ: Action démocratique du Québec (first ran in the 1994 election)
Table 1.4 Panel estimation results

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<td>(1.92)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UE</td>
<td>115***</td>
<td>-.92*</td>
<td>-80</td>
<td>-71</td>
<td>-90*</td>
</tr>
<tr>
<td></td>
<td>(45)</td>
<td>(51)</td>
<td>(180)</td>
<td>(53)</td>
<td>(51)</td>
</tr>
<tr>
<td>INC</td>
<td>.0336</td>
<td>-.0427</td>
<td>.0630</td>
<td>.0327</td>
<td>-.0401</td>
</tr>
<tr>
<td></td>
<td>(.0250)</td>
<td>(.0721)</td>
<td>(.1409)</td>
<td>(.0728)</td>
<td>(.0721)</td>
</tr>
</tbody>
</table>

Fixed effects  no  yes  yes  yes  yes
Year effects   yes  yes  yes  no   yes
$R^2$          .5646  .7555  .8134  .7544  .7568
Observations  1158  1168  345  1168  1168

Notes: Dependent variable: district-level expenditure. Constants included but unreported. Robust standard errors in parentheses, adjusted for clustering. Levels of statistical significance: 1% (***) 5% (**) and 10% (*).

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Table 1.5 Pooled regressions with loyalty

<table>
<thead>
<tr>
<th></th>
<th>MAR</th>
<th>LOYAL</th>
<th>GOV</th>
<th>MIN</th>
<th>FE</th>
<th>$R^2$</th>
<th>corr(MAR,LOYAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark regression (no control for loyalty)</td>
<td>2089**</td>
<td>453</td>
<td>685*</td>
<td>No</td>
<td>.5608</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(832)</td>
<td>(338)</td>
<td>(364)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L1) Loyal for 3 elections (85, 89, 94)</td>
<td>1072</td>
<td>1110***</td>
<td>118</td>
<td>576</td>
<td>No</td>
<td>.5676</td>
<td>.33***</td>
</tr>
<tr>
<td></td>
<td>(880)</td>
<td>(384)</td>
<td>(355)</td>
<td>(356)</td>
<td></td>
<td>(6.4)</td>
<td></td>
</tr>
<tr>
<td>(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)</td>
<td>700</td>
<td>1673***</td>
<td>100</td>
<td>448</td>
<td>No</td>
<td>.5739</td>
<td>.36***</td>
</tr>
<tr>
<td></td>
<td>(829)</td>
<td>(407)</td>
<td>(345)</td>
<td>(345)</td>
<td></td>
<td>(6.9)</td>
<td></td>
</tr>
<tr>
<td>(L3) Loyal in the past (81 onwards)</td>
<td>79</td>
<td>1510***</td>
<td>36</td>
<td>457</td>
<td>No</td>
<td>.5710</td>
<td>.50***</td>
</tr>
<tr>
<td></td>
<td>(895)</td>
<td>(385)</td>
<td>(353)</td>
<td>(350)</td>
<td></td>
<td>(9.3)</td>
<td></td>
</tr>
<tr>
<td>(L4) Loyal in the future</td>
<td>1228</td>
<td>1298***</td>
<td>81</td>
<td>535</td>
<td>No</td>
<td>.5717</td>
<td>.28***</td>
</tr>
<tr>
<td></td>
<td>(813)</td>
<td>(350)</td>
<td>(349)</td>
<td></td>
<td></td>
<td>(5.4)</td>
<td></td>
</tr>
<tr>
<td>(L5) Loyal in the past (81 and 85 only)</td>
<td>103</td>
<td>1608***</td>
<td>90</td>
<td>458</td>
<td>No</td>
<td>.5744</td>
<td>.46***</td>
</tr>
<tr>
<td></td>
<td>(884)</td>
<td>(373)</td>
<td>(342)</td>
<td>(350)</td>
<td></td>
<td>(8.2)</td>
<td></td>
</tr>
<tr>
<td>(L6) Loyal in the future (98 and 03 only)</td>
<td>881</td>
<td>1359***</td>
<td>56</td>
<td>546</td>
<td>No</td>
<td>.5729</td>
<td>.35***</td>
</tr>
<tr>
<td></td>
<td>(811)</td>
<td>(331)</td>
<td>(345)</td>
<td>(344)</td>
<td></td>
<td>(6.3)</td>
<td></td>
</tr>
<tr>
<td>(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)</td>
<td>-529</td>
<td>236</td>
<td>729*</td>
<td>268</td>
<td>Yes</td>
<td>.7551</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(765)</td>
<td>(482)</td>
<td>(410)</td>
<td>(270)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)</td>
<td>-84</td>
<td>907***</td>
<td>309</td>
<td>Yes</td>
<td>.7543</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(751)</td>
<td>(306)</td>
<td>(268)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L2) Construction expenditure only</td>
<td>-835</td>
<td>778**</td>
<td>273</td>
<td>Yes</td>
<td>.4721</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(711)</td>
<td>(306)</td>
<td>(258)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>(L2) Maintenance expenditure only</td>
<td>750*</td>
<td>128</td>
<td>36</td>
<td>Yes</td>
<td>.8280</td>
<td></td>
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<tr>
<td></td>
<td>(390)</td>
<td>(200)</td>
<td>(163)</td>
<td></td>
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</tbody>
</table>

Notes: Dependent variable: district-level expenditure. Constants included but unreported. Robust standard errors in parentheses (robust $t$-stats in the last column), adjusted for clustering. Levels of statistical significance: 1% (***) , 5% (**) and 10% (*). n=1158. Full set of district characteristics ($X$) and year effects included.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Loyal to the Liberals</th>
<th>Others</th>
<th>Diff. (t-stat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA</td>
<td>4.7</td>
<td>5.8</td>
<td>-1.8*</td>
</tr>
<tr>
<td>POP</td>
<td>52,962</td>
<td>52,034</td>
<td>0.6</td>
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<tr>
<td>URB</td>
<td>81</td>
<td>74</td>
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</tr>
<tr>
<td>FIRMS</td>
<td>128</td>
<td>112</td>
<td>1.0</td>
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<tr>
<td>UE</td>
<td>11.1</td>
<td>12.8</td>
<td>-1.7*</td>
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<tr>
<td>INC</td>
<td>42,937</td>
<td>41,351</td>
<td>0.9</td>
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<tr>
<td>FRENCH</td>
<td>65</td>
<td>87</td>
<td>-5.6***</td>
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Notes: Level of statistical significance: 1% (**), 10% (*). Loyalty measure: (L2). Two-sided t-tests.
<table>
<thead>
<tr>
<th>OLS: (L1) Loyal for 3 elections (85, 89, 94)</th>
<th>MARGIN</th>
<th>LOYAL</th>
<th>GOV</th>
<th>MIN</th>
<th>$R^2$</th>
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</thead>
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<tr>
<td></td>
<td>1072</td>
<td>1110</td>
<td>118</td>
<td>576</td>
<td>.5676</td>
</tr>
<tr>
<td></td>
<td>(880)</td>
<td>(384)</td>
<td>(355)</td>
<td>(356)</td>
<td></td>
</tr>
<tr>
<td>(L1) Loyal for 3 elections (85, 89, 94)</td>
<td>-1085</td>
<td>3465</td>
<td>-594</td>
<td>344</td>
<td>.5373</td>
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<tr>
<td></td>
<td>(1604)</td>
<td>(1377)</td>
<td>(545)</td>
<td>(401)</td>
<td></td>
</tr>
<tr>
<td>(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)</td>
<td>-993</td>
<td>3712</td>
<td>-331</td>
<td>160</td>
<td>.5545</td>
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<td></td>
<td>(1571)</td>
<td>(1510)</td>
<td>(476)</td>
<td>(432)</td>
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<tr>
<td>(L3) Loyal in the past (81 onwards)</td>
<td>-3153</td>
<td>3861</td>
<td>-613</td>
<td>103</td>
<td>.5464</td>
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<tr>
<td></td>
<td>(2367)</td>
<td>(1548)</td>
<td>(562)</td>
<td>(439)</td>
<td></td>
</tr>
<tr>
<td>(L4) Loyal in the future</td>
<td>111</td>
<td>2982</td>
<td>-402</td>
<td>381</td>
<td>.5534</td>
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<tr>
<td></td>
<td>(1206)</td>
<td>(1150)</td>
<td>(496)</td>
<td>(372)</td>
<td></td>
</tr>
<tr>
<td>(L5) Loyal in the past (81 and 85 only)</td>
<td>-1703</td>
<td>3071</td>
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<td>252</td>
<td>.5632</td>
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<tr>
<td></td>
<td>(1753)</td>
<td>(1160)</td>
<td>(443)</td>
<td>(396)</td>
<td></td>
</tr>
<tr>
<td>(L6) Loyal in the future (98 and 03 only)</td>
<td>-585</td>
<td>3008</td>
<td>-425</td>
<td>378</td>
<td>.5552</td>
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<tr>
<td></td>
<td>(1367)</td>
<td>(1131)</td>
<td>(502)</td>
<td>(359)</td>
<td></td>
</tr>
<tr>
<td>(L2) Construction expenditure only</td>
<td>-1224</td>
<td>2552</td>
<td>-180</td>
<td>50</td>
<td>.2104</td>
</tr>
<tr>
<td></td>
<td>(1154)</td>
<td>(1103)</td>
<td>(352)</td>
<td>(347)</td>
<td></td>
</tr>
<tr>
<td>(L2) Maintenance expenditure only</td>
<td>231</td>
<td>1160</td>
<td>-151</td>
<td>110</td>
<td>.6822</td>
</tr>
<tr>
<td></td>
<td>(807)</td>
<td>(740)</td>
<td>(237)</td>
<td>(199)</td>
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<table>
<thead>
<tr>
<th>First-stage diagnostics</th>
<th>Correlation</th>
<th>F-test</th>
<th>Partial $R^2$</th>
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</thead>
<tbody>
<tr>
<td>(L1)</td>
<td>-.29***</td>
<td>29.9***</td>
<td>.09</td>
</tr>
<tr>
<td>(L2)</td>
<td>-.36***</td>
<td>27.5***</td>
<td>.09</td>
</tr>
<tr>
<td>(L3)</td>
<td>-.39***</td>
<td>29.7***</td>
<td>.09</td>
</tr>
<tr>
<td>(L4)</td>
<td>-.35***</td>
<td>39.0***</td>
<td>.10</td>
</tr>
<tr>
<td>(L5)</td>
<td>-.46***</td>
<td>43.9***</td>
<td>.12</td>
</tr>
<tr>
<td>(L6)</td>
<td>-.40***</td>
<td>42.8***</td>
<td>.10</td>
</tr>
</tbody>
</table>

Notes: Dependent variable: district-level expenditure. Constants included but unreported. Robust standard errors in parentheses, adjusted for clustering. Levels of statistical significance: 1% (***) , 5% (**) and 10% (*). n=1158. Full set of district characteristics (X) and year effects included. No district fixed effects. LOYAL instrumented with FRENCH. First-stage diagnostics for the excluded instrument (FRENCH): robust test statistics, adjusted for clustering.
Table 1.8 Difference-in-differences estimates

<table>
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<th>All expenditure</th>
<th>Construction</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loyal Liberal ridings - Liberals in power</td>
<td>5999</td>
<td>2882</td>
<td>3117</td>
</tr>
<tr>
<td>Loyal Liberal ridings - PQ in power</td>
<td>4634</td>
<td>1981</td>
<td>2653</td>
</tr>
<tr>
<td>Difference (1)</td>
<td>1365</td>
<td>901</td>
<td>464</td>
</tr>
<tr>
<td></td>
<td>(1249)</td>
<td>(598)</td>
<td>(760)</td>
</tr>
<tr>
<td>Other ridings - Liberals in power</td>
<td>5270</td>
<td>2079</td>
<td>3191</td>
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<tr>
<td>Other ridings - PQ in power</td>
<td>5417</td>
<td>2586</td>
<td>2830</td>
</tr>
<tr>
<td>Difference (2)</td>
<td>-147</td>
<td>-507</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>(579)</td>
<td>(328)</td>
<td>(335)</td>
</tr>
<tr>
<td>Difference-in-difference (1)-(2)</td>
<td>1511</td>
<td>1407**</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>(1377)</td>
<td>(683)</td>
<td>(831)</td>
</tr>
<tr>
<td>D-in-D with full set of controls</td>
<td>990</td>
<td>1160**</td>
<td>-170</td>
</tr>
<tr>
<td></td>
<td>(734)</td>
<td>(535)</td>
<td>(406)</td>
</tr>
</tbody>
</table>

Notes: Dependent variable: district-level expenditure. Robust standard errors in parentheses, adjusted for clustering. Loyalty measure: (L2). **Significant at the 5% confidence level. Full set of controls includes district characteristics (X), political variables (Z) and year effects. No district fixed effects.
Chapter 2

Intertwined Federalism: Accountability Problems under Partial Decentralization

“... decentralization often creates a more complex, intertwined form of governance that bears little resemblance to the forms of decentralization envisioned in textbooks on fiscal federalism or in public choice theories.”


2.1 Introduction

Citizens in a democracy face a key challenge in holding their political representatives accountable, a theme emphasized in the large theoretical literature on political agency problems.\footnote{For a comprehensive survey of this literature, see Besley (2006).} Accountability is especially hard to achieve given the complex array of
tasks performed by modern governments and the limited set of levers that voters can pull – typically, just one collective reelection decision per political cycle – giving rise to a potentially severe advantage in favour of politicians over voters. Decentralization of expenditure responsibilities from central to local levels of government is generally thought to mitigate this agency problem by bringing the policymaking process closer to citizens and, hence, to increase overall government accountability. The World Bank (2004), for example, has strongly advocated decentralization on the basis that it will help to solve corruption problems, especially in developing countries.

The standard intuition that decentralization should be accountability-improving is consistent with theoretical models considering complete decentralization, i.e. the full transfer of a given expenditure responsibility from a higher level of government to a lower one. In practice, decentralization reforms tend to be partial in nature, leading to the involvement of multiple tiers of government in the provision of public goods. With benevolent governments, partial decentralization (as opposed to complete decentralization or complete centralization) is a desirable constitutional arrangement as long as there is some degree of vertical complementarity in public good provision. However, this result does not necessarily hold if governments are opportunistic.

Under partial decentralization, policy outcomes are the joint result of actions taken by politicians at different levels of government. This joint accountability in public good provision has two important consequences: First, it gives rise to informational problems which may complicate the task faced by voters in disciplining politicians via the ballot box. Second, partial decentralization introduces vertical interactions between levels of

---

2 Oates’ (1972) seminal decentralization theorem has this flavour, although it was not originally derived in terms of a political agency problem. Theoretical treatments of decentralization in the context of agency models have been provided, amongst others, by Seabright (1996), Lockwood (2002), Besley and Coate (2003), Tommasi and Weinschelbaum (2007) and Bardhan and Mookherjee (2000, 2005, 2006a). However, these papers do not directly tackle the issues pertaining to partial decentralization and shared responsibility.
government in public good provision.

This chapter sets out an analytical framework to assess the efficiency consequences of partial expenditure decentralization. The analysis is cast in the context of a pure moral hazard political agency model, an approach initiated by Barro (1973) and Ferejohn (1986). Two levels of government are involved in the provision of a public good and voters are imperfectly informed about each government’s contribution to the good. Under complete centralization or complete decentralization, voters can limit governments’ rent-seeking by setting appropriate reelection incentives. This is not necessarily true under shared expenditure responsibility. Unless voters can observe each level of government’s competence and effort towards the provision of the public good (arguably a very strong assumption), the ability of voters to hold politicians accountable is lower under partial decentralization than under either complete decentralization or complete centralization. Thus, a reform from one of these polar cases towards partial decentralization will, in general, have ambiguous consequences for voter welfare, the benefits associated with the vertical complementarity of governments being weighed against the loss of accountability following from imperfect information.

The model yields both positive and normative implications. From a positive point of view, the model has empirically testable predictions about the determinants of the degree of decentralization. Under shared expenditure responsibility, the equilibrium degree of decentralization is endogenous and depends on three factors: (i) the relative competence

---

3 Another question is whether partial decentralization is equity-enhancing, an issue that I abstract from in this paper.

4 In order to focus on vertical interactions between the two levels of government, this version of the model does not consider horizontal interactions among subnational governments. However, future work will extend the proposed framework to allow for interactions among multiple subnational governments. For related models addressing this issue, see Seabright (1996) and Besley and Coate (2003).

