What determines the length of a typical Canadian parliamentary government?

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Abstract

In this paper we examine the length of political tenure in Canadian federally elected parliamentary governments since 1867. Using data on tenure length, we categorize the distribution of governing tenures in terms of a hazard function--the probability that an election will arise in each year, given that an election has not yet been called. We then ask whether that distribution responds in a systematic way to characteristics of the political and/or economic environment. Our particular focus is on whether there is evidence of electoral timing and whether governing parties have used economy policy in conjunction with federal elections. Finally we investigate whether partisan effects emerge. The results suggest that, independent of party affiliation, governing parties do engage in election timing. The data also suggest that election calls coincide with periods of monetary expansion and more with tax decreases than with expenditure increases, supporting the Persson and Tabellini (2003) hypothesis that under parliamentary systems, it is tax cuts (rather than expenditure increases) that will be most closely associated with elections. Unlike the case in other parliamentary systems, however, Canadian data also support the hypothesis that tough measures (expenditure cuts) are postponed until after elections.

Classification codes: C41, H11.

Key words: duration models, election timing, political business cycles, political policy cycles.

1. Introduction and Motivation

For most of Canada's democratic parliamentary history, the maximum time that a federal political party could govern without renewing its electoral mandate was fixed (in the Constitution Acts of 1867 and 1982) at five years.[1] Hence it might be expected that Canadian federal elections would arise roughly every five years. Yet surprisingly, only nine of the thirty nine federal governments since Confederation (in 1867) remained in power for their full term (i.e., 4.6 years or longer) and, on average, the length of time spent in power has been only 3.2 years.[2] In part, the relatively short use of potential governing time can be explained by the fact that some elections did not result one party gaining a majority of the seats in the House of Parliament, requiring the winning party to maintain the cooperation and support of at least one of the opposition parties. And typically such support has not lasted long--a minority government in Canada has lasted only 1.4 years on average. Nevertheless, even if we restrict our attention to the twenty nine instances of majority government, relatively few of these governments have served their full term. The average duration of a majority government has been only 4.2 years, with the recent trend to even shorter times.[3] This suggests to us, first, that the time at which to call an election is a strategic choice for the political party in power and, second, that enough variation exists in the actual length of time spent in office that the distribution of election times might be used to uncover some of the economic and political factors that have gone into making that choice.

In this paper we use duration analysis to examine the determinants of the length of political tenure in Canadian federally elected governments since 1870. Our starting point is the hypothesis that the experience of each elected government can be treated as a random drawing from a stable distribution of governing tenures. Then we use Canadian data on tenure length to construct the characteristics of the hazard function—the probability of having an election called or, stated inversely, the distribution of survival times for elected federal governments. Finally we ask whether that distribution has responded in a systematic manner to the underlying characteristics of the political and/or economic environment.

The paper is organized as follows. In Section 2 we describe in detail the methodology used in the paper. In Section 3 we apply that methodology to a data set of Canadian economic and political variables and present the findings. Section 4 contains our conclusions. Tables and figures are relegated to appendices at the end of the paper.

2. General Approach

We begin from the proposition that the duration experience of an elected government can be treated as a random drawing from a stable distribution of election lengths. By incorporating randomness, we first recognize that some (important) determinants of election length remain unobservable at the aggregate level and hence will be unaccounted for by our analysis. As importantly, however, we also argue that some part of the duration experience can be explained and that these that influences are political and economic in nature. In examining potential influences, we are particularly interested in whether there is

[1] Bill C-16, An Act to Amend the Canada Elections Act, was recently passed by the Conservative government (receiving Royal Assent on May 3 2007). This fixed the date for the each following federal election at the third Monday in October every four years (subject to no earlier dissolution of Parliament). It is interesting to note that in its first period of application an election was called by the same Conservative government one year early.

[2] Elections Canada On-Line, General Information, Appendix III.

[3] For example, the Chretien governments averaged only 3.5 years.

a common observable durational response by parties to changes in the economic environment and/or whether there are common economic policies adopted by parties in relation to elections. Finally we are interested in whether a difference in response can be detected across party types. In essence we are interested in whether there is evidence that calling an election responds to economic circumstances (election timing), whether changes in economic policy coincide with the timing of elections (political timing of economic policy), and whether there are significant differences in these responses across the two major political parties (partisanship).

We begin by describing graphically the hazard function for Canada. Such graphs are useful not only for visualizing how the problem to be explained but also for illustrating how the probability of an election in each governing year responds to such important differences across governments as whether the government in power had a majority of the seats in the House or not. We then turn to consider how variables that are time varying and continuous in nature can be incorporated into the analysis and use the Cox proportional hazard model to assess the significance of a set of economic and political factors that are often argued to be plausible determinants of election timing (see summaries in Alesina, Roubini & Cohen, 1997 and Drazen, 2000). The Cox method uses regression in relation to continuous covariates that may or may not vary with time and allows us to interpret the regression coefficients as changing the relative risk of a cycle failure (in our case, the risk that an election may arise this period). In the next section we describe in some detail how the Cox method is used to uncover the effect of different variables on the election hazard.

