Public Investment as Political Investment: Evidence from Road Spending in Québec

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Abstract

Is the geographic allocation of public spending distorted by electoral politics? Despite widespread anecdotal support for this, researchers have documented surprisingly little convincing evidence of such 'pork-barrel' politics. This paper sheds new light on this question. To clarify the main forces at work, it sets out a simple dynamic probabilistic voting model in which an incumbent government allocates a fixed budget across electoral districts that differ in their loyalty to the ruling party. The model predicts that the contemporaneous geographic pattern of spending depends on the way the government balances long-run 'machine politics' considerations and the more immediate concern to win over swing voters. Informed by this conceptual framework, I analyze rich data on road spending from a panel of electoral districts in Québec. Empirical results provide robust evidence that electoral politics is a key driver of the geographic allocation of spending. In particular, I find that districts which display loyalty to the incumbent government receive disproportionately more spending, especially close to an election. This result contrasts with the standard 'swing voters' view and draws attention to the importance of dynamic considerations when modelling the political process.

Keywords: centrally-provided local public goods, geographic allocation, pork-barrel politics, political competition, partisan loyalty.

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1 Introduction

A central question in the modern political economy research agenda is whether political institutions are able to allocate public goods in an efficient way. In particular, a large body of theoretical literature highlights that centrally-provided local public goods are especially subject to inefficient provision given the primary role played by politics in the allocation process.[1] Indeed, the behaviour of self-interested politicians – the usual starting point of political economy models – raises obvious concerns for the efficiency of the allocation process. A key issue, which has important normative implications, is the ability of a centralized government to generate an efficient geographic allocation of local public goods. Simply put, politicians preoccupied with the distribution of 'pork' are unlikely to target expenditures to local areas where the underlying needs of the population are greatest.

The bulk of previous work on this issue has focused on the extent to which *political competition* may distort governments' policy choices. This emphasis on political competition has led researchers to largely neglect another salient feature of the political environment in which policies are decided: *partisan loyalty*. This paper demonstrates that ignoring the role of partisan loyalty may lead to considerable downward biases in assessments of the extent to which politics influences the geographic allocation of public spending. To clarify why this is the case, I present a simple dynamic probabilistic voting model of the political incentives faced by a central government with respect to the geographic allocation of local public goods.

The key advantage of this model over existing theories – e.g. Cox and McCubbins (1986), Lindbeck and Weibull (1987, 1993), Dixit and Londregan (1996) – and also the paper's theoretical contribution is that adopting a dynamic perspective of this question conveniently rationalizes the potentially conflicting effects of political competition and partisan loyalty on the allocation process. Specifically, I argue that these two features of the political environment pertain to different time horizons: political competition is relevant to short-run political conditions, while partisan loyalty presupposes the existence of long-lasting relationships between voters and parties, requiring a dynamic framework.

In the model, incumbent governments face a trade-off with respect to the allocation of public

[1] While the *local* provision of local public goods can be studied in a Tiebout-style 'politics-free' framework, the *centralized* provision of local public goods cannot. In particular, Tiebout's (1956) efficiency result, which follows from mobility across local jurisdications, don't apply to the latter. To study centrally-provided local public goods, one necessarily needs to take the centralized political process seriously. See Knight (2004) for a good discussion of this question.

spending. On the one hand, they 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 results, leading to the usual 'swing voters' prediction. On the other hand, the existence of long-term relationships provide an incentive for forward-looking incumbent governments to favour the districts that constitute their traditional electoral base, in order to secure their support *in the future*. As a result, the current allocation of spending is affected by two conflicting incentives, and I show that the standard swing voters prediction can be reversed under some conditions.

The empirical relevance of this model is assessed by taking advantage of data covering a period of rich political activity in Québec.[2] I exploit unique yearly riding[3]-level data on road expenditure by the Québec government for the period 1986-1996, in conjunction with the corresponding provincial electoral data. Road spending is a natural candidate when it comes to studying the misallocation of centrally-provided public goods, as it is typically local in nature but decided by higher levels of government – see e.g. Knight (2002, 2004). In particular, the long-lasting character of road expenditures makes them a suitable choice for studying the dynamic aspects of pork-barrel politics highlighted in the theoretical model.

In the empirical application, I weigh the relative effects of political competition and partisan loyalty on the allocation of road spending by the Québec government across electoral districts.[4] The paper's main empirical contribution is to provide robust evidence that so-called 'machine politics' spending patterns are a significant by-product of electoral politics – even more so, in this instance, than the usual swing voters patterns.

This empirical exercise involves some nontrivial measurement and identification issues. The first is to construct measures of both political competition and partisan loyalty from detailed data on election results. Then, the main identification challenge involves disentangling the role of 'pork-barrel' politics from the numerous non-political considerations that drive the geographic allocation of government spending. In this respect, I follow Milligan and Smart (2005) in exploiting the panel structure of the data to account for fixed, unchanging geographic determinants of government spending. Additional empirical strategies – instrumental variables and difference-in-difference –

[2] During the 1980s and 1990s (the period covered by this study), the Canadian province of Québec underwent a heated debate about its political status. A referendum on Québec's independence was held on October 30, 1995. Independence was only just rejected, by 50.6% of the vote.

[3] In Canada, the term 'riding' is often used to denote an electoral district.

[4] In closely related empirical contributions, Case (2001) and Dahlberg and Johansson (2002) also test for pork-barrel spending directed to both 'safe' and 'swing' constituencies using, respectively, Albanian and Swedish data. However, their empirical strategies don't directly exploit the dynamic properties of partisan loyalty.

are used to further address the potential endogeneity issues that typically arise in studying the relationship between electoral politics and public finance.

The paper is organized as follows. Section 2 presents a simple theoretical model that highlights the key trade-off of interest. Section 3 then describes the data used in the analysis. In Section 4, I introduce the empirical implementation strategy and present empirical results. Section 5 discusses some additional results on the political return to pork-barrel behaviour, and Section 6 concludes.

2 Partisan Loyalty and Expenditure: A Simple Model

The model presented in this section derives the implications of one particular form of district heterogeneity on the allocation of public spending across districts – their degree of loyalty to the ruling party. Loyalty to one political party typically translates into high winning margins and repeated victories for that party in a given district. Whether this should lead to higher or lower spending in loyal districts is unclear. On the one hand, these districts may not need much attention (i.e. much public spending) to vote for the ruling party in the short run; on the other hand, the long-run loyalty relationship between a district and a political party needs to be nurtured. As for 'low loyalty' districts, they may vote for the incumbent government if they are given sufficient attention prior to the election, although this one-time extra attention is not generally likely to translate into longer term loyalty.

2.1 Relation to Existing Theories

A large body of theoretical work studies the forces driving the allocation of public spending across jurisdictions from a positive perspective. This positive literature is characterized by two competing views regarding government 'pork-barrel' behaviour. The first, which I label the *'swing voters' view* following Dixit and Londregan (1996), states that governments should be expected to direct expenditure to groups or districts that are most likely to change sides in the next election, i.e. where political competition is the strongest. This swing voters hypothesis is a standard prediction of most formal voting models in the literature on pork-barrel politics and public finance. Lindbeck and Weibull (1987, 1993) have developed what is perhaps the most influential model that leads to this prediction.

The second view, which Dixit and Londregan (1996) label the *'machine politics' view*, states that governments should in contrast tend to direct expenditure to their core supporters (i.e. loyal groups

or districts). This view is consistent, for example, with a government rewarding its constituents in districts that delivered high majorities in previous elections. Despite widespread anecdotal evidence of machine politics patterns, the latter view has received little attention from theorists of the political process, at least until recently. An exception to this is Cox and McCubbins' (1986) model of stable political coalitions. Their central prediction is that campaign promises will be chiefly directed towards core supporters. However, their result crucially depends on the controversial assumption that candidates are risk-averse. This limitation of Cox and McCubbins' analysis is no stranger to the fact that it belongs to a body of literature that has tended to adopt a static perspective, while the machine politics view raises inherently dynamic considerations involving long-run relationships between politicians and their constituents.[5]

Dixit and Londregan (1996) were the first to provide a formal framework to reconcile these two views. They proposed a model, in which voters have heterogeneous ideological affinity for the parties, that has both predictions as special cases. The feature that plays a central role in their analysis is the lower cost that political parties face when delivering favors to their own support groups (perhaps as a result of better information channels between a party and its core members). While this assumption seems plausible, a different route is followed in the model developed hereafter. Indeed, such an assumption on the cost side is not necessary to deliver the machine politics prediction in a dynamic framework. The key effect of partisan loyalty will instead be captured on the benefit side, with loyal districts delivering durable benefits to the incumbent government (vs. short-run benefits for 'swing' districts).

Although not directly interested in the swing voters vs. machine politics debate, Besley and Preston (2006) develop an alternative model populated by 'loyal' and 'swing' voters.[6] In their model, the incumbent government maximizes the welfare of its party members, which leads to a

[5] The dominance of static models in the political economy literature is reflected in the extensive survey by Persson and Tabellini (1999), which is restricted 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 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 (2005), this time within the framework of a legislative bargaining model.

[6] Using a similar model, Besley (2005) provides a discussion that is more directly related to the swing voters vs. machine politics debate.

bias in favour of core supporters. Spending benefiting 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 simple model developed in this paper differs from that of Besley and Preston (2006) since it assumes a purely opportunistic (but forward-looking) government.[7]

2.2 A Two-District Model

I first present a simple two-district, two-election model of government expenditure allocation across districts (indexed by j). For expositional purposes, one of these districts will be referred to as the 'swing' district (labeled with superscript $j = s$) and the other, as the 'loyal' district (labeled with superscript $j = l$). Consider an incumbent government's expected utility, which depends on the probability (x_t^j) of being in office in the two districts over two periods (t and $t+1$). Assume that the government's period-t Bernoulli utility function is linear in the number of seats:[8]

$$u_t(n) = n,$$

where $n \in \{0, 1, 2\}$ is the number of seats held. Assuming time separability and no discounting of the future,[9] this yields expected utility:[10]

$$U = x_t^l + x_t^s + x_{t+1}^l + x_{t+1}^s.$$

[7] Theory suggests other mechanisms through which the centralized provision of local public goods might lead to inefficiencies. For example, Knight (2004) highlights the conflicting incentives of individual legislators to increase own-district spending and restrain the own-district tax burden. Cadot *et al.* (2002) focus on the link between the productivity of public capital and influence activities by corporate lobby groups. For a comprehensive survey of the related literatures, see Persson and Tabellini (1999).

[8] This government objective assumes away the issue of winning the 'national' election *per se*. Cox and McCubbins (1986), Dixit and Londregan (1996) and Lindbeck and Weibull (1993) also assume that political parties are merely vote maximizers. A relevant alternative is the maximization of the probability of winning a majority of seats. Lindbeck and Weibull (1987) and Case (2001) contrast these two objectives.

[9] The no-discounting assumption is adopted for simplicity only and can be relaxed in a straightforward manner. A similar assumption is made by Besley and Coate (1998). In the current setup, the extent of intertemporal linkages is captured by a single parameter, the persistence of political support (δ^j).