5 In this respect, the current paper complements Seabright’s (1996) earlier political agency model by exploring the consequences of partial decentralization, which was beyond the scope of that paper. See Rodden (2004) for a critical survey of the related literature.
of each level of government, (ii) their relative rents from holding office, captured in the model by each level of government’s access to the tax base, and (iii) the political conditions prevailing in both elections, i.e. the extent to which each level of government can affect its electoral fortunes by contributing to the public good. From a normative point of view, as is customary when moving from first-best to second-best analysis, otherwise welfare-improving partial decentralization (because of beneficial complementarities among levels of government) may not be desirable when voters cannot hold each level of government individually accountable for its contribution to public good provision. Partial decentralization is especially detrimental when the features of the political environment distort the degree of decentralization towards the level of government that is the least competent in providing the public good.

In a closely related contribution, Besley and Coate (2003) also adopt a political economy approach to the provision of local public goods in a federation. Their model predicts the misallocation of public goods as a result of conflicts of interest in a centralized legislature and horizontal interactions among subnational governments. This chapter complements Besley and Coate’s analysis by studying the political economy of vertical interactions between two levels of government involved in the provision of public goods that are valued by the same constituency, shifting the focus away from decentralization per se and towards the way decentralization is implemented.

Examples of the kind of situation that the model intends to capture abound. Building a new road may involve the province (e.g. for the ground portions) and the federal government (e.g. for the bridges); security is provided by both provincial and federal police forces; environmental policy (such as complying with the Kyoto protocol) requires actions to be taken by both the federal and provincial governments; the provinces and

\[6\] As noted by Wilson and Janeba (2005), “the political economy approach to fiscal federalism remains relatively unexplored.” Noteworthy exceptions are Panizza (1999) and Arzaghi and Henderson (2005).
local governments are together involved in the provision of public education, etc.

The chapter proceeds as follows. In Section 2.2, I set up a simple pure moral hazard political agency model with two levels of government. Section 2.3 derives the main insight of the chapter in a simplified version of the model in which the inputs produced by both levels of government are perfect substitutes, the two levels of government are equally competent at providing the public good, and elections are deterministic. The model highlights that imperfect information about the intergovernmental composition of spending and vertical strategic interactions between the two levels of government preclude partial decentralization from improving upon the level of voter welfare attainable in a unitary state. Section 2.4 relaxes the perfect substitutes and deterministic elections assumptions, and presents the chapter’s core results. Section 2.5 analyses a series of variants and extensions: First, in Section 2.5.1, I attenuate politicians’ objective, which are assumed to maximize their reelection probability rather than the resources that they can divert from the citizenry. Then, to capture some features of real-world elections, Section 2.5.2 considers a variant of the model in which voters receive systematically biased signals about the contribution of the other level of government when voting in a given election, e.g. as a result of biased media coverage. Section 2.5.3 then analyses the consequences of relaxing the assumption that both governments set their contribution levels simultaneously. Section 2.5.4 briefly considers an extension of the model in which governments supply both a shared public good and specific (non-shared) goods also valued by voters. Section 2.6 discusses the contribution of this chapter to the long-standing debate in the literature about the consequences of decentralization for the size of the public sector. Policy implications are discussed in Section 2.7, and Section 2.8 concludes.
2.2 A Model of Shared Responsibility in Public Good Provision

This section lays down the main building blocks of a model in which a public good valued by the voters in a given jurisdiction is jointly provided by two levels of government (labelled ‘federal’ and ‘provincial’). I describe the environment (composed of two governments and \( N \) identical voters) and characterize the social optimum.

In each of two periods, two levels of government choose fiscal policy (taxes collected and spending) to maximize their expected level of rent extraction, subject to the constraint that they need to seek reelection at the end of the first period. Voters, who value public goods, can observe total taxes and can infer total rents. However, they imperfectly observe the intergovernmental composition of expenditures. Public good provision is positively related to the reelection probability of both governments such that the spending decisions of one level of government affects not only its own reelection probability but that of the other level of government as well (a positive externality arises). Each level of government’s equilibrium contribution to the public good equates its own marginal benefit from reelection – with an incentive to free-ride on the other level of government’s contribution – to the marginal cost of foregone rents in the first period, taking as given the strategy of the other level of government.

\( ^7 \) While the labels ‘federal’ and ‘provincial’ (or its equivalent ‘state’) correspond best to federal countries such as Canada, the US, Germany or Australia, the applicability of the model is much more general. As Breton (1996) argues, it is hard to think of countries where public good provision is not undertaken by two, if not three or more, levels of government. Indeed, countries that are not organized as federations (quasi-federations such as Spain and even unitary states such as France) typically have subnational tiers of government, often with elected officials. In addition to subnational tiers of government, countries are increasingly involved in supranational institutions, some of which exhibit many features of federal countries, a prominent example being the EU.
2.2.1 The Environment

Every period, the federal government (indexed by superscript $f$) and the provincial government (indexed by superscript $p$) each contribute to the provision of a public good $g$ in a given jurisdiction (e.g. a province). Government $j$ produces $g^j \geq 0$ units of a publicly-provided input. Together, the federal and provincial inputs are converted into a public good $g$ by a constant elasticity of substitution (CES) technology:

$$g = \left( \theta^f (g^f)^\rho + \theta^p (g^p)^\rho \right)^{1/\rho}, \quad (2.1)$$

where $\rho \leq 1$, $\theta^p$ and $\theta^f$ are parameters that denote each level of government’s competence.

Each government levies a lump-sum tax ($T^j$) and faces a common unit cost of production ($\bar{\tau}$). Politicians in office can divert tax revenues away from public good provision and towards their own benefit. Assuming balanced budgets at each level of government, any of the jurisdiction’s $N$ individuals faces a total tax bill of

$$T = T^f + T^p = \tau (g^f + g^p) + s^f + s^p, \quad (2.2)$$

where $\tau = \bar{\tau}/N$ and $s^j$ are the per capita rents extracted by government $j$.

All individuals have the following quasi-linear utility function:

$$u(g, z) = h(g) + z, \quad (2.3)$$

where $z$ denotes the consumption of a private good and $h$ is a well-behaved concave

---

*Nishimura (2006) also uses such an aggregation technology in a similar context.*
function. For tractability, let us assume a simple functional form for $h$:

$$h(g) = g^\alpha,$$  \hspace{1cm} (2.4)

where $0 < \alpha < 1$. Furthermore, every period each individual is endowed with $y$ units of the private good such that

$$z + T = y.$$  \hspace{1cm} (2.5)

Without loss of generality, normalize the population of the jurisdiction to unity ($N = 1$) since all individuals are identical.

### 2.2.2 Benevolent Governments and the Optimal Degree of Decentralization

Given the focus on the extent of decentralization on the expenditure side, for expositional purposes, it will be useful to define the ‘degree of decentralization’ ($d$) as the share of provincial spending in total spending:

$$d = \frac{g^p}{g^j + g^p} \in [0, 1].$$  \hspace{1cm} (2.6)

The case in which $d = 1$ will be referred to as complete decentralization, $d = 0$ as complete centralization, and $0 < d < 1$ will correspond to instances of partial decentralization.

Optimality requires that politicians extract no rents while in office ($s^j_S = s^p_S = 0$) and that the Samuelson condition be satisfied (a superscript $S$ denotes the social optimum). In this model, the latter implies that government $j$ contributes to the public good according to the following expression:

$$g^j_S = \left(\frac{T}{\alpha}\right)^{\frac{1}{\alpha-1}} \left((\theta^j)^{\frac{1}{1-\rho}} + (\theta^{-j})^{\frac{1}{1-\rho}}\right)^{\frac{\rho-\alpha}{\rho(\alpha-1)}}$$ if $\rho < 1,$  \hspace{1cm} (2.7)
where \(-j\) denotes the other level of government. It follows from (2.7) that the optimal spending ratio (which determines the optimal degree of decentralization) is a function of the relative competence of the two levels of government:

\[
\left( \frac{g^p}{g^f} \right)^S = \left( \frac{\theta^p}{\theta^f} \right)^{\frac{1}{1-\rho}}.
\] (2.8)

If the inputs produced by both levels of government do not exhibit any complementarity \((\rho = 1)\) – a case in which these inputs are ‘perfect substitutes’ – the socially optimal levels of \(g^f\) and \(g^p\) are given by the following conditions:

\[
\begin{align*}
g^jS &= \left( \frac{z}{\alpha} \left( \frac{1}{\theta^j} \right)^{\alpha} \right)^{\frac{1}{\alpha-1}} \quad \text{if } \theta^j > \theta^{-j}, \\
g^p + g^f &= \left( \frac{z}{\alpha} \left( \frac{1}{\theta} \right)^{\alpha} \right)^{\frac{1}{\alpha-1}} \quad \text{if } \theta^p = \theta^f = \theta, \text{ for some } \theta, \\
g^jS &= 0 \quad \text{if } \theta^j < \theta^{-j}.
\end{align*}
\] (2.9)

The above results are summarized by the following proposition.

**Proposition 1 (Optimal Decentralization).** The involvement of both levels of government in the provision of a public good – i.e. ‘partial decentralization’ – is optimal provided that there is some degree of complementarity between \(g^f\) and \(g^p\). Complete centralization can be optimal only if there is no complementarity in \(g^f\) and \(g^p\) \((\rho = 1)\) and if the federal government is more competent than the provincial government \((\theta^f \geq \theta^p)\). Similarly, complete decentralization is optimal only if \(\rho = 1\) and \(\theta^f \leq \theta^p\).

In the special case in which both levels of government are equally competent and their competence is normalized to unity \((\theta^p = \theta^f = 1)\), the socially optimal levels of \(g^f\)
and $g^p$ are given by

$$
g^f_S = g^{pS} = 2^{\frac{\rho}{(\alpha - 1)}} \cdot \left( \frac{z}{\alpha} \right)^{\frac{1}{\alpha - 1}} \quad \text{if } \rho < 1, \\
g^f_S + g^{pS} = \left( \frac{z}{\alpha} \right)^{\frac{1}{\alpha - 1}} \equiv g^S \quad \text{if } \rho = 1.
$$

When $g^f$ and $g^p$ are perfect substitutes ($\rho = 1$), the case which the next section focuses on, there is no \textit{a priori} reason to favour decentralization over centralization (or vice versa) and any degree of decentralization can be socially optimal. The indeterminacy that characterizes optimal decentralization with $\rho = 1$ disappears once imperfect substitutability is introduced in the model, with $d = \frac{1}{2}$ being optimal when $\rho < 1$.

### 2.2.3 Introducing Politics: Opportunistic Politicians and Strategic Voters

Unless governments are assumed to be benevolent social planners, their behaviour depends on the incentives provided by the political process. This chapter considers a two-period model, with separate elections taking place at the provincial and federal levels between the two periods. The model builds upon Besley and Smart’s (2006, 2007) political agency model (the pure moral hazard case), extending it to a hierarchy of governments. In this model, elections can act as an imperfect disciplinary device, the basic intuition being given in the next section in the context of a unitary state.\(^9\)

**Politicians** Each government maximizes expected discounted rents (per capita) over the two periods, given by

$$
S^j = s^j_1 + P^j \beta s^j_2,
$$

\(^9\)For more details, see Besley and Smart (2006).
where subscripts indicate periods, $\beta \in [0,1]$ is a discount factor and $P^j$ is incumbent $j$’s perception of his reelection probability.

**Voters and elections** Voters face a simple binary reelection decision in the elections held at the two levels of government at the end of period 1. Unless mentioned otherwise, the two elections are assumed to take place simultaneously. Furthermore, following Besley and Smart (2006), voters are taken to be able to announce and commit to a reelection rule before the elections take place.

**Information** The information available to voters at election time is crucial to the ability of elections to act as disciplinary devices. Two sources of imperfect information will be crucial to the analysis that follows:

1. Voters imperfectly observe the contribution of each level of government to the shared public good. However, voters observe the aggregate level of the public good. In other words, voters observe $g$ but not $g^f$ and $g^p$.

2. The analysis is conducted under two different sets of assumptions as to how uncertain voters and incumbents are about the upcoming elections. In Section 2.3, elections are ‘deterministic’ in the following sense: the outcome is fully determined by the strategies played by the agents. In Section 2.4, uncertainty about the election outcome is introduced and resolved only after incumbents have taken all relevant decisions and just before the voters cast their ballots. From the point of view of incumbents, elections are ‘probabilistic’ in this case.

The next section derives the main insight of the chapter under the assumption that elections are deterministic.
2.3 Shared Responsibility Federalism with Perfect Substitutes and Deterministic Elections

The purpose of this section is to compare two constitutional arrangements: a unitary state, and a federal state with shared expenditure responsibility. To this end, I analyse a simplified version of the model which assumes that the inputs provided by the two levels of government are perfect substitutes ($\rho = 1$), that the two levels of government are equally competent in providing the public good ($\theta^p = \theta^f = 1$), and that elections are deterministic. In this simplified model, the key mechanism by which shared responsibility affects electoral accountability is evident: Shared responsibility creates a coordination problem between the two levels of government, with positive provision of the public good by one government generating a positive externality for the other one through increased re-election probabilities.

2.3.1 Unitary State

Let us first analyse the case in which only one level of government provides the public good (unitary state, labeled $US$). This case corresponds to the pure moral hazard case in Besley and Smart (2006).

Although any politician will always extract maximum rents in the final period of the game ($s_2 = y$), politicians’ ability to extract rents can be limited in period 1 by the need to win re-election. In period 1, the incumbent can always set $s_1 = y$ and be defeated for sure, which leads to the following indifference condition:

$$\hat{s}_1(\sigma) + \sigma \beta y = y,$$

where $P = \sigma$ is the representative voter’s re-election rule, i.e. the probability that she
reelects the incumbent, and $s_1(\sigma)$ is the incumbent’s optimal choice of $s_1$.

With only one government involved in public good provision, voters observe perfectly the government’s fiscal policy, i.e. both $g_1$ and $T_1$ are observed. Since we have assumed a balanced budget and provided that $\tau$ is common knowledge, voters can exactly infer the government’s level of rent extraction: $s_1 = T_1 - \tau g_1$. The voters’ reelection rule can therefore be conditioned upon $s_1$. The indifference condition (2.12) implies that $\frac{\partial s_1(\sigma)}{\partial \sigma} \leq 0$, leading voters to adopt the (pure) equilibrium strategy $\sigma = 1$ (i.e. reelect the incumbent for sure) if observed rents are no higher than $(1 - \beta)y$. This level of rent extraction leaves the government indifferent between being reelected and stealing everything today (and being defeated for sure). Therefore, the subgame perfect equilibrium outcome of this game is: $s_1 = (1 - \beta)y$ and $s_2 = y$. This result is summarized in the following proposition:

**Proposition 2 (Unitary state).** There exists a subgame perfect equilibrium of the game with a unitary state in which the incumbent is always reelected and the amount of rents extracted in period 1 is limited to $(1 - \beta)y$. The level of public good provision in period 1 is given by $g_{US} = \arg\max g f_u(g, \beta y - \tau g) \leq g^S$.

**Proof.** Besley and Smart (2006). \hfill \Box

Hence, in a unitary state, elections have been shown to act as a disciplinary device. The remainder of this section will show how this result is affected by the introduction of a second level of government: the answer depends critically on the information available to voters.

### 2.3.2 Shared Responsibility Federalism

I now turn to the analysis of a hierarchy of two governments. I consider an institutional context in which the constitution does not attribute specific responsibility for the
provision of $g$, i.e. there is shared responsibility. However, to avoid complications, it is assumed that neither government can tax more than half of the shared tax base:

$$T^j \leq y/2.$$  \hspace{1cm} (2.13)

Perfect Information

I first assume that voters have perfect information (labeled $PI$) about the fiscal policy conducted by each level of government. Given the above revenue constraint, both governments extract rents $s^j_2 = y/2$ in period 2. In the first period, indifference conditions analogous to condition (2.12) hold for both incumbents:

$$\hat{s}^j_1(\sigma^j) + s^j_1 \beta y/2 = y/2,$$  \hspace{1cm} (2.14)

where $\sigma^j$ is the reelection rule that the representative voter applies to government $j$. It is straightforward to see, in line with the unitary state case, that the following proposition holds:

**Proposition 3 (Decentralization with perfect information).** With shared responsibility and perfect information, the subgame perfect equilibrium outcome is, for each government, rent extraction $s^{jPI}_1 = (1 - \beta)y/2$ and $s^{jPI}_2 = y/2$. The electorate’s (pure) strategies on the equilibrium path in both elections are $\sigma^j = 1$. Any degree of decentralization can be an equilibrium outcome, with $g^{jPI} + g^{pPI} = g^{US}$ and $s^{jPI}_1 + \tau g^{jPI} \leq y/2$.