2.1 Econometric Methodology

For our purposes, the important advantage of using the Cox proportional hazard model is that we do not need to specify the form of the distribution of election lengths—the Cox function is semi-parametric and therefore flexible to misspecification errors.[4] More specifically, its underlying form is:

$$\theta(t_i|x_{it}) = \lambda(t_i)\phi(x_{it}), \tag{1}$$

where for our problem the hazard, $\theta(t_i|x_{it})$, is the probability that an elected federal government with characteristics given by the values of the variables (covariates), x_{it}, will fail this period having already been in power t_i years (where the $t_i's$ are the potential durations of election cycle i, i = 1, 2,.., N= 5).[5] Hence the probability that a cycle will fail (i.e., the likelihood that an election will be called) after t_i periods depends upon the product of two terms. The first term, $\lambda(t_i)$, is called the baseline hazard. By construction it is time-varying, estimated non-parametrically, and measures the probability that an election will arise in year t for an election cycle that has all of its covariates equal to zero. The second term then allows for a set of (possibly) time varying influences on the election hazard, $\phi(x_{it})$. Under the

[4] The necessity of dealing with time-varying covariates poses two types of problems for duration analysis: first, treating a time-varying variable as fixed may introduce misspecification; and second, the presence of time-varying covariates may involve feedback. The first we deal with by excluding parametric estimation models since they allow only for fixed variables. This explains our preference for the continuous semi-parametric Cox proportional hazard model which is robust to misspecification error. Within this approach, the baseline hazard is non-parametrically determined and allowed to be time-varying. The second issue of potential feedback within the cycle is more difficult and is generally unresolved. It remains an important caveat.

[5] There was one occasion in Canadian history when a federal government lasted longer than its constitutional term of five years. This was in WWI when Sir Robert Borden's 1911 government postponed an election call in hope of achieving a wartime coalition government.

Cox model this is set equal to $e^{x'_{it}\beta}$. It follows that the baseline hazard captures what is common to all cycles across time that is not explained by variations in specific political and economic covariates.

To find estimates of the influence of the covariates on the hazard [the β parameters of $e^{x'_{it}\beta}$], we maximize a partial log-likelihood function, where the partial likelihood is constructed by comparing at each time of failure, the risk for the failed subject relative to the risk for all the other subjects at risk at that time. Then by making the comparison relative, the baseline hazard is completely eliminated from the problem and need not be estimated, unless the baseline hazard is needed for other purposes (as it will be in our later analysis). The $\beta's$ indicate the proportional change in the hazard relative to the baseline hazard rate.

A hazard model for each election cycle, θ_i, is derived in the following way. First, the partial likelihood of the proportional hazard model with time-varying covariates that are specific to the cohort of elections sharing characteristics x_j is

$L_P = Pr\{government\ with\ characteristic\ x_j\ fails\ at\ t_j | some\ government\ failed\ at\ t_j\}$

which, in turn is equivalent to

$$L_P = \frac{Pr\{government\ with\ x_j\ fails\ at\ t_j\}}{Pr\{some\ government\ fails\ at\ t_j\}}.$$

In other words,

$$L_P = \prod_{j\ \epsilon\ failed\ governments} \frac{e^{x'_{it_j}\beta}}{\sum_{l\ \epsilon\ risk\ set\ at\ t} e^{x'_{lt_j}\beta}}\ , \qquad (2)$$

where the observed time of failure (time at which an election is called) is denoted by t_j with j = 1,...,T and $t_{j-1} < t_j$.

Then taking the logarithm of (2), the partial log-likelihood function is now defined as

$$lnL_P = \sum_{i=1}^{N} \left[(1 - d_i)x'_{it_j}\beta - d_i ln\left(\sum_{l\ \epsilon\ risk\ set\ at\ t_j} e^{x'_{lt_j}\beta}\right)\right] \qquad (3)$$

where j is the government that fails at time t_j and d_i is an indicator that takes the value 1 if the governing period is incomplete (censored) and zero if the government has finished its term (is uncensored). In our case we have only one censored observation--the 39th (Conservative) government was still serving in 2006. Hence $ln\left(\sum_{l\ \epsilon\ risk\ set\ at\ t_j} e^{x'_{lt_j}\beta}\right)$ is the contribution to the partial log-likelihood of the right-censored observation and $e^{x'_{it_j}\beta}$ is the contribution to the partial log-likelihood of the uncensored observation. For the time-invariant covariates, L_P compares the covariate x_j of the government that fails to the covariates x_l in the risk set at each failure time t. For the time-varying covariates, L_P compares the covariate x_{jt_j} at time t_j of the government that failed to the other covariates x_{lt_j} at time t_j in the risk set. The estimate of the parameters of interest is found by maximizing the partial log-likelihood with respect to each parameter.[6]

In order to test the robustness of our results we will consider the issue of unobserved heterogeneity. In our case unobserved heterogeneity is introduced into the model multiplicatively using a gamma distribution. While this is one way of accounting for unobserved heterogeneity, in principle any distribution with a mean equal to one, finite variance, and positive support could be used.