[10] In any period, three events can occur: $u_t(0) = 0$ with probability $(1 - x_t^l)(1 - x_t^s)$, $u_t(1) = 1$ with probability $1 - (1 - x_t^l)(1 - x_t^s) - x_t^l x_t^s$, and $u_t(2) = 2$ with probability $x_t^l x_t^s$. This yields expected utility in period t :

$$U_t = 1 - (1 - x_t^l)(1 - x_t^s) - x_t^l x_t^s + 2x_t^l x_t^s,$$

which reduces to:

$$U_t = x_t^l + x_t^s.$$

I analyse the problem of a government allocating a fixed budget $\bar{e}$ between the two districts in period t. The entire budget is distributed in period t but the spending allocation has impacts in both periods through the political process. I consider the following simple timing of events:

1. At the beginning of period t, spending is allocated between the two districts such that $e^l + e^s = \bar{e}$ (with $e^l, e^s \geq 0$).

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

3. In period $t+1$, a second election is held.

From the incumbent government's point of view, districts differ along two time-invariant dimensions:

1. The initial level of 'political capital,' denoted γ^j hereafter; and

2. The persistence over time of political support, which is governed by the parameter δ^j.

Public spending affects the incumbent's probability of being elected in the period-t election in a particular district through the 'voting function' $F(\gamma^j + e^j)$. This reduced-form approach to modelling the behaviour of voters, similar to the one adopted by Cox and McCubbins (1986), is the simplest way to capture the political interaction between the incumbent government and its constituents.[11] In this model, local political competition is a direct consequence of initial political capital and is captured by the single parameter γ^j. If γ^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 γ^j is low, the incumbent's advantage is low, which leads to a high degree of political competition. In the limit, if $\gamma^j = 0$, the incumbent has no advantage and the playing field is level.

In the period-$t+1$ election, the probability of winning is the same as in period t, with the exception that political support 'depreciates' fully in district s (the swing district) and at rate $(1-\delta)$ in district l (the loyal district).[12] Political support in the swing district therefore displays

[11] Obviously, factors other than political capital and public spending may enter the voting function: characteristics of the challengers, characteristics of the local population, the national political climate, etc. Such undoubtedly important influences on local politics are essentially abstracted from here in order to keep the exposition as simple as possible but will be introduced at the empirical implementation stage.

[12] This amounts to positing the following law of motion for political support: $x^j_{t+1} = \delta^j x^j_t$. Box-Steffensmeier and Smith (1996) find empirical support for such a law of motion for 'party affiliation.' Their estimates of δ^j (in my notation) are in the order of .7-.8, which is consistent with the interpretation of δ^j as a depreciation factor.

no intertemporal persistence. A logical consequence of such a characterization of a swing district is that the initial political capital in a swing district, presumably inherited from past political interactions, will also tend to be low. Consequently, it is also assumed that $\gamma^s = 0$. This (non-trivial) normalization allows me to consider δ and γ as being characteristics of the loyal district alone. This yields the following optimization problem for the government:[13]

$$\begin{aligned}
&\max_{e^l, e^s} \left\{ x_t^l + x_t^s + x_{t+1}^l + x_{t+1}^s \right\} \\
&\text{s.t. } x_t^l = F(\gamma + e^l) \\
&\qquad x_t^s = F(e^s) \\
&\qquad x_{t+1}^l = \delta F(\gamma + e^l) \\
&\qquad x_{t+1}^s = \frac{1}{2} \\
&\qquad e^l + e^s = \bar{e},
\end{aligned}$$

where $F' > 0$, $F'' < 0$, $0 \leq F(e) \leq 1 \ \forall e$ and $F(0) = \frac{1}{2}$.[14] I also assume $0 \leq \delta \leq 1$ and $\gamma \geq 0$. Substituting the constraints in the objective yields

$$\max_{e^s} \left\{ F(e^s) + (1+\delta) F(\gamma + \bar{e} - e^s) + \frac{1}{2} \right\}.$$

Assuming that the problem has an interior solution, the first-order condition for spending in the swing district is:

$$F'(e^{s*}) = (1+\delta) F'(\gamma + \bar{e} - e^{s*}). \tag{1}$$

The left-hand side of the equation is the marginal benefit of the last unit spent in s, and the right-hand side is the marginal benefit of spending in district l (which has a period-t and a period-$t+1$ component) or, alternatively, the marginal opportunity cost of spending in district s. The basic mechanism at work here involves decreasing returns. Because of decreasing returns, public spending is less productive in terms of marginal political support in the loyal district than in the swing district – this captures, in a simple way, the standard *political competition effect* that has been the focus of the prior literature. However, the loyal district also requires attention since the government is forward-looking and cares about future elections – I will refer to the latter as the

[13] This setting is reminiscent of a durable/nondurable consumption problem or of a consumption/investment trade-off.

[14] These assumptions on F, which has the interpretation of a c.d.f., imply that the short-run rate of return is higher in riding s. Such concavity assumptions are also adopted by Cox and McCubbins (1986), Lindbeck and Weibull (1993), and Dixit and Londregan (1996).

persistence effect. Propositions 1 and 2 summarize comparative static results that will be useful to understand the forces in play.

Proposition 1 (persistence effect): *In the two-district model, an increase in the persistence of political support (δ) in the loyal district unambiguously reduces equilibrium spending in the swing district (and increases spending in the loyal district).*

Proof. Totally differentiating (1) with respect to e^{s*} and δ yields

$$\frac{de^{s*}}{d\delta} = \frac{F'(\gamma + \bar{e} - e^{s*})}{F''(e^{s*}) + (1+\delta)F''(\gamma + \bar{e} - e^{s*})} \leq 0,$$

which is signed in a straightforward way by means of the properties of F. ■

The intuition for this first result is that an increase in the persistence of political support in the loyal district raises the marginal benefit of spending in this district. In terms of spending in the swing district (s), a higher δ raises the marginal opportunity cost of spending, and so by condition (1), spending in the swing district must decrease. This comparative static result is illustrated in Figure 1. The figure depicts the marginal benefit of spending in the swing district (decreasing in e^s) and the marginal opportunity cost of spending in this district (increasing in e^s). An increase in δ (from a low level, δ_L, to a higher level, δ_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). Since this comparative static result has to do with the long-lasting nature of political support, I label it the persistence effect.

Proposition 2 (political competition effect): *In the two-district model, an increase in the initial political capital in the loyal district (γ) unambiguously increases equilibrium spending in the swing district (and decreases spending in the loyal district).*

Proof. Totally differentiating (1) with respect to e^{s*} and γ yields

$$\frac{de^{s*}}{d\gamma} = \frac{(1+\delta)F''(\gamma + \bar{e} - e^{s*})}{F''(e^{s*}) + (1+\delta)F''(\gamma + \bar{e} - e^{s*})} \geq 0,$$

which is also signed in a straightforward way by means of the properties of F. ■

Proposition 2 is illustrated in Figure 2. An increase in the initial political capital in the loyal district (from γ_L to γ_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 above, γ captures the

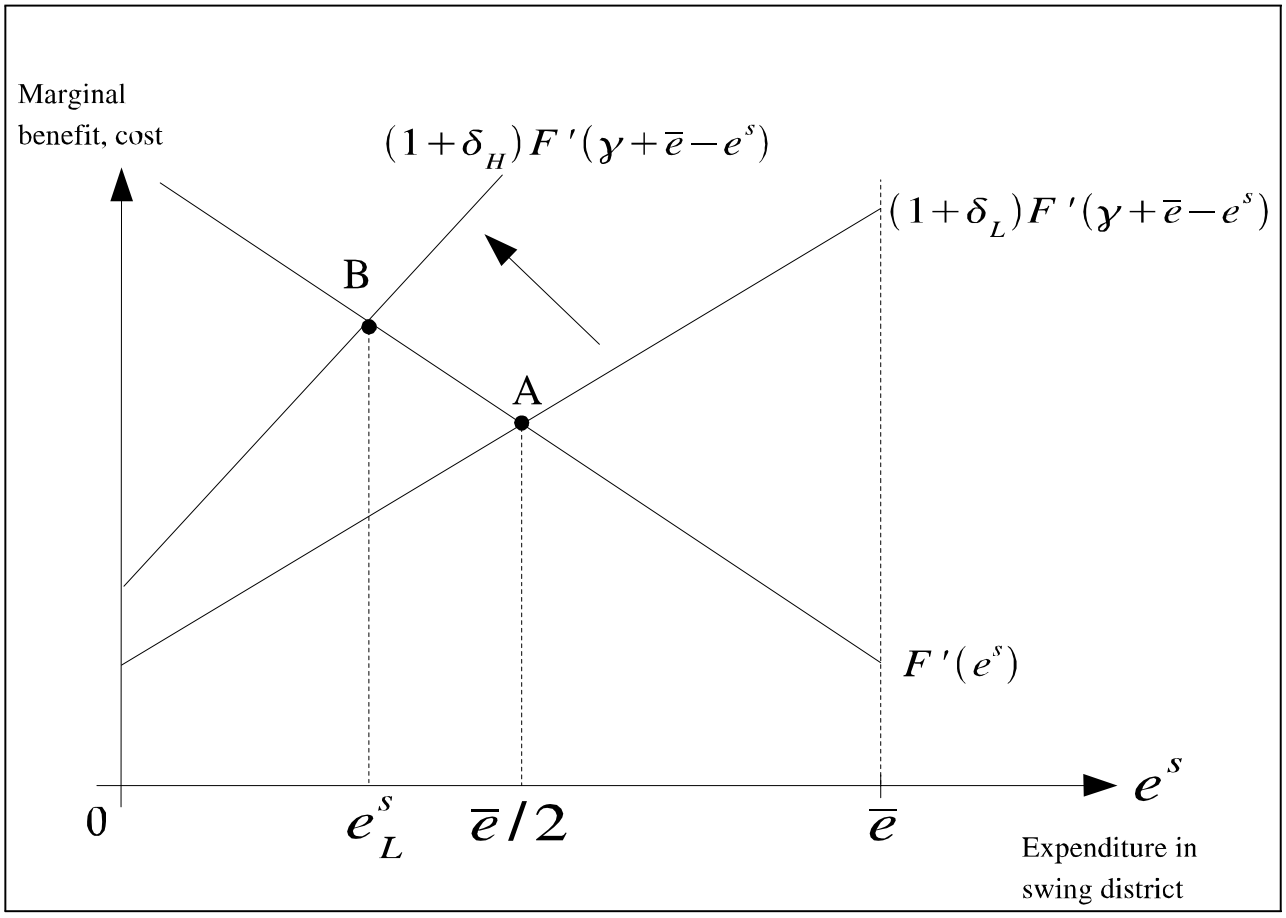

Figure 1: Effect of an increase in the persistence of political support

political advantage that the incumbent government holds over her challengers in the loyal district (e.g. as a result of previous investments in political capital in this district). A higher γ is thus indicative of less intense local political competition, which allows the incumbent government to focus on the swing district. Following this logic, I label this second comparative static result the political competition effect.

In sum, spending in the swing district is decreasing in the intertemporal link between elections in the loyal district and increasing in the initial stock of political capital in the loyal district. Together, these two opposing effects lead to the key insight of the model, which is captured by the following proposition.