*Proof. See Appendix.*

The ability of elections to act as a disciplinary device in this environment is the

---

None of the results in this section rely on the assumption that the tax base be split in equal shares. This restriction makes the outcome of the second period certain from the point of view of incumbent politicians, conditional upon reelection, by ruling out vertical interactions between the two levels of government in the second period. One could alternatively assume any tax sharing constraint.
same in a unitary state and in a decentralized state if voters have perfect information about the intergovernmental composition of fiscal policy. This is a strong assumption: voters know perfectly each level of government’s contribution to public good provision and tax tally. The remainder of the chapter analyses the consequences for government accountability of imperfect information about fiscal policy induced by decentralization.

No Information about the Composition of Spending

Assume now that voters observe only total taxes $T_t$ and total public good provision $g_t$. Voters can therefore infer total rents $s_t$ but, in general, not their composition. This precludes the electorate from using a reelection rule based directly on the behaviour of individual governments. Given their observation of aggregate fiscal policy, voters can either adopt a ‘symmetric reelection rule’ (reelect or fire both governments according to some criterion) or an ‘asymmetric reelection rule’ (always reelect or fire one government, and reelect or fire the other according to some criterion).\textsuperscript{11}

I first consider possible pure-strategy equilibria involving symmetric reelection rules of the form:

$$
\sigma = \begin{cases} 
1 & \text{if } s_1 \leq \bar{s}_1 \\
0 & \text{if } s_1 > \bar{s}_1
\end{cases},
$$

(2.15)

where $\sigma$ is a reelection probability that applies to both governments and $\bar{s}_1 < y$ is a given level of rents. In the presence of such a cut-off rule based on aggregate rents, governments face a coordination problem. They need to coordinate to be reelected and share $\bar{s}_1$; otherwise, they are both defeated for sure. Recall that for any government to accept rents less than $y/2$ in period 1, it must be the case that the government is at least indifferent between being reelected and being defeated, that is, $s_1^j \geq (1 - \beta)y/2$.

\textsuperscript{11}The analysis is restricted to pure strategy equilibria.
Given $\sigma$, the two governments play the following period-1 coordination game, in which they can either coordinate (C) to share rents $\bar{s}_1$ or defect (D):

\[
\begin{array}{c|cc}
 & C & D \\
\hline
C & (\frac{\bar{s}_1}{2} + \beta \frac{y}{2}, \frac{\bar{s}_1}{2} + \beta \frac{y}{2}) & (\frac{\bar{s}_1}{2}, \frac{y}{2}) \\
D & (\frac{y}{2}, \frac{\bar{s}_1}{2}) & (\frac{y}{2}, \frac{y}{2})
\end{array}
\] (2.16)

Note that this payoff matrix assumes that if they coordinate, the governments divide $\bar{s}_1$ equally, an assumption compatible with the two governments having equal bargaining power. It is straightforward to show that both (C,C) and (D,D) are Nash equilibria.

If voters have no information about the composition of spending (an assumption labeled NI), decentralization raises the possibility of multiple equilibria. With symmetric reelection rules, both ‘non-coordinated’ and ‘coordinated’ equilibria can arise. In non-coordinated equilibria, both governments extract maximum rents in period 1 and are defeated for sure, regardless of the cutoff level for aggregate rents set by the voters. However, a coordinated equilibrium can also arise, in which $s^{j}_1 = s^{j}_1 = (1 - \beta)y/2$ and both incumbents are reelected for sure.

Other equilibria involve asymmetric firing rules of the following form: always fire or reelect one of the governments ($j$) and reelect the other one ($-j$) if $s_1 \leq y/2 + (1 - \beta)y/2$. In such asymmetric equilibria, voters forego $y/2$ in period 1 to hold government $-j$’s level of rent extraction to its minimum compatible with its incentive constraint, that is $s^{-j}_1 = (1 - \beta)y/2$. In terms of aggregate rent-seeking, the asymmetric equilibria lie in between the coordinated and non-coordinated symmetric equilibria, with $s_1 = (2 - \beta)y/2$. Note that it is only in the coordinated symmetric equilibrium that decentralization does not reduce voter welfare, a result formalized by Proposition 4.\textsuperscript{12}

\textsuperscript{12}One might wonder how robust the non-coordinated symmetric equilibrium is. Intuitively, couldn’t the voters increase $\bar{s}_1$ above $(1 - \beta)y$ and induce both governments to coordinate? Indeed, it can
Proposition 4 (Decentralization with no information). Any equilibrium of the political agency model with two governments and no information about the composition of spending involves equal or higher rent-seeking than in a unitary state. Any degree of decentralization can be observed in equilibrium.

Proof. See Appendix.

An interesting parallel can be drawn between the analysis of this section and the seminal analysis of Brennan and Buchanan (1980). While Brennan and Buchanan’s main argument – based on a competitive markets analogy – is favourable to decentralization or to a federal constitution, they also briefly allude to the possibility of collusion between governments in a federal system. The coordinated equilibrium in the present analysis is reminiscent of this conjecture, with an important difference: Here, ‘collusion’ between the two levels of government (to earn reelection) is actually beneficial to the voters. That being said, to the extent that shared expenditure responsibility is associated with an imperfect ability by the voters to observe each government’s contribution to the shared public good, moving towards shared expenditure responsibility in never welfare-improving in the simple environment assumed in this section.

Recall that this stark result is derived under three strong assumptions: First, the inputs produced by the two levels of government are perfect substitutes; second, the two levels of government are equally competent at providing the public good; and third, elections are deterministic in the sense that voters can commit to a strict reelection rule.

be shown that the non-coordinated equilibrium fails to pass Carlsson and van Damme’s (1993) risk-dominance criterion. The idea is to introduce an arbitrarily small degree of uncertainty by allowing a small proportion of politicians to deviate from Nash equilibrium strategies. Applying iterated strict dominance to this new game yields a unique equilibrium in which the two levels of government coordinate to share rents in period 1 and jointly earn reelection. Note that taking into consideration this result would allow us to write Proposition 4 with strict inequality, both the asymmetric and the risk-dominant symmetric equilibria of the political agency model with two governments involving strictly higher rent-seeking than in a unitary state.
about which there is no uncertainty from the incumbents’ point of view. These assumptions are relaxed in the next section. Assuming probabilistic elections will smooth the problem and avoid the multiplicity of equilibria that arises in the special case studied in this section. Furthermore, relaxing the perfect substitutes and the equal competence assumptions will have important consequences on the equilibrium degree of decentralization.

2.4 Imperfect Substitutes and Probabilistic Elections

This section introduces uncertainty in electoral conditions. In the spirit of probabilistic voting models, such as those developed by Persson and Tabellini (2000) or more recently by Alesina and Tabellini (2007, 2008), election results are typically uncertain from the point of view of politicians (at least to some extent) since a series of shocks may affect the electorate’s decision beyond fiscal policy (e.g. other issues arising during the campaign, characteristics of challengers, partisan loyalty). As before, voters base their reelection decisions on observed aggregate fiscal policy variables. However, it is now assumed that, just before an election, they receive information about other factors affecting their willingness to reelect the incumbent. This information is specific to a given level of government, introducing heterogeneity in the electoral conditions between the elections taking place at the two levels of government. The information becomes available to voters only after both levels of government have taken period-one fiscal policy decisions.\(^{13}\)

The timing of the game is as follows:

1. Incumbents set period-1 fiscal policy (determining the contribution to the shared public good and the level of rents);

\(^{13}\) One interpretation for this is that information about the quality of the challengers becomes available just before the election.
2. Voters observe the realization of two random variables which summarize the electoral conditions specific to each election;

3. The federal and provincial elections take place; and

4. If reelected, the incumbents set period-2 fiscal policy. Otherwise, voters achieve the utility level associated with challengers (similar in all respects to incumbents).

The main consequence of introducing uncertainty about electoral conditions is that voters cannot commit \textit{ex ante} to such a stark reelection cut-off as in equation (2.15). The best that voters can do is now to announce that they will reelect each incumbent if their period-1 utility level exceeds some random threshold value, the distribution of which is assumed to be common knowledge. The cut-off utility level relevant to the provincial election is denoted \( \bar{u} \) and is a random variable distributed according to \( F \), a c.d.f. Hence, voters reelect the provincial government if

\[
\begin{equation}
\begin{aligned}
    u(g, T) &\geq \bar{u}.
\end{aligned}
\end{equation}
\]

Symmetrically, they reelect the federal government if their utility exceeds the realization of a random variable \( \bar{v} \), distributed according to \( G \), a c.d.f.

From the point of view of incumbents, reelection is now probabilistic. Electoral results depend on aggregate public good provision and on the realization of the stochastic reservation utility levels. The probability that the provincial incumbent is reelected is

\[
\begin{equation}
\begin{aligned}
P^p = \Pr [u(g, T) \geq \bar{u}] = F[u(g, T)].
\end{aligned}
\end{equation}
\]

For simplicity, let us assume that \( \bar{u} \) is uniformly distributed on the interval \( [0, u^*] \),
implying that
\[ P^p = \frac{1}{u^*} u(g, T). \] (2.19)

Note that the reelection probability is decreasing in \( u^* \), the upper bound on the random cut-off utility level. Hence, the election is riskier from the incumbent’s point of view the higher is this upper bound.

For simplicity, let us make a few additional assumptions about taxes. Since taxes are lump-sum in this model, we can assume that individuals and governments take total taxes collected \((T^p \text{ and } T^f)\) as given. Let us further assume that \( T^p \) and \( T^f \) are fixed at some pre-determined levels that are sufficient for each level of government to provide some arbitrary maximum level of the public good \((\bar{g})\). In sum, we assume the following series of inequalities for each government \( j \):

\[ \tau \bar{g} \leq T^j \leq y. \] (2.20)

We can now consider the provincial incumbent’s problem in period 1:

\[ \max_{s^p} T^p - \tau g^p + \beta T^p \frac{1}{u^*} \left( (\theta^f (g^f)^p + \theta^p (g^p)^p)^{\alpha/p} - T^p - T^f \right), \] (2.21)

which is obtained by substituting the government’s budget constraint \((\tau g^p + s^p = T^p)\) and equation (2.19) in equation (2.11).\(^{14}\) The federal government solves a symmetric problem, with \( \bar{v} \sim U [0, v^*] \). The two levels of government are assumed to behave non-cooperatively in setting their contribution to the public good, taking the contribution level of the other government as given. Since elections are simultaneous, the equilibrium contribution levels in period 1 will be those observed in a Nash equilibrium.

\(^{14}\)Time subscripts are dropped from now on since the period-2 problem is trivial, with maximum rents being taken by each government. All decision variables relate to period 1.
As in the previous section, the main exercise performed here is to compare two constitutional institutions: a constitution attributing the provision of the public good to one level of government and a federal state with shared expenditure responsibility. Whenever one of the two levels of government is more competent than the other, the specific-responsibility constitution attributes public good provision to the most competent. In the spirit of Oates’ decentralization theorem, let us restrict the analysis to cases where $\theta^f < \theta^p$, that is the level of government closest to citizens has an advantage in production. Let us first consider the case in which the constitution attributes a specific responsibility to one of the levels of government.

### 2.4.1 Specific Responsibility

If the constitution attributes the provision of the public good to the province only, the incumbent will provide the following level of its specific input:

$$g^p = \left[ \frac{\tau}{\alpha} \left( \frac{1}{\theta^p} \right)^\frac{\alpha}{\beta} \frac{u^*}{\beta T^p} \right]^{\frac{1}{\alpha-1}}. \quad (2.22)$$

Note that $g^p$ is increasing in the discounted value of period-2 rents ($\beta T^p$) and in the competence parameter ($\theta^p$), but that it is decreasing in the tax rate ($\tau$) and in the upper bound on the voters’ random utility cutoff ($u^*$). Note also that $g^p$ is different from its socially optimal level, given by equation (2.7), in part because the ‘forced’ complete decentralization in this scenario foregoes the benefits of complementarity between $g^p$ and $g^f$. 

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2.4.2 Shared Responsibility and Endogenous Decentralization

How does the outcome under a constitution attributing public good provision to the most competent level of government compare to the outcome under shared responsibility? Under shared responsibility, the degree of decentralization is endogenous and is the outcome of vertical interactions between the two levels of government that are shaped by the degree of substitutability between the public inputs.\(^{15}\)

Perfect Substitutes Revisited

Before turning to the general case in which the inputs produced by the two governments display at least some degree of complementarity, I first revisit the perfect substitutes case \((\rho = 1)\) of the previous section to highlight the role played by the probabilistic nature of elections.

The first-order condition for the problem in (2.21) yields the following reaction function:

\[
g^{p*}(g^f) = \frac{1}{\theta^p} \left( \frac{\tau}{\alpha} \frac{u^*}{\beta T^p} \right)^{\frac{1}{\alpha - 1}} - \frac{\theta^f}{\theta^p} g^f. \tag{2.23}\]

The federal government’s problem is symmetric and yields the following reaction function:

\[
g^{f*}(g^p) = \frac{1}{\theta^f} \left( \frac{\tau}{\alpha} \frac{v^*}{\beta T^f} \right)^{\frac{1}{\alpha - 1}} - \frac{\theta^p}{\theta^f} g^p. \tag{2.24}\]

Note that since these reaction functions are parallel, the outcome of the game with perfect substitutes will involve either complete centralization or complete decentralization unless the intercepts coincide. Which government provides the good is determined, in

\(^{15}\)Whereas high complementarity mitigates the ability of each government to merely free-ride on the other’s contribution, complementarity is also associated with a more indirect effect of aggregate spending on reelection probabilities.
equilibrium, by the relative values of the ratios \( \frac{u^*}{T_p} \) and \( \frac{v^*}{T_f} \). Specifically,

\[
g^f = \frac{1}{\varphi^f} \left( \frac{\tau}{\alpha} \frac{u^*}{\beta T_f} \right)^{\frac{1}{\alpha-1}} \text{ and } g^p = 0 \quad \text{if } \frac{u^*}{T_f} < \frac{u^*}{T_p},
\]

Any \((g^f, g^p)\) s.t. \( g = \left( \frac{\tau}{\alpha} \frac{u^*}{\beta T_f} \right)^{\frac{1}{\alpha-1}} \) if \( \frac{u^*}{T_f} = \frac{u^*}{T_p} = \pi \), \hspace{1cm} (2.25)

\[
g^p = \frac{1}{\varphi^p} \left( \frac{\tau}{\alpha} \frac{u^*}{\beta T_p} \right)^{\frac{1}{\alpha-1}} \text{ and } g^f = 0 \quad \text{if } \frac{u^*}{T_f} > \frac{u^*}{T_p}.
\]

This result is summarized in the following proposition.

**Proposition 5 (Endogenous decentralization with perfect substitutes).** When the inputs produced by the two levels of government are perfect substitutes \((\rho = 1)\), the equilibrium degree of decentralization (complete decentralization by assumption) corresponds to the optimal degree of decentralization only if \( \frac{T_p}{T_f} > \frac{u^*}{v^*} \), i.e. if the provincial-federal revenue ratio exceeds the provincial-federal ratio of the voters’ reservation utility levels. While any degree of decentralization can be observed if \( \frac{T_p}{T_f} = \frac{u^*}{v^*} \), complete centralization arises in equilibrium if \( \frac{T_p}{T_f} < \frac{u^*}{v^*} \).

Note that assuming that both levels of government are equally competent at providing the shared public good would not fundamentally alter this result since the relative competence of the two levels of government does not play the crucial role in the determination of which government produces the public good.