Finally, to decide upon the appropriate version of the model, we consider a number of different covariate specifications that all pass the proportionality criterion and then choose the one that produces the most consistent and parsimonious set of results.

3. Application and Results

3.1 The Empirical Hazard Function for Canadian Federal Governments

The solid line on Figure 1 illustrates the empirical hazard function produced by the duration experiences of the 39 federal governments elected in Canada between Confederation (in 1867) and 2006.[7] Here the vertical axis represents the hazard (the probability that an election arose for a random government with certain characteristics given that an election had not yet been called) and the horizontal axis measures the successive years in power. As the figure illustrates, the hazard function may rise or fall in the first few years of governing, but must eventually rise to one by the end of the five year mandate.[8] On the graph we also illustrate the significance of one important conditioning circumstance, whether the winning party won a majority of the seats in the House or governed with a minority. If we use dominance to mean a government with a higher proportion of longer durations (i.e., lying lower on the hazard diagram), the graph conveniently illustrates the following stylized political facts. Minority governments have the shortest duration, none surviving more than four years. On the other hand, majority governments dominate all other political groupings. The diagram also illustrates that in Canada the election hazard decreases in the second year of the governing cycle before rising continuously over the rest of their mandate. That is, the probability of an election being called does not rise monotonically over the election cycle.

3.2 The Cox Proportion Hazard Model Results

To test for the significance of more continuous variables on the hazard function, we estimate a series of different specifications of the Cox proportional hazard model. These are designed to test an expanding set of political and policy cycle hypotheses. The results are presented in Table 1. In interpreting the outcomes, it is important to remember that the β_i coefficient estimates generated by the Cox procedure measure a proportional change in the hazard ratio (the ratio between the actual hazard and the baseline hazard). Hence the key feature is whether the coefficient estimate of each covariate is significantly greater than one (indicating an increase in the hazard ratio) or significantly less than one (indicating a

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[6] When an estimate of the baseline hazard is needed, it is found by maximizing the approximate joint log-likelihood function. See the Appendix for details.

[7] The empirical hazard was constructed as the number of individual government cycles that ended between t+dt divided by the total number of government cycles minus the number of government cycles that ended by time t.

[8] Once again the 1911 Sir Robert Borden government is the notable exception to the rule. This is what produces in Figure 1 the final kink on the diagram for year six (for majority governments).

decrease in that ratio).[9] The higher numbered columns in the table correspond to ever more expanded versions of the basic model. Our interest is in both the significance of each set of variable additions to the basic model and the constancy of previous coefficient estimates as the new hypotheses are added to the model.

Our diagrammatic presentation showed that majority versus minority status matters considerably for governing durations so we begin with that factor. However, rather than entering majority/minority status discretely, we utilize the ability of the Cox model to incorporate continuous variables to add the size of the governing majority as a determinant of the likelihood of calling an election. In Model 1, then, we use the variable, majority_seats, to represent the proportion of seats in the House of Commons won by each majority winning government.[10] Hence its coefficient in the first row of column (1) represents the proportional effect on the baseline hazard of having a bigger parliamentary majority and can be seen to be significantly less than one.[11] A brief glance across the adjacent columns of the table indicates the same finding for all forms of our test. All coefficient estimates are significantly less than one indicating that a larger sized parliamentary majority reduces the hazard of an election, thus increasing the survival properties of that elected government.[12]

The covariate majority_seats in Model 1 analyzes the effect on the hazard of a categorical difference across elected majority governments, a characteristic that distinguish among governments but does not vary across the length of governing tenure. In the models that follow, we test for the importance of different economic and political factors that do vary across time. Model 2 then adds to Model 1 a test of election timing—the hypothesis that elections are more likely to be called in a period when times are good. Here we test that hypothesis by adding two time varying variables to Model 1: the rate of growth of real GNP, Growth Rate, and an exponentially weighted growth rate, where the weight corresponds to its position within the election cycle.[13] The latter variable was designed to capture the associate hypothesis that the growth rate should matter more in the later stages of a governing cycle than the earlier stages. Experimentation across different weighting measures resulted in the form used in Models 2-5.

The results for Model 2, presented in column (2), suggest that the election hazard has been highly dependent upon both the current growth rate and its exponential, year-weighted value. The coefficient estimate on the growth rate (1.035) implies that an increase in the experienced growth will increase the likelihood of an election being called and its standard error implies that this effect is significantly different from zero.[14] The coefficient estimate on the weighted growth variable tells us that when growth rates later in the election cycle are weighted proportionately more, the hazard falls. Hence it

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[9] Our Cox regression results utilize a robust (Huber/White) method of estimating standard errors. It is robust in the sense that it does not assume that errors are identically distributed.