Proposition 3: *In the two-district model, the swing district receives more (less) spending than the loyal district if and only if initial political capital (γ) in the loyal district*

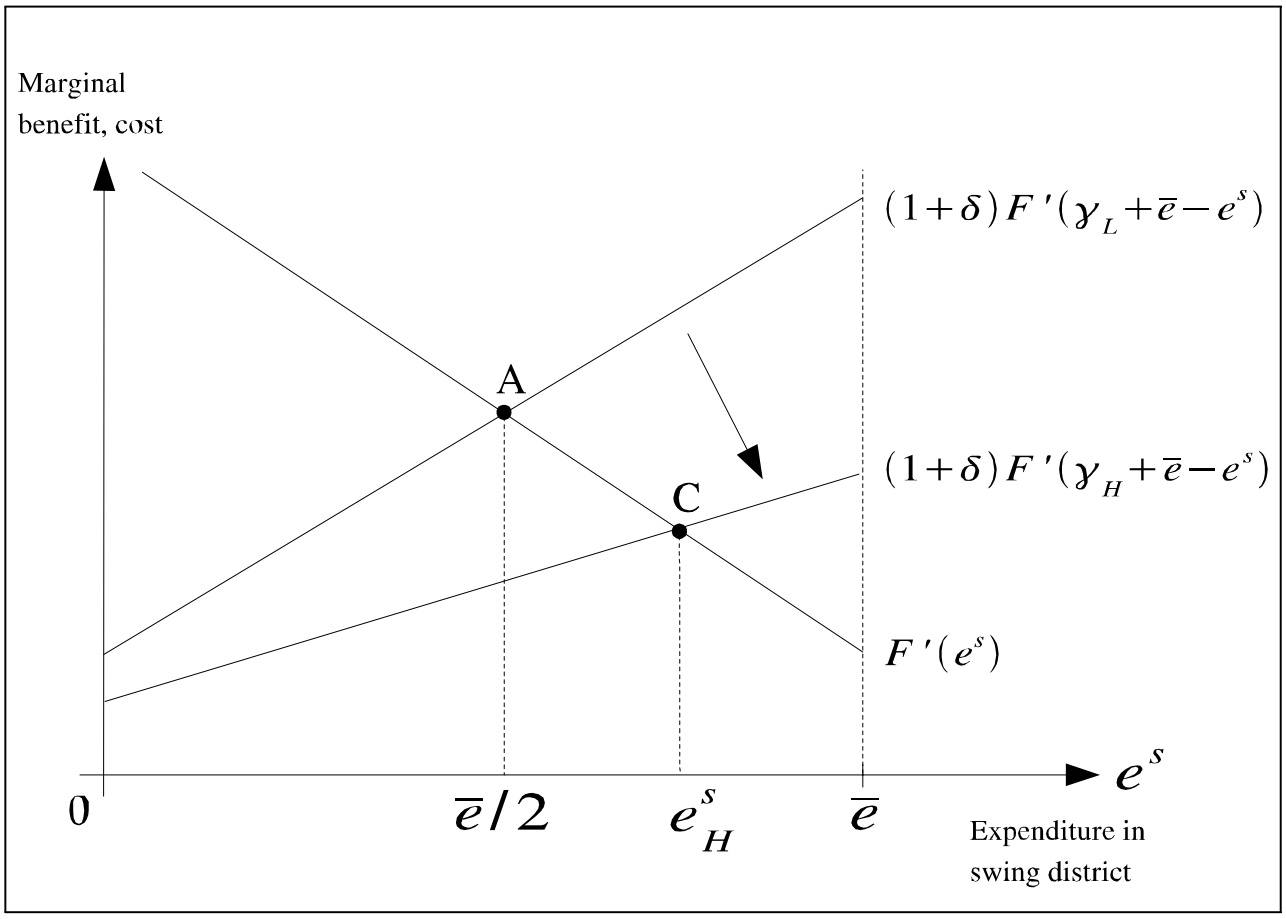

Figure 2: Effect of an increase in initial political capital

is relatively high (low) and the intertemporal link (δ) is relatively weak (strong).

Proof. First, consider the case where $e^{s*} = e^{l*} = \frac{\bar{e}}{2}$ (i.e. the two districts receive an equal share of the budget). Condition (1) must be satisfied, so $F'(\frac{\bar{e}}{2}) = (1+\delta)F'(\gamma+\frac{\bar{e}}{2})$. (a) For a given value of γ, denoted $\bar{\gamma}$, the latter condition defines the required value of δ as a function of $\bar{\gamma}$ and $\bar{e}$: $\delta(\bar{\gamma},\bar{e}) = \frac{F'(\frac{\bar{e}}{2})}{F'(\bar{\gamma}+\frac{\bar{e}}{2})} - 1$. Note that to have $\delta \leq 1$ it must be the case that $\bar{\gamma}$ is not too high. Now consider an increase in e^{s*} of ϵ above $\frac{\bar{e}}{2}$ and, accordingly, a reduction of ϵ in e^{l*}. This yields: $\delta(\bar{\gamma},\bar{e},\epsilon) = \frac{F'(\frac{\bar{e}}{2}+\epsilon)}{F'(\bar{\gamma}+\frac{\bar{e}}{2}-\epsilon)} - 1$. Since $F'' < 0$, we have: $\delta(\bar{\gamma},\bar{e},\epsilon) \leq \delta(\bar{\gamma},\bar{e},0)$. Similarly, we have: $\delta(\bar{\gamma},\bar{e},-\epsilon) \geq \delta(\bar{\gamma},\bar{e},0)$. Hence, for a given value of γ, $e^{s*} \geq \frac{\bar{e}}{2} \geq e^{l*}$ iff δ is relatively low, and $e^{l*} \geq \frac{\bar{e}}{2} \geq e^{s*}$ iff δ is relatively high. (b) Now, for a given value of δ, denoted $\bar{\delta}$, this condition defines the required value of γ as a function of $\bar{\delta}$ and $\bar{e}$: $\gamma(\bar{\delta},\bar{e}) = F'^{-1}\left(\frac{F'(\frac{\bar{e}}{2})}{1+\delta}\right) - \frac{\bar{e}}{2}$, which must satisfy $\gamma(\bar{\delta},\bar{e}) \geq 0$.

Consider again an increase in e^{s*} of ϵ above $\frac{\bar{e}}{2}$ and a reduction of ϵ in e^{l*}. This yields: $\gamma(\bar{\delta}, \bar{e}, \epsilon) = F'^{-1}\left(\frac{F'(\frac{\bar{e}}{2}+\epsilon)}{1+\delta}\right) - \frac{\bar{e}}{2} + \epsilon$. Again since $F'' < 0$, we have: $\gamma(\bar{\delta}, \bar{e}, \epsilon) \geq \gamma(\bar{\delta}, \bar{e}, 0)$ and $\gamma(\bar{\delta}, \bar{e}, -\epsilon) \leq \gamma(\bar{\delta}, \bar{e}, 0)$. Thus, for a given value of δ, $e^{s*} \geq \frac{\bar{e}}{2} \geq e^{l*}$ iff γ is relatively high, and $e^{l*} \geq \frac{\bar{e}}{2} \geq e^{s*}$ iff γ is relatively low. ■

The intuition for this proof is again captured by Figures 1 and 2. Provided that there exist values of δ and γ such that the spending allocation is equal across the two districts ($e^{s*} = e^{l*} = \frac{\bar{e}}{2}$), Proposition 1 implies that an increase in δ above that level (holding γ constant) will yield an allocation that is favourable to the loyal district (Figure 1). Conversely, Proposition 2 implies that an increase in γ above that level (holding δ constant) will yield an allocation that is favourable to the swing district (Figure 2). Therefore, spending will be higher in the swing district if and only if, relative to each other, the persistence of political support in the loyal district is low and initial political capital is high. Note that the ambiguous result of Proposition 3 relies on the dynamic nature of the government's optimization problem. In the static case, i.e. the case in which $\delta^s = \delta^l = 0$, only the political competition effect would be present and the swing district would always be favoured.

2.3 Generalizing to Multiple Districts

Generalizing, one can think of a large finite number of districts differing with respect to their persistence factor (δ^j). Towards an empirical implementation, it will be useful to assume a more general specification for the district-specific initial political capital than in the two-district model: $\gamma^j = \gamma(\delta^j) + \xi^j$, where $\gamma' \geq 0$ and ξ^j captures any other factor affecting local political competition.[15] High loyalty districts will tend to display high values for γ^j and δ^j, while low loyalty districts will display low values for both parameters. Since these two parameters capture opposing effects on district expenditure, as stated in Propositions 1 and 2, moving from low loyalty to high loyalty (thus increasing δ^j and γ^j), I expect to find an ambiguous relationship between district expenditure and the degree of loyalty, depending on which of the political competition or persistence effect dominates.

Consider multiple districts, indexed such that $j \in \{1, ..., J\}$. Assuming as before that the government's utility depends linearly on the number of seats held, generalization of the two-district

[15] The positive correlation between γ^j and δ^j assumed here is a natural extension of the two-district case, in which the loyal district is characterised by positive γ and δ. Remember that both of these parameters are set to 0 for the swing district.

case yields the following problem:

$$\max_{\{e^j\}_{j=1}^J} \left\{ \sum_{j=1}^J x_t^j + \sum_{j=1}^J x_{t+1}^j \right\}$$
$$\text{s.t. } x_t^j = F(\gamma^j + e^j) \quad \forall j$$
$$x_{t+1}^j = \delta^j F(\gamma^j + e^j) \quad \forall j$$
$$\sum_{j=1}^J e^j = \bar{e}.$$

Making the appropriate substitutions, the Lagrangian for this problem may be written as

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

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

$$e^{j*} = F'^{-1}\left(\frac{\lambda}{1+\delta^j}\right) - \gamma^j = F'^{-1}\left(\frac{\lambda}{1+\delta^j}\right) - \gamma(\delta^j) - \xi^j, \quad \forall j. \tag{2}$$

Summing over all districts yields an implicit expression for the Lagrange multiplier λ in terms of the model parameters:

$$\bar{e} + \sum_{j=1}^J \gamma^j = \sum_{j=1}^J F'^{-1}\left(\frac{\lambda}{1+\delta^j}\right) \Rightarrow \lambda \geq 0.$$

The following proposition 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 with loyalty (δ^j) as long as the persistence effect dominates the political competition effect.*

Sketch of proof. Differentiating (2) with respect to δ^j, assuming λ constant, yields

$$\frac{\partial e^{j*}}{\partial \delta^j} \cong \underbrace{\frac{-\lambda}{(1+\delta^j)^2 F''(\gamma^j + e^{j*})}}_{\geq 0} - \gamma'(\delta^j) \lesseqgtr 0. \tag{3}$$

The first additive term is signed in a straightforward way by means of the properties of F and using the fact that $\lambda \geq 0$. ■

Hence, mirroring the two-district case, changes in loyalty have an ambiguous effect on district-level spending. The first term in (3) is positive, corresponding to the persistence effect of Proposition 1 in the two-district case. The second term is negative and depends on the magnitude of $\gamma'(\delta^j)$, corresponding to the political competition effect of Proposition 2.

2.4 Empirical Predictions

My primary interest in the empirical analysis that follows is to study the relationship between transportation expenditure at the district level and measures of political competition and partisan loyalty. As stated in Proposition 4, the model leads to an ambiguous prediction with respect to the sign of the relationship between partisan loyalty and expenditure; a dominant persistence effect is consistent with the machine politics view discussed above, whereas a dominant political competition effect is consistent with the swing voters view.