**Imperfect Substitutes**

This subsection analyses the full-blown model, with \( \rho < 1 \). In this case, the reaction functions are given by:

\[
\frac{\beta T_p}{u^*} (\theta^f (g^f)^\rho + \theta^p (g^p)^\rho) \frac{p}{p-1} (g^p)^{\rho-1} \theta^p = \frac{\tau}{\alpha}, \hspace{1cm} (2.26)
\]

\[
\frac{\beta T_f}{v^*} (\theta^f (g^f)^\rho + \theta^p (g^p)^\rho) \frac{p}{p-1} (g^f)^{\rho-1} \theta^f = \frac{\tau}{\alpha}. \hspace{1cm} (2.27)
\]
Solving (2.26) for an interior solution yields the Nash equilibrium spending ratio:

\[
\frac{g^p}{g^f} = \left( \frac{\theta^p T^p \nu^*}{\theta^f T^f u^*} \right)^{\frac{1}{1-\rho}},
\]  

(2.28)

which in general is different from the optimal spending ratio given by equation (2.8), unless \( T^p u^* = T^f u^* \). Notice that equation (2.28) implies a linear relationship between the logarithm of the spending ratio and the three ratios on the right-hand side. The following equation provides a useful decomposition of the equilibrium spending ratio:

\[
\ln\left( \frac{g^p}{g^f} \right) = \frac{1}{1-\rho} \ln \left( \frac{\theta^p}{\theta^f} \right) + \frac{1}{1-\rho} \ln \left( \frac{T^p}{T^f} \right) + \frac{1}{1-\rho} \ln \left( \frac{u^*}{u^*} \right)
\]  

(2.29)

**Proposition 6 (Endogenous decentralization with imperfect substitutes).** When the inputs produced by the two levels of government are imperfect substitutes (\( \rho < 1 \)), the equilibrium degree of decentralization corresponds to the optimal degree of decentralization (which exceeds \( \frac{1}{2} \) by assumption) only if \( T^p u^* = T^f u^* \), i.e. if the provincial-federal revenue ratio is equal to the provincial-federal ratio of the voters’ reservation utility levels. Otherwise, the equilibrium spending ratio differs from the optimal ratio and is determined by the product of three ratios: the relative competencies \( \left( \frac{\theta^p}{\theta^f} \right) \), the revenue ratio \( \left( \frac{T^p}{T^f} \right) \), and the relative re-election uncertainties \( \left( \frac{u^*}{u^*} \right) \).

Together, the results derived in this subsection and the previous one show how a decentralization reform that leads to *de facto* shared expenditure responsibilities may not be socially optimal despite the existence of complementarities amongst levels of government. The key reasons for why this is the case in this model are (i) voters’ inability to hold each level of government individually liable for its actions, and (ii) vertical interactions amongst levels of government, which take into account factors other
than relative competencies.

So far, the analysis has relied on the assumption that voters receive no information about each government’s contribution to the shared public good (other than the aggregate level of $g$) and that politicians’ objective is to divert resources from the public good. The next section explores variants of the model in which voters receive some information about each government’s contribution to the public good and in which politicians are vote maximizers rather than rent maximizers, with the main insights of the analysis remaining essentially intact. The assumption of simultaneous elections is also relaxed.

2.5 Extensions and Variants

In this section, I alter some features of the model to show that this framework can be used to study a wide variety of policy-relevant situations. First, I restrict the ability of politicians to extract rents from tax revenues; instead, politicians will be assumed to value holding office *per se*. Second, voters will now be assumed to receive some (imperfect) information about each level of government’s contribution to the shared public good. Finally, I consider briefly the consequences of sequential rather than simultaneous elections, and of assuming that the private goods $s^p$ and $s^f$ valued by politicians in the original model are also valued by voters.

2.5.1 Tamed Leviathans: Shared Responsibility with Ego Rents

The results of sections 2.3 and 2.4 have been derived under the arguably strong assumption that politicians behave in the manner of Brennan and Buchanan’s (1980) Leviathan, their only objective being to divert public resources for their own benefit. This is a strong assumption. Let us now assume that politicians are not able to steal resources from the public. Instead, they are assumed to value holding office *per se*, from which they ob-
tain what may be referred to as ‘ego rents.’ Normalizing those ego rents to unity, an incumbent’s problem now reduces to maximizing its reelection probability by choosing a period-1 contribution level to the shared public good. Hence, the provincial incumbent’s optimization problem becomes:

\[
\max_{g} \frac{1}{u^c} (g^a - \tau g). \tag{2.30}
\]

Despite the great simplicity of this model, the application that follows shows that it is nevertheless a useful framework for discussing some of the consequences of shared-responsibility federalism.

### 2.5.2 Media Bias and Imperfect Information

Building on the simplified model of Section 2.5.1, I now relax the assumption that the composition of spending is completely unobservable to voters. A key insight of the model developed in this chapter involves the nature of reelection rules under shared responsibility: If policy outcomes are the joint result of actions undertaken by two levels of government, voters take into account the actions of the other level of government when deciding whether or not to reelect an incumbent. For example, it is not the level of spending by the provincial government \per se\ that matters but the joint policy outcome. Hence, in an extreme case, the provincial government will be reelected for spending zero on the public good if the federal government is already providing alone the optimal level of the good. I now assume that voters benefit from imperfect information about the other government’s level of spending when voting in a given election.
A Model with Imperfect Information

When voting in a provincial election, voters are now able to observe the province’s contribution to \( g \) perfectly and to form an assessment of the federal contribution, given by \( \tilde{g}^f = \vartheta g^f \). \( \vartheta \) can be thought of as the realization of a random variable that is known by both levels of government before making their contribution decisions. This is meant to capture the idea of biased media coverage in electoral campaigns, with the focus being on the actions of the level of government holding an election and those of the other level of government being kept in the background.

Throughout this section, I assume that both governments are equally competent \( (\theta^f = \theta^p = 1) \), and I initially assume that \( g^f \) and \( g^p \) are perfect substitutes. Voters reelect the incumbent provincial government if their utility exceeds the stochastic cut-off \( \bar{u} \):

\[
(g^p + \tilde{g}^f)^{\alpha} - T^p - T^f \geq \bar{u}. \tag{2.31}
\]

Similarly in a federal election, they observe the provincial government’s contribution with noise: \( \tilde{g}^p = \xi g^p \). Voters reelect the federal incumbent if

\[
(\tilde{g}^p + g^f)^{\alpha} - T^p - T^f \geq \bar{v}. \tag{2.32}
\]

I now consider the provincial government’s problem, whose objective is to maximize its reelection probability, subject to its budget constraint:

\[
\max_{g^p} \frac{1}{u^*} \left( ((g^p + \vartheta g^f)^{\alpha} - \tau g^p - T^f) \right). \tag{2.33}
\]
The first-order condition for this problem gives the following reaction function:

\[ g^{p*}(g^f) = \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha-1}} - \vartheta g^f. \]  

(2.34)

The federal government’s problem is symmetric and yields the following reaction function:

\[ g^{f*}(g^p) = \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha-1}} - \xi g^p. \]  

(2.35)

Under the assumption that the vertical interactions between the two governments follow Nash behaviour, the equilibrium contributions to the shared public good are given by:

\[ (g^f, g^p) = \left( \frac{1 - \xi}{1 - \vartheta}, \frac{(1 - \vartheta) \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha-1}}}{1 - \xi \vartheta} \right), \]  

(2.36)

as long as it is not the case that \( \xi = \frac{1}{\vartheta} \). Equation (2.36) implies that aggregate public spending in such a Nash equilibrium is:

\[ g = g^f + g^p = \frac{(2 - \xi - \vartheta)}{1 - \xi \vartheta} \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha-1}}, \]  

(2.37)

which in general is different from the social optimum, given by equation (2.10). In the special case in which the voters perfectly observe each government’s contribution to the shared public good, i.e. \( \xi = \vartheta = 1 \), the Nash equilibrium allocation corresponds to the social optimum:

\[ (g^f, g^p) \in \left\{ (g^f, g^p) : g^f + g^p = \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha-1}}; g^f, g^p \geq 0 \right\}. \]  

(2.38)

These results are summarized in the following proposition.

**Proposition 7 (Inefficiency with imperfect information).** As long as there is
some degree of imperfect information on the part of the voters with respect to the level of spending by the other level of government when voting in a given election, the Nash equilibrium outcome is inefficient. If voters perfectly observe each government’s contribution to the shared public good, the Nash equilibrium aggregate level of all public goods is efficient.

A Special Case: Underestimating the Contribution of the Other Government

I now consider a special case of the previous analysis: When voting in a federal election, voters take full account of federal spending on the shared public good but they may systematically underestimate the contribution of the provincial government, while the opposite holds in a provincial election. This amounts to setting \( \vartheta, \xi \in [0, 1] \). Taking the federal election as an example, at one extreme if \( \xi = 0 \) voters completely ignore the provincial public good; at the other extreme, if \( \xi = 1 \) voters fully acknowledge the provincial public good.

I turn first to the implications of such an informational environment in the perfect substitutes case.

**Perfect Substitutes** With \( \vartheta, \xi \in [0, 1] \), equation (2.37) implies that \( g > g^S \). In words, there is overspending in equilibrium, a result formalized in the following proposition.

**Proposition 8 (Overspending with perfect substitutes).** If voters underestimate the contribution of the other level of government when voting in a given election, the Nash equilibrium aggregate level of public spending is inefficiently high in the perfect substitutes case.

If voters completely ignore spending by the other level of government, i.e. \( \xi, \vartheta = 0 \), overspending is maximized and exceeds the social optimum by a factor of 2. At the other
end of the spectrum, if voters can fully account for spending by the two governments when voting, i.e. $\xi, \vartheta = 1$, the set of Nash equilibria corresponds to the social optimum.

**Imperfect Substitutes** I now analyse the more general model in which the public goods can be imperfect substitutes and even perfect complements, while keeping the simplifying assumption that $\vartheta, \xi \in [0, 1]$. The following analysis shows that the degree of substitutability among goods produced at both levels of government plays a crucial role in shaping the outcome of vertical fiscal interactions.

The first-order conditions of the federal and the provincial governments’ problems with respect to the shared good are now, respectively:

\[
\begin{align*}
((g^f)^\rho + (\xi g^p)^\rho)(g^f)^{\frac{\rho(\rho-1)}{\alpha-\rho}} &= \left(\frac{\tau}{\alpha}\right)^{\frac{\rho}{\alpha-\rho}}, \\
((\vartheta g^f)^\rho + (g^p)^\rho)(g^p)^{\frac{\rho(\rho-1)}{\alpha-\rho}} &= \left(\frac{\tau}{\alpha}\right)^{\frac{\rho}{\alpha-\rho}}.
\end{align*}
\] (2.39) (2.40)

For simplicity, I restrict the analysis to the case in which $\xi = \vartheta \neq 1$, focusing attention on the set of symmetric Nash equilibria (i.e. $g^f = g^p = g^j$). In such an equilibrium, both first-order conditions collapse to (with superscripts omitted)

\[
(\vartheta g^j)^\rho + g^j)^{\frac{\rho(\rho-1)}{\alpha-\rho}} = \left(\frac{\tau}{\alpha}\right)^{\frac{\rho}{\alpha-\rho}},
\] (2.41)

which is solved by

\[
g^f = g^p = \left(\frac{1}{1 + \vartheta^\rho}\right)^{\frac{\rho}{\rho(\alpha-1)}} \left(\frac{\tau}{\alpha}\right)^{\frac{1}{\alpha-1}}.
\] (2.42)

To determine whether such a Nash equilibrium is efficient, i.e. that $g^N = g^S$, recall from equation (2.10) that, with CES utility, optimality requires that $g^fS = g^pS = 2^{\frac{\rho-\alpha}{\rho(\alpha-1)}} \left(\frac{\tau}{\alpha}\right)^{\frac{1}{\alpha-1}}$. The answer depends crucially on the parameter $\rho$. Indeed, efficiency
requires:
\[
\frac{1}{1 + g^p} = \frac{1}{2},
\]  
(2.43)

which is solved only if \( \rho = 0 \). This corresponds to the Cobb-Douglas case. Otherwise, we have:

\[
g > g^S \iff \rho \in (0, 1],
\]  
(2.44)

\[
g < g^S \iff \rho \in (-\infty, 0).
\]  
(2.45)

The results of this subsection are summarized in the following three propositions.

**Proposition 9.** If voters underestimate the contribution of the other level of government when voting in a given election, three types of symmetric Nash equilibria can arise:

(i) **Overspending equilibrium:** spending is inefficiently high if \( \rho \in (0, 1] \);

(ii) **Efficient equilibrium:** spending is efficient if \( \rho = 0 \); and

(iii) **Underspending equilibrium:** spending is inefficiently low if \( \rho \in (-\infty, 0) \).

In the special case in which \( \rho \to -\infty \), i.e. Leontief preferences, both governments provide public goods that are perfect complements. The only pure strategy Nash equilibrium in such a case is zero provision by both governments. A sufficient degree of substitutability between the public inputs provided at each level of government is thus required for the over-provision result to obtain.

### 2.5.3 The Federal Government as a Stackelberg Leader

I assume again that \( \rho = 1 \), i.e. the public inputs are perfect substitutes, and follow the informational assumptions of the above ‘special case.’ However, I now relax the assumption that both governments move simultaneously. Instead, the federal government
decides its level of public good provision before the provincial government, i.e. the federal government is modelled as a ‘Stackleberg leader.’ This gives the federal government a first-mover advantage.

In a subgame perfect equilibrium, the federal government supplies a higher quantity of the public good than the provincial government does:

\[
g_f = \frac{1}{1 - \xi \theta} \left\{ \frac{\tau (1 - \vartheta)}{\alpha (1 - \xi \vartheta)} \right\}^{\frac{1}{\alpha - 1}} - \xi \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha - 1}}, \tag{2.46}
\]

\[
g_p = \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha - 1}} - \frac{\vartheta}{1 - \xi \theta} \left\{ \frac{\tau (1 - \vartheta)}{\alpha (1 - \xi \vartheta)} \right\}^{\frac{1}{\alpha - 1}} - \xi \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha - 1}}. \tag{2.47}
\]

Total spending in the SPE is given by

\[
g = g^f + g^p = \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha - 1}} + \frac{1 - \vartheta}{1 - \xi \theta} \left\{ \frac{\tau (1 - \vartheta)}{\alpha (1 - \xi \vartheta)} \right\}^{\frac{1}{\alpha - 1}} - \xi \left( \frac{\tau}{\alpha} \right)^{\frac{1}{\alpha - 1}} \geq g^S. \tag{2.48}
\]

These results translate into the following proposition.

**Proposition 10 (Overspending with a Stackleberg leader).** *If voters underesti-
mate the contribution of the other level of government when voting in a given election, the subgame perfect equilibrium aggregate level of public spending is inefficiently high in the perfect substitutes case. The government moving first supplies a higher share of aggregate spending.*

### 2.5.4 Introducing Specific Responsibilities

I have assumed so far that governments provide only one public good, namely the shared public good. In reality, governments typically provide some public goods under specific responsibility and others under shared responsibility. It is straightforward to extend the model of the present section to allow for the simultaneous provision of both a shared...
public good and tier-specific public goods. To do so, one might assume that $s^p$ and $s^f$ are now specific public goods that are valued by voters rather than resources merely stolen from the citizenry. In such a model, each level of government provides a specific public good in addition to its contribution to the shared public good. Voter utility is now:

$$u(g, s^p, s^f, z) = g^\alpha + p(s^p) + f(s^f) + z,$$  \hspace{1cm} (2.49)

where $p$ and $f$ are increasing and concave functions. Without any alteration to the budget constraints of governments and individuals, the socially optimal contributions to the shared public good are given by equation (2.10) above, and the socially optimal levels of the specific public goods are given by $p'(s^pS) = f'(s^fS) = 1$. In future work, it will be interesting to extend the analysis along those lines.

The next section offers a brief discussion of the contribution of this chapter to the ongoing debate in the literature about the relationship between decentralization and government size.

### 2.6 Relation to the Literature on Decentralization and Government Size

The relationship between the ‘federal’ structure of the government sector and the total size of the government sector has fueled considerable debate in the literature. Indeed, among the prime candidates to explain the rapid growth of the government sector in the second half of the XXth century was the simultaneous growth in the decentralization of government activities (Oates, 1972).\footnote{Oates’ hypothesis (borrowed from John Wallis) is that decentralization brought government policymaking closer to citizens, who were then more inclined to demand publicly-provided goods (Oates, 1985).} This positive association between the extent...
of decentralization and the size of the public sector is the opposite of Brennan and Buchanan’s (1980) conjecture that federalization should apply downward pressure on the size of the government sector. As a matter of fact, the Brennan and Buchanan view has received only limited empirical support (Oates, 1985 and 1989; Nelson, 1986). Using Canadian data, Grossman and West (1994) observe an increase in both provincial and federal own-purpose expenditures (as a share of GNP) as a result of increased decentralization over the 1958-1987 period. Recent international evidence (Jin and Zou, 2002) also documents a positive relationship between expenditure decentralization and aggregate government size.

