The political costs of taxes and government spending

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Abstract. The marginal political costs of different types of taxes and government spending, as well as voter preferences over different fiscal variables, are examined using two different specifications for political cost – one based on the probability of incumbent defeat and the other based on the incumbent's percentage of the vote. Models associated with these two specifications, in which voting behaviour depends on disaggregated taxes and government expenditures, are estimated using data from Canadian provincial elections. The empirical results, which indicate that different types of taxes and expenditures have quite different marginal political costs, have important implications for models that incorporate voter preferences.

Les coûts politiques des impôts et des dépenses gouvernementales. Ce mémoire examine les coûts marginaux politiques des impôts et des dépenses gouvernementales, aussi bien que les préférences des électeurs en ce qui concerne les divers instruments fiscaux. Deux spécifications des coûts politiques sont considérées – la probabilité que le gouvernement n'est pas réélu et le pourcentage des votes obtenus par le gouvernement. Dans les deux spécifications, les électeurs considérent les impôts et les dépenses gouvernementales désagrégées avant de voter. Des données provenant des élections provinciales canadiennes donnent des résultats empiriques qui indiquent que les coûts politiques se différencient par la catégorie d'impôt ou de dépense. Ces résultats sont importants pour tout modèle des préférences électorales.

I. INTRODUCTION

The behaviour of voters, vote-maximizing politicians and utility-maximizing social planners has often been modelled as if different types of taxes and government spending are indistinguishable to voters. While this is a convenient simplification,

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there are two principal reasons why such an approach may not be appropriate. First, the incidence of particular taxes and types of expenditures may vary across voters or may fall to varying degrees on individuals in other jurisdictions or generations. Second, some types of taxes and expenditures may be less easily perceived by voters. For example, various types of spending may be difficult for voters to perceive because the benefits of this spending cannot be observed directly or may be difficult to quantify even if observed (e.g., defence, regulation). Similarly, taxes are often hidden in prices (e.g., excise taxes) and so are difficult to perceive, or they are deducted at source (e.g., corporate taxes, resource rent taxes), so that taxpayers may misperceive the true size of their gross income and thus the tax burden they are bearing. Furthermore, some taxes are relatively small and are paid only infrequently (e.g., licence fees), while others, though small, may be paid frequently and thus may continually reinforce the voter's perception of the tax (e.g., sales taxes).

Owing to these discrepancies in incidence and/or perception, various types of taxes and government spending may have differing effects on voting behaviour. Evaluation of the nature and extent of these different effects is important for a number of reasons. First, to the extent that the distribution of taxes across revenue sources and of expenditures across types of goods is actually important to voters, models that assume otherwise are likely to suffer from aggregation bias and therefore to yield potentially misleading conclusions.

Second, if voting behaviour does differ in response to different types of taxes and government expenditures, it may be possible to determine the types of taxes and spending that political agents prefer by estimating the political (as opposed to the economic) marginal cost or benefit of different taxes and government expenditures. As noted by Hettich and Winer (1984), the politically optimal tax structure is one in which the marginal *political* cost of raising an additional dollar of taxes is the same for all taxes.

Third, by examining voting behaviour as a function of disaggregated taxes and expenditures, it may be possible to clarify the form of voters' utility functions. Many of the economic models used to describe the behaviour of policy makers assume, either explicitly or implicitly, a particular form for the utility function of voters. For example, the political business cycle literature typically assumes voters reward or punish politicians on the basis of their success at restraining inflation and unemployment. Evidence that voters consider these factors to be the most important determinants of their vote is not provided, nor is evidence provided to suggest why voting behaviour should not also depend on the taxation and spending behaviour of governments.[1] Similarly, analyses of the allocation of government expenditures between different public goods generally specify the goal of government policy makers to be the maximization of a representative (or median) voter's utility function. It is typical of this literature to specify the form and arguments of the utility

1 For a review of this literature see Nordhaus (1989) and the comment by Alesina (1989) as well as the references cited therein.

function to be maximized without testing which services are actually perceived by voters to provide positive utility.[2]

The purpose of this paper is to address these issues by examining the impact of disaggregated taxes and government expenditures on voting behaviour and the political success of the incumbent political party. A model is specified in which the utility of each voter depends on disaggregated government taxes and expenditures as well as on the size of the government debt. Voters allocate their vote to the party that is expected to increase their utility by the greatest amount. This model is estimated using data from seventy-one Canadian provincial elections. Estimates obtained under each of two alternative objective functions for the governing party – maximization of the percentage of the vote and maximization of the probability of victory – provide evidence on voter preferences over taxes and expenditures as well as on the relative political costs of different fiscal packages.[3]

The empirical analysis undertaken here is most similar to that in Peltzman (1992). He found that voters do not like growth in government spending of any type (although welfare spending is the most disliked) and that voters do not distinguish between spending that is tax or deficit financed. In contrast to the analysis here, Peltzman employed data from U.S. state and national elections, considered only one objective function (the percentage of the vote), and concentrated on disaggregating the effects of expenditures rather than both expenditures and taxes. The results given below indicate that Canadian voters approve of some forms of government spending but dislike others, and that, while they disapprove of most current taxes, only non-decisive voters reward or penalize government saving or dissaving.[4]

The paper is organized as follows. In section II an economic model of voting behaviour is described.[5] In section III this model is transformed into a form that is estimable using provincial level data. Alternative specifications of the objective

2 Typical examples of this large literature can be found in Deacon (1978), Dunne et al. (1984), and Coyte and Landon (1990).

3 For early examples of the use of empirical models of voting behaviour to reveal voter preferences for public goods see Deacon and Shapiro (1975) and the references cited therein. Note that the analysis below examines voter behaviour, not the behaviour of politicians. For examples of the latter see Hettich and Winer (1984, 1988).

4 The modelling approach used here also has similarities with the analyses of Schram and Van Winden (1989) and Schram (1990), although they do not include taxes or intertemporal fiscal effects. As well, Schram and Van Winden (1989) do not disaggregate spending, while Schram (1990) disaggregated government spending to only a limited extent. In addition to these papers, there exists an extensive empirical literature that attempts to explain voting behaviour. One strand of the political science literature uses individual demographic and social data (ignoring economic conditions) to explain voting behaviour, while other studies have concentrated on estimating the impact of campaign expenditures on voting behaviour (Jacobson 1990). Economics-related studies generally are concentrated on macroeconomic conditions such as inflation, unemployment, and growth (Alesina and Rosenthal 1989; Chappell 1990; Erikson 1989, 1990; Suzuki 1991), although some studies present analyses of the impact of aggregate government spending on voting behaviour (Feldman and Jondrow 1984). Another branch of the literature (Enelow et al. 1986; Studlar et al. 1990) investigates the impact of specific government policies on election outcomes. None of these studies examines the impact of disaggregated taxes and government spending on voting behaviour and the political success of the incumbent political party.

5 Certain aspects of the approach described here and in section III have similarities to the analysis in Deacon and Shapiro (1975).

function of the governing party, along with the corresponding estimation methodologies, are also considered in this section. A discussion of the data is provided in section IV, and the estimated coefficients are presented and analysed in section V. In this section an analysis of the adequacy of aggregating taxes and expenditures in voting functions is included and measures of the marginal political cost of different types of taxes and spending are provided. Concluding comments are given in section VI.

II. THE MODEL

Let period t be the period that is relevant to the current political campaign (assumed to be the term of office of the government to be elected at the beginning of period t). The utility of voter i in period t is given by

$$U_t^i = U(c_t^i, g_t^i, D_t^i), \tag{1}$$

where c_t^i = a vector of private consumption goods,
g_t^i = a vector of publicly provided goods,[6]
D_t^i = voter i's share (obligation to pay taxes) of the government debt at the end of period t.[7]

Individual i maximizes utility by choosing the elements of c_t^i subject to the constraint that the value of consumption equals disposable income (taking prices, some of which may depend on tax policy, as given). This yields a set of consumption functions for voter i that have as arguments the voter's gross income, y_t^i (i.e., income before all taxes and transfers),[8] government transfer payments (represented by a subset of the elements of g_t^i) and a vector of taxes, T_t^i. Substitution of these consumption functions into equation (1) yields the indirect utility function:

$$\max U_t^i = V_t^i = V(y_t^i, T_t^i, g_t^i, D_t^i). \tag{2}$$

By incorporating vectors of taxes and government expenditures (rather than just aggregate taxes and expenditures), this function allows for differential impacts of different types of taxes and spending on the voter's utility possibilities set. Thus, it

6 The impact of the elements of g_t^i on utility depends on the ability of the voter to perceive a benefit from each type of spending as well as on the incidence of this benefit. The marginal utility of each element of g_t^i may not be positive if the voter receives negative utility from a particular type of spending, owing, perhaps, to envy of a benefit going to others or the belief that this type of spending is simply wasteful.