Towards an empirical implementation, assume that equilibrium spending in district j (e^{j*}) depends on γ^j and δ^j in the way suggested by (2), and on some observable ($\mathbf{X}^j$) and unobservable (ϵ^j) district characteristics. I assume that $\mathbf{X}^j$ and ϵ^j enter the voting function $F(e^j; \mathbf{X}^j, \epsilon^j)$ in such a way that e^{j*} is a linear function of district characteristics, yielding:

$$e^{j*} = G(\delta^j) - (\gamma(\delta^j) + \xi^j) + \theta \mathbf{X}^j + \epsilon^j, \tag{4}$$

where $G(\delta^j) = F'^{-1}\left(\frac{\lambda}{1+\delta^j}\right)$. The most obvious problem in estimating equation (4) comes from the fact that $\gamma(\delta^j)$ and $G(\delta^j)$ are only indirectly observable. Therefore, in the empirical application that follows the strategy will not be to estimate these primitive parameters directly but instead to identify the related persistence and political competition effects.

Equation (4) provides a conceptual framework for analysing both the political and non-political determinants of local spending. The first two terms in (4) pertain to the political sphere. $G(\delta^j)$ captures the persistence effect, that is the role that local spending plays in securing the support of loyal districts in the future. According to the persistence effect, one expects a *positive relationship between expenditure and partisan loyalty.* The second term, $\gamma^j = (\gamma(\delta^j) + \xi^j)$, captures the political competition effect. According to the political competition effect, one expects a *negative relationship between expenditure and a low intensity of political competition.* The decomposition of γ^j accounts for the fact that the intensity of political competition is typically negatively correlated to partisan loyalty, but also influenced by the local and economy-wide political conditions. For example, characteristics of the local challengers and the national political climate (not explicitly modelled here) undoubtedly enter the incumbent's allocation problem. Finally, local expenditure will also (and perhaps primarily) be driven by non-political expenditure needs, i.e. various characteristics of the local population. These are captured by the remaining terms in (4).

3 Data

To investigate the empirical relevance of the simple theory presented in the previous section, I exploited rich data on road expenditure published by Québec's Department of Transportation for each provincial electoral district.[16] The expenditure data cover fiscal years 1986-87 to 1996-97 (with the exception of 1991-92 when the data were not compiled by the Department of Transportation).[17] 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.[18]

Over the period covered by this study, redistricting occurred three times but most changes to district limits 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 with parts of a number of incumbent districts. Thus, the number of cases varies from year to year.[19] Another source of variation in the number of cases has to do with missing data points in the official publications, which generally concern urban districts where expenditure is very small.

As shown by Figure 3, 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.[20] In 1996, expenditure had declined to $5.22 million. Each year, roughly one fourth of the ridings – typically small urban ones – received zero or almost zero expenditure. The maximum spending received by a single district varied from $20.75 million in 1986 to $29.69 million in 1987. Some summary statistics are provided in Table 1.[21]

I obtained data on district characteristics from the Directeur général des élections du Québec, the body responsible for organizing elections and referenda in the province.[22] Most of these data

[16] 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. Publication of these data stopped after 1996-1997.

[17] I hereafter refer to fiscal years as if they were calendar years, e.g. 1986 refers to the 1986-87 fiscal year.

[18] Most roads in Canada are under provincial/municipal jurisdiction. Federal spending on infrastructure is not included here.

[19] There were 122 districts in 1985, and this number had reached 125 by 1996.

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

[21] Tables and figures are located at the end of the paper.

[22] The source is Directeur général des élections du Québec (various years).

come from special tabulations from the census and, hence, do not vary every year (see Table 1 for available years). I constructed the following 'district characteristics' variables: area covered by the district ($AREA^j$), population size (POP_t^j), urban population share (URB^j), French-speaking population share ($FRENCH_t^j$), number of manufacturing firms ($FIRMS^j$), unemployment rate (UE_t^j) and household income (INC_t^j).[23] The $AREA^j$ variable is the only one to which I apply a log transformation in order to account for the wide 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 (summary statistics are provided in Table 1). For example, 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 varied 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), from 13% to 99%. The unemployment rate varied between 5.3% and 48.9%, while the average household's real income was \$24,813 in the 'poorest' riding in 1995 and \$70,520 in the 'richest' in 1985.

The election data cover six general elections (1981, 1985, 1989, 1994, 1998 and 2003), two referenda (1992 and 1995) and two ruling parties. Provincial politics in Québec, which is the focus of this paper, is essentially bipartisan:[24] the 'federalist' Québec Liberal Party and the 'independentist' Parti Québécois (PQ) have alternated in power since 1970.[25] The general votes held between 1985 and 1995 are more directly related to the expenditure data. In the 1985 election, the Liberals were elected with 99 seats out of 122, and they were then re-elected in 1989, with 92 seats out of 125. In 1992, the Liberal government organized a referendum on the Charlottetown constitutional accord,[26] which it favoured, and lost by a substantial majority.[27] The PQ returned to power in 1994, with a

[23] Based on data availability (see Table 1), some of these variables are coded as time-invariant (they are $AREA^j, URB^j$ and $FIRMS^j$).

[24] I am concerned here with provincial politics. Separate elections are also held at the federal, municipal and school-board levels.

[25] Two other parties have been represented in the National Assembly (N.A.) during this 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).

[26] The Charlottetown Accord was a wide-ranging federal-provincial accord that would have led Québec to sign the 1982 Constitution Act. This act was adopted without the assent of the Québec National Assembly when the Canadian Constitution was patriated from the United Kingdom to Canada.

[27] It is noteworthy that referenda are not decisional in Québec, but only a consultation device for the government.

77-seat parliamentary group. In 1995, the PQ called a referendum on Québec's independence, and lost it by a small margin of 40,000 votes. Table 2 provides some summary statistics on the elections and referenda held over the 1981-2003 period.

From the electoral data, I construct several 'political' variables. First, the GOV_t^j variable takes values 1 if the district is represented by a member of the National Assembly (M.N.A.) from the government party and 0 otherwise. Similarly, the MIN_t^j variable equals one if a district's M.N.A. was a cabinet minister during the previous year, 0 otherwise.

The main political variables will be used to capture the political competition and the persistence effects highlighted in the theory section. I first construct a standard measure of 'closeness' of elections at the riding level (MAR_t^j). This variable is defined in a straightforward manner for a particular district j and the last election before year t as[28]

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

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 candidate, etc. Thus MAR_t^j captures the margin of the winner over total votes cast and will be used in the empirical analysis to capture the political competition effect.

In the empirical analysis that follows, I use six measures of partisan loyalty to capture the persistence effect. All share the same logic: $LOYAL_t^j = 1$ if riding j *repeatedly* voted for the incumbent government in a given series of elections, 0 otherwise. The six loyalty variables (L1 to L6) include different combinations of elections (see Table 1 for details).

4 Empirical Analysis

In this section, I test the predictions of the theoretical model presented above with respect to the geographical allocation of road spending in Québec. The basic estimating equation relates spending (EXP_t^j) in district j and year t to the political variables and district characteristics defined in the previous section:

$$EXP_t^j = \alpha + \gamma MAR_t^j + \delta LOYAL_t^j + \beta \mathbf{Z}_t^j + \theta \mathbf{X}_t^j + \varphi_t + \phi^j + \epsilon_t^j. \quad (5)$$

[28] In election years, the previous election is also used. A similar convention is adopted by Milligan and Smart (2005). They also use a similar measure of election closeness.

The dependent variable corresponds to e^{j*} in the theoretical discussion and is measured as the level of road spending.[29] The $\mathbf{X}_t^j$ vector includes all district characteristics described in the previous section except for $FRENCH_t^j$ which will belong to the first stage of the instrumental variables (IV) estimation strategy described below. $\mathbf{Z}_t^j$ captures house member characteristics; it includes the direct effect of GOV_t^j and MIN_t^j. φ_t is a vector of year effects, ϕ^j is a vector of district fixed effects, and ϵ_t^j is an error term.

The main parameters of interest are γ and δ. In line with the swing voters view, γ is expected to be negative: a low margin is typically associated with strong political competition, which the theoretical model's political competition effect predicts should lead to higher spending. Consistent with the machine politics view, δ is expected to be positive: the theoretical model's persistence effect predicts more spending in loyal districts, holding political competition constant.

4.1 Estimating the Political Competition Effect

A number of empirical papers have tested the relationship between political competition and local public spending. These papers typically provide support for the swing voters view – see, for example, Milligan and Smart (2005), Dahlberg and Johansson (2002), Cadot *et al.* (2002), Schady (2000), and Stein and Bickers (1994).[30] Swing voters patterns are also a typical result in the literature on campaign spending (e.g. Strömberg (2002)). The standard test of the political competition effect involves regressing expenditure on a measure of political competition, generally winning margin (MAR_t^j). However, in none of these earlier contributions are direct controls for partisan loyalty included.

As a benchmark, I start by presenting results that correspond to the standard regression in the literature, i.e. abstracting from issues of partisan loyalty:

$$EXP_t^j = \alpha + \eta MAR_t^j * GOV_t^j + \vartheta MAR_t^j * OPP_t^j + \beta \mathbf{Z}_t^j + \theta \mathbf{X}^j + \varphi_t + \phi^j + \epsilon_t^j, \qquad (6)$$

where $OPP_t^j = 1 - GOV_t^j$. This specification is slightly richer than what has generally been used

[29] Results are generally insensitive to this particular 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. Those are available upon request.

[30] One exception is a recent study by Francia and Levine (2005), which does find support for the machine politics view, using aggregate state-level data to study geographic discrepancies in the US federal budget during George W. Bush's first presidency. Case (2001) also finds evidence of machine politics patterns in Albanian social spending. In both of these cases, the authors do not have access to detailed panel data.

in previous work since it allows the effect of winning margin on expenditure to differ in ridings held by the government and the opposition parties.

The results for this first regression are presented in the first two columns of Table 3. Specification (1) includes district characteristics (the $\mathbf{X}_t^j$ vector) but no district fixed effects.[31] A first noteworthy result is that most 'economic' controls enter the regression significantly and with the expected signs. The area and urban population variables are strongly significant, as expected, 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. The positive signs on the other two economic variables (income and number of firms) are consistent with a positive relationship between economic activity and spending, but only the number of firms coefficient is (weakly) statistically significant.[32]

The main parameters of interest are η and ϑ. The basic empirical test can be thought of as follows: the standard theoretical view (the swing voters view) predicts that both η and ϑ 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. This corresponds to the political competition effect in the theoretical model. However, Specification (1) displays a strong *positive* effect of winning margin in government-held ridings ($\hat{\eta} > 0$). This *a priori* counter-intuitive benchmark result motivates most of the empirical analysis that follows. The coefficient on $MAR_t^j * OPP_t^j$ ($\hat{\vartheta}$) 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.

This asymmetry between government and opposition ridings is consistent with the theory. Indeed, the persistence effect – which is not controlled for in Specification (1) – 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 persistence effect and the political competition effect tend to work against each other. High margins should be associated with lower spending ($\eta < 0$) according to the political competition effect, but since they are also associated with high partisan loyalty the persistence effect will work in the opposite direction, leading to an ambiguous relationship

[31] Since some district characteristics are coded as time-invariant, inclusion of fixed effects absorbs them. Hence, in specifications (2) to (5), $AREA^j, URB^j$ and $FIRMS^j$ are dropped and fixed effects are included.