[10] We can also report that the use of the electoral turnout rate, the ratio of electoral eligibility and a combination of the two (the effective participation rate) as discrete determinants of the election hazard had no explanatory power.

[11] The marginal fixed effect of adding the size of the winning majority to the baseline hazard is -.5449453 with a standard error of .0888 and associated z value of -6.14.

[12] Note that elsewhere in the literature (see, for example, Ferris, Park and Winer, 2008), the size of the winning majority has been used as a (inverse) measure of the degree of political competition. Under this interpretation, our results suggest that less competitive parliaments are more reluctant to return to the polls.

[13] The variable exponentially weighted (.7) growth rate was the result of our experimentation across different values of the general form: growth*exp(a*year) where a = .1, .2,…,.9. The use of a = .7 produced the weight that produced the best fit in the regression equation. The exponential form allows nonlinearity to capture the importance of growth in the period just before the election.

[14] Note that when the analysis controls for the policy factors that might affect the hazard (in Models 3-5), the coefficient estimate rises from 1.035 to 1.042 or more.

appears that good times in the later stages of the governing cycle prolong rather than shorten the tenure of the established governments. When we combine these two growth rate effects together, an increase in the growth rate implies both an upward shift and a flattening of the slope of the hazard function across time.[15] This finding also appears to be robust across models. Anticipating our later results by glancing across the columns of Table 1, it is apparent that both the size of the coefficient estimates and their level of significance remain largely unaffected by the incorporation of other hypotheses and their control variables.

Model 3 adds a test for strategic opportunism in the tradition of Nordhaus (1975), Rogoff and Sibert (1988), Besley and Case (1995), Mink and de Hann (2005), and Shi and Svensson (2006). The hypothesis that the governing political party will use economic policy to achieve electoral success implies that an election will be more likely when monetary policy (measured by a higher (base) money growth rate) and/or fiscal policy (measured by government expenditure (taxes) rising (falling) relative to GDP) are expansive. In Canada, the question of whether a policy induced political business cycle exists has been quite controversial. For example, Kneebone and McKenzie (2001) over the1961-1996 period use a Hodrick-Prescott filter to control for long run factors and find evidence of both opportunism and partisanship in the fiscal structure at all levels of government. This stands in contrast to Serletis and Afxentiou (1998) who, using longer annual data for 1926 to 1994, find no evidence of any regularity arising between a set of Hodrick-Prescott filtered policy target variables (such as output and unemployment) and a set of similarly filtered government policy instruments (such as government consumption and investment).[16] Our Cox findings, presented in column (3), are generally supportive of policy cycles, consistent with two of the three possibilities. The coefficient estimates imply that both higher money growth rates and lower tax levels have been associated with the higher likelihood of an election. The former effect is significant at the one percent significance level, while the latter becomes significant only if we use the lowest (ten percent) significance level. On the other hand, higher levels of government spending show no significant relationship with the hazard. In this form, then, the data give support only to hypothesis of a political policy cycle in money and, to a less extent, in taxes.

In Model 3 we do not distinguish by party type. Hence in Model 4, we test for whether the two major political parties have used economic policies differently and/or responded in a different way to economic circumstance and present the most favorable outcome in column (4). First we simply report that distinguishing Canadian governments (discretely) by Liberal versus Conservative political party had no explanatory power.[17] Hence partisanship, in the sense of Hibbs (1977), has had no significant effect on the election hazard and thus appears to have played no role in the timing of Canadian elections. However, when we add partisanship to strategic opportunism, the results are not as easily dismissed (see also Haynes and Stone, 1990). For the most part, our experiments interacting partisanship with economic outcome and economic policy variables indicate no observable difference across the two political parties. In combination with the results from Model 3, this would suggest that there is no evidence that Conservatives and Liberals use economic policy differently to affect electoral outcomes. Similarly, we find no evidence in our results that the two parties respond differently to economic

[15] The additional contribution of this addition to the explanatory power of the base model is roughly six percent.

[16] Winer (1986) finds evidence of a weak feedback at electoral cycle frequencies from the Gallup poll measure of party popularity to monetary growth under flexible but not under fixed exchange rates since 1945. Kneebone and McKenzie (1999) also consider and find evidence of policy response in relation to provincial governments. Other work on Canadian provinces also suggests the existence of political influence: Reid (1998) finds evidence of opportunism, Kneebone and McKenzie (2001) find opportunism and partisanship in fiscal policy, and Tellier (2006) shows that political popularity affects the extent to which provincial governments can satisfy ideological preferences.