7 In view of data limitations, the intertemporal character of the utility function is kept as simple as possible. This form of the utility function implies that government policies in periods beyond period t are independent of the government elected in period t, except to the extent that the level of government debt affects the voter's utility by altering consumption possibilities in future periods. The size of the debt effect on utility will depend on the extent to which voter i's future consumption set is altered, the voter's discount rate, and the degree to which the voter is forward looking.

8 Gross income is assumed to be independent of government taxing and spending policies.

is consistent with very general tax, spending, and income perception and incidence effects.[9]

Voters are assumed to reward or penalize political parties through the allocation of their vote at the beginning of period t according to their expectation of the relative extent to which the actions of each party will alter their utility during this period. Let Z_{It}^i be a measure of the value voter i attributes to a victory by the incumbent party (I):

$$Z_{It}^i = Z^I(\Delta V_{It}^i) + \varepsilon_{It}^i, \tag{3}$$

where ΔV_{It}^i = the expected change in the utility of voter i during period t if the incumbent party is re-elected (which, in turn, depends on the changes in taxes (ΔT_{It}^i), spending (Δg_{It}^i), income (Δy_{It}^i), and debt (ΔD_{It}^i) that are expected to prevail if the incumbent is re-elected),

ε_{It}^i = a random variable (error term) representing non-observable factors that alter voter i's preference for the incumbent party.

The actual form of the $Z^I(\Delta V_{It}^i)$ function will depend on the extent to which voters systematically attribute expected increases or decreases in utility to the incumbent party (rather than to exogenous factors that are out of the government's control).

A corresponding voter valuation function exists for the opposition (O):

$$A_{Ot}^i = Z^O(\Delta V_{Ot}^i) + \varepsilon_{Ot}^i, \tag{4}$$

where ΔV_{Ot}^i is the change in utility expected under a government led by the opposition (which, in turn, depends on the changes in taxes (ΔT_{Ot}^i), spending (Δg_{Ot}^i), income (Δy_{Ot}^i), and debt (ΔD_{Ot}^i) that are expected to prevail if the opposition is elected) and ε_{Ot}^i is a random error.

Voter i will vote for the opposition party only if $\Delta Z_t^i = (Z_{Ot}^i - Z_{It}^i) > 0$, where, from (3) and (4), ΔZ_t^i is given by

$$\Delta Z_t^i = (Z^O(\Delta V_{Ot}^i) - Z^I(\Delta V_{It}^i)) + \varepsilon_t^i, \tag{5}$$

where $\varepsilon_t^i = (\varepsilon_{Ot}^i - \varepsilon_{It}^i)$. Thus, the probability that voter i votes for the opposition, Prob $(\Delta Z_t^i > 0)$ is given by

$$\text{Prob}\,(\varepsilon_t^i > -[Z^O(\Delta V_{Ot}^i) - Z^I(\Delta V_{It}^i)]). \tag{6}$$

9 In choosing their optimal consumption vector, voters may know their disposable income and prices, but they may not accurately perceive how these depend on the government's fiscal policies. For example, a voter may misperceive the size of his/her gross income and the incidence of taxes and government spending and, thus, may not be aware of the true impact each type of tax and spending has on his/her disposable income. The consumption function of the voter, and hence the parameters of $V(\cdot)$, will reflect these perception effects.

III. EMPIRICAL IMPLEMENTATION USING AGGREGATE DATA

In the absence of data on individuals, it is necessary to transform (6) into a form that can be estimated using aggregate election, income, and fiscal data. Available aggregate election data indicate the proportion of voters who voted for the opposition or the incumbent party, as well as whether the incumbent party won or lost. As discussed below, use of one or the other of these forms of election data is consistent with a particular view of the objective function of the governing party – maximization of its percentage of the vote, or maximization of the probability of its re-election.[10] Since the choice of objective function has implications both for the conduct of the empirical analysis as well as for the interpretation of the marginal political cost of a change in the government's fiscal program, each of these two objectives is considered in turn.

1. Maximization of the percentage of the vote

One of the reasons why empirical voting models that utilize aggregate election data have tended to concentrate on the percentage of the vote received rather than the actual election outcome (see, e.g., Peltzman 1990, 1992; Deacon and Shapiro 1975) may be the relationship between observed (aggregate) vote percentages and voting probabilities derived from individual choice models, as in (6) above. Specifically, as shown by Deacon and Shapiro (1975), apart from a random error, the observed vote percentage equals the probability that a randomly chosen voter will vote in a certain way. Therefore, a political party interested in maximizing the probability that it will obtain the vote of a randomly chosen voter can be viewed as if it is maximizing its percentage of the vote. In this context the marginal political costs of particular fiscal policies can be defined as the effect on this vote percentage of changes in various taxes and expenditures.[11]

To transform (6) into a form that can be used with election percentage vote data as well as aggregate income and fiscal data, let the difference in the value that voter i attributes to a victory by the opposition rather than the incumbent, ΔZ_t^i, have a distribution with mean $\Delta\bar{Z}$ and variance σ^2, where

10 According to Riker and Ordeshook (1973), 'the goal of candidates and of parties is to win elections' (335). They give four different interpretations of winning: garnering the most votes; winning some seats; winning a sufficient number of seats to be in a coalition; and winning a plurality or a majority of seats. These different definitions of winning lead to the following different possible objectives of parties and candidates: the maximization of their plurality; the maximization of votes; maximizing the proportion of votes received; and maximizing the probability of winning. (This contrasts with Downs's 1957 approach, which equates winning elections with vote maximization – 'the main goal of very party is the winning of elections. Thus all its actions are aimed at maximizing votes' (35).)

Stigler (1972) contends that the political effectiveness of a government (or opposition party) depends positively on its level of electoral support. However, he equates political support with seats rather than votes – 'the larger a party's plurality (or majority) in the legislature, the greater its control over the government' (126). With a first-past-the-post electoral system, a party's proportion of seats and its proportion of votes may differ significantly.

11 A second reason for concentrating on vote percentages may be that empirical models that do so are typically perceived to utilize more information than models which focus only on whether a party won or lost an election.

$$\Delta\bar{Z} = Z^O(\Delta\bar{V}_{Ot}) - Z^I(\Delta\bar{V}_{It}), \tag{7}$$

and where $\Delta\bar{V}_{Ot}$, the average change in utility expected under a government led by the opposition, and $\Delta\bar{V}_{It}$, defined analogously for a government led by the incumbent party, represent the average over voters in election t of ΔV^i_{Ot} and ΔV^i_{It}, respectively. The probability that a randomly chosen voter will vote for the opposition is given by Prob $(\Delta Z^i_t > 0)$ or Prob $((\Delta Z^i_t - \Delta\bar{Z})/\sigma > -\Delta\bar{Z}/\sigma)$. Under the assumption that ΔZ^i_t is normally distributed, this probability can be written as $\Phi(\Delta\bar{Z}/\sigma)$, where $\Phi(\cdot)$ is the standard normal cumulative density (distribution) function. Using data on the percentage of the vote received by the opposition, along with specifications for $\Delta\bar{V}_{Ot}$ and $\Delta\bar{V}_{It}$ (which, as discussed below, depend on aggregate income and fiscal variables) and linearizations of the value functions $Z^O(\cdot)$ and $Z^I(\cdot)$ in (7), the parameters of the model can be estimated using a grouped (data) probit estimation procedure (Amemiya 1985, 275–8). The resulting weighted least squares estimates indicate the estimated impact of different types of taxes and spending on the probability that a random voter will vote for the opposition rather than the incumbent.