[32] The number of manufacturing firms is central to the analysis of Cadot *et al.* (2002), which they interpret as a proxy for lobbying activities. Although this interpretation may be controversial, my results corroborate the presence of a significant link between the number of firms and spending.

between margin and spending in government-held ridings. However, in districts held by opposition parties only the standard political competition effect should be present. In fact, partisan 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. As a consequence, if the persistence effect dominates the political competition effect in government-held ridings, we should observe $\hat{\eta} > 0$ but $\hat{\vartheta} < 0$. This is indeed what Specification (1) suggests.

Specifications (2) and (3) provide robust evidence on the political competition effect. As is typical in such applications, there are concerns that contemporaneous district expenditure and winning margin may be driven by unobserved district characteristics. For example, one possibility is that the stock of public capital (which the theoretical model suggests is linked to political support) and the current expenditure flow are correlated. Since the available data do not allow for direct controls for the stock of public capital at the district level, one might worry that political variables, such as $MAR_t^j * GOV_t^j$ and $MAR_t^j * OPP_t^j$ in equation (6) are correlated with the residual.

In fact, the main 'endogeneity' problem in estimating equation (6) is, as will be argued in length in the remainder of the paper, that it suffers from an omitted variable bias. Not controlling for partisan loyalty most likely leads to an upward bias in $\hat{\eta}$. Indeed, the theoretical model has shown that local partisan loyalty can be expected, through the persistence effect, to lead to higher local public spending. This will lead to an upward biased $\hat{\eta}$ if winning margin and partisan loyalty are positively correlated. Strong evidence for a positive correlation between winning margin and partisan loyalty is provided in the last column of Table 5. Regardless of the loyalty measure (L1 to L6), there is a strong positive correlation between MAR_t^j and $LOYAL_t^j$. 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.

Given the panel structure of the data, the inclusion of fixed effects in Specification (2) effectively controls for the endogeneity of political variables. To the extent that partisan loyalty is a fixed characteristic of an electoral district, fixed effects should control for loyalty and take care of the omitted variable bias that undermines Specification (1). The results for Specification (2) indicate that this conjecture is indeed correct. $\hat{\eta}$ and $\hat{\vartheta}$ have the same signs as in Specification (1) but none of them is statistically significant with fixed effects included. In particular, $\hat{\eta}$ is now much smaller. Again, these results provide very little evidence in favour of the standard theoretical prediction

($\hat{\eta}, \hat{\vartheta} < 0$). On the contrary, a positive correlation is still observed between winning margin and expenditure in government-held ridings.

Specification (3) arguably provides an additional control for endogeneity. Indeed, a recent study by Lee *et al.* (2004) proposes a novel strategy to control for endogeneity problems in electoral settings. Their rationale is 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. Nevertheless, Specification (3) presents the results from a fixed-effect regression on the subsample of districts that were in the first three deciles of the winning margin variable in 1985.[33] 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 smallest margins that one would expect the swing ridings prediction to be the strongest – 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 $\hat{\eta}$ and $\hat{\vartheta}$ now have the negative sign predicted by the political competition effect. The effect is significant for opposition-held ridings but is still insignificant for government-held ridings.

Should we conclude from this weak political competition effect in government-held ridings that politics does not significantly distort the geographical allocation of spending? In order to answer this question, the remainder of the paper focuses on estimating the persistence effect. However, before turning to regressions that explicitly account for partisan loyalty, the next subsection discusses the timing of spending and documents an electoral budget cycle.

4.2 Timing of Spending: Evidence of an Electoral Budget Cycle

Although the theoretical model does not make specific predictions as to the timing of spending (it is exogenous in the model), in the model's spirit it should be the case that spending allocation is most affected by electoral considerations close to an election. This is consistent with the idea that political support 'depreciates' over time (as captured by δ^j in the model) and amounts to saying

[33] There is a trade-off here in restricting the sample to closer races, which arguably reduces the endogeneity bias but reduces the number of observations and hence the precision of the results. Unreported results show that reducing the window of close races does not significantly alter the qualitative pattern of the political variables.

that we should witness an 'electoral budget cycle.'[34]

The first three specifications in Table 3 make the very strong assumption that the impact of political variables such as $MAR_t^j * GOV_t^j$ is constant over time. Year-by-year regressions (see Table 4) and the pattern of the year effects in Specification (2) suggest that this is clearly a strong assumption.

In year-by-year regressions, $MAR_t^j * GOV_t^j$ turns out to be the most important political determinant of the allocation of road spending. Indeed, $\hat{\eta}$ is positive and significant in election years (1989 and 1994) and in pre-election years (1988 and 1993). It is also positive and significant in 1990, a post-election year. $\hat{\eta}$ is negative only in 1996 and the coefficient is not significant. The coefficient on $MAR_t^j * OPP_t^j$ is negative in all years except for two, but is only significant (and negative) in 1988. The time pattern of $\hat{\eta}$ and $\hat{\vartheta}$ is plotted in Figure 4 and provides a first evidence of the presence of an electoral budget cycle in these data. It is noteworthy that having a M.N.A. that belongs to the parliamentary majority does not raise significantly the likelihood of getting more road spending in any given year – the effect is even negative in most years after controlling for the interaction term $MAR_t^j * GOV_t^j$. Similarly, the coefficient on the cabinet minister variable is significant (and positive) only in 1987 and 1989. The time pattern of year effects in Specification (2), depicted in Figure 5, provides additional evidence on the presence of an electoral budget cycle. Year dummies are significant and positive in and around election years (1986 is the omitted category).

Specifications (4) and (5) of Table 3 allow the impact of $MAR_t^j * GOV_t^j$ to vary over the political cycle. In specification (4), $MAR_t^j * GOV_t^j$ 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, $MAR_t^j * GOV_t^j$ is only significant when interacted with the $ELEC_t$ dummy, confirming that a lot of the action seems to be concentrated in election years. Note that the coefficient on $MAR_t^j * OPP_t^j$ (which is not interacted with electoral cycle dummies here) now has the expected negative sign and is significant. Specification (5) is presented as a robustness test for the positive sign on $MAR_t^j * GOV_t^j * ELEC_t$ 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 $MAR_t^j * GOV_t^j * ELEC_t$) appears to be robust.

[34] Brender and Drazen (2005) revisit the evidence on the 'political budget cycle,' the well-known phenomenon that aggregate government budget fluctuations are influenced by political dynamics. An earlier contribution is Blais and Nadeau (1992).

These results nicely summarise the pattern of the data: the dynamics in opposition ridings tends to conform to the standard swing voters view. However, in government-held ridings, there is no evidence of the standard sign predicted by this view. 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 persistence effect associated with partisan loyalty.

4.3 Including Partisan Loyalty: Estimating the Persistence Effect

I now present the central results of the paper, which are based on equation (5). This complete specification includes the measures of partisan loyalty discussed in Section 3 and provides evidence on the relative strengths of the political competition (MAR_t^j) and persistence ($LOYAL_t^j$) effects of the theoretical discussion.

Table 5 reports results from regressions with the six loyalty variables, with and without fixed effects. It also reports the results from a 'baseline regression' excluding $LOYAL_t^j$ but still including MAR_t^j. Mirroring the results presented above, the coefficient on MAR_t^j ($\hat{\gamma}$) is positive and significant in the baseline regression. Regardless of which loyalty measure is being used, the inclusion of $LOYAL_t^j$ in the regression considerably decreases the coefficient on MAR_t^j. Although it remains positive in most cases, it is never significant. On the contrary, the coefficient on $LOYAL_t^j$ ($\hat{\delta}$) is always positive and significant at the 1% confidence level in all specifications but one.

When equation (5) is estimated with fixed effects, $\hat{\delta}$ is still positive but not significant.[35] This is explained by the fact that, with fixed effects, identification comes from *changes* in loyalty. By construction of the loyalty variables, such changes in loyalty occur only when there is a change in government, i.e. in 1994. However, these changes are hard to disentangle from changes in the GOV_t^j variable, many of which correspond to the changes in $LOYAL_t^j$. When GOV_t^j is removed from the regression, $\hat{\delta}$ is strongly significant even with fixed effects.

On the one hand, these results again illustrate the difficulty of identifying any evidence of the standard swing voters hypothesis in the Québec data using road spending as a dependent variable.

[35] Table 8 presents results for fixed effect 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 $LOYAL_t^j$.

On the other hand, I find strong support for the machine politics view: the coefficient on $LOYAL_t^j$ in the fixed effect regression reported in Table 5 implies that a loyal district received 17% more spending than the average district.

The data allows for a separate analysis of construction and maintenance expenditure, with the former containing the major road improvement projects. 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 the major projects, i.e. those with the biggest long-term value to voters, are being driven by partisan loyalty. The positive coefficient on MAR_t^j (significant at the 10% confidence 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.

In what follows, I assess the robustness of these results by presenting IV and difference-in-difference estimates to account for the potential endogeneity of the $LOYAL_t^j$ variable.

4.4 Addressing the Endogeneity of Partisan Loyalty

How likely is it that $LOYAL_t^j$ is an endogenous variable and what is the expected direction of the bias in the Ordinary Least Squares (OLS) estimates? A first look at this question is provided by Table 6, which 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. Liberal strongholds are statistically different from the other districts along three observable dimensions: loyal districts tend to be 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 OLS bias on the $LOYAL_t^j$ coefficient is unclear. On the one hand, Liberal strongholds tend to be economically dynamic areas (low unemployment rate) and hence can be expected to have a strong need for new or improved roads. If this is true, we 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 have a low preference for road spending compared to other public spending. This alternative story suggests that OLS estimates might instead be downward-biased.

Addressing the potential endogeneity of $LOYAL_t^j$ is trickier than in the case of MAR_t^j. Whereas fixed effects arguably provide sufficient control for endogeneity concerns related to MAR_t^j, partisan

loyalty is essentially a fixed district characteristic that fixed effects tend to absorb. This subsection proposes two strategies to assess the robustness of the previous subsection's results pertaining to the effect of local loyalty on local spending.

I first present IV results that use the French-speaking population variable ($FRENCH_t^j$) to predict political loyalty. A similar IV strategy has been used by Milligan and Smart (2005). The rationale for this strategy comes from a fundamental characteristic of the political environment in Québec: loyalty to the Liberal Party (in office from 1985 to 1994) tends to arise in districts where the English-speaking population is concentrated (e.g. Western Montréal). Anecdotal evidence 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. Similarly, in these 12 ridings, the No option garnered near 85% of the vote in the 1995 independence referendum. Table 7 presents some first-stage diagnostics documenting the strong correlation between $FRENCH_t^j$ and $LOYAL_t^j$. If a low French-speaking population appears to be a good predictor of political loyalty to the Liberal Party, language is unlikely to be a direct predictor of the level of transportation expenditure.[36]

IV results, featured in Table 7, are qualitatively similar to the baseline results. In fact, $\hat{\delta}$ is slightly bigger and still statistically significant in all specifications (again except for maintenance expenditure).[37] $\hat{\gamma}$ is negative in most specifications but, again, is never significantly different from zero. I conclude from this IV exercise that endogeneity is not the main driving force behind the estimated positive correlation between partisan loyalty and expenditure. The exogenous variation provided by the $FRENCH_t^j$ variable is also indicative that causality is working in the direction predicted by the theory.