[17] The coefficient estimate on the discrete covariate Liberal (1 if Liberal Party government; 0 otherwise) is less than one in size, suggesting somewhat longer governing durations than Conservative governments, but is not significantly different from one.

circumstances. The result presented as Model 4, however, does represent the most significant exception to this finding of indifference. That is, under Liberal Party governments, fiscal (spending) policy is found to be positively related to the hazard of election. The coefficient estimate on the variable Liberal D_LNGsize is now greater than one (rather than being found to be less than one in Model 3) and its size would suggest that the probability of an election being called is roughly fifty percent higher (than under a Conservative government) when government spending is increased (relative to GDP).[18] On the other hand, the coefficient estimate is not significantly different from one. Overall, then, the data do not support the hypothesis that Liberal versus Conservative governments behave any differently with respect to economic circumstance or policy choice when making the decision when to call an election.

In Model 5 we alter the timing of the policy variables to test for the presence of two empirical regularities found by Persson and Tabellini (2003). In their 1960-1998 panel study of electoral cycles across sixty political systems, Persson and Tabellini found that while pre-election tax cutting was universal, it was only in presidential systems where unpleasant fiscal readjustments (decreases in government spending) were postponed until after the election. In column (5) then we present the results of re-estimating Model 3 with this altered timing. The results are interesting in a number of ways. The first result is that this re-dating of the policy variables improves the overall fit of the model. Moreover, in comparison with the other versions of our models, the log likelihood function is highest for this version of our test. Second, in terms of specific hypothesis tests, the forward re-dating of government spending in the dataset now results in a significant decrease in the likelihood of an election. In Model 3 the negative coefficient on government spending was inconsistent with the hypothesis that government spending increases led into elections. However, with re-dating of government spending, the same negative coefficient is now consistent with the hypothesis that government spending decreases follow election outcomes. Third, the coefficient estimate on D_LnTaxsize is consistent with the hypothesis that taxes are decreased ahead of elections—in our interpretation, tax decreases increase the likelihood of an election next period. Somewhat surprisingly, while our results confirm the Persson and Tabellini's taxation finding over a much longer time horizon, our longer term results are inconsistent with their conjecture for government spending. That is, in contrast to their finding for presidential systems, Canada appears to be one parliamentary democracy that has adopted the practice of postponing necessary fiscal readjustments until after elections.

Lastly, if we consider Model 5 as the most appropriate policy form of our test, we can assess the contribution of the political budget cycle to the explanation of the election cycle by considering the change in the likelihood function from Model 2 to Model 5. On that basis, policy considerations have resulted in a 5.9% improvement in the explanatory power of the model.

3.3 Model Evaluation and Robustness Tests

In this section, we report on the different test procedures used to insure that the Cox methodology is appropriate and correctly applied so that the parameter estimates presented above are consistent.

First the key requirement for using the Cox model appropriately is that the hazards must be proportional and the test for such proportionality is based on Schoenfeld residuals. In essence the test states that if the categorical covariates generate hazards that are proportional, then a zero slope should be observed when a generalized regression of scaled Schoenfeld residuals is run on time. In our case, when a regression of scaled Schoenfeld residuals on time was run for our categorical variable, majority_seats, a

[18] Liberal D_LNGsize = Liberal (1 if Liberal; 0 otherwise) * D_LNGsize.

non-significant slope value of 0.045 with a standard error of 0.024 was found. Hence Model 1 did not fail the test of proportionality.[19] To establish an appropriate model specification, then, we considered a number of models that passed the proportionality criterion and chose the one that presented the most consistent and parsimonious results.

Second, we tested the specification of our functional form and overall model fit by first comparing the estimated hazards for all our specifications with the empirical hazard computed from the data (Figure 1). Figure 2 illustrates this diagrammatically by showing relative to the empirical hazard the position of the estimated hazard functions for Model 1 through Model 5. By inspection we can see that Model 1 produces an estimated hazard function that overstates the empirical hazard at all durations while Model 3 has underestimated the rise in the hazard between years three and four. When all the dimensions of our analysis are accounted for in Model 5, we find an estimate that is very close to the empirical hazard.

A more formal way to test overall model fit is through the use of Cox-Snell residuals. If the model fits the data perfectly, the plot of the cumulative hazard versus the Cox-Snell residuals should lie on a 45 degree line. For our preferred Model 5, Figure 3 shows that the cumulative hazard lies very close to the 45 degree line, which confirms more formally the visual check of the estimated hazard plot versus the empirical hazard done in Figure 2. In general, the deviations from the 45 degree line are partially due to the variance of these estimators. Our empirical specification has included both proportional and time-varying variables. Our proportional variable (majority seats) captures the time-invariant effects on the hazard rates for a particular government cycle, while the time-varying variables (varying growth rates and politically influenced policy variables) are introduced to account for any uncommon time-effects.