2. Maximization of the probability of victory

In the context of analysing the marginal political cost of changes in the government's fiscal program, there are a number of advantages in viewing the incumbent party's objective as being the maximization of its probability of victory rather than the maximization of its percentage of the vote. First, the objective of maximizing the probability of victory is more consistent with the contention in Riker (1962, 33) that rational political agents desire to win elections but will seek to maximize votes 'only up to the point of subjective certainty of winning. After that point they seek to minimize, that is, to maintain themselves at the size (as subjectively estimated) of a minimum winning coalition.' In other words, as also noted in Stigler (1972), parties recognize that policies that attract too wide a vote will dilute their power and the benefits of power.

Second, the power of a political party varies significantly depending on whether it is in or out of government. As a result, loss of government generally represents a significant political cost. Since a change in government may occur with only a small change in the percentage of the vote, changes in this percentage may not be a good reflection of the political costs of different policies.

Third, in the many jurisdictions with first-past-the-post electoral systems, the overall percentage of the vote received by a party may bear little relationship to the probability that the party will wield power. Only a plurality is required in each constituency and only a plurality of seats is required to win elections. Furthermore, the relationship between votes and victory depends on the number and strength of opposition coalitions, and these, in turn, depend on the policies of the incumbent government. Given these complexities, changes in the percentage of the vote garnered by a party in an election may not be closely related to the probability of victory and, thus, may not accurately reflect political costs.

Fourth, an objective function based on vote maximization implies that the preferences of all voters, even those in marginal non-decisive groups, have equal influence on the marginal political costs of a particular policy. If the objective of a party is political victory, the cost (or benefit) of a policy is its impact on the probability of victory, and thus, this type of political objective function weights the preferences of decisive voters much more heavily than those of marginal voters.

Despite these advantages, few empirical studies focus on the probability of victory as opposed to the probability that a random voter will vote for the incumbent party. In part this may reflect the perception that such an approach is inefficient, since it does not utilize information on the percentage of the vote received by each party, even though typically such data are available. A shortcoming of vote percentage data, however, is that generally they cannot imply anything about victory or defeat except in single-jurisdiction two-alternative contests.

A second more pragmatic reason may be the somewhat more complex issues that are involved in modelling the probability of victory or, conversely, the probability that the incumbent party will be defeated. The latter probability depends on the probability that each voter will vote for the opposition, the probability that the opposition will win enough votes to win individual constituencies, and the probability that the opposition will obtain the threshold number of seats to form the government. These probabilities depend on how voters perceive the expected fiscal package of the incumbent as well as on the extent to which the opposition is able to coalesce around one party, which, in turn, may also depend on voters' perceptions of the incumbent's program.

Thus, while there are a number of advantages in viewing the objective of the incumbent party as maximization of the probability of victory, because of the complexities involved in modelling this probability empirical implementation is difficult. However, this complex empirical problem can be simplified by proxying the probability of defeat for the incumbent party with the probability that a decisive voter will vote for the opposition. Here, the decisive voter's choice is defined as a binary variable that is equal to unity if the opposition wins the election and zero otherwise. Under this approach, the probability that a decisive voter will vote for the opposition is given by Prob $(\Delta Z_t^i > 0)$, which, as shown above, can be written as $\Phi(\Delta \bar{Z}/\sigma)$. Using specifications for $\Delta \bar{V}_{Ot}$ and $\Delta \bar{V}_{It}$, to be discussed below, and linearizations of $Z_O(\cdot)$ and $Z_I(\cdot)$, the parameters of the function determining the probability that the opposition will win an election can be estimated using standard probit analysis (see, e.g., Maddala 1983).

Given the advantages of modelling the probability of victory rather than the percentage of the vote, it is important to evaluate the empirical performance of this decisive voter specification, in both absolute and relative terms. A comparison of the empirical results obtained under each of the two objective functions may also yield information on the importance of determining the appropriate objective function when the political cost of changes in a government's fiscal program are modelled. On the one hand, it is likely that policies that are perceived by voters to be beneficial will both raise the incumbent's percentage of the vote and reduce

the probability of his/her defeat, suggesting that determination of the appropriate objective is not important. On the other hand, the different weights attached to the votes of decisive and non-decisive voters by the two objective functions may cause estimates of the quantitative marginal political costs of various policies to differ significantly.

3. Specification of the change in utility

Regardless of the objective function chosen, it is necessary to specify the average expected change in voter utility associated with the election of the opposition, $\Delta\bar{V}_{Ot}$, and the incumbent, $\Delta\bar{V}_{It}$. One difficulty in defining $\Delta\bar{V}_{Ot}$ is that voters often have very little information on opposition parties and the policies they are likely to implement if elected (or they may attach a low degree of credibility to the information they do have). Many opposition parties (and politicians) have never been in government, while, for those who have previously held power, the time that has elapsed since their last period in government has often been lengthy. As a result, the use of announced policies or previous behaviour in government as a forecast of the opposition's future behaviour seems inappropriate.[12] Given the limited information on the potential performance in government of the opposition party, $\Delta\bar{V}_{Ot}$ is treated as a constant. This implies that, on average (and after allowing for randomness), the opposition party will be preferred to the incumbent if the value of a victory by the incumbent party falls below some reservation level.

Two factors determine voter expectations of the average change in utility that will follow the re-election of the incumbent party, $\Delta\bar{V}_{It}$. First, while voters do not know for certain the future policies that the incumbent party will pursue, they do know how it has performed since the last election. Given the availability of this information, voters are likely to use it as a signal of the incumbent's future performance. As such, the average expected changes in income, taxes, transfers, government spending and debt that enter (a linearization of) $\Delta\bar{V}_{It}$ are proxied by the actual changes in these variables since the last election.[13]

The second factor determining voter expectations of incumbent party actions is the availability of information that does not directly enter voters' utility functions but that may signal the incumbent's future behaviour. Such information may have a systematic impact on the probability that a voter will vote for the incumbent party. As a result, the average expected change in voter utility if the incumbent party is re-elected is specified to depend on a vector of variables, X_t, that incorporate this additional information. This vector might be expected to include variables reflecting the incumbent's overall economic performance, such as changes in the unemployment rate, as well as other variables that reflect particular characteristics

12 Since any previous behaviour in government of the current opposition party has already been rejected by voters, it seems reasonable to expect that the opposition will undertake actions that are different from those of their previous period in office.

13 Voters are assumed to use all the information that has become available since the last election to forecast the incumbent's behaviour, not only the last year of information. This assumption is consistent with evidence in Peltzman (1992), which shows that voters have relatively long time horizons.

of the incumbent party, such as years in office. Other possible elements of the X_t vector are considered in the next section.

IV. DATA

The economic data used to estimate the voting equations described above are taken from Canada's annual provincial national accounts for the years 1961 through 1990.[14] (See the appendix for a description of data sources.) Elections were matched with these annual economic data by associating the previous year's data with an election that took place on or before 30 June and the current year's data with elections that took place after the middle of the year. The tax, transfer, spending, debt, and output variables were transformed into constant dollars per capita, differenced (election-to-election) and then normalized in two ways. First, because of differences in the size of government across provinces and the sample period, the differences in the tax, spending, debt, and output variables each were divided by the level of real provincial per capita GDP for the year associated with the election. Second, because elections in Canada do not occur at specified times, the change in each variable was normalized to equal the average change per year from the time of the previous election. Relatively minor aggregation of expenditure and tax categories (to preserve degrees of freedom) left data available for the real annual per capita change in eight different types of taxes and six types of spending and transfers (as enumerated in table 1).[15]

As described in the previous section, the expected change in utility is forecast using lagged changes in fiscal variables as well as a vector of additional variables, X_t. Candidate variables for the X_t vector include the change in the provincial unemployment rate from one election to the next (ΔUR) – a possible signal of the incumbent's overall economic policy success; a dummy variable to indicate whether the incumbent party was the same as the governing national party (FD) – voters might believe their utility depends on whether the incumbent party can cooperate with or counterbalance the federal government; a dummy variable for whether the incumbent party had a new leader within the twelve months prior to the election (NLD) – a new leader might not be held responsible by voters for the past actions of the government; and the number of years the incumbent party has held office (YIO) as well as this number squared (YIO^2) – voters may perceive the incumbent party to be more alienated from the public the longer it is in power, and this perception may not grow at a constant rate.[16]

14 There were eighty-two provincial elections during this period, but the 24 March 1972 election in Newfoundland took place less than five months after the preceding election and thus was excluded from the data set, since independent results for this election could not be determined. This leaves eighty-one elections and, after differencing the data for each province to obtain the election-to-election change in each explanatory variable, seventy-one usable observations.