Note that $FRENCH_t^j$ is essentially a time-invariant district characteristic and therefore, in this particular application, is not a suitable instrument in the fixed effects regressions. However, the fact that there is a change in the ruling party in 1994 allows for a different identification strategy which exploits variation over time in loyalty. The rationale for this second robustness check 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 is suggestive of a difference-in-difference strategy that compares spending in ridings that are loyal to the Liberals (l) to spending in the other ridings

[36] In support of this conjecture, the $FRENCH^j$ variable is almost never significant if added as a control in the year-specific baseline regressions (results unreported but available upon request).

[37] The fact that 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.

(o), before and after the 1994 election. The effect of partisan loyalty is identified as follows:

$$\hat{\delta} = (\overline{EXP}^{l}_{86-94} - \overline{EXP}^{l}_{95-96}) - (\overline{EXP}^{o}_{86-94} - \overline{EXP}^{o}_{95-96}) \tag{7}$$

where the upper bars denote averages.

Table 8 presents the results pertaining to this difference-in-difference exercise. Results are presented for all expenditure and for construction and maintenance expenditure separately. I also present results from a regression implementation with the full set of district characteristics. $\hat{\delta}$ 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 $\hat{\delta}$ is still positive and of the same magnitude as with 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. Figure 6 provides visual evidence corresponding to this identification strategy.

4.5 Discussion and Relation to the Previous Empirical Literature

The empirical analysis has shown that, while the standard swing voters pattern is present in opposition-held ridings, machine politics patterns dominate in government-held ridings (especially close to an election). This is consistent with the theory, which suggests a trade-off in the allocation of spending within the government coalition.[38]

Milligan and Smart (2005) provide the most compelling empirical evidence in the literature in support of swing voters patterns, based on panel data analysis combined with the use of instrumental variables; it is also the closest research in the literature to the current paper. Previous studies had typically relied on cross-sectional data – e.g. Stein and Bickers (1994), Case (2001), Dahlberg and Johansson (2002), Francia and Levine (2005). Those studies are therefore especially sensitive to endogeneity problems.

Previous studies have also tended to use data on campaign spending or relatively small *ad hoc*, discretionary transfer programs – for example, Peru's Social Fund in Schady (2000) or Sweden's environmental grants to municipalities in Dahlberg and Johansson (2002). Unlike road spending, it is plausible to think that voters would not perceive these expenditures to have sufficient long-term significance to be appropriate instruments for building enduring political support. Milligan

[38] Milligan and Smart (2005) find a similar dichotomy, with swing voters patterns being stronger in opposition-held ridings.

and Smart (2005) study the allocation of regional development grants by the Canadian federal government, grants which are also known for their discretionary nature. Although a portion of those 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.

In a more general setting, 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), this paper complements other work in the literature that has focused on more short-term discretionary projects. The results of this paper suggest, more broadly, that a minimal requirement for observing machine politics patterns is that the spending instrument in question has the necessary long-term significance for the voters.

5 Why Do They Do It? A Look at the Political Return to Road Spending

The evidence presented in the previous section suggests that the allocation of transportation expenditure across ridings is indeed influenced, to some extent, by pork-barrel considerations. A closely related question is whether there is any discernible political gain from the use of public expenditure for partisan purposes. The existing empirical literature has devoted considerable attention to this issue, asking for example which types of expenditure (e.g. campaign spending, public goods) can make a political difference. It has generally been very hard to identify any significant impact of either campaign or public spending on electoral outcomes (Stein and Bickers (1994)).[39]

This null *short-run* return raises the key question of why politicians keep allocating expenditure according to political considerations even if they do not appear to benefit politically from such expenditure. In this section, I provide evidence showing that the short-run political return to road spending in Québec is no different than the typical null return reported by most previous studies.

[39] However, some researchers have found such impacts for both campaign spending (Levitt (1994), Strömberg (2002)) and public spending (Levitt and Snyder (1997)). Unsurprisingly, this literature also identifies the key role of 'close' districts – see e.g. Strömberg (2002).

One explanation for this empirical puzzle, suggested by the analysis in this paper, is that patterns of pork-barrel spending are primarily driven by *long-run* political considerations.

I estimate the impact of spending and other factors on the probability of winning in a riding from the government's point of view, estimating the following regression for election years:

$$PWIN_t^j = F(\alpha + \psi_1(EXP/POP)_t^j + \psi_2(EXP/POP)_{t-1}^j + \mu \mathbf{W}_t^j) + u_t^j \tag{8}$$

where $PWIN_t^j$ is simply the GOV_t^j variable in 1989 and $(1 - GOV_t^j)$ in 1994. $(EXP/POP)_t^j$ measures transportation expenditure per capita for year t. The $\mathbf{W}_t^j$ vector includes the GOV_t^j variable lagged, winning margin (MAR_t^j) in the previous election, previous referendum results (YES_t^j)[40] and district characteristics. u_t^j is an error term.

Logit estimation results are presented in Table 9 for the two election years for which I have expenditure data: 1989 and 1994.[41] These two years differ fundamentally in terms of election outcomes. In 1989, the Liberal government managed to preserve its strong majority in the National Assembly (its number of seats only slightly decreased, as discussed earlier). However, in 1994 the PQ took office, increasing its number of seats by 48 (out of 125). Thus, whereas only limited movement can be observed in 1989, a lot of variation occurred in 1994.

In 1989, having won a riding in the previous election (1985) was the only significant predictor of the probability of winning a riding. The preceding general vote was also the best predictor of a Liberal victory in the 1994 election; ridings which strongly supported the government in the 1992 referendum (the 'yes' option) were significantly more likely to elect a Liberal M.N.A. Interestingly, the only other significant predictor of a Liberal victory in 1994 was a low riding-level unemployment rate. In both years, the per capita expenditure variables were not statistically significant.

A similar conclusion with respect to expenditure variables can be drawn from the referenda held in 1992 and 1995, for which I ran linear regressions similar to equation (8).[42] Significant predictors of a high 1992 'yes' vote share were the usual indicators of federalist loyalty:[43] having a Liberal M.N.A. and having elected him or her with a high margin in the 1989 election, and a relatively low French-speaking population. Consistent with the evidence from the general elections cited above, road expenditure was not correlated with the 1992 riding-level referendum results. In 1995,

[40] YES_t^j is defined as the vote share for the 'yes' option. See Table 2 for some summary statistics on the 1992 and 1995 referenda.

[41] Similar results were obtained using probit regression.

[42] Results are also presented in Table 9.

[43] The negative sign on the urban population variable is hard to interpret, as federalist strongholds tend to be located in the metropolitan area of Montréal. The latter tendency is probably captured here by the language variable.

however, contemporaneous road spending was a significant predictor of a *low* 'yes' vote share. The negative sign on this variable is puzzling; contrary to conventional expectations, a higher vote share for the government's 'yes' option was associated with lower expenditure. A potential explanation for this counter-intuitive finding is that 1995 expenditures still reflected spending decisions taken by the previous Liberal government, as major infrastructure projects typically involve implementation lags. Other than the surprising negative correlation with the 1995 expenditure variable, significant predictors of a high 'yes' vote share in 1995 were the expected ones: a low 'yes' vote share in the 1992 referendum, a relatively low urban population, and a relatively high unemployment rate.

In line with most of the previous literature, the lack of correlation between electoral results and road spending at the riding level demonstrate the difficulty of identifying a significant *short-run* political return to the geographic allocation of public spending. This is consistent with the theory of the political process developed above, in which *long-run* relationships between ridings and political parties play a key role.

6 Conclusion

This paper has examined an important dimension of government behaviour with respect to the allocation of public goods, namely, the geographic patterns of pork-barrel spending by incumbent governments. Two opposing predictions dominate the previous theoretical literature : the 'swing voters' view, following amongst others Lindbeck and Weibull (1987, 1993), and the 'machine politics' view, following 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, i.e. loyal districts. Depending upon which of these two views one holds, the expected relationship between winning margin and public spending will be negative (the 'swing voters' view) or positive (the 'machine politics' view).

Using a dynamic political economy model in which the incumbent party accumulates political capital in some ridings, I have demonstrated that the 'swing voters' and the 'machine politics' motives work against each other to produce an ambiguous short-run relationship between political competition and public spending in government-held ridings. This model combines the two views of pork-barrel behaviour in a transparent way, making clear how they follow from incentives pertaining to different time horizons.

To shed light on the relative importance of these two views, I have exploited a unique data set on the allocation of public expenditure on roads amongst electoral ridings in Québec. Specifically, I have explored the empirical relationship between district loyalty, political competition and the geographic distribution of public spending. I find that the standard 'swing voters' prediction was not the main factor driving the interaction between politics and expenditure allocation in Québec's recent experience, although there was some evidence of additional spending being directed towards ridings held by opposition parties where election outcomes were close. In government-held ridings, however, there was a positive relationship between expenditure and winning margin, a pattern consistent with a government rewarding its constituents in ridings that delivered high majorities in the previous election. In fact, road spending exhibits an electoral cycle, with 'machine politics' patterns especially discernible close to elections. My main finding is robust evidence that districts which display loyalty to the incumbent government receive disproportionately more spending. Consistent with the existing literature, the results suggest that there does not appear to be any significant positive link between road expenditure and the probability of winning a riding in the short run.

More generally, I have shown that long-run political relationships are a key determinant of the allocation of centrally-provided public goods, at least in the case of road spending. The theoretical perspective adopted in this paper also helps rationalize why the previous empirical literature has generally failed to identify machine politics patterns: it typically focused on programs that lack a significant time dimension. 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.

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Table 1. Summary statistics

Variable	Description	Years	Obs.	Mean	Std. Dev.	Min.	Max.
Expenditure (dependent variable)							
EXP	Infrastructure spending (1992 Canadian dollars, '000$)	All	1185	5396	5205	0	29694
District characteristics							
AREA	District area (ln(km^2))	1991	125	5.55	2.81	1.20	12.75
POP	District population (count)	1986	125	52242	7753	14530	68820
		1991	122	55237	9927	13990	76535
		1996	122	57099	11393	13765	82931
URB	Urban population (share)	1986	125	.7605	.2655	.1081	1.0
FIRMS	Manufacturing firms (count)	1988	124	115.52	75.48	7	426
UE	Unemployment rate (%)	1986	125	12.46	4.84	5.3	29.17
		1996	122	15.06	7.18	6.6	48.9
INC	Mean household income	1985	125	41706	8563	25061	70520
	(1992 Canadian dollars, $/year)	1995	122	41066	7971	24813	65892
FRENCH	French-speaking pop. (share)	1986	125	.8185	.1990	.1305	.9896
		1991	122	.8225	.2023	.1352	.9924
		1996	122	.8056	.2087	.1313	.9818
Political variables							
MAR	Winning margin	1985	120	.2047	.1777	.0029	.8693
		1989	125	.1581	.1083	.0024	.4984
		1994	122	.2157	.1767	.0009	.7489
GOV	Government dummy	1985	120	.8167	.3886	0	1
		1989	125	.7360	.4426	0	1
		1994	122	.6066	.4905	0	1
Partisan loyalty dummies (elections included)							
L1	85, 89, 94	All	1250	.2912	.4545	0	1
L2	81, 85, 89, 94, 98, 03	All	1250	.2032	.4025	0	1
L3	All past elections	All	1250	.2752	.4468	0	1
L4	All future elections	All	1250	.3056	.4608	0	1
L5	81, 85	All	1250	.2976	.4574	0	1
L6	98, 03	All	1250	.3472	.4763	0	1
MIN	Cabinet minister	All	1250	.2016	.4014	0	1