The Brennan and Buchanan view has received its most convincing echo in the tax competition literature, associated with the well-known ‘race to the bottom’ outcome (see, e.g., Wilson, 1986). That literature has three main limitations when it comes to explaining the relationship between government size and federalization: (i) it typically treats public good provision as the residual by-product of a tax-setting game; (ii) by focusing on the implications of horizontal factor mobility, it is usually framed in a Tibout-style environment with minimal treatment of political economy considerations; and (iii) it highlights horizontal fiscal interactions, abstracting from the vertical structure of government.

This chapter shifts the attention towards vertical fiscal interactions in the provision

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17 Studies that found some support for the Brennan and Buchanan view include Marlow (1988) and Zax (1989).
18 Grossman and West (1994) suggest that their result provides support for a conjecture, also attributed to Brennan and Buchanan (1980), that governments may collude to extract rents from voters (rather than compete). The present paper shows that one need not resort to a collusion story to rationalize a positive relationship between decentralization and government size. The Canadian experience, characterized by incessant conflict between the federal government and the provinces, seems a priori more likely to fit the predictions of an intergovernmental competition model than of a collusion model.
19 An emerging view of fiscal interactions within federations has emphasized vertical tax externalities between central and subnational governments, predicting that total taxes may in fact be too high in equilibrium (Keen and Kotsogiannis, 2002). This alternative view has received recent empirical support (Brülhart and Jametti, 2006).
of public goods and away from the usual horizontal tax competition.\textsuperscript{20} While the full transfer of spending responsibility from the federal government to the provinces may not lead to bigger government, the growing involvement of both levels of government in a given field of activity may trigger vertical inter-governmental competition and lead to bigger government. The simple model developed in Section 2.5.2 predicts aggregate overspending in a federation where the federal government and the province provide public goods that display a sufficiently high degree of substitutability. Although this prediction has been derived under a rather specific assumption about the nature of the information problem faced by voters, namely systematic underestimation of the other government’s spending when voting in a given election, it conveniently lends itself to empirical investigation.

\subsection*{2.7 Policy Relevance}

Partial decentralization of expenditure responsibilities is an increasingly pervasive institution in both developed and developing countries. From a policy perspective, the current analysis stresses that decentralization \textit{per se} might not generally lead to the oft-trumpeted improvements in accountability. With partial decentralization, the usual accountability benefits of decentralization – which include the potential for yardstick competition across local governments highlighted by Besley and Case (1995) – have to be weighed against the informational problems associated with the involvement of more than one level of government in policymaking. Hence, how decentralization is implemented matters crucially: for example, the full transfer of spending responsibilities from the center to local governments may reduce rent-seeking, but the growing involvement of multiple levels of government in a given field of activity is likely to worsen pre-existing

\textsuperscript{20}Breton (1996) also highlights the need to consider vertical fiscal interactions.
corruption problems and even create new rent-seeking opportunities.

Evidence from recent decentralization reforms in developing countries, typically characterized by partial decentralization, highlights potentially sizeable accountability problems. In his assessment of Brazil’s 1988 decentralization reform, Baiocchi (2006) identifies “overlapping responsibilities in most areas” as an obstacle to the reform’s implementation, together with evidence of corruption at the state and local levels through a “strengthening of the system of spoils for regional elites.” Similarly, Indonesia’s Law 22 of 1999 – designed to improve government accountability via decentralization – is characterized by an “assignment of functions” that is “far from clear” (Hofman and Kaiser, 2006). The authors note that, following the Indonesian reform, “rent-seeking is perceived to have proliferated in many regions because many new politicians are taking turns at the trough.” Azfar et al. (2006) also report overlapping and poorly defined jurisdictions to be a key concern in Uganda’s recent decentralization experience.21

As pointed out by Bardhan and Mookherjee (2006c), these issues are especially relevant in developing countries, where voters tend to be less educated and the circulation of accurate information is poorer. Yet they are also of primary importance in many developed countries (such as the U.S., Canada and the EU) where ongoing debates about the assignment of responsibilities among levels of government are taking place.22

From a normative perspective, the first-best could be restored in this chapter’s model by precluding either government from providing the shared public good – at least when

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21 For an excellent recent survey of decentralization in developing countries, see Bardhan and Mookherjee (2006b).

22 In Canada, the growing involvement of the federal government in areas of provincial jurisdiction (through so-called ‘federal spending power’) gives rise to a heated debate, especially in the autonomy-seeking province of Québec. For example, Québec’s Commission on Fiscal Imbalance (2002) notes that “in the administration of health care, a field of particular public concern, Canadians find it very difficult to clearly identify the roles and responsibilities of each order of government. They seem to overestimate the financial contribution of the federal government and, more generally, do not seem to know exactly who is responsible for what.”
the actions of both levels of government can be thought of as a substitutes. Hence, the analysis has stark policy implications for the allocation of spending responsibilities across levels of government. In particular, it suggests that an optimal constitution would allocate separate and clear spending responsibilities to each level of government, and avoid a blurry allocation of shared powers. However, shared responsibilities exist today in many federations. Furthermore, in some federations there exists a so-called ‘federal spending power,’ such that areas of exclusive provincial responsibility are de facto characterized by shared responsibility. In this spirit, the model highlights the need for constitutional reform in federations to take into account the reality of the political process. In particular, shared responsibility in areas that are politically sensitive (e.g. infrastructure investment) may be especially conducive to inefficient public spending.

2.8 Conclusion

‘Federalization’ has occurred in many regions of the World since the eighteenth century, including North America (the United States of America in 1776 and Canada in 1867) and other large-scale federations (e.g. Australia and Russia). In the aftermath of the Second World War, the creation of the United Nations and what is now the European Union led the way for a new wave of political integration. The recent increase in the membership of the European Union is a clear illustration that independent countries are often willing to forgo part of their national sovereignty to take part in a larger political entity. While political integration is in vogue, so is decentralization (see Stegarescu (2006) for an interesting assessment of these related phenomena). These two trends have a common consequence: the creation or reinforcement of a hierarchy of governments.

23 One example is the area of regional development in Canada, in which both the federal and provincial governments are active players.
A fundamental question is whether these additional levels of government improve the efficiency of public good provision.

Depending upon the specific constitutional rules, both levels of government in a federation (or a decentralized ‘unitary’ state) are more or less involved in similar sectors of activity. In such a context – typical in real-world federations – making coherent collective choices is a complex undertaking for voters, who need to garner information about the contribution of each level of government to the aggregate policy outcomes that they observe. To capture such informational complexity, this chapter has considered a political agency model in which the presence of a hierarchy of governments involved in the provision of a public good is a source of ‘fiscal illusion’ on the spending side (with respect to the intergovernmental composition of government spending). In the model, the provision of public goods by both levels of government in a federation is the margin along which political competition occurs. In a given subnational jurisdiction, the central and the subnational governments compete for the support of the same voters (though in separate elections) by each providing public goods. Under some realistic conditions – chiefly, imperfectly informed voters and substitutable central and subnational public goods – the model predicts inefficient provision of shared public goods in equilibrium.

The next chapter brings to life the ideas developed theoretically in this chapter in the context of an empirical application to public education in California.

\[24\] The literature on fiscal illusion has typically dealt with the tax side of fiscal policy (see Oates (1988) for an early survey). However, as argued by Musgrave (1981), “[...] fiscal illusion is not limited to the tax side only. It is no less plausible to maintain that the benefits of public expenditures are undervalued. [...] Their benefits are more remote [than private goods], and taken for granted much like sunshine, and hence may not be given an adequate evaluation.”
2.A Appendix

2.A.1 Proof of Proposition 3

Proof. Each level of government being taken independently, the proof is exactly the same as for Proposition 2, with maximum rents being $y/2$ for each government instead of $y$. The level of public good provided by each level of government is the outcome of vertical interactions between the two levels of government, with government $j$’s reaction function being given by $g^j = \arg \max \{ u (g^j + g^{-j}, \beta y - \tau (g^j + g^{-j})) \}$ subject to $s^j_1 + \tau g^j \leq y/2$. 

2.A.2 Proof of Proposition 4

Proof. Consider first symmetric voting strategies on the part of the voters. Given the environment, voters are restricted to a binary reelection decision. Since voter utility is monotonically decreasing in $s_1$, it can be shown that the voters’ best response function has the cut-off form given in (2.15). Taking as given an arbitrary cutoff $\bar{s}_1$ and the assumption that the two governments have equal bargaining power, the stage game played by the two levels of government has two Nash equilibria, as long as $\bar{s}_1 \geq (1 - \beta)y$: one in which each governments plays $s^j_1 = \frac{\bar{s}_1}{2}$ (a ‘coordinated’ equilibrium) and one in which each government plays $s^j_1 = \frac{y}{2}$ (a ‘non-coordinated’ equilibrium). If $\bar{s}_1 < (1 - \beta)y$, however, the stage game has a unique, non-coordinated equilibrium. Given these outcomes of the vertical interactions between the two incumbent governments, the rational choice of $\bar{s}_1$ by the electorate is $\bar{s}_1 = (1 - \beta)y$. The two symmetric subgame perfect equilibria of the game can therefore be characterized by (i) $\bar{s}_1 = (1 - \beta)y$, $s^p_1 = s^f_1 = \frac{\bar{s}_1}{2}$ and $s^p_2 = s^f_2 = \frac{y}{2}$, and (ii) $\bar{s}_1 = (1 - \beta)y$, $s^p_1 = s^f_1 = \frac{y}{2}$ and $s^p_2 = s^f_2 = \frac{y}{2}$. In these two equilibria, any level of decentralization can be an equilibrium outcome.
Consider now asymmetric voting strategies. In an asymmetric reelection strategy, one of the governments (denote it by \( j \)) is always defeated or always reelected. In both of these cases, that government extracts maximum rents in both periods. Knowing this and the aggregate levels of public good provision and taxes, the electorate can infer the amount of rent-seeking by the second government (denote it by \(-j\)). Following the logic of the unitary state case, voters set their threshold amount of rents to keep government \(-j\) indifferent between being defeated and being reelected. In this case, only one of the two governments will provide the public good in equilibrium, leading to complete centralization if \( j = \hat{f} \) or complete decentralization if \( j = \hat{p} \).
Chapter 3

Sharing the Blame? Local Electoral Accountability and Centralized School Finance in California

“... the voters of California deeply distrust Sacramento, and it is impossible to imagine that they would favor an initiative to eliminate school districts and local school boards. Yet, there are clear signs that the institutions of local governance are crumbling.”

– Brunner and Sonstelie (2006)
3.1 Introduction

After years of timid federal K-12 education policy leaving the lion’s share to state and local governments, the *No Child Left Behind Act* of 2001 (NCLB) has opened a new era of strong federal intervention in U.S. schools. At the heart of NCLB is a federally mandated full-fledged accountability system. Yet NCLB has left intact the fundamental decision-making institution of the school system: the elected school board. Local elected officials remain in charge of most strategic decisions and, crucially, of the allocation of the bulk of education dollars. And school board members remain directly accountable to their local electorates.

The 2001 federal act marks the climax of 30 years of centralization in the school finance system, sparked by the 1971 Serrano ruling in California. Across the U.S., and especially in California, centralized school finance (at the state level) has been criticized on the grounds that it impedes ‘local electoral accountability’ – i.e. the ability of local elections to act as a disciplining device. According to critics, centralization has transformed school board elections into meaningless disciplining devices.\(^1\) In light of such criticisms, the further centralization in Washington caused by President George W. Bush’s NCLB initiative appears to be at odds with the law’s prominent objective of “increased accountability for States, school districts, and schools.”\(^2\)

This chapter explores the link between school finance centralization and electoral accountability at the school board level, both before and after NCLB, in the state with the most centralized school finance system: California. Although shared expenditure responsibility is an increasingly relevant phenomenon in both developing and developed countries, exogenous changes from tier-specific expenditure responsibility to shared re-

\(^1\)See Timar (2006) for a critical discussion in the Californian context.
sponsibility are scarce in practice. Brunner and Sonstelie (2006) argue, however, that centralized school finance in California provides a rare “experiment in fiscal federalism,” permitting an assessment of the accountability consequences of the growing involvement of a higher tier of government in an area previously under the primary responsibility of local governments.

The empirical framework of this chapter is derived from a theoretical model related to the one developed in Chapter 2. In this model, the growing involvement of multiple tiers of government in the provision of a public good creates a shared accountability problem. With shared responsibility, electoral accountability can be expected to worsen. Thinking about a reform featuring a move away from a situation of complete decentralization (say, at the local level) and towards a growing involvement of higher tiers of government (say, state and federal governments), the mechanism highlighted in the theory predicts a loss in voters’ ability to hold politicians accountable. However, state and federal programs are often specifically designed to improve local accountability – this is especially true of recent initiatives. The theoretical effect of an increased involvement of higher tiers of government in the provision of public education on local electoral accountability is therefore ambiguous and warrants empirical investigation.\(^3\)

From a methodological standpoint, school board elections have desirable features as a ‘laboratory’ for testing the extent of electoral accountability. A key advantage of school boards is the fact that they determine the fate of politicians dealing with a single policy function, namely providing public elementary and secondary education. By contrast, the main problem with assessing the role of national elections as accountability devices is the complex array of tasks that higher tiers of government are involved with, not to mention the small sample sizes typically associated with studying national election

\(^{3}\)This does not rule out the possibility of separately identifying these two opposing effects.
outcomes and the many potential confounding factors.\(^\text{4}\) Hence, local elections present a promising alternative to national elections for studying electoral accountability as they typically deal with fewer policy issues, and as a much larger number of them are held every year – California alone is divided in approximately 1,000 districts.\(^\text{5}\)

More importantly, the institutional environment of California’s school districts provides the type of variation needed to investigate the effect of centralization on local electoral accountability. The analysis exploits the heterogenous degree of school finance centralization across school districts to test whether and, if so, how the extent of school finance centralization affects the electoral accountability of school board members. The California Elections Data Archive (CEDA) provides school board election results for the period 1995-2004, allowing the analysis to capture within-district time variation in the degree of state and federal involvement at the local level, including, crucially, the variation associated with NCLB after 2001.

Despite widespread skepticism surrounding the role played by local elections in a highly centralized system such as California’s, results show that the reelection probability of local incumbents is responsive to differences in dropout rates and pupil-teacher ratios.\(^\text{6}\) Incumbents also appear less likely to be reelected when a district’s degree of centralization is high, conditional on a large set of socio-demographic district controls.

\(^{4}\) A large body of literature has studied the prevalence of ‘economic voting’ at the national level, i.e. the extent to which voters reward or punish politicians for macroeconomic outcomes observed at the time of an election. See Nadeau \textit{et al.} (2002) for a recent contribution. While the correlation between macroeconomic and electoral variables highlighted by this literature is interesting in its own right, it is quite hard to interpret this correlation as evidence of electoral accountability.

\(^{5}\) The main limitation to the use of local elections data in assessing electoral accountability is the lack of comprehensive data. In the U.S., besides California’s CEDA initiative, only South Carolina mandates centralized collection of school board election results – see Berry and Howell (2007) for a paper using data on the state’s 85 districts for the 2000-2004 period. Municipal elections data is equally scarce. To address this limitation, Ferreira and Gyourko (2007) exploit original data from a survey that they conducted at the municipal level in the US.

\(^{6}\) Rincke (2007) finds similar results using California’s Academic Performance Index (API). While Rincke is also interested in local electoral accountability in California’s school boards, he does not address the role of school finance centralization – the main focus of the current paper.
Fixed effect regression results also suggest that the increased involvement of the federal government after 2001 has sharpened local electoral accountability. Together, these results do not seem to support the view that local elections are meaningless devices in a highly centralized local finance system, in addition to highlighting a potentially beneficial role for higher levels of government in fostering local accountability.

The chapter contributes to three strands of literature. First, it complements the existing literature on the effect of school finance centralization by exploring its consequences on local politics. Second, this chapter contributes to the small but growing literature that specifically studies the consequences of No Child Left Behind. Third, the analysis also contributes to our understanding of the political economy consequences of decentralization by studying a single public good (i.e. education), supplementing a large body of literature on decentralization that typically uses data on broad categories of spending or on total government spending.