15 In contrast to Peltzman (1992), the set of fiscal variables does not include federal transfers to the provinces, since these transfers appear indirectly through the provincial spending, tax and deficit variables.

16 The limited number of degrees of freedom restricted the number of variables that could reason-

TABLE 1
The tax and expenditure variables

Tax variables	
DTP	Direct Taxes on Persons
CORPT	Corporate Taxes
GT	Gasoline Tax
NRT	Natural Resource Taxes
ST	Sales Taxes
MIT	Miscellaneous Indirect Taxes
LT	Licences, Permits and Other Fees
PT	Provincial Property Tax
Expenditure variables	
EGS	Expenditure on Goods and Services
TPR	Transfers to Persons
TBS	Transfers to Business: Subsidies
TBCA	Transfers to Business: Capital Assistance
TLG	Transfers to Local Government
TH	Transfers to Hospitals

Following the analysis of the previous section, two different voting models are estimated below – one describing the percentage of the vote won by the opposition and the other describing the probability of defeat for the incumbent party. In the first model the dependent variable is a function of the opposition's percentage of the vote. This percentage has a mean value of 54.49, a maximum of 80.35, and a minimum of 37.35. In the probability of defeat model the associated binary variable takes the value of one if the incumbent party is defeated and the value of zero if the incumbent party is re-elected. In our sample of seventy-one observations, twenty-four observations take the value of one and forty-seven take the value of zero. Thus, on average, the data imply that the empirical probability that the opposition will defeat the incumbent (24/71) is much smaller than the empirical probability that a random voter will vote for the opposition.

V. EMPIRICAL RESULTS

1. Estimates of the percentage vote function

Table 2 presents grouped probit estimates of three versions of the model describing

ably be included in X_t. Variables that could otherwise be included are dummy variables for the different provinces and dummy variables for the different political parties. A dummy variable for each political party was not included for two additional reasons. First, the character of provincial political parties with the same party name varies widely across the country. Second, a particular party may be associated with a particular tax-expenditure policy. If this is the case, it would be impossible to separate the tax and spending effect on voting behaviour (in which we are primarily interested) from the party effect. Note that monetary policy is a federal responsibility and so is taken as given by voters in provincial elections. As a result, inflation is not included either directly in the utility function or in the X_t vector. This contrasts with much of the voting literature, which concentrates on evaluating the impact of unemployment and inflation on election results.

TABLE 2
Estimated coefficients of the model describing the opposition's vote percentage

	I	II	III	Impact on the incumbent's vote percentage of a $1 increase in each explanatory variable (column II estimates)
ΔDTP	22.17	23.87		0.00077
	(1.33)	(1.60)		
ΔCORPT	10.94	5.72		0.00018
	(0.30)	(0.16)		
ΔGT	24.77	26.75		0.00086
	(0.44)	(0.53)		
ΔNRT	4.79	15.09		0.00049
	(0.07)	(0.22)		
ΔST	56.34**	53.18**		0.00171**
	(2.26)	(2.21)		
ΔMIT	13.63	20.54		0.00066
	(0.12)	(0.20)		
ΔLT	−95.44***	−95.12***		−0.00307***
	(3.13)	(3.41)		
ΔPT	21.12	22.33		0.00072
	(0.55)	(0.61)		
ΔREV			16.91	
			(1.54)	
ΔEGS	−17.55*	−17.60*		−0.00057*
	(1.81)	(1.88)		
ΔTPR	27.21	30.22*		0.00097*
	(1.35)	(1.65)		
ΔTBS	19.97	32.49		0.00105
	(0.48)	(0.88)		
ΔTBCA	−132.36	−113.92		−0.00368
	(1.53)	(1.45)		
ΔTLG	33.21	35.98*		0.00116*
	(1.57)	(1.81)		
ΔTH	28.12	34.54		0.00111
	(0.71)	(0.92)		
ΔEXP			−8.99	
			(1.41)	
ΔDEBT	3.73	4.01*	2.77	0.00013*
	(1.45)	(1.70)	(1.16)	
ΔRGDPPC	−1.64	−2.43	−0.58	−0.00008
	(0.74)	(1.22)	(0.33)	
ΔUR	1.41		2.82*	
	(0.80)		(1.73)	
FD	−0.16**	−0.17***		
	(2.47)	(2.75)		
YIO	0.004	0.006***	0.002	
	(0.32)	(2.62)	(1.02)	
YIO^2	0.00003			
	(0.09)			
NLD	0.018		−0.07	
	(0.21)		(0.88)	

TABLE 2 (*Concluded*)

	I	II	III	Impact on the incumbent's vote percentage of a $1 increase in each explanatory variable (column II estimates)
Constant	−0.043	−0.052	0.13	
	(0.34)	(0.57)	(1.57)	
R^2	0.439	0.429	0.141	
$\bar{R}^2$	0.198	0.231	0.046	
LR1			21.44†	
LR2			6.31	
LR3			16.40†	

NOTES
The number in brackets below each coefficient estimate is the absolute value of the asymptotic *t*-statistic.
***coefficient is significant at 1 per cent
**coefficient is significant at 5 per cent
*coefficient is significant at 10 per cent
These designations are also used in the final column to indicate the significance of the corresponding coefficient in column II.
†rejects restrictions at 5 per cent
LR1 Likelihood ratio test of the revenue and expenditure aggregation restrictions (12 degrees of freedom)
LR2 Likelihood ratio test of the expenditure aggregation restrictions (5 degrees of freedom)
LR3 Likelihood ratio test of the revenue aggregation restrictions (7 degrees of freedom)

the percentage of the vote obtained by the opposition. Column I of this table refers to the results obtained when all candidate variables for X_t are included, while column II presents the results when insignificant variables in the X_t vector are omitted. In these two columns of table 2 there are only two significant non-fiscal variables, FD and YIO. The negative coefficient on FD implies that the incumbent provincial party benefits (the opposition's vote percentage falls) when the national and provincial governing parties are the same; while the positive coefficient on YIO indicates that the percentage of the vote for the incumbent party decreases as its term in office lengthens. The change in real per capita GDP (ΔRGDPPC), the change in the unemployment rate (ΔUR), YIO^2, and the dummy variable indicating a change in leader for the incumbent party (NLD) all are not statistically significant. The insignificance of the constant term suggests that a randomly chosen voter does not systematically prefer the incumbent party to the opposition.

Relatively few of the coefficients associated with the government budget variables are significant in columns I and II of table 2. On the revenue side, only those coefficients associated with the sales tax (ΔST) and licence fees (ΔLT) are generally significant, with an increase in sales taxes reducing the percentage of the incumbent's vote and an increase in licence fees increasing this percentage. Though insignificant, all the other tax variables have positive coefficients, implying that tax increases may have a negative impact on the tendency of voters to vote for the incumbent party.

On the expenditure side, the coefficient associated with the expenditure on goods and services variable (ΔEGS) is negative and significant at 10 per cent, indicating that increased expenditure of this type is likely to raise the percentage of the vote received by the incumbent. Subsidies to business (ΔTBS) and transfers to hospitals (ΔTH) both have insignificant coefficients, while transfers to persons (ΔTPR) and transfers to local government (ΔTLG) are significant at the 10 per cent level in column II. All these coefficients are positive, indicating that increased transfers of these types may reduce the incumbent's vote. Finally, the estimated coefficient on the deficit variable (ΔDEBT) is positive and significant at the 10 per cent level in column II. This implies that a debt increase may reduce the percentage of the vote received by the incumbent party.

The estimated coefficients in column III of table 2 pertain to the case in which all the revenue variables (ΔDTP, ΔCORPT, ΔGT, ΔNRT, ΔST, ΔMIT, ΔLT and ΔPT) are aggregated into a single revenue variable (ΔREV) and all the expenditure variables (ΔEGS, ΔTPR, ΔTBS, ΔTBCA, ΔTLG and ΔTH) are aggregated into a single expenditure variable (ΔEXP). Although the signs of the coefficients associated with ΔREV and ΔEXP indicate that increased taxes lower the incumbent's percentage of the vote, while increased expenditure raise this percentage, neither of these aggregate variables has a statistically significant effect. In fact, the fit of this aggregated model is much worse than that of the model with disaggregated revenues and expenditures. Only the change in the unemployment rate (ΔUR) has a significant coefficient (and only at a 10 per cent significance level).