Table 2. Summary statistics: Provincial general election and referendum results, Québec, 1981-2003

Vote date	Number of seats in the National Assembly					Vote share (%)	
	QLP	PQ	EP	ADQ	Total	Yes	No
General elections							
April 13, 1981	42	80			122		
Dec. 2, 1985	99	23			122		
Sept. 25, 1989	92	29	4		125		
Sept. 12, 1994	47	77	0	1	125		
Nov. 30, 1998	48	76	0	1	125		
April 14, 2003	76	45	0	4	125		
Referenda							
Oct. 26, 1992 (Charlottetown Accord)						43.3	56.7
Oct. 30, 1995 (Independance)						49.4	50.6

Legend:
QLP: Québec Liberal Party
PQ: Parti Québécois
EP: Equality Party (first ran in the 1989 election)
ADQ: Action démocratique du Québec (first ran in the 1994 election)

Table 3. Panel estimation results

	(1)	(2)	(3)	(4)	(5)
*MAR*GOV*ELEC*				4120**	3041*
				(1720)	(1588)
*MAR*GOV*PREELEC*				1799	
				(1334)	
*MAR*GOV*POSTELEC*				1487	
				(1012)	
*MAR*GOV*	3507***	238	-1496	-1881	-411
	(972)	(928)	(3037)	(1161)	(979)
*MAR*OPP*	-1392	-1771	-7733**	-1843*	-1830
	(1521)	(1082)	(3107)	(1062)	(1085)
GOV	-324	435	100	618	494
	(466)	(417)	(784)	(416)	(418)
ELEC				-534	47
				(326)	(411)
PREELEC				-341	
				(292)	
POSTELEC				-293	
				(249)	
MIN	528	210	-415	111	183
	(367)	(274)	(524)	(267)	(274)
AREA	867***				
	(135)				
POP	.0179	-.0120	-.0394	-.0103	-.0117
	(.0213)	(.0343)	(.0507)	(.0308)	(.0345)
URB	-5999***				
	(1381)				
FIRMS	3.71*				
	(1.92)				
UE	115***	-92*	-80	-71	-90*
	(45)	(51)	(180)	(53)	(51)
INC	.0336	-.0427	.0630	.0327	-.0401
	(.0250)	(.0721)	(.1409)	(.0728)	(.0721)
Fixed effects	no	yes	yes	yes	yes
Year effects	yes	yes	yes	no	yes
R^2	.5646	.7555	.8134	.7544	.7568

Notes: Constants unreported. Robust standard errors in parentheses, adjusted for clustering of political variables. Levels of statistical significance: 1% (***), 5% (**) and 10% (*). Specification (1): n=1158. Specifications (2)-(4): n=1168. Specification (1a): n=345 (close races only). Dependent variable: district-level expenditure.

Table 4. Year-by-year regressions (political variables)

	*MAR*GOV*	*MAR*OPP*	*GOV*	*MIN*	*n*	R^2
1986	2170	268	594	585	118	.7247
	(1566)	(10757)	(1029)	(510)		
1987	304	-18471	-258	2250**	118	.7398
	(1996)	(12243)	(1163)	(875)		
1988	4875**	-27961**	-3224**	1503	118	.6898
	(2244)	(13758)	(1307)	(967)		
1989	5142**	-13503	-1260	2034**	118	.5531
	(2519)	(15236)	(1447)	(1013)		
1990	13127***	-10134	-2023	-225	123	.5261
	(4454)	(6889)	(1461)	(1066)		
1992	3222	-9132	-611	-495	108	.5820
	(3968)	(6489)	(1363)	(936)		
1993	8265*	60	-167	-357	108	.5427
	(4186)	(7105)	(1437)	(1008)		
1994	11407***	-515	-1032	-616	115	.6139
	(4144)	(6939)	(1444)	(1013)		
1995	676	-1473	-1204	332	112	.5582
	(3452)	(2876)	(1149)	(717)		
1996	-2535	-684	460	54	120	.5605
	(3622)	(2800)	(1144)	(1055)		

Notes: All regressions include full set of district characteristics ($\boldsymbol{X}$ vector) and constant. Levels of statistical significance: 1% (***), 5% (**) and 10% (*). Year 1991 is missing (not released by the Ministry of Transportation). Dependent variable: district-level expenditure. OPP = 1 - GOV.

Table 5. Pooled regressions with loyalty

	MAR	*LOYAL*	*GOV*	*MIN*	*FE*	R^2	corr(*MAR*,*LOYAL*)
Baseline regression (no control for loyalty)	2089**		453	685*	No	.5608	
	(832)		(338)	(364)			
(L1) Loyal for 3 elections (85, 89, 94)	1072	1110***	118	576	No	.5676	.33***
	(880)	(384)	(355)	(356)			(6.4)
(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)	700	1673***	100	448	No	.5739	.36***
	(829)	(407)	(345)	(345)			(6.9)
(L3) Loyal in the past (81 onwards)	39	1510***	36	457	No	.5710	.50***
	(895)	(385)	(353)	(350)			(9.3)
(L4) Loyal in the future	1228	1298***	81	553	No	.5717	.28***
	(813)	(350)	(344)	(349)			(5.4)
(L5) Loyal in the past (81 and 85 only)	103	1608***	90	458	No	.5744	.46***
	(884)	(373)	(342)	(350)			(8.2)
(L6) Loyal in the future (98 and 03 only)	881	1359***	56	546	No	.5729	.35***
	(811)	(331)	(345)	(344)			(6.3)
(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)	-529	236	729*	268	Yes	.7551	
	(765)	(482)	(410)	(270)			
(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)	-84	907***		309	Yes	.7543	
	(751)	(306)		(268)			
(L2) Construction expenditure only	-835	778**		273	Yes	.4721	
	(711)	(306)		(258)			
(L2) Maintenance expenditure only	750*	128		36	Yes	.8280	
	(390)	(200)		(163)			

Notes: Constants unreported. Robust standard errors in parentheses (robust *t*-stats in the last column), adjusted for clustering of political variables. Levels of statistical significance: 1% (***), 5% (**) and 10% (*). n=1158. Dependent variable: district-level expenditure. Full set of district characteristics and year effects included.

Table 6. Summary statistics: Liberal strongholds vs. other ridings, 1986

Variable	'Loyals'	Others	Diff. (*t*-stat)
AREA	4.7	5.8	-1.8*
POP	52,962	52,034	0.6
URB	81	74	1.1
FIRMS	128	112	1.0
UE	11.1	12.8	-1.7*
INC	42,937	41,351	0.9
FRENCH	65	87	-5.6***
Number of ridings	28	97	

Notes: Level of statistical significance: 1% (***), 10% (*). Loyalty measure: (L2). Two-sided t-tests.

Table 7. Pooled IV regressions

	MARGIN	*LOYAL*	*GOV*	*MIN*	R^2
OLS: (L1) Loyal for 3 elections (85, 89, 94)	1072	1110***	118	576	.5676
	(880)	(384)	(355)	(356)	
(L1) Loyal for 3 elections (85, 89, 94)	-1085	3465**	-594	344	.5373
	(1604)	(1377)	(545)	(401)	
(L2) Loyal for 6 elections (81, 85, 89, 94, 98, 03)	-993	3712**	-331	160	.5545
	(1571)	(1510)	(476)	(432)	
(L3) Loyal in the past (81 onwards)	-3153	3861**	-613	103	.5464
	(2367)	(1548)	(562)	(439)	
(L4) Loyal in the future	111	2982***	-402	381	.5534
	(1206)	(1150)	(496)	(372)	
(L5) Loyal in the past (81 and 85 only)	-1703	3071***	-240	252	.5632
	(1753)	(1160)	(443)	(396)	
(L6) Loyal in the future (98 and 03 only)	-585	3008***	-425	378	.5552
	(1367)	(1131)	(502)	(359)	
(L2) Construction expenditure only	-1224	2552**	-180	50	.2104
	(1154)	(1103)	(352)	(347)	
(L2) Maintenance expenditure only	231	1160	-151	110	.6822
	(807)	(740)	(237)	(199)	

First-stage diagnostics	**Correlation**	***F*-test**	**Partial R^2**
(L1)	-.29***	29.9***	.09
(L2)	-.36***	27.5***	.09
(L3)	-.39***	29.7***	.09
(L4)	-.35***	39.0***	.10
(L5)	-.46***	43.9***	.12
(L6)	-.40***	42.8***	.10

Notes: Constants unreported. Robust standard errors in parentheses, adjusted for clustering of political variables. Levels of statistical significance: 1% (***), 5% (**) and 10% (*). n=1158. Dependent variable: district-level expenditure. Full set of district characteristics 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 8. Difference-in-difference estimates

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

Note: Robust standard errors (adjusted for clustering) in parentheses. Loyalty measure: (L2). **Significant at the 5% confidence level.

Table 9. Explaining election results

	Elections		Referenda	
	1989	**1994**	**1992**	**1995**
EXP/POP(t)	1.91	10.25	-.0897	-.1055*
	(5.77)	(11.45)	(.0758)	(.0558)
EXP/POP(t-1)	-1.04	-12.71	.0329	.0034
	(5.85)	(12.50)	(.0682)	(.0543)
GOV(t-1)	4.84***	-2.02	.0708***	.0130
	(.91)	(1.34)	(.0113)	(.0094)
MAR(t-1)	1.87	3.56	.1537***	-.0006
	(3.40)	(4.72)	(.0480)	(.0219)
YES(t-1)	d.n.a.	55.64***	d.n.a.	-1.02***
		(15.58)		(.06)
URB	.97	-1.41	-.0842***	-.0558***
	(2.36)	(3.11)	(.0322)	(.0200)
FRENCH	3.73	3.46	-.6653***	-.0560
	(3.27)	(7.51)	(.0318)	(.0435)
FIRMS	.0011	-.0076	.0000	.0000
	(.0041)	(.0091)	(.0001)	(.0000)
UE	-.0495	-.3435**	-.0009	.0032***
	(.1013)	(.1605)	(.0016)	(.0009)
INC	-.0001	-.0001	.0000	.0000
	(.0001)	(.0001)	(.0000)	(.0000)
Pseudo-R^2 or R^2	.4753	.6941	.8824	.9608
n	118	110	111	114

Notes: Constants unreported. Standard errors in parentheses. Levels of statistical significance: 1% (***), 5% (**) and 10% (*). Logit regressions for elections and OLS regressions for referenda. Dependent variable: *PWIN* dummy or *YES* vote share. d.n.a.: does not apply.