Third, duration analysis investigates whether the observed differences across election cycles (the model's covariates) *as well as* the common aspects of the cycles (the baseline hazard) relate well to the prospect of having a governing cycle end. While the analysis above has focused on the contribution of the covariates, it is the estimated baseline hazard that captures the otherwise common elements of duration dependence. Duration dependence, however, could arise for two very different types of reasons: spurious state dependence (SSD) and true state dependence (TSD). Spurious state dependence arises when unobserved heterogeneity is present in the model and, in such cases, the baseline hazard will not capture the true cycle dependence on duration.

Models that do not control for SSD (unobserved heterogeneity) assume implicitly that all observations that have the same values for their covariates are in fact identical. If this is not the case, the model will be misspecified. Hence to account for the possibility that the two effects are co-present in our preferred model, a multiplicative form of unobserved heterogeneity was introduced into the model. In our tests, a gamma distribution was used to proxy unobserved heterogeneity (a distribution with positive support, a mean of one and finite variance of θ^2).[20] After allowing for this form of unobserved heterogeneity, our re-estimation found that the assumption that those observations with the same

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[19] The appropriate test for the models with time-varying covariates is the test for unobserved heterogeneity. This is discussed below.

[20] In principle, any distribution with a mean equal to one, a finite variance, and positive support can be used.

values for covariates are identical did not fail.[21] Our ability to conclude that multiplicative unobserved heterogeneity is not significant in our model gives us much greater assurance that the estimated baseline hazards captures true versus spurious duration dependence. While this result is also partially due to the flexible specification (non-parametric) of the baseline hazard, the overall finding is important for us to be able to conclude that the shape of the baseline hazard is very close to the shape of the empirical hazard.

4. Conclusion

In this paper we have used duration analysis to shed new light on the time pattern of the federal election cycle in Canada over a long time horizon. In the preferred form of our model, the data generates an estimated hazard function that is consistent with both the hypothesis of election timing and the hypothesis that there exists a political cycle in elements of public policy (particularly in money growth and taxation). In contrast with the Persson and Tabellini (2002) conjecture that parliamentary systems differ from presidential in that difficult fiscal spending retrenchment is postponed until after elections, our analysis uncovers evidence consistent with that practice in Canada. This may help to explain why different analysts using different approaches have found mixed results with respect to the expenditure side of fiscal policy.

Perhaps most interestingly, our findings are largely independent of party affiliation. There is only weak support (in relation to government spending) for the hypothesis that liberal governments consistently spend more in the periods leading into federal elections. Otherwise there appears to be no difference across political parties in Canada (liberal versus conservative) in terms of their strategy for calling an election. Finally, we find strong evidence that governing durations are longer, the larger is the majority held by the winning party. To the extent that the size of the winning majority is a proxy for the lack of competition in the political process, less political competition results not only in "excessive government size" (Ferris, Park and Winer, 2008), but also in longer periods of inefficient government.

[21] More specifically, our estimate of theta = .072 with a standard error of .403. The likelihood-ratio test of $\theta^2 = 0$ is equal to 0.03 with a p-value = 0.42. This implies that we do not reject the hypothesis that $\theta^2 = 0$.