The aggregation necessary to form ΔREV is appropriate only if all the disaggregated revenue variables have the same coefficients, while the aggregation necessary to form ΔEXP is appropriate only if the coefficients on all the disaggregated expenditure variables are the same. The likelihood ratio test statistics reported in table 2 indicate that the expenditure aggregation restrictions (that the coefficients on all six expenditure variables are equal) cannot be rejected. This is most likely because of the general insignificance of most of the estimated coefficients on the expenditure variables reported in Columns I and II. In contrast, the revenue aggregation restrictions (that the coefficients on all eight tax variables are equal) are rejected at the 5 per cent level, as are the joint aggregation restrictions that all the expenditure coefficients are equal and all the revenue coefficients are equal. These test results, in conjunction with the parameter estimates reported in table 2, imply that different types of taxes and expenditures appear to affect the incumbent's percentage of the vote in significantly different ways. Not taking these differences into account could have a crucial impact on the conclusions drawn from empirical voting models.[17]

2. Estimates of the probability of defeat function

Estimates of two different versions of the probability of defeat function using

17 For example, the aggregate model implies that an increase in tax revenues has an insignificant impact on the incumbent's vote percentage. The disaggregated results imply that, if revenues are increased through a rise in the sales tax, this will have a significant negative effect on the vote percentage of the incumbent.

disaggregated government budget variables are presented in the first two columns of table 3. These versions vary only with respect to the variables included in the X_t vector, with the most insignificant variables omitted in column II. Of the non-budget variables, the only significant coefficients are associated with YIO, and these indicate that the number of years a party has been continuously in power has a positive and significant effect (at the 10 per cent level) on the probability of defeat. The estimated constant term is also significant, though negative, implying that, everything else equal, decisive voters prefer the incumbent party.

The signs of the estimated coefficients associated with the real per capita GDP variable (ΔRGDPPC) in columns I and II of table 3 imply that an increase in real per capita output during the incumbent party's mandate will decrease the probability of its defeat. These coefficients are insignificant in both cases, however, implying that decisive voters do not systematically attribute changes in the level of their gross income to the actions of provincial governments.

Many of the coefficients associated with the disaggregated government budget variables are statistically significant in table 3. Real government spending on goods and services (ΔEGS) has an estimated coefficient that is significant and negative, indicating that increased spending will reduce the probability of the incumbent's defeat. Conversely, an increase in the sales tax (ΔST) has a significant positive impact on the probability of defeat. Higher gasoline taxes (ΔGT) and direct taxes on persons (ΔDTP) also tend to reduce the probability of re-election. In contrast, increased licence fees and 'other transfers from persons' (ΔLT) cause voters to vote for the incumbent party. These fees and transfers tend to be service specific, and voters may see them as resulting in better service (i.e., shorter lines), something the aggregate ΔEGS variable may not be able to reflect fully. In addition, the average voter may not use many of the services funded by these fees and so may prefer that they be financed on a user-pay basis rather than out of general revenues.

In general, transfers from the government either increase the probability of the incumbent's defeat or have no systematic effect on this probability. For example, subsidies to business (ΔTBS), transfers to persons (ΔTPR), and transfers from the provincial government to local government (ΔTLG) have a significant positive impact on the probability of defeat. The average voter may not believe that he/she benefits from such expenditures or may simply consider them to be wasteful. Transfers to business for capital assistance (ΔTBCA) and transfer to hospitals (ΔTH) have no systematic effect on the probability of defeat.

Other budget items, such as the corporate tax (ΔCORPT), miscellaneous indirect natural resource taxes (ΔNRT), miscellaneous indirect taxes (ΔMIT), and provincial property taxes (ΔPT) all have no significant impact on the probability that the incumbent party will be defeated. A similar result is found for a change in the per capita provincial debt (ΔDEBT).[18] Either voters misperceive future budget consequences of current spending and taxing policies or they have sufficiently high discount rates

18 In addition, no significant role for debt is found in an alternative specification in which the change in debt (ΔDEBT) is replaced by the level of the per capita debt.

TABLE 3
Estimated coefficients of the zero-one model of the probability of incumbent defeat

Number of observations: 71 (24 at 1; 47 at 0)	I	II	III	Impact on the probability of defeat of a $1 increase in each explanatory variable (column II estimates)
ΔDTP	283.52*	243.53*		0.0040*
	(1.80)	(1.67)		
ΔCORPT	368.49	353.03		0.0058
	(0.89)	(0.92)		
ΔGT	881.72*	780.09*		0.0127*
	(1.83)	(1.78)		
ΔNRT	−281.92	−156.40		−0.0025
	(0.43)	(0.25)		
ΔST	326.28*	319.88*		0.0052*
	(1.72)	(1.74)		
ΔMIT	72.58	23.05		0.0004
	(0.10)	(0.03)		
ΔLT	−1312.10**	−1212.80**		−0.0195**
	(2.45)	(2.38)		
ΔPT	461.63	397.39		0.0065
	(1.27)	(1.13)		
ΔREV			79.23	
			(1.36)	
ΔEGS	−264.60***	−252.02***		−0.0041***
	(2.69)	(2.73)		
ΔTPR	357.26**	314.07*		0.0051*
	(1.99)	(1.89)		
ΔTBS	616.22**	570.41**		0.0093**
	(1.99)	(2.08)		
ΔTBCA	−68.58	−13.69		−0.0002
	(0.11)	(0.02)		
ΔTLG	427.53**	381.38**		0.0062**
	(2.28)	(2.17)		
ΔTH	−364.51	−364.62		−0.0059
	(1.24)	(1.29)		
ΔEXP			−36.64	
			(1.48)	
ΔDEBT	27.83	21.42	0.34	0.0004
	(1.20)	(1.04)	(0.03)	
ΔRGDPPC	−21.13	−20.29	1.25	−0.0003
	(1.19)	(1.21)	(0.14)	
ΔUR	11.50	12.33	7.98	
	(1.04)	(1.18)	(1.15)	
FD	−0.40			
	(0.73)			
YIO	0.18*	0.18*	0.08	
	(1.69)	(1.70)	(1.29)	
YIO^2	−0.003	−0.003	−0.002	
	(1.32)	(1.30)	(1.11)	
NLD	0.69			
	(0.75)			

TABLE 3 (*Concluded*)

Number of observations: 71 (24 at 1; 47 at 0)	I	II	III	Impact on the probability of defeat of a $1 increase in each explanatory variable (column II estimates)
Constant	−3.25***	−3.02***	−1.18**	
	(2.87)	(2.87)	(2.01)	
Cragg-Uhler R^2	0.606	0.594	0.102	
Log of the likelihood	−25.01	−25.54	−42.71	
LR-ALL	40.82†	39.77†	5.42	
	(21)	(19)	(7)	
LR1			34.35†	
LR2			20.66†	
LR3			17.56†	
Proportion of correct predictions	0.873	0.859	0.634	

NOTES
See notes to table 2.
LR-ALL Likelihood Ratio test that all the coefficients except the constant are zero (degrees of freedom are in parentheses).

(or, in the context of provincial elections, they feel that they can avoid future taxes by moving to another province).[19]

Overall, the results in columns I and II of table 3 indicate that, other than spending on goods and services, no other type of spending or transfer significantly increases the probability that the incumbent party will be re-elected. Of the eight different taxes examined, increases in three tend to increase a government's probability of defeat, while one, changes in permit and licence fees (ΔLT), seems to decrease the probability of defeat. The other four taxes (representing just under 17 per cent of revenues on average) have no systematic effect on the probability of defeat for the incumbent party. Either they are not perceived by the decisive voter or the burden of these taxes does not fall on this voter.

The estimates in column III of table 3 correspond to the case in which all the revenue variables are aggregated into a single revenue variable, ΔREV, and all the expenditure variables are aggregated into a single expenditure variable, ΔEXP. As in table 2, these two aggregate variables have the expected signs, but are insignificant. Apart from the constant, all the non-budget variables also are insignificant. The

19 Rather than rewarding or penalizing political parties for expected changes in utility (as in the model estimated here), the voting decisions of voters may depend on the level of their utility. In this case, the decisions of voters depend on the level of the explanatory variables rather than their change. If the model is re-estimated using levels rather than differences, the coefficients are much less precisely estimated than those in table 3 (standard errors are larger) and the fit of the model is worse, but the signs of the estimated coefficients are generally unchanged.

likelihood ratio statistics included in table 3 indicate that, both individually and jointly, the revenue and expenditure aggregation restrictions are rejected. Thus, different types of taxes and expenditures appear to affect the probability of defeat in significantly different ways.