The chapter proceeds as follows. Section 3.2 presents a simplified version of the theoretical model developed in Chapter 2 and discusses its empirical implementation. In Section 3.3, I discuss the institutional environment of California’s school districts and place California’s experience in the context of the broader debate about school finance centralization in the United States. The data are described in Section 3.4. Empirical results are presented and discussed in Sections 3.5 and 3.6. First, Section 3.5 focuses on the extent to which voters in school board elections react to good policy outcomes by reelecting incumbents (and to bad policy outcomes by defeating them), and on how

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8To the best of my knowledge, this is the first paper to look at the electoral accountability consequences of No Child Left Behind. Other accountability dimensions of the federal reform have been studied, among others, by Neal and Whitmore Schanzenbach (2007), Hastings and Weinstein (2007), Hanushek and Raymond (2007), and Holmes et al. (2007).

9A number of important papers in this literature are discussed in Chapter 2.
centralization affects the probability that an incumbent is reelected. Section 3.6 takes
the investigation of the role played by centralization one step further, exploiting the
variation in federal funding associated with No Child Left Behind. Some concluding
remarks are collected in Section 3.7.

3.2 Theoretical Framework and Empirical Implementation

In this section, I set up a theoretical framework of voter behaviour in an environment
derived by the involvement of more than one level of government in public good
characterized by the involvement of more than one level of government in public good
provision. The model is an application of the political agency model developed in Chap-
ter 2, tailored to capture the key electoral accountability aspects of school finance cen-
tralization.10 This theoretical model supplies the basic relationship to be estimated.

3.2.1 A Simple Model of Shared Electoral Accountability

Consider a model in which the population of a local jurisdiction $j$ – here a school district
– derives utility from a local public good ($O_j$). In the context of this chapter, $O_j$ is best
thought of as the quality of public education delivered by the local education agency
(LEA).

---

10 Other theoretical models devoted to the study of this issue include Hoxby (1999), Nechyba (2003)
and Borck (2008). Hoxby's model predicts that decentralized finance can do almost as well as centralized
finance. Hence, in that sense, her model provides little guidance for empirical investigation. Another
issue is the absence of a political process in her model, though she recognizes that "ongoing politics are
necessary." Both the present work and Borck (2008) attempt to address this concern by modeling ex-
licitly some dimension of the political process. While I highlight the informational problems associated
with the growing involvement of a second tier of government in the provision of public education, Borck
(2008) focuses on the heterogeneous experiences of different income groups (with centralization being
preferred by some and decentralization by others). In work that is highly related to both the theoretical
work of Borck and the current empirical application, Nechyba (2003) emphasizes the important role of
mobility across districts, peer effects and private school enrollment on the outcomes of school finance
reforms.
Technology and Preferences

The public good, $O_j$, is the outcome of a combination of public ‘inputs’ produced by three levels of government: the LEA ($g^l_j$), the State ($g^s_j$), and the federal government ($g^f_j$). Assume the following technology for $O_j$:

$$O_j = G(g^l_j, g^s_j, g^f_j), \quad (3.1)$$

where $G$ is a production function which is increasing in the quantity of its three inputs. These inputs can be interpreted as each politician’s effort toward public good provision.

The representative voter in a district derives utility from the public good and from other ‘goods’ (denoted by the vectors $X_j$ and $Z_j$). Assume that she has the following linear utility function:

$$u_j = \alpha + O_j + \gamma X_j + \delta Z_j, \quad (3.2)$$

where $X_j$ captures various district characteristics and $Z_j$ stands for characteristics of local politicians (beside their effort toward public good provision).

Information, Centralization and Local Elections

Voters reelect the local incumbent if they judge that the expected utility level that they derive from his contribution to the public good (labeled $Eu^l_j$) exceeds the (realized) utility level associated with a random challenger:

$$\text{Reelect } l \text{ if } Eu^l_j + \xi_j \geq \bar{u}^l_j, \quad (3.3)$$

where $\bar{u}^l_j$ is a random utility level, iid across districts with cdf $F$, and $\xi_j$ is a district-specific shock. The probability that voters reelect the local politician in district $j$ (de-
noted $P_l^j$ is thus given by

$$P_l^j = \Pr \left[ u_l^j \leq E u_l^j + \xi_j \right] = F \left[ E u_l^j + \xi_j \right].$$  \hspace{1cm} (3.4)

Voters do not directly observe the quantity of public inputs produced by each level of government. Assume that voters form their expectation of the utility level associated with the actions of the local incumbent as follows:

$$E u_l^j = \alpha + E \left[ g_l^j | O_j, C_j \right] + \gamma X_j + \delta Z_j,$$  \hspace{1cm} (3.5)

where $C_j$ is a district’s degree of centralization, defined as the share of higher levels of government (State and federal) in total spending:

$$C_j = \frac{g_s^j + g_f^j}{g_l^j + g_s^j + g_f^j}.$$  \hspace{1cm} (3.6)

Hence, voters must infer the effort exerted by the local incumbent politician ($l$) based on a retrospective observation of $O_j$ and their knowledge of the relative role of the local government in the production process ($C_j$). When forming their expectation, assume that voters receive an imperfect signal about the contribution of the local incumbent. In other words, they seek to difference out from the observed outcome ($O_j$) the portion that is not attributable to $l$’s actions, but rather to state and federal intervention. Accordingly, assume that voters form their expectations according to the following ‘accountability function,’ which translates observed policy outcomes ($O_j$) into votes for the incumbent politician:

$$E \left[ g_l^j | O_j, C_j \right] = (1 - C_j) \partial O_j,$$  \hspace{1cm} (3.7)
where \( \vartheta \) captures the quality of the signal that voters receive about the level of effort exerted by their local politician. Equation (3.7) has the following implications: if \( C_j = 1 \), the local politician’s reelection probability does not depend on observed policy outcomes; at the other extreme, if \( C_j = 0 \) the voters fully attribute the observed outcomes (\( \vartheta O_j \)) to the local politician.

Assume further that spending by the state and federal governments can improve the quality of the signal received by voters about their LEA’s performance (for example through mandated dissemination of information on \( O_j \)):

\[
\vartheta = \vartheta(C_j),
\]

(3.8)

where \( 0 \leq \vartheta(C_j) \leq 1 \) and \( \vartheta'(C_j) \geq 0 \). If \( \vartheta = 1 \), voters perfectly observe \( O_j \) and attribute \( g_j^I = (1 - C_j)O_j \) to the local politicians. And if \( \vartheta = 0 \), they do not observe \( O_j \) at all. For intermediate values of \( \vartheta \), voters take only part of \( O_j \) into consideration when assessing the local politician’s performance.

Substituting in equation (3.8), equation (3.7) can be characterized by its partial and cross-partial derivatives:

\[
\psi_O = \frac{\partial E[g_j^I|O_j, C_j]}{\partial O_j} = \vartheta(C_j)(1 - C_j) \geq 0,
\]

(3.9)

\[
\psi_C = \frac{\partial E[g_j^I|O_j, C_j]}{\partial C_j} = \vartheta'(C_j)(1 - C_j) - \vartheta(C_j) \geq 0, \text{ and}
\]

(3.10)

\[
\psi_{OC} = \frac{\partial^2 E[g_j^I|O_j, C_j]}{\partial O_j \partial C_j} = \vartheta'(C_j)(1 - C_j) - \vartheta(C_j) \geq 0.
\]

(3.11)

When observing a change of \( \Delta O_j \) in the outcome variable, voters will attribute only \( \Delta E[g_j^I|O_j, C_j] = \psi_O \Delta O_j \) to the local politician. The first potential role of the degree
of centralization in this environment is to alter the slope of the accountability function \( \psi_O \). According to equation (3.11), the effect of centralization on \( \psi_O \) is ambiguous: On the one hand, centralization’s direct effect decreases \( \psi_O \) by reducing the fraction of \( O_j \) attributed to the local government (the second term in \( \psi_{OC} \), \( -\vartheta(C_j) \)); but on the other hand, centralization may improve the quality of the signal received by voters, increasing \( \psi_O \) (the first term in \( \psi_{OC} \), \( \vartheta'(C_j)(1 - C_j) \)). Note that the first-order effect of centralization on \( E\left[ g_j^j|O_j, C_j \right] \), \( \psi_C \), is ambiguous for the same reasons.

### 3.2.2 Empirical Implementation

Equation (3.4) forms the basis of the empirical strategy pursued in this chapter. Substituting in equation (3.5), we get:

\[
P_j^l = F \left[ \alpha + E \left[ g_j^j|O_j, C_j \right] + \gamma X_j + \delta Z_j + \xi_j \right].
\] (3.12)

Exploiting the properties of \( E \left[ g_j^j|O_j, C_j \right] \) and linearizing, I will estimate the following equation to identify \( \psi_O \), \( \psi_C \) and \( \psi_{OC} \):

\[
P_j^l = F \left[ \alpha + \psi_O O_j + \psi_C C_j + \psi_{OC} C_j \cdot O_j + \gamma X_j + \delta Z_j + \xi_j \right].
\] (3.13)

The main parameters of interest for the analysis of this chapter are \( \psi_O \), \( \psi_C \) and \( \psi_{OC} \). In what follows, the measurement convention will be that \( O_j \) is a public bad (e.g. a high dropout rate), that is we will expect an increase in \( O_j \) to reduce an incumbent’s reelection probability. Under that measurement convention, \( \hat{\psi}_O \) will be expected to be negative if local elections are meaningful accountability devices. \( \hat{\psi}_C \) and \( \hat{\psi}_{OC} \) will characterize the effect of centralization of school finance on incumbents’ reelection probability. Negative values for both parameters will be indicative that centralization conveys information
to voters about negative characteristics of incumbents, while positive values will be consistent with centralization weakening local electoral accountability.\(^{11}\)

To estimate equation (3.13), additional assumptions will be required about the distributions of \(\xi_j\) and \(\tilde{u}_j\). If \(\tilde{u}_j\) is assumed to follow a uniform distribution on the \([0, 1]\) interval (which implies a normalization to unity of the maximal utility associated with a challenger) and if \(\xi_j\) is normally distributed, the parameters in equation (3.13) can be estimated by means of the following linear probability model:\(^{12}\)

\[
P_{jt} = \alpha + \psi_{OC}C_{jt} + \psi_{OC}C_{jt} \times O_{jt} + \gamma X_{jt} + \delta Z_{jt} + \xi_{jt}. \tag{3.14}
\]

In what follows, I estimate various empirical specifications of equation (3.14) using detailed data at the school district level in California. The next section provides some institutional background on school finance reform in the U.S., highlighting the specificity of the Californian experience.

### 3.3 School Finance in California: A Primer

The provision of elementary and secondary (K-12) public education in California falls under the responsibility of school districts. School boards are responsible for a variety of fiscal, administrative and academic matters, including adopting the district’s budget, collective bargaining and hiring the superintendent.

While the provision of public education in the State is under the primary responsibility of school districts, both the State and to a lesser extent the federal government play

\(^{11}\)Note that alternative explanations could rationalize positive or negative values for \(\hat{\psi}_C\) and \(\hat{\psi}_{OC}\). For example, a high \(C_j\) could denote a local politician’s strong abilities to secure state and federal funds for his LEA, consistent with a positive \(\hat{\psi}_C\). However, a high \(C_j\) could also be associated with a required intervention by higher levels of government to punish shirking by the local politicians, consistent with a negative \(\hat{\psi}_C\).

\(^{12}\)If \(\tilde{u}_j\) is standard normal, equation (3.13) can also be estimated using a Probit regression.
an important role through a series of transfer programs and various legislative require-
ments. The involvement of the State government in California is especially strong, with
California having the most centralized school finance system in the United States. Fed-
eral involvement has also become more prominent in recent years following the inception
of No Child Left Behind in 2001.

### 3.3.1 State Programs in California

California’s centralized school finance system is the result of a series of court decisions
starting with the 1971 Serrano ruling, by which the historical school finance system –
dominated by local taxes and local accountability mechanisms – was deemed unconsti-
tutional and was overturned.

Serrano led to a sharp increase in the share of district revenues coming from the
State. Consequently, transfers to school boards in California now amount to a large
number of state and federal programs, including both general-purpose transfers (mostly
equalization) and a long list of categorical funds. The latter are the result of a complex
mix of programs and historical entitlements, often unrelated to district needs.

The underlying complexity of California’s transfer system is well illustrated by the
case of one of the State’s main categorical programs: the Economic Impact Aid (EIA).
The EIA is a categorical program whose objective is “to support additional programs and
services for English learners (EL) and compensatory education services for educationally
disadvantaged students” (LAO, 2004). All districts can apply for these funds. This is a
significant program: it awarded $973,388,000 to a total of 974 districts in 2006-2007.\(^{13}\)
Before 2006, EIA was determined by two main formulae. The primary formula used
a “complex multistep process” based on ‘needs’ and poverty. A district’s needs were

\(^{13}\)These figures are from the California Department of Education.
measured by its concentration of EL, poor, and transient students.\textsuperscript{14} The secondary formula distributed funds to districts “whose primary funding allocations would not be sufficient to serve a reasonable portion of the population of pupils from disadvantaged backgrounds” (LAO, 2004).\textsuperscript{15}

In February 2004, the California Legislative Analyst’s Office (LAO) released the following statement about EIA in its analysis of the 2004-05 budget bill:

We find that the EIA funding formula is outdated and results in district allocations that appear arbitrary and unpredictable. We recommend the Legislature simplify the EIA formula so that district allocations are predictable and meet local needs for serving both poor and English learner students.

The empirical analysis of Section 3.5 will exploit such essentially exogenous variation across districts to identify the effect of centralization on electoral outcomes.\textsuperscript{16}

3.3.2 California in Perspective: State Programs in Other States

The Serrano ruling opened the way to similar school finance reforms in many other states. Between 1971 and 1992, the historical school finance systems were overturned in 12 states (see Card and Payne, 2002). Card and Payne’s numbers show that a key consequence of the reforms that followed these rulings has been, as expected, an increase in the state governments’ contribution to expenditures on public education. In these

\textsuperscript{14} The formula also used two measures of poverty: the enrollment of students from families receiving California Work Opportunity and Responsibility to Kids (CalWORKs) grants and poverty data from the 1990 Census.

\textsuperscript{15} The secondary formula has two elements. (1) Per-Pupil Grant: Districts that would receive a relatively small allocation through the primary formula receive funding based solely on the number of CalWORKs and EL students. In 2003-04, approximately 600 school districts received $219 for each student in the two target groups. (2) Minimum District Grant: Districts with very low numbers of EL pupils and pupils from families receiving CalWORKs receive a minimum grant. In 2003-04, approximately 175 school districts received minimum grants.

\textsuperscript{16} In particular, see Section 3.5.4 for a discussion of identification issues.
12 states, the share of the state government increased from 44.5% in 1977 to 56.7% in 1992, a 12.2 percentage point increase. In contrast, very limited action can be observed in the other states. For instance, in the 21 states without a court decision in 1992, the states’ involvement increased by a mere 1.4 percentage point on average, and it even decreased by 0.6 percentage point in the 15 states in which school finance systems were judged constitutional. Despite a slightly lower share of the state government in states with school finance systems judged unconstitutional (44.5% vs. 46.2% in states with constitutional systems and 46.3% in states with no ruling), the three categories of states displayed remarkably similar degrees of school finance centralization in 1977.

Interestingly, the states with court-ordered reform did not experience higher growth of total per-student expenditure. In fact, the growth of spending was 3 percentage points lower in states with court-ordered reforms than in states with court decisions upholding preexisting school finance systems. Thus, in aggregate, the growing involvement of state governments did not increase aggregate support for public education in these states. This result is arguably driven to a significant extent by California, which experienced a large and puzzling decline in education spending relative to other states (Brunner and Sonstelie, 2006). This puzzle is suggestive of local accountability problems associated with centralized school finance, and warrants empirical investigation of the accountability consequences of school finance centralization.

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17 Those ratios are computed from enrollment-weighted averages provided by Card and Payne (2002).
18 One potential explanation is that, knowing that they can’t hold their school boards accountable as tightly as before, voters are less inclined to agree to state money being sent to (inefficient, unaccountable) school boards. Instead, they may be expected to favour other categories of public spending (consistent with California spending more than average in other spending categories).
3.3.3 Federal Programs and No Child Left Behind

The recent years have been marked by a significant increase in the involvement of the federal government in education policy and school finance through the *No Child Left Behind Act* of 2001 (NCLB). A broad initiative, the objectives of the Act included:

- Increased accountability for states, school districts, and schools;
- Greater school choice, especially in the presence of low-performing schools;
- More flexibility for states and LEAs in the use of Federal education dollars; and
- A stronger emphasis on reading, especially for the youngest children.