Figure 1

The Empirical Hazard Function for 39 governments

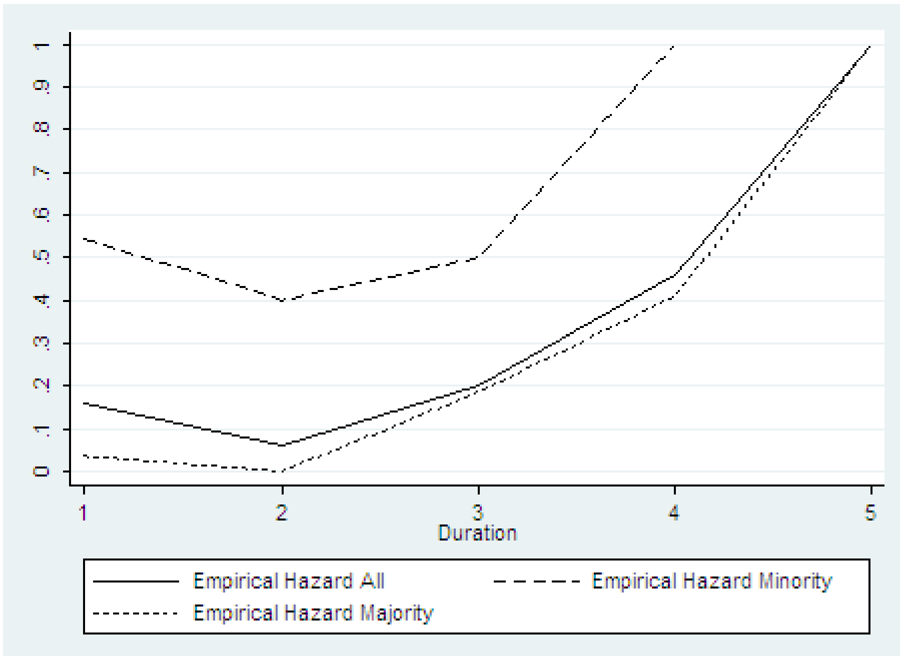

Figure 2

The Estimated Hazard Functions for Model 1 through Model 5

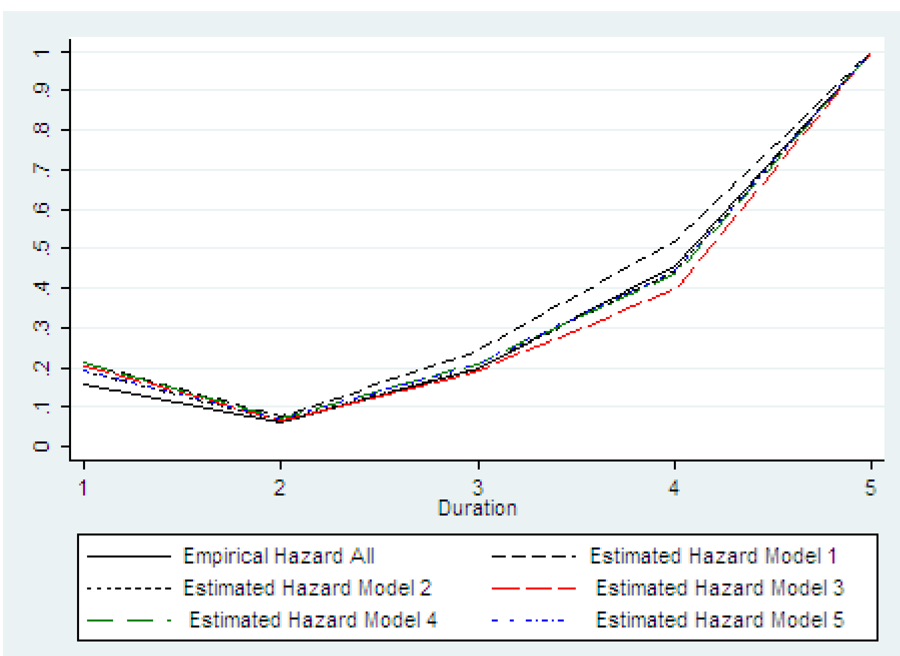

Figure 3
Goodness of Fit Using Cox-Snell Residuals
Model 5

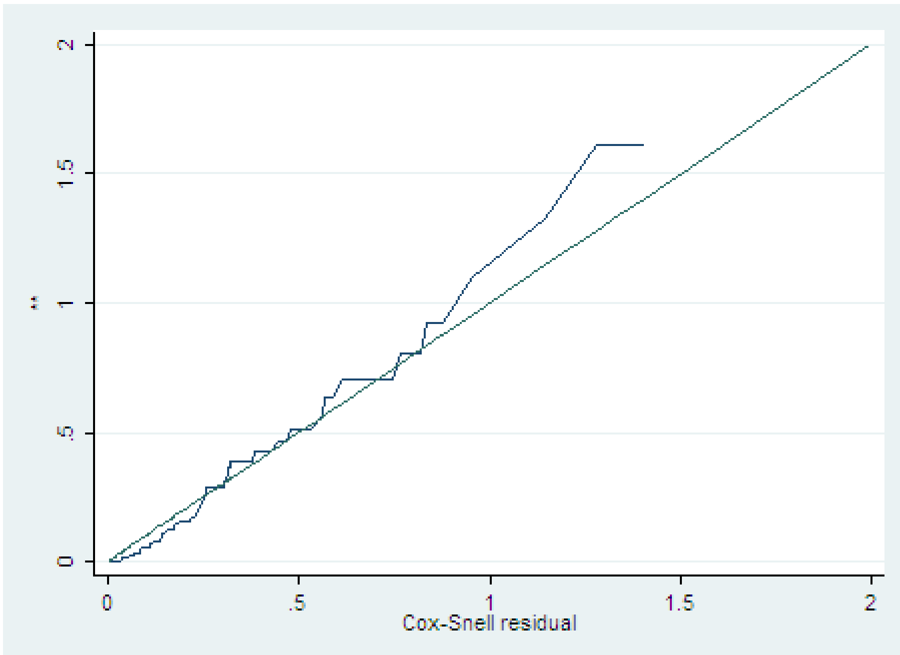

Table 1
Cox Proportional Hazard expβ Estimates
(Robust Huber/White z values in brackets below estimates)