3. Marginal political cost estimates

The meaning of the estimated coefficients presented in tables 2 and 3 can be clarified by calculating the political cost of a $1 increase in each per capita tax, transfer, and spending variable. The last column of table 2 gives the average (over the seventy-one observations) change in the percentage of the vote going to the opposition in response to this $1 change, while the last column of table 3 gives the change in the probability of incumbent defeat (both use the coefficient estimates from column II).[20]

The results presented in the last column of table 2 indicate that a $1 increase in government expenditures on goods and services (EGS) would increase the incumbent's percentage of the vote by 0.00057. However, this does not take into account how this spending increase is financed. If it leads to an increase in the sales tax (ST), there would be a net decrease in the incumbent's vote percentage, but in contrast, if it is debt financed (at least until taxes must be raised to meet interest and principal payments), the increased spending would have a net positive effect on the incumbent's percentage of the vote. As a result, governments may prefer to pursue policies that increase both spending and debt finances.[21] While increases in licence fees tend to have a large positive impact on a government's vote percentage, both transfers to persons and transfers to local governments have a large (relative to spending on goods and services) negative effect on this percentage.[22]

Estimates of the impact on the probability of defeat of the incumbent of a $1 change in each fiscal variable and RGDPPC are presented in the last column of table 3. These results show that a $1 increase in government expenditure on goods and services (EGS), financed by a $1 rise in direct taxes (DTP), would leave the probability of re-election unchanged. In contrast, the negative effects on the re-election probability of a $1 increase in either sales taxes (ST) or gasoline taxes (GT) would clearly dominate any positive effect of this increased spending. Since the effect of an increase in DEBT is small and the associated coefficient insignificant, these results imply that a government attempting to maximize the probability of its re-election may, at least in the short run, want to finance increased spending by issuing debt. As in table 2, increases in licence fees (LT) have a large positive effect

20 The coefficient estimates used for this simulation imply that the average estimated probability of defeat is 0.3407 and the average estimated percentage of the vote going to the opposition is 56.34.

21 Obviously this is a short term policy (since it implies future tax increases that will reduce the incumbent's vote percentage in the future), and the degree to which it is pursued will depend on the politicians' discount rate as well as the ability of the province to borrow.

22 Several other fiscal variables also have relatively large marginal political costs, but these are not associated with significant coefficients (e.g., DTP, GT, PT). These variables may have a large impact on some election outcomes, but this impact is not systematic across elections.

on the probability of re-election, while transfers to persons (TPR), local governments (TLG), and business subsidies (TBS) have relatively large and significant negative effects on this probability.

4. Marginal efficiency costs versus marginal political costs

The differences in the marginal political costs of the various types of taxes reported in tables 2 and 3 could influence the tax policies of governments. If the relative political costs of different taxes are positively correlated with their relative economic efficiency costs, governments may choose the most efficient taxes while attempting to minimize the political costs of taxation. On the other hand, if the political and efficiency costs are negatively correlated, governments may be more likely to choose tax instruments that are less efficient, but politically less costly.

Jorgenson and Yun (1991) have calculated the marginal efficiency costs of several different taxes for the United States. From least to most efficient, with the efficiency cost (welfare burden) of raising an additional dollar of revenue in parentheses, these are as follows: the corporate tax (0.838), individual income tax (0.508), sales tax (0.256), and property tax (0.174).[23] As indicated in tables 2 and 3, both taxes at the opposite ends of this list, CORPT and PT, are associated with statistically insignificant coefficients and, therefore, are statistically indistinguishable. On the other hand, while both the sales tax and direct taxes on persons are associated with estimated coefficients that are significant (except for direct taxes in table 2), the relationship between the marginal political costs of these two taxes is just the reverse of the relationship that Jorgenson and Yun found between their marginal efficiency costs. That is, sales taxes have a larger marginal political cost than direct taxes, but a lower marginal efficiency cost. To the extent that the efficiency ranking of tax instruments in the United States is mirrored in the Canadian provincial setting, this suggests that governments attempting to reduce the political costs of revenue generation may not choose taxes with the lowest marginal efficiency costs.

5. A Comparison of the two objective functions

Although the estimates in table 2 are based on the assumption that the incumbent is attempting to maximize its percentage of the vote, while those in table 3 are based on the objective of maximizing the probability of victory, for the most part the estimates in these tables are qualitatively very similar. The principal differences between them are that the coefficients in table 3 are estimated more precisely than those in table 2 (many more are statistically significant), and two variables are

23 As a referee has pointed out, there may be difficulties associated with interpreting these findings in the Canadian provincial setting. These difficulties, however, are more likely to apply to the specific numerical values than to the relative efficiency ranking of the various tax instruments. Owing to differing potential tax bases and existing stocks of debt, efficiency and political costs are also likely to vary across provinces. Unfortunately, information on the marginal efficiency costs of different tax instruments is not available at the provincial level, and the data series used here are not sufficiently long to allow separate estimation of marginal political costs for each province.

significant in table 2 that are not significant in table 3 – FD and ΔDEBT. These differences may arise because the estimates in table 3 reflect the preferences of decisive voters, while those in table 2 reflect the preferences of all voters, including those on the fringes of the political spectrum. The differences in the significance of the parameters in the two tables imply that the preferences of voters as a whole differ much more significantly across provinces and elections than do the preferences of decisive voters. The significance of the deficit variable in the model that explains the percentage of the vote and the insignificance of this variable in the probability of defeat model implies that changes in the level of provincial debt may systematically affect the votes of some voters, but these voters are not, in general, decisive when it comes to determining the outcome of elections.

The relative sizes of the marginal political cost effects are generally similar in both tables, although the quantitative effects reported in table 2 are much smaller (in absolute value) than those in table 3. Since small movements in the percentage of the vote can often lead to a change in government, the probability of defeat for the incumbent party is likely to be much more sensitive to changes in the fiscal variables than is the incumbent's vote percentage. Therefore, the political cost (in terms of winning and losing) of small changes in taxes and spending could be quite large even if the cost in terms of lost votes is relatively small.

Finally, with respect to the tests of the restrictions implied by the aggregation of the different taxes into a single revenue variable and the various types of expenditures into a single expenditure variable, both objective functions yield similar results. As can be seen from column III in tables 2 and 3, these restrictions generally are rejected in both cases. These results imply that different types of taxes and spending have different marginal effects on both the probability of defeat and the percentage of the vote.

6. Within and out-of-sample predictions

The robustness of the estimates of each objective function can be assessed using within-sample and out-of-sample predictions of the two models. Within-sample predictions are obtained by employing the coefficients estimated using all seventy-one observations to predict either the percentage of the vote received by the incumbent in specific elections (based on the table 2 estimates) or the outcome for the incumbent of specific elections (based on the table 3 estimates).[24] Out-of-sample predictions employ coefficients estimated from a subsample that does not include the elections that are to be predicted and, therefore, provide a more stringent evaluation of model performance. Since the small number of available observations is somewhat limiting, predictions are examined only for the seven most recent observations (each of which represents an election in a different province). Thus, out-of-sample predictions are based on estimated coefficients obtained using only the first sixty-four observations in the sample. Table 4 lists the province and month

24 Based on conventional practice (see, e.g., Greene 1993, 651–2), predicted probabilities of defeat for the incumbent that exceed 0.5 are viewed as indicating a loss by the incumbent, while probabilities less than 0.5 indicate re-election of the incumbent.

TABLE 4
Within-sample and out-of-sample predictions

Province	Election date	Actual incumbent's vote percentage	Actual change in government	Predictions of the incumbent's vote percentage		Predictions of the probability of incumbent defeat	
				Within-sample	Out-of-sample	Within-sample	Out-of-sample
Nova Scotia	9/88	0.435	No	0.473	0.476	0.005*	0.006*
Alberta	3/89	0.443	No	0.419	0.366	0.092*	0.431*
Newfoundland	4/89	0.476	Yes	0.403	0.413	0.909*	0.947*
Princ Edward Island	5/89	0.607	No	0.442	0.420	0.209*	0.393*
Quebec	9/89	0.500	No	0.470	0.454	0.004*	0.013*
Manitoba	8/90	0.420	No	0.507	0.519	0.157*	0.282*
Ontario	9/90	0.324	Yes	0.340	0.361	0.989*	0.984*

* The model predicts the result of the election correctly (when a change of government is predicted every time the predicted probability of a change is greater than 0.5).

of the seven elections for which predictions are made, the vote percentage for the incumbent, and whether a change in government actually took place.