Figure 3. Mean road expenditure (constant 1992 dollars) and general votes, 1986-1996

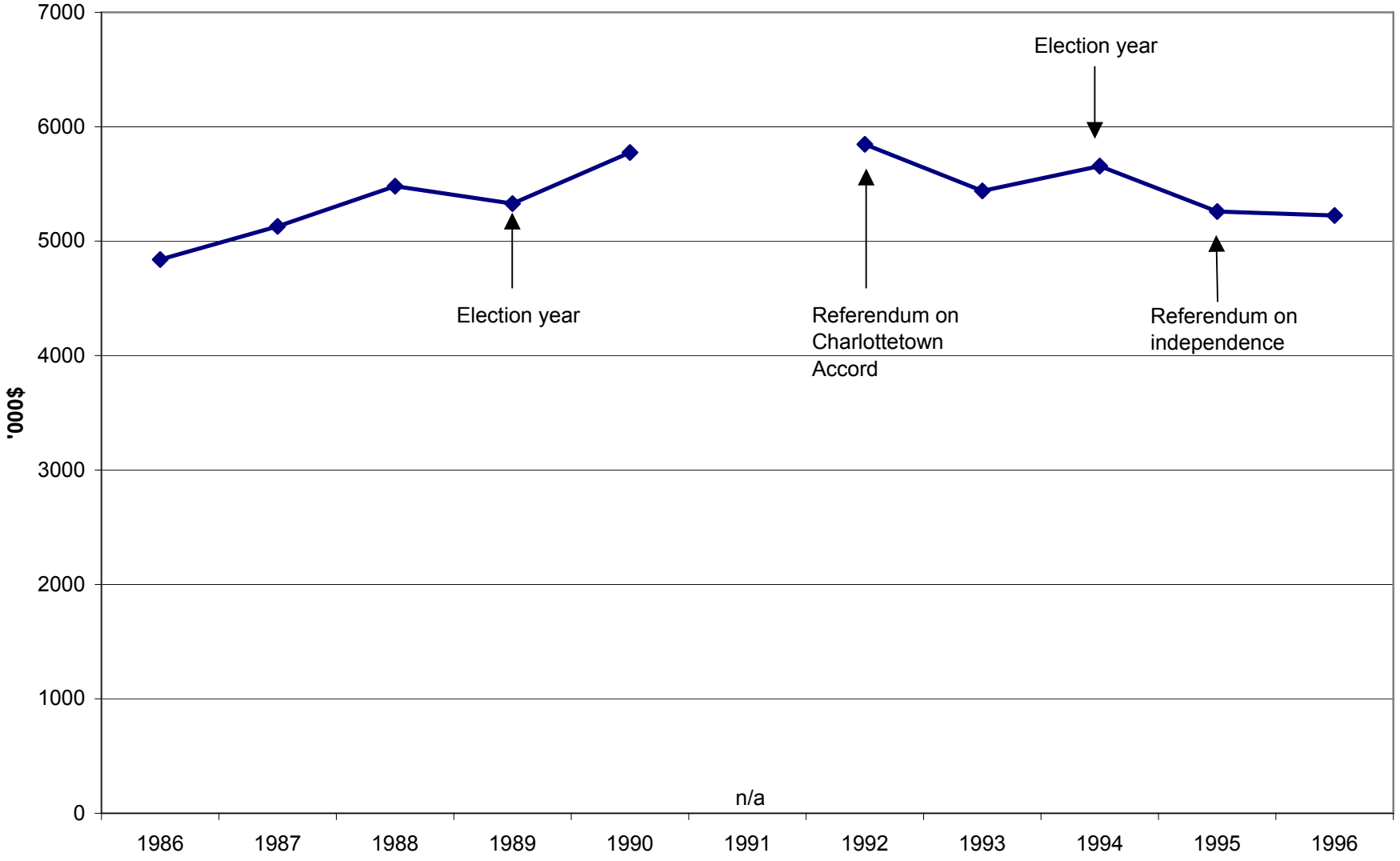

Figure 4. Year-by-year OLS regressions, political competition effects

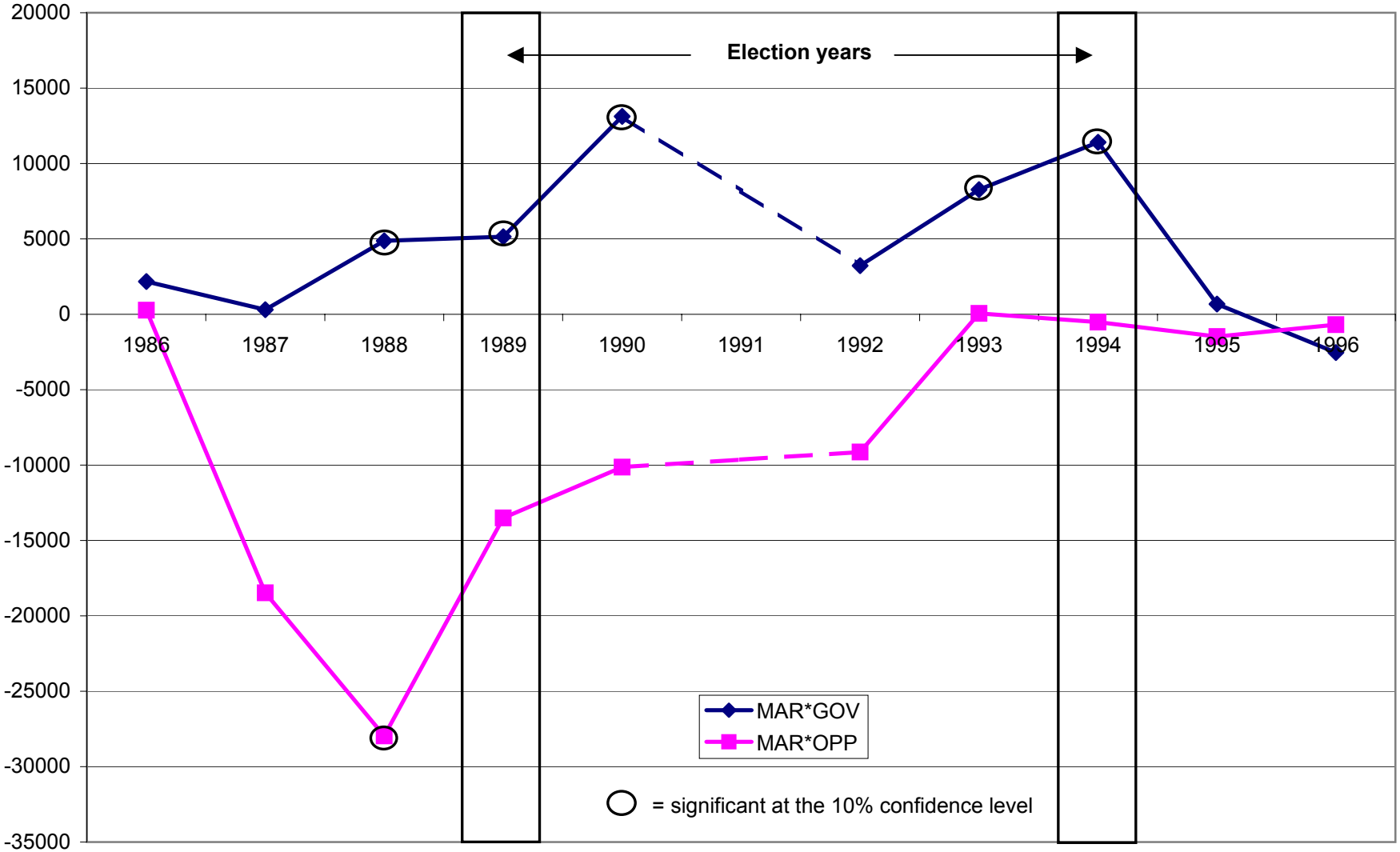

Figure 5. Year effects, Specification (2)

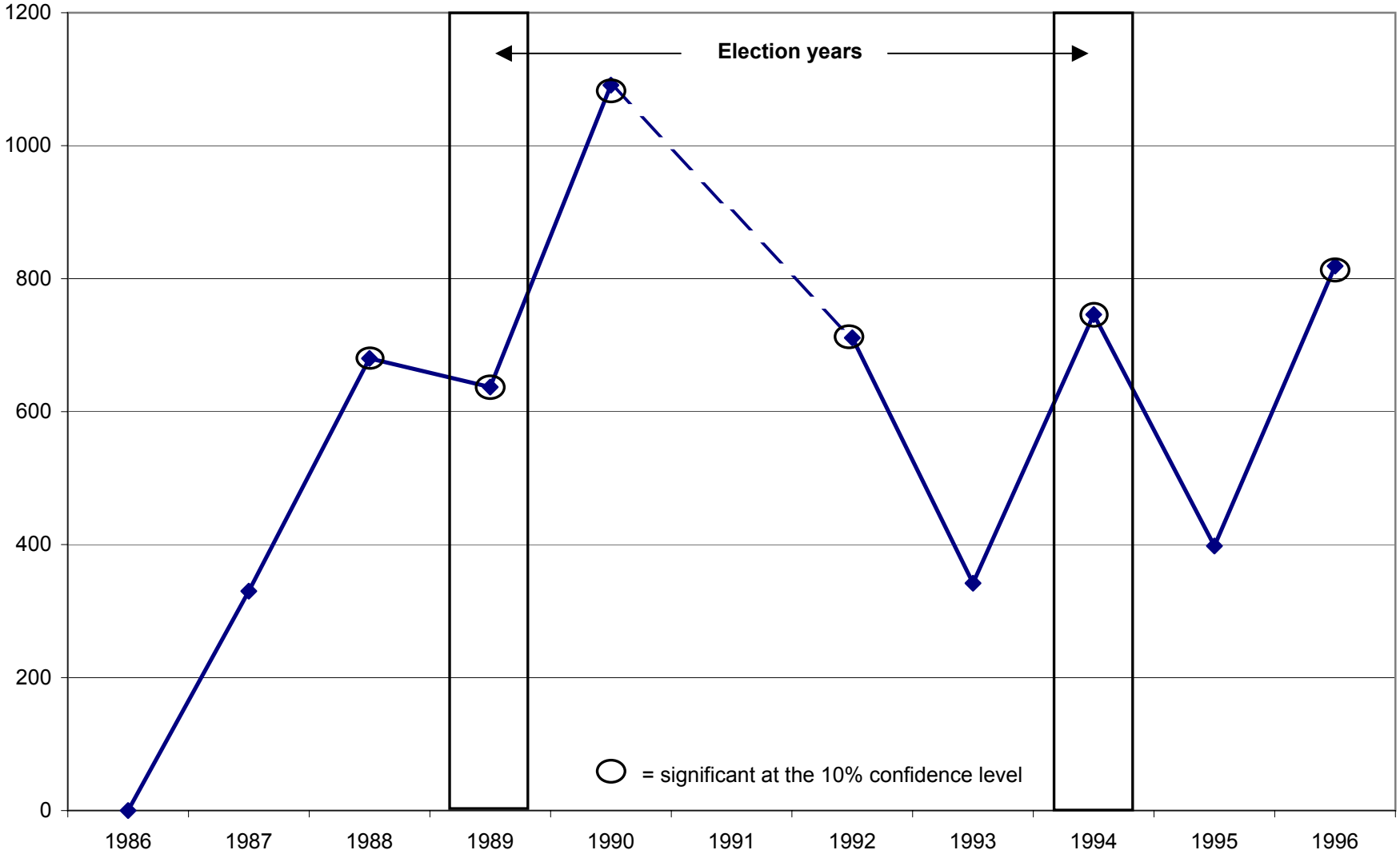

Figure 6. Road construction expenditure in Liberal strongholds vs. other ridings