According to the U.S. Department of Education (2002), NCLB aimed to increase accountability in the following sense:

The NCLB Act will strengthen Title I accountability by requiring States to implement statewide accountability systems covering all public schools and students. These systems must be based on challenging State standards in reading and mathematics, annual testing for all students in grades 3-8, and annual statewide progress objectives ensuring that all groups of students reach proficiency within 12 years. Assessment results and State progress objectives must be broken out by poverty, race, ethnicity, disability, and limited English proficiency to ensure that no group is left behind. School districts and schools that fail to make adequate yearly progress (AYP) toward statewide proficiency goals will, over time, be subject to improvement, corrective action, and restructuring measures aimed at getting them back on course to meet State standards. Schools that meet or exceed AYP objectives.

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or close achievement gaps will be eligible for State Academic Achievement Awards.

The next section describes the data used in this chapter to investigate the effect of centralization on local electoral accountability.

3.4 Data and Variables

Four main data sources will be used in the analysis: the California Elections Data Archive (CEDA), the Census of Governments, the California Department of Education, and the 2000 Census. In what follows, I describe these data sources, discuss the variables used in the analysis and provide summary statistics. In this chapter, the unit of analysis is the school district \( j \), and the data cover the 1995-2004 decade.

In school year 2004-05, there were a total of 979 school districts in the State: 562 elementary (or primary) school districts, 88 secondary (or high) school districts and 326 ‘unified’ districts (overseeing both primary and high schools). Maps 1 to 4 (located at the end of this chapter) depict the geography of California’s public school system.\(^\text{20}\) Map 1 shows the location of all public schools in the State, highlighting the concentration of California’s population in the San Francisco Bay and Los Angeles areas. Maps 2 to 4 respectively locate each of California’s unified districts (Map 2), elementary districts (Map 3) and secondary districts (Map 4), featuring their total population.

3.4.1 Elections

Every school district is governed by an elected school board, generally composed of three, five or seven members. Typically, every two years a fraction of the board must earn

\[^{20}\text{The maps of this chapter were generated using the School District Demographics System, which provides special tabulations of the 2000 US Census at the school district level.}\]
reelection in first-past-the-post elections. In collaboration with the State government, the Institute for Social Research and the Center for California Studies systematically collect all local election results in California. For my purposes, the crucial feature of CEDA is that data on school district elections are readily available starting in 1995.\textsuperscript{21}

To isolate the role of elections in holding incumbents accountable, the analysis of this chapter is based on the subsample of electoral races in which the incumbent seeks reelection. Three electoral variables are constructed from these data: the percentage of incumbents reelected in year $t$ and district $j$ ($P_{jt}^{l}$), incumbents’ average vote share, and the average number of candidates running. The latter two variables form the $Z_{jt}$ vector.\textsuperscript{22} Some districts are subdivided in election wards while others elect at-large board members. In both cases, since the analysis of this chapter is conducted at the district level, these three variables are defined as district averages.

Summary statistics for the election variables are displayed in Table 3.1. The dataset is composed of 2,507 district/year observations, with a yearly average of 251 districts holding at least one election. The annual count is higher in even years. School board elections are most often held in conjunction with other political races and even years correspond to statewide election years – for example, elections held in 1998 and 2002 were held together with gubernatorial elections. Odd years tend to be reserved for local races.

On average, 77.8\% of incumbents were reelected during the period covered by CEDA. The typical incumbent wins with 30.0\% of the popular vote and is involved in a 4.6-candidate race.

\textsuperscript{21} These data are available from the Institute for Social Research. CEDA is housed by California State University, Sacramento.

\textsuperscript{22} An unfortunate limitation of the California elections data is the absence of turnout data.
3.4.2 Public Finance

The local elections data is merged with detailed public finance data at the school district level. These data are compiled yearly by the Census Bureau in its Census of Governments.\(^{23}\) The key public finance variable of interest is the share of funding coming from the state and/or federal governments (denoted by \(C_{jt}\)).

Table 3.2 presents summary statistics on this variable for all districts in California. The average state share over the 1995-2004 period was 54.9%, more than 7 time higher than the average federal share (7.2%). The state share peaked in 2001 at 57.2% and declined sharply in the three years that followed. Mirroring the decline in the state share, the federal share increased steadily in the post-NCLB period (2002-2004).

Californian school districts vary widely with respect to the involvement of higher tiers of government, as is evident from Figure 3.1. At the left extreme of the histogram are located a small number of wealthy districts that do not receive any state funding, the ‘Basic Aid Districts.’ These districts rely solely on property taxes to fund public education. As we move to the right of the figure, districts are less wealthy and rely more heavily on state and federal transfers, with a large number of districts receiving more than half of their budget in transfers.

3.4.3 Policy Outcomes

The third source of data covers educational outcomes. Every year, the California Department of Education releases data on the activities conducted by the State’s school districts. In what follows, I use two ‘performance measures’ as policy outcomes at the district level (\(O_{jt}\)): the high school dropout rate and the pupil-teacher ratio (see Table 3.2 for summary statistics). A key advantage of these two performance measures is their

\(^{23}\)The data are available from the U.S. Census Bureau.
Figure 3.1: Histogram of the share of revenues from state and federal governments, 2004 availability for the entire period covered by the elections data, and in particular for both the pre- and post-NCLB periods. As previously mentioned, the measurement convention is that an increase in $O_{jt}$ corresponds to a worsening in performance.

The average annual dropout rate in the State between 1995 and 2004 was 2.44%, with higher figures observed at the beginning and at the end of the period.\footnote{Note that the CDE does not release dropout data for 1999.} It is important to note that the dropout rate pertains to districts with high schools only (high school and unified districts), while the pupil-teacher ratio is available for all districts. A typical teacher had 20.17 pupils to supervise during the period of interest, with the highest ratio being observed at the beginning of the period, in 1995. Ten years later, the pupil-teacher ratio had declined by more than three students, a result of statewide efforts to reduce class size in the 1990s.

Additional variables constructed from the State’s data are a dummy variable for
primary school districts, a dummy for high school districts, the total yearly enrollment in the district, and the number of schools in the district. These form the $X_{jt}$ vector, together with a series of socio-demographic characteristics extracted from the 2000 Census.

### 3.4.4 Socio-Demographic Characteristics

Finally, a broad set of socio-demographic controls are included in the $X_{jt}$ vector. The Census variables included in the analysis are: the median family income, the age distribution, the share of immigrants, the population’s educational attainments, the quality of spoken English, the share of households with children, the median rent, the median house value, the share of households renting, a poverty count, the racial composition, rent as a percentage of income, the total population, the urban population, and the median effective property tax rate.

In line with the heterogeneity in the degree of centralization across districts depicted in Figure 3.1, districts vary widely according to their socio-demographics. For example, see maps 5 and 6 for plots highlighting district heterogeneity in racial composition (Map 5) and median house value (Map 6).

### 3.5 Reelection Probability, Educational Outcomes and Centralization

The regression results presented in this section provide an initial exploration of the impact of state and federal transfers on the reelection probability of school board members. The empirical strategy involves estimating a linear probability model based on equation
where $Y_t$ is a vector of year effects, and $D_j$ is a vector of district fixed effects.\footnote{Note that equation (3.15) differs from equation (3.14) in that it does not include the slope effect of centralization on reelection probability ($\psi_{OC}$). Of course, nothing precludes the inclusion of the slope parameter in the regressions conducted in this section. In unreported regression results corresponding to the ones discussed in this section (available upon request), $\psi_{OC}$ is never significant. These results indicate no statistically significant difference in how voters react to observed policy outcomes in centralized vs. centralized districts. See Section 3.6 for results including the interaction effect.}

This section will, in turn, consider results from regressions where $O_{jt}$ is measured by the change in a district’s dropout rate (results in Table 3.3) and by the change in a district’s pupil-teacher ratio (results in Table 3.4). Note that all regressions in this section include the level of $O_{jt}$ as a control and additional control variables to capture potential differences in voting behaviour between the different types of districts (unified, primary and high school districts).

Three sets of results are reported in tables 3.3 and 3.4. First, data on the full sample of districts are used (specifications (1) and (2)). Then, the sample is split into two groups based on whether districts experienced a decrease in the dropout rate (the ‘positive outcome’ specifications (3) and (4)) or an increase (the ‘negative outcome’ specifications (5) and (6)) – these results pertaining to the asymmetry between rewarding and punishing incumbents are discussed below in Subsection 3.5.3. For each of these three sets of results, two specifications are estimated: In specifications (1), (3) and (5), a large set of (time-invariant) census variables is included,\footnote{In these specifications, standard errors are adjusted for clustering within districts.} while in specifications (2), (4) and (6) district fixed effects are included.

\footnote{I also estimated Probit models, with similar results (available upon request).}
3.5.1 High School Dropout Rate Regressions

Table 3.3 collects the estimation results with $O_{jt}$ measured as the year-to-year change in the dropout rate. Because the dropout rate is irrelevant for primary schools, these regressions are estimated on a subset of districts including only high school and unified districts.

The first striking result of Table 3.3 is that school board elections do not appear to be meaningless as local accountability instruments, contrary to the critical view reported in the introduction of this chapter: an increase in the dropout rate is associated with a lower reelection probability. The coefficient is significant at the 5% confidence level when fixed effects are included (Specification (2)). The level of the dropout rate is, by itself, not significant.

Unsurprisingly, the electoral controls (incumbent vote share and number of candidates) have strong explanatory power. Reelection probability is higher for dominant incumbents, those winning the election with a higher share of the popular vote. The number of candidates is also positively related to reelection probability, consistent with a divided opposition reinforcing the incumbent’s position.

School politics also appear to differ in systematic ways across types of district. Reelection probability tends to be lower in high school districts, as opposed to unified districts, according to the fixed effects results. This may simply denote a stronger incumbency advantage for elementary schools — see the results for primary school districts in the next subsection.28 District size is also related to electoral outcomes: districts with a larger number of schools tend to display lower reelection rates, but student enrollment does not have a significant effect.

Finally, key parameters of interest are the effects of centralization at the state and

28Note, however, that the sign on the high school dummy is reversed in Specification (1), when fixed effects are not included.
federal levels on reelection probabilities. According to Specification (1), centralization at the federal level seems to explain some of the variation in incumbents’ reelection probabilities. The federal share variable displays a negative coefficient, indicating that the slope of the accountability function (equation (3.7) in Section 3.2) with respect to centralization, $\psi_C$, is negative for federal funds. This is an indication that districts where the federal government’s presence is strong tend to defeat their local incumbents at a higher rate. Strong federal presence may reflect otherwise unobserved district characteristics since the coefficient on the federal share is not significant in the fixed effect regression (Specification (2)) – see Subsection 3.5.4 below for a discussion of some related identification issues. Note also that the state share variable is significant in neither specification.

### 3.5.2 Pupil-Teacher Ratio Regressions (All Districts)

A relatively similar picture emerges when the change in pupil-teacher ratios is used as the outcome measure. Table 3.4 displays those results, which now pertain to all three types of districts.

The coefficient on the change in pupil-teacher ratio is negative and significant in Specification (1). While the coefficient is also negative in Specification (2), it is not statistically significant.\(^{29}\) Again, when significant, the centralization coefficients are negative. According to Specification (2), districts in which a high proportion of revenues coming from the state government tend to reelect their incumbents at a lower rate, controlling for district fixed effects.\(^{30}\)

Two additional results from these specifications are noteworthy. First, there is evi-

\(^{29}\) See Subsection 3.5.4 below for some remarks on identification with fixed effects in the context of this application.

\(^{30}\) Note that the discrepancy between this result and the result in Table 3 can be explained by the fact that elementary school districts are now included in the sample.
idence of a stronger incumbency advantage in primary school districts, captured by the positive coefficient on the primary school district dummy (significant at the 1% confidence level in Specification (1)). Second, student enrollment is positively related to reelection probability (significant in Specification (2)), contrary to the other measure of district size (number of schools).

3.5.3 Punishing vs. Rewarding

Together, the results presented so far are suggestive that school board elections are playing some role as accountability devices: reelection probability tends to be negatively related to the occurrence of bad educational outcomes. Are the above results evidence that voters punish politicians for bad outcomes, that they reward them for good outcomes, or both? To explore the potential asymmetry between the punishing and the rewarding functions of school board elections, tables 3.3 and 3.4 display results for the subsample of observations for which the year-to-year variation in the outcome measure is positive (specifications (3) and (4)), and negative (specifications (5) and (6)).

Looking first at the results from dropout rate regressions (Table 3.3), there is some evidence that voters reward politicians for positive outcomes – the coefficient on the change in dropout rates is negative and significant in Specification (3). However, there is no significant evidence that politicians were punished for an increasing dropout rate in the ‘negative outcomes’ specifications.\(^{31}\) It is interesting to note that the negative effect of the federal share variable found in Specification (1) appears to be especially present in the ‘positive outcomes’ sample.

With the larger sample size due to the inclusion of primary school districts, the coefficients from pupil-teacher ratio regressions are more precisely estimated (see Table

\(^{31}\)The relatively small sample size for the ‘negative outcomes’ specifications must be acknowledged.
3.4). These results display evidence of both rewarding and punishing behaviour. The latter is especially clear in the results, including in the fixed effects results of Specification (6). The negative effect of the state share variable found in Specification (2) appears to be driven by the ‘negative outcomes’ sample.

In the remainder of this section, I discuss the identification issues underlying the robustness of the above results.

3.5.4 Remarks on Identification and the Peculiarities of California’s Transfer System

The main challenge in estimating equations (3.14) or (3.15) comes from the fact that the extent to which a district relies on the state and the federal governments to fund its public schools ($C_{jt}$) is endogenous. In an ideal experiment, each district would be randomly allocated to one of two (or more) groups, one in which no funding would be received from higher tiers of government (the control group) and the other in which some funding would be provided by the state and federal governments (the treatment group). Alternatively, one could envision two or more groups with different degrees of state/federal involvement. However, the main effect of the school finance reforms enacted since the 1970s has been to boost state funding to poorer districts, increasing their aggregate financial resources and improving students’ outcomes.\textsuperscript{32} Thus, districts with a more centralized funding structure tend to differ in systematic ways from districts with a less centralized funding structure (e.g. Basic Aid Districts), the former typically being the more disadvantaged districts.

In this section, the identification strategy has involved the inclusion of a comprehensive set of socio-demographic district-level controls. These controls are constructed from

\textsuperscript{32}See Card and Payne (2002).
the 2000 Census and, as a consequence, are treated as fixed over the period covered by
the elections data. The effect of centralization at the state and federal levels have thus
been identified by the variation in centralization that cannot be explained by differences
in socio-demographic characteristics of districts.

While there are obvious caveats applying to this simple strategy, some of which
are addressed by the empirical strategy pursued in the next section, it is reasonable
to assert that the variation in the centralization variable is relatively exogenous once
socio-demographic differences among districts are controlled for. The rationale for this
identification strategy is related to the fact that California’s school finance system is
highly complex, with intergovernmental transfers being the result of a combination of a
variety of state and federal programs – see Section 3.3 for a detailed discussion.

Identification of the effect of centralization on reelection probability in the above
results has therefore relied on differences between otherwise similar districts that are
treated differently by state and federal transfer programs. The inclusion of district fixed
effects has also allowed for identification of these effects from within-district variation.
The main drawbacks of the inclusion of fixed effects are a reduction in the number
of available control variables, and the limited variation in electoral variables due to
the small number of electoral cycles covered by the data. Despite these limitations,
Section 3.6 exploits within-district variation associated with a major reform in the federal
government’s transfers to school districts.

3.6 No Child Left Behind and Electoral Accountability

This section focuses more specifically on the federal share variable, taking advantage of
the sharp increase in the federal government’s role associated with No Child Left Be-
hind (NCLB) after 2001. NCLB represents a rare quasi-experiment in fiscal federalism,
with the federal government significantly increasing its role in both LEA’s finances and accountability. While one of the consequences of NCLB’s accountability requirements is to limit local politicians’ leeway – thus restricting the scope for effective local electoral accountability – the federal initiative has led to the implementation of a visible and uniform accountability system which puts the spotlight on local educational outcomes – the output of this accountability system now serves as a key input in school board elections.