As can be seen from table 4, the within-sample predictions of the incumbent vote percentage (based on the estimates in column II of table 2) exceed the actual vote percentage in three of the seven elections. The largest within-sample prediction errors, of 16.5, 8.7, and 7.3 percentage points, are for Prince Edward Island, Manitoba, and Newfoundland, respectively. The out-of-sample predictions are worse than the within-sample predictions (relative to the actual percentages) by less than 2 percentage points, except for Alberta, which is more than 5 percentage points worse, and Newfoundland, which is 1 percentage point better. The similarity of the within and out-of-sample predictions, other than for one province (Alberta), indicates that the estimates of the percentage vote model are relatively robust to the change in sample length.

Within-sample predictions of the probability of defeat of the incumbent (based on the estimates in column II of table 3) predict the actual election result correctly in all seven cases. The predicted probabilities of defeat are less than 0.25 in all cases in which the incumbent won and greater than 0.9 in both cases in which the incumbent lost. As can be seen from the final column of table 4, out-of-sample predictions of the probability of defeat for the incumbent yield the same qualitative conclusions as the within-sample predictions. Although the actual election outcome is again correctly predicted for all seven elections, the predicted probability of defeat is now somewhat higher than the within-sample predictions in Alberta, Prince Edward Island, and Manitoba. Overall, this evidence indicates that the estimates of the probability of defeat model are also relatively robust to the change in sample length.

One further way of analysing the performance of the two models is to compare their within and out-of-sample predictions with the actual data. Such a comparison is difficult for the vote percentage model because there is no obvious standard against which to measure the degree of accuracy of the predictions. In addition, since estimates of the incumbent's vote percentage provide no direct information on the election result, it is not possible to use the election outcome to evaluate these predictions.[25]

In contrast, estimates of the probability of defeat model yield predictions of election outcomes, which easily can be compared with the actual election results. As noted above, both the within-sample and the out-of-sample estimates predict all seven elections correctly. Thus, not only is this model robust in the sense that its within and out-of-sample predictions are the same, it is also robust in the sense that it is able to predict actual election outcomes correctly.

VI. CONCLUSION

The purpose of this analysis is to determine the marginal political costs of different types of taxes and government spending as well as to determine voter preferences for different fiscal variables. Based on data from Canadian provincial elections, estimates of the marginal political cost of various taxes and expenditures are found to be qualitatively similar, whether the objective of the incumbent party is to maximize its percentage of the vote or its probability of victory. However, the marginal political cost estimates are much larger in the latter case. In addition, the model in which the objective of the incumbent party is to maximize its probability of victory is estimated much more precisely than the alternative model, and its out-of-sample predictions are easy to interpret and correctly predict election outcomes.

Considerable variation is found in the marginal political cost estimates of the different types of taxes and expenditures. In general, the most visible taxes (sales taxes, gasoline taxes and direct taxes on persons) have the largest systematic political costs. The significantly positive impact of licence and other fees on the incumbent's political success suggests a distinct voter preference for user-pay methods of financing publicly provided goods. Government spending on goods and services is shown to reduce both the probability of incumbent defeat and the percentage of the vote going to the opposition. Increased transfers to individuals, businesses, or local governments have either a neutral or a detrimental impact on the vote percentage and probability of re-election of the incumbent. Generally, spending on goods and services is the only type of spending that reduces the probability of defeat,[26] while the change in the level of government debt is shown to have only an extremely small and insignificant direct impact on this probability. Although an increase in

25 Based on the out-of-sample predictions of the incumbent vote percentage in Alberta (0.366) and Prince Edward Island (0.420), defeat of the incumbent might easily have been incorrectly anticipated using this model.

26 This result contradicts the assumption in many theoretical models that increased government spending of any type increases voter support (see Hettich and Winer 1988 for example).

the debt does seem to reduce the incumbent's percentage of the vote, this effect is relatively small.

A number of conclusions can be drawn from the results presented above. Governments that want to reduce the probability of their defeat or raise their percentage of the vote are likely to reduce their reliance on broad-based visible taxes (such as sales taxes, gasoline taxes, and income taxes) and concentrate on raising revenue from less visible revenue sources such as natural resource royalties, corporate taxes, and user fees and, in addition (at least in the short run), may have a preference for debt financing. The results also indicate that governments will maximize their political success by increasing spending on goods and services while reducing transfers to individuals, local governments, and businesses. Because of the differences between the relative marginal economic and relative marginal political costs of particular taxes, governments are unlikely to choose the tax mix that minimizes the economic cost of taxation.

The estimates indicate that voters do not treat all types of taxes and spending as if they are identical. Therefore, models that assume they do may suffer from aggregation bias. The differential impact of various types of taxes and expenditures on voting behaviour implies that restricting the number of dimensions across which parties compete, as is true in much of the spatial voting literature (see, e.g., Enelow and Hinich 1990), could yield biased empirical estimates.

The results do not reveal a preference by voters for most publicly provided goods. As a consequence, it is unclear how to interpret estimates of demand equations for public goods that assume that the utility of the representative voter depends positively on all publicly provided goods. Finally, the results show that taxing and spending policies have a potentially large impact on voter behaviour. Therefore, models of voting behaviour and optimal political behaviour should not exclude these variables in favour of inflation and unemployment.

APPENDIX

CGD Change in government variable. It equals one if a provincial election leads to a change in government and zero otherwise. *Source*: Feigert (1989) and the *Canada Yearbook*, various issues.

CORPT Direct provincial taxes: corporations plus indirect taxes on corporations. *Source*: Statistics Canada, Cansim Series (for each province from east to west) – D12838, D12858, D12878, D12898, D12918, D12938, D12958, D12978, D12998, D12818 plus D42162, D42185, D42208, D42231, D42254, D42277, D42300, D42323, D42346, D44252.

DEBT Cumulative provincial government dissaving. *Source*: Statistics Canada, Cansim Series – D12852, D12872, D12892, D12912, D12932, D12952, D12972, D12992, D13012, D12832.

DTP Direct provincial taxes: persons (including contributions to social security and government pension plans). *Source*: Statistics Canada, Cansim Series – D12837, D12857, D12877, D12897, D12917, D12937, D12957, D12977, D12997, D12817.

EGS Provincial government expenditure on good and services. *Source*: Statistics Canada, Cansim Series – D12845, D12865, D12885, D12905, D12925, D12945, D12965, D12985, D13005, D12825.

EXP Aggregate provincial expenditures = EGS + TPR + TBS + TBCA + TLG + TH.

FD A dummy variable for equality between the provincial and national governing parties. It equals one if at least one month prior to the election the governing party at the national level is the same as the incumbent party in the province having the election and equals zero if the two parties differ. *Source*: Feigert (1989) and the *Canada Yearbook*, various issues.

GT Provincial gasoline tax. Source: Statistics Canada, Cansim Series – D42163, D42186, D42209, D42232, D42255, D42278, D42301, D42324, D42347, D44253.

LT Motor vehicle permits (paid by business rather than individuals) plus other licences, fees, and permits. Other transfers from persons (including taxes fees and permits paid by persons out of personal income, but not based on income. These include motor vehicle licences, hospital and medical care premiums, and various miscellaneous licences and permits (i.e., hunting and fishing, marriage licences, fines and penalties, charitable contributions to hospitals). *Source*: Statistics Canada, Cansim Series – D42164, D42187, D42210, D42233, D42256, D42279, D42302, D42325, D42348, D44254 plus D42165, D42188, D42211, D42234, D42257, D42280, D42303, D42326, D42349, D44255 plus D12840, D12860, D12880, D12900, D12920, D12940, D12960, D12980, D13000, D12820.

MIT Miscellaneous indirect provincial taxes plus the amusement tax. *Source*: Statistics Canada, Cansim Data Base, Matrices – 5038, 5039, 5040, 5041, 5042, 5043, 5044, 5045, 5046, 6955.

NLD New leader dummy variable. It equals one if the leader of the incumbent provincial party has changed in the twelve months prior to the election, zero otherwise. *Source*: *The Canadian Parliamentary Guide* (Toronto: Globe and Mail Publishing) 1992.

NRT Miscellaneous provincial taxes on natural resources. *Source*: Statistics Canada, Cansim Series – D42166, D42189, D42212, D42235, D42258, D42281, D42304, D42327, D42350, D44256.

PT Real provincial property tax. *Source*: Statistics Canada, Cansim Series – D42167, D42190, D42213, D42236, D42259, D42282, D42305, D42328, D42351, D44257.

REV Aggregate provincial revenue = DTP + CORPT + GT + NRT + ST + MIT + LT + PT.

RGDPPC Real provincial GDP per capita. *Source*: Statistics Canada, Cansim Series – D31544, D31558, D31572, D31586, D31600, D31614, D31628, D31642, D31656, D44000.

ST Provincial retail sales tax plus profits of liquor commissions. *Source*: Statistics Canada, Cansim Matrices – 5038, 5039, 5040, 5041, 5042, 5043, 5044, 5045, 5046, 6955.

TBCA Provincial transfers to business: capital assistance (i.e., grants to encourage new construction or for plant expansion and improvement). *Source*: Statistics Canada, Cansim Series – D12848, D12868, D12888, D12908, D12928, D12948, D12968, D12988, D13008, D12828.

TBS Provincial transfers to business: subsidies (i.e., grants to business to cover the current costs of production). *Source*: Statistics Canada, Cansim Series – D12847, D12867, D12887, D12907, D12927, D12947, D12967, D12987, D13007, D12827.

TH Provincial transfers to hospitals. *Source*: Statistics Canada, Cansim Series – D12850, D12870, D12890, D12910, D12930, D12950, D12970, D12990, D13010, D12830.

TLG Provincial transfers to local governments minus transfers from local governments. *Source*: Statistics Canada, Cansim Series – D12849, D12869, D12889, D12909, D12929, D12949, D12969, D12989, D13009, D12829 minus D12843, D12863, D12883, D12903, D12923, D12943, D12963, D12983, D13003, D12823.

TPR Provincial transfers to persons (including scholarships and research grants, social welfare payments, grants to private non-commercial institutions, grants to post-secondary educational institutions, and government pensions paid to government employees). *Source*: Statistics Canada, Cansim Series – D12846, D12866, D12886, D12906, D12926, D12946, D12966, D12986, D13006, D12826.

UR Provincial unemployment rate. *Source*: 1966–90: Statistics Canada, Cansim Series – D768914, D769861, D768752, D769893, D769842, D769905, D769949, D769970, D769991, D769923; 1961–5: *Historical Statistics of Canada*, Second Edition, tables D491–D497. For the 1961 to 1965 period the data do not distinguish between the unemployment rates for Nova Scotia, New Brunswick, and Prince Edward Island or between the rates in Alberta, Saskatchewan, and Manitoba. The Cansim Database does not include the annual unemployment rate for Prince Edward Island for the years 1966 through 1971 for 1973 and 1974. For these eight years the average of available monthly rates was taken from Statistics Canada, *Historical Labour Force Statistics 1991* (71-201).

YIO Years the incumbent party has been governing. *Source*: Feigert (1989) and the *Canada Yearbook*, various issues.

NOTE: Series were transformed into real per capita terms using the following data:

Population: Statistics Canada, Cansim Series – D892586, D892904, D893222, D893540, D893858, D894176, D894494, D894812, D895130, D895448.

Price Index: 1971–90: Implicit Price Index for Final Domestic Demand by Province, Statistics Canada, Cansim Series – D44764, D44778, D44792, D44806, D44820, D44834, D44848, D44862, D44876, D44890; 1960–70: Consumer Price Index

by Major Metropolitan Area, *Historical Statistics of Canada*, Second Edition, tables K23–K32. A price index does not exist for Prince Edward Island for the 1961 to 1970 period. The price index of Newfoundland was used as a proxy for this price index, since from 1971 to 1990 the correlation of the price index of Prince Edward Island was higher with that of Newfoundland than with that of any other province.

REFERENCES

Alesina, A. (1989) 'Comments and discussion.' *Brookings Papers on Economic Activity* 2, 50–6

Alesina, A., and H. Rosenthal (1989) 'Partisan cycles in congressional elections and the macroeconomy.' *American Political Science Review* 83, 373–98

Amemiya, T. (1985) *Advanced Econometrics* (Cambridge, MA: Harvard University Press)

Chappell, H.W. (1990) 'Economic performance, voting and political support: a unified approach.' *Review of Economics and Statistics* 72, 313–20

Coyte, P.C., and S. Landon (1990) 'Cost-sharing versus block-funding in a federal system: a demand systems approach.' This *Journal* 23, 817–38

Deacon, R.T. (1978) 'A demand model for the local public sector.' *Review of Economics and Statistics* 60, 184–92

Deacon, R., and P. Shapiro (1975) 'Private preference for collective goods revealed through voting on referenda.' *American Economic Review* 65, 943–55

Downs, A. (1957) *An Economic Theory of Democracy* (New York: Harper and Brothers)

Dunne, J.P., P. Pashardes, and R.P. Smith (1984) 'Needs, costs and bureaucracy: the allocation of public consumption in the UK.' *Economic Journal* 94, 1–15

Enelow, J.M., and M.J. Hinich, eds (1990) *Advances in the Spatial Theory of Voting* (New York: Cambridge University Press)

Enelow, J.M., M.J. Hinich, and N.R. Mendell (1986) 'An empirical evaluation of alternative spatial models of elections.' *Journal of Politics* 48, 675–93

Erikson, R.S. (1989) 'Economic conditions and the presidential vote.' *American Political Science Review* 83, 567–73

— (1990) 'Economic conditions and the congressional vote: a review of the macrolevel evidence.' *American Journal of Political Science* 34, 373–99

Feigert, F. (1989) *Canada Votes, 1935–1988* (Durham NC: University Press)

Feldman, P., and J. Jondrow (1984) 'Congressional elections and local federal spending.' *American Journal of Political Science* 28, 147–64

Greene, W.H. (1993) *Econometric Analysis*, Second Edition (New York: Mcmillan)

Hettich, W., and S. Winer (1984) 'A positive model of tax structure.' *Journal of Public Economics* 24, 67–87

— (1988) 'Economic and political foundations of tax structure.' *American Economic Review* 78, 701–12

Jacobson, G.C. (1990) 'The effects of campaign spending in house elections: new evidence for old arguments.' *American Journal of Political Science* 34, 334–62

Jorgenson, D.W., and K.-Y. Yun (1991) 'The excess burden of U.S. taxation.' *Journal of Accounting, Auditing, and Finance* 6, 487–508

Maddala, G.S. (1983) *Limited-Dependent and Qualitative Variables in Econometrics* (New York: Cambridge University Press)

Nordhaus, W.D. (1989) 'Alternative approaches to the political business cycle.' *Brookings Papers on Economic Activity*, 2, 1–49

Peltzman, S. (1990) 'How efficient is the voting market?' *Journal of Law and Economics* 33, 27–63
— (1992) 'Voters as fiscal conservatives.' *Quarterly Journal of Economics* 107, 327–61
Riker, W.H. (1962) *The Theory of Political Coalitions* (New Haven, CT: Yale University Press)
Riker, W.H., and P.C. Ordeshook (1973) *An Introduction to Positive Political Economy* (Englewood Cliffs, NJ: Prentice-Hall)
Schram, A. (1990) 'A dynamic model of voter behaviour and the demand for public goods among social groups in Great Britain.' *Journal of Public Economics* 41, 147–82
Schram, A., and F. Van Winden (1989) 'Revealed preference for public goods: applying a model of voter behaviour.' *Public Choice* 60, 259–82
Stigler, G.J. (1972) 'Economic competition and political competition.' *Public Choice* 13, 91–106; reprinted in (1986) *The Essence of Stigler*, ed. K.R. Leube and T.G. Moore (Stanford, CA: Hoover Institution Press)
Studlar, D.T., I. McAllister, and A. Ascui (1990) 'Privatization and the British electorate: microeconomic policies, macroeconomic evaluations, and party support.' *American Journal of Political Science* 34, 1077–101
Suzuki, M. (1991) 'The rationality of economic voting and the macroeconomic regime.' *American Journal of Political Science* 35, 624–42