This section explores the consequences of NCLB not on educational outcomes themselves but on local political outcomes in California. Has NCLB reinforced the trend toward a marginalisation of local governance in the education system or, on the contrary, did NCLB boost local electoral accountability by improving voters’ information and choice sets?

### 3.6.1 Identification Strategy

As shown in Figure 3.2, the share of federal transfers in school districts’ total revenues has been on the rise since 2001, following a period of remarkable stability. This sudden increase corresponds to the passage of the *No Child Left Behind Act* by the federal government in 2001. Exploiting this variation, the strategy pursued in this section is to identify the effect of centralization out of within-district differences in centralization, before and after 2001.

I estimate the following version of equation (3.14), which includes interaction terms with a post No Child Left Behind (*NCLBt*) dummy:

\[
P_{jt} = \alpha + \delta_1 C_{jt} * O_{jt} * NCLB_t + \delta_2 O_{jt} * NCLB_t + \delta_3 C_{jt} * O_{jt} + \delta_4 C_{jt} * NCLB_t + \delta_5 O_{jt} + \delta_6 NCLB_t + \delta_7 C_{jt} * \gamma X_{jt} + \delta Z_{jt} + \gamma Y_t + D_j + \xi_{jt},
\]
where $C_{jt}$ is the federal share variable and $X_{jt}$ now includes the state share. In this specification, both the own effect of centralization and the interaction between centralization and outcomes are allowed to change in the pre- and post-NCLB periods, as well as the effect of educational outcomes on reelection probability. The main coefficients of interest are $\delta_1$, $\delta_2$ and $\delta_4$: they capture the effect of the No Child Left Behind on local electoral accountability.

### 3.6.2 Results

Table 3.5 presents estimation results for this empirical strategy, alternatively measuring $O_{jt}$ as the dropout rate – Specification (1) – and the pupil-teacher ratio.\(^{33}\) Two specifications are provided for the latter: Specifications (2) uses the same sample as Specification (1), i.e. excluding primary school districts, and Specification (3) uses the whole sample.

\(^{33}\)In this section, the outcome variables are measured in levels. Note however that with district fixed effects included identification comes from within-district changes over time in the variables.
High School Dropout Rate

In the dropout rate regression, the effect of NCLB on the interaction of outcomes and centralization ($\delta_1$) is significant, displaying a negative sign. The negative sign reveals that in the post-reform period centralization has tended to reinforce the link between higher dropout rates and lower reelection probabilities. In other words, this result suggests that NCLB has increased the effect of centralization on voters’ reactivity to adverse educational outcomes, captured by the cross-partial derivative ($\psi_{OC}$) of the accountability function, equation (3.7). However, this effect is somewhat dampened by the positive coefficient (significant at the 10% confidence level) on the outcome variable in the post-NCLB period ($\delta_2$).

The strongly significant negative coefficient on the NCLB dummy itself is also noteworthy, suggesting that NCLB could be associated with an overall reduction in the incumbency advantage of school board members. Consistent with the results of the previous section, the vote share and number of candidates variables are strongly significant.

Pupil-Teacher Ratio

While the triple interaction term ($\delta_1$) is not significant in Specification (2), which uses the same sample of high school and unified districts as in Specification (1) but the pupil-teacher ratio to measure outcomes, both the direct effects of educational outcomes ($\delta_2$) and centralization ($\delta_4$) on reelection probabilities are significantly different before and after 2001. These two coefficients draw a picture of the effect of NCLB similar to the one that emerges from the dropout rate specification: In the post-reform period, the pupil-teacher ratio is more negatively correlated with reelection probability than before (as revealed by a negative $\delta_2$), and the federal share is also more negatively correlated...
with the dependent variable (negative $\hat{\delta}_4$).\textsuperscript{34} Finally, note that according to the results for Specification (3) these effects do not seem to be present in primary school districts.

Overall, the results of this section suggest that NCLB is affecting local democracy in California’s high school and unified districts. Interestingly, these exploratory results seem to indicate an improvement in local electoral accountability associated with the increased federal intervention characterizing the post-2001 period.

### 3.7 Conclusion

The role of the ballot box as a discipline on the providers of public goods has been an issue of longstanding interest in public economics. One requirement for the ballot box to exert an influence is that voters should be responsive to the performance of incumbents. As a consequence, the ability of voters to hold politicians accountable depends crucially on the information available to them when casting their ballot. While the extent to which voters have sufficient information to link outcomes to the politician who is responsible for them is unobservable, it is likely to vary with features of the institutional environment. And here, of primary importance is the number of levels of government being involved.

This chapter has provided an empirical exploration of the effects of school finance centralization on local electoral accountability. To identify the effect of policy outcomes and centralization on the reelection probabilities of school board members, it exploited both between-district and within-district time variation associated with the peculiarities of state and federal transfer programs to school districts in California. In particular, the analysis covered both the pre-NCLB and post-NCLB periods.

Three main conclusions can be drawn from the analysis. First, somewhat surprisingly

\textsuperscript{34}Note that these negative coefficients are compensated to some extent by the positive estimated direct effect of the NCLB dummy.
and contrary to what critics of centralized school finance often argue, some electoral accountability is apparent in California’s public school boards despite the system’s highly centralized nature. Second, an incumbent’s reelection probability tends to be lower in highly centralized districts – a given policy outcome will deliver a lower reelection probability. This can be seen as a parallel shift down in the reward scheme of incumbents. And third, the increased involvement of the federal government after 2001 appears to have sharpened local electoral accountability.

The analysis has caveats. For example, both policy and political outcomes are measured at the district level, thus aggregating potentially diverging trends at the school level. Indeed, some schools in a district may be performing well while others are trailing. Also, outcomes are measured annually while it could be more appropriate in some instances to average them over electoral cycles. Future work should address those issues, together with broadening the set of outcome measures used in the analysis, conditional on data availability.
Table 1. Descriptive statistics, election variables, district averages of ward-level results, 1995-2004

<table>
<thead>
<tr>
<th>Year</th>
<th>Elections Count</th>
<th>Incumbents reelected (share) Mean</th>
<th>Incumbents reelected (share) Std. Dev.</th>
<th>Incumbent vote share Mean</th>
<th>Incumbent vote share Std. Dev.</th>
<th>Number of candidates Mean</th>
<th>Number of candidates Std. Dev.</th>
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<tr>
<td>1995</td>
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<td>.7923</td>
<td>.3319</td>
<td>.3108</td>
<td>.1415</td>
<td>4.68</td>
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<td>1996</td>
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<td>.3259</td>
<td>.1283</td>
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</tr>
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<td>2.01</td>
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<td>1.75</td>
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<tr>
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<td>.1283</td>
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<td>2.01</td>
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Table 2. Descriptive statistics, public finance and policy outcome variables, district averages, 1995-2004

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<th>Year</th>
<th>State transfers</th>
<th>Federal transfers</th>
<th>Dropout rate</th>
<th>Pupil-teacher ratio</th>
</tr>
</thead>
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<tr>
<td></td>
<td>(share of total revenues)</td>
<td>(share of total revenues)</td>
<td>(%)</td>
<td>(count)</td>
</tr>
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<td>.5113 (.1607)</td>
<td>.0710 (.0530)</td>
<td>3.07 (2.18)</td>
<td>22.91 (3.80)</td>
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<td>.0695 (.0517)</td>
<td>2.67 (2.15)</td>
<td>21.61 (3.60)</td>
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<td>.0622 (.0473)</td>
<td>2.42 (1.78)</td>
<td>20.17 (3.25)</td>
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<td>1998</td>
<td>.5697 (.1554)</td>
<td>.0631 (.0481)</td>
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<td>1999</td>
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<td>.0693 (.0558)</td>
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<td>19.31 (3.07)</td>
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<td>.0977 (.0633)</td>
<td>2.55 (4.61)</td>
<td>19.84 (3.29)</td>
</tr>
<tr>
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<td>.0715 (.0550)</td>
<td>2.44 (3.01)</td>
<td>20.17 (3.50)</td>
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<td>N</td>
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<td>11847</td>
<td>3397</td>
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Note: Standard deviations in parentheses.
Table 3. Dropout rate regressions, high school and unified districts only

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<th>(5)</th>
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<td>-.0277*</td>
<td>-.0286</td>
<td>.0296</td>
<td>.0213</td>
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<td>(.0111)</td>
<td>(.0167)</td>
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<td>(.0251)</td>
<td>(.0366)</td>
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<td>(.0161)</td>
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<td>(.1688)</td>
<td>(.2051)</td>
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<td>(.3513)</td>
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<td>.0170</td>
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Notes: Dependent variable: reelection probability. Constants included but unreported. Robust standard errors in parentheses, adjusted for clustering (specifications 1, 3, 5). Levels of statistical significance: 1% (**), 5% (*) and 10% (*).
<table>
<thead>
<tr>
<th></th>
<th>(1) Full sample</th>
<th>(2) Positive outcomes</th>
<th>(3) Negative outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in pupil-teacher ratio</td>
<td>-.0147**</td>
<td>-.0158*</td>
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Fixed effects: No Yes No Yes No Yes
Year effects: Yes Yes Yes Yes Yes Yes
Census controls: Yes No Yes No Yes No

Notes: Dependent variable: reelection probability. Constants included but unreported. Robust standard errors in parentheses, adjusted for clustering (specifications 1, 3, 5). Levels of statistical significance: 1% (***) 5% (**) and 10% (*).
Table 5. Effect of No Child Left Behind on Local Electoral Accountability

<table>
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<tr>
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<th>(1) Dropout rate</th>
<th>(2) Pupil-teacher ratio</th>
<th>(3) All districts</th>
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<td>High &amp; unified districts</td>
<td>High &amp; unified districts</td>
<td>All districts</td>
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<td>-0.4436*</td>
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<td>(.0939)</td>
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<td>Outcome*Post-NCLB</td>
<td>0.0408*</td>
<td>-0.0402**</td>
<td>0.0060</td>
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<td>(.0238)</td>
<td>(.0161)</td>
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<td>0.2471</td>
<td>0.0041</td>
<td>-0.0342</td>
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<td>(.1631)</td>
<td>(.1376)</td>
<td>(.0750)</td>
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<td>0.8907</td>
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<td>0.8000</td>
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<td>(.7277)</td>
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<td>0.0029</td>
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<td>(.0147)</td>
<td>(.0076)</td>
</tr>
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<td>Post-NCLB</td>
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<td>0.6925*</td>
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<td>(.1106)</td>
<td>(.3614)</td>
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<td>(.2219)</td>
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<tr>
<td>Student enrollment</td>
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<td>0.0000**</td>
</tr>
<tr>
<td></td>
<td>(.0000)</td>
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<td>(.0000)</td>
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Fixed effects: Yes
Year effects: Yes
R²: .0615 .0717 .0829
Observations: 1167 1167 2458

Notes: Dependent variable: reelection probability. Constants included but unreported. Standard errors in parentheses. Levels of statistical significance: 1% (**), 5% (*) and 10% (*).
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<td>More Cities</td>
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<tr>
<td>County</td>
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<tr>
<td>State</td>
<td></td>
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</table>

Map Image

http://mapx.nces.ed.gov/sisfgis

138
Map 2. Total district population, unified districts, 2000 census

Legend

Total Population
Cities
Unified

0 - 5075
5076 - 10779
10780 - 23675
23676 - 38965
38966 - 68379
68380 - 124547
> 124547

Map Details

State: California
School District: Unified
Demographic Option: Total Population

http://mapz.nces.ed.gov/California
Map 3. Total district population, elementary districts, 2000 census

Legend

- Total Population
- Cities
- Elementary

<table>
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<td>6531 - 15971</td>
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<td>15972 - 39435</td>
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<tr>
<td>&gt; 39835</td>
<td>Dark purple</td>
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Map Details

State: California
School District: Elementary
Demographic Option: Total Population

Map Image

http://map.rncces.ed.gov/old/sfgis
Map 4. Total district population, secondary districts, 2000 census

Legend

| Total Population |
| Cities |
| Secondary |

- 0 - 8566
- 8567 - 19254
- 19255 - 41819
- 41820 - 77558
- 77559 - 137595
- 137596 - 213544
- > 213544

Map Details

State: California
School District: Secondary
Demographic Option: Total Population

Map Image

http://map2.nrces.edu/wisdgls
Map 5. Non-white population, unified districts, 2000 census

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<tr>
<td>Cities</td>
<td>School District: Unified</td>
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<td>Unified</td>
<td>Demographic Option: Percentage Non white Alone</td>
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<tr>
<td>8% - 20.23%</td>
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<td>20.24% - 27%</td>
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<td>27.01% - 34.55%</td>
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<td>34.56% - 44.78%</td>
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<td>58.01% - 71.37%</td>
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<td>&gt; 71.37%</td>
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Map Image

http://map.gis.ornl.gov/oldcgis
Map 6. Median house value (all owner-occupied units), unified districts, 2000 census

Legend

Median Value

Cities

Unified

0 - 86600
86601 - 113100
113101 - 143900
143901 - 178800
178801 - 237300
237301 - 327400
> 327400

Map Details

State: California
School District: Unified
Demographic Option: Median Value (Dollars) For All Owner-Occupied Housing Units
Chapter 4

Conclusion: Towards a New Political Economy of Local Public Goods

The introduction of this thesis summarized each chapter’s endeavour by a question:

1. Does the “road to power” involve catering to swing districts, or nurturing long-run relationships in loyal districts?

2. What are the net welfare consequences of an “intertwined federalism” system characterized by shared expenditure responsibility in local public good provision?

3. Are politicians at all levels of government “sharing the blame” for bad policy outcomes?

I believe that the three chapters of this thesis have contributed elements of answer to each of these questions. Chapter 1’s empirical results have provided strong support for
a theory of distributive politics that accounts for the existence of long-run relationships between political parties and their core supporters. In a federalism model featuring political feedback mechanisms of the type Chapter 1 provided empirical support for, Chapter 2 derived a series of propositions highlighting that the welfare effect of shared expenditure responsibilities depends primarily on the quality of voter information, on the degree of complementarity among levels of government, and on the relative political conditions at each level of government. The empirical results of Chapter 3 showed that despite a highly centralized finance system, local electoral accountability has some bite with California’s school boards, suggesting that local politicians are indeed taking some of the blame for bad local educational outcomes.

Much like the burgeoning literature on the new political economy of public goods taken as a whole, this thesis is far from providing a unified and comprehensive treatment of the centralized provision of local public goods. It leaves much room for future work, both theoretical and empirical.

In a more general setting than the one developed in Chapter 1, one might envisage the government being able to pull a variety of pork-barrel levers, ranging from those well-suited to yielding short-term political advantages just prior to election time (in the limit, pure cash) to much longer-term investments that may help secure enduring political support. In providing a panel data analysis of an important example of the latter (road spending), Chapter 1 of this thesis complemented other work in the literature that has focused on more short-term discretionary projects. The results of this chapter suggested that a minimal requirement for observing machine politics patterns is that the spending instrument in question has the necessary long-term significance for voters. In future work, it will be useful to revisit these issues using comprehensive data on different types of public expenditure displaying different degrees of durability.
The analysis of Chapter 2 also calls upon further theoretical refinements. This chapter has focused on two key aspects of partial decentralization, namely the vertical interactions between levels of government and the informational demands on voters associated with areas of shared responsibility. The inefficiencies that this approach has shed light on obviously need to be weighed against other potential advantages of decentralization that previous research has identified. Future work could therefore extend the simple model presented here to incorporate, for example, the accountability benefits associated with horizontal yardstick competition advanced by Besley and Case (1995). A more general version of the model would include multiple subnational jurisdictions (as in Besley and Coate’s (2003) model) or a ‘proximity advantage’ for local governments (as in Panizza (1999) and Arzaghi and Henderson (2005)).

Finally, future work should be conducted to assess the robustness of Chapter 3’s results, chiefly by analysing a broader set of policy outcomes in California. However, the crucial need for more comprehensive datasets on local electoral outcomes must also be addressed in order to replicate the analysis in other jurisdictions with different institutional features. Only a broad data collection initiative on the local government sector around the world will allow researchers in the field to conduct the necessary ongoing back-and-forth between new political economy theoretical models and empirical research.
Bibliography


[14] Béland, Mario (various years). Compilation des dépenses ministérielles par circonscription électorale provinciale sur le réseau routier (title varies from year to year), Ministère des transports du Québec.