Variable Type	Covariates	Model 1 (1)	Model 2 (2)	Model 3 (3)	Model 4 (4)	Model 5 (5)
Categorical	Majority_seats	0.034*** (-5.04)	0.045*** (-4.69)	0.026*** (-4.86)	0.026*** (-5.01)	0.023*** (-5.08)
Time dependent continuous	Growth Rate		1.035*** (3.81)	1.045*** (3.51)	1.043*** (3.45)	1.042*** (4.11)
	Exponentially weighted (.7) growth rate		0.995*** (-4.29)	0.993*** (-4.67)	0.993*** (-4.94)	0.994*** (-5.48)
	D_LnGsize			0.839 (-0.64)		
	D_LnGsize(+1)					0.607* (-1.83)
	D_LnTaxsize			0.333* (-1.78)	0.230** (-2.37)	
	D_LnTaxsize(-1)					0.305** (-2.49)
	Growth Rate of Money Base			9.18*** (2.76)	5.68** (2.21)	6.07*** (2.77)
Partisan Interactive	Liberal D_LnGsize				1.53 (1.28)	
	Log Likelihood	-165.84	-156.25	-151.30	-150.87	-147.00

***(**)[*] significant at 1 (5) and [10] percent

Appendix A

The construction and estimation of the Baseline Hazard

The baseline hazard itself can be estimated through the following steps. First let α_j denote the conditional probability that a government doesn't fail in $[t_{j,}\ t_{j+1}]$ given that it has survived to time t_j. Then normalizing $\alpha_0$to be 1, the survival rate equals

$$S_0(t_j) = 1 - F(t_j|x_{jt}) = \prod_{i=0}^{j-1} \alpha_i, \tag{A.1}$$

And the conditional probability that a government with covariate values x_{jt} fails in $[t_{j,}\ t_{j+1}]$ given survival to the beginning of the interval is approximately equal to

$$\frac{S_0(t_j)^{e^{x'_{jt}\beta}} - S_0(t_{j+1})^{e^{x'_{jt}\beta}}}{S_0(t_j)^{e^{x'_{jt}\beta}}} = 1 - \alpha_j^{e^{x'_{jt}\beta}}, \tag{A.2}$$

so that the conditional probability that a government with covariate values x_{jt} survives bejond t_j given its survival to the beginning of the interval is

$$\frac{S_0(t_{j+1})^{e^{x'_{jt}\beta}}}{S_0(t_j)^{e^{x'_{jt}\beta}}} = \alpha_j^{e^{x'_{jt}\beta}}. \tag{A.3}$$

With this we can construct the approximate joint likelihood as

$$L_A = \prod_{j=0}^{T} \left[\prod_{i=1}^{N} \left(1 - \alpha_j^{e^{x'_{itj}\hat{\beta}}}\right)^{d_j} \left(\alpha_j^{e^{x'_{itj}\hat{\beta}}}\right)^{1-d_j} \right], \tag{A.4}$$

where d_j is an indicator of failed subjects and is set equal to one if the election cycle fails, zero otherwise. Then maximizing L_A subject to $\alpha_j$we get $\hat{\alpha}_j$as the solution to

$$\sum_{i \,\epsilon\, risk\ set\ at\ t} \frac{e^{x'_{jt}\hat{\beta}}}{1 - \hat{\alpha}_j^{e^{x'_{it}\hat{\beta}}}} = \sum_{i \,\epsilon\, risk\ set\ at\ t} e^{x'_{it}\hat{\beta}}. \tag{A.5}$$

When there are no ties the resulting solution is[22]

$$\hat{\alpha}_j = \left[1 - \frac{e^{x'_{jt}\hat{\beta}}}{\sum_{i \,\epsilon\, risk\ set\ at\ t} e^{x'_{it}\hat{\beta}}}\right]^{e^{-x'_{jt}\hat{\beta}}}. \tag{A.6}$$

We can then estimate the contribution of the baseline hazard, λ_t, by solving $\hat{\lambda}_c(t_j) = 1 - \hat{\alpha}_j$. The final step uses the fact that the previously estimated hazard ratio can be represented as

$$\frac{\hat{\theta}(t_i|x_{it})}{\hat{\lambda}(t_i)} = e^{x'_{it}\hat{\beta}}. \tag{A.7}$$

[22] When there are ties, an iterative procedure is needed. Stata uses the Peto (1972) - Breslow (1974) approximation.

Data Appendix

The data come from several sources: Urquhart (1993) and Leacy et al. (1983) for the economic variables in the earliest time period (1870 through 1921); *Cansim I* and *II*, the statistical databases maintained by Statistics Canada, for these variables in the later time period (1921-2001); Gillespie's (1991) reworking of the Federal public accounts from 1870 to 1990, updated by Winer and Ferris (2008); and then Beck (1968) and the *official web site of Parliament* www.parl.gc.ca for election data. More precise definitions and their sources are given below.

Special data problems:

1. Very little economic data exists for Canada before 1870 but observations are needed to keep our data censored only on the right hand side (for Cox estimation). Hence to derive estimates for first two years of the 1867-1872 1st MacDonald government, we projected from Federal Government data that is available. In particular, we assumed that tax revenues would best capture the variation in real output so that the 1870 federal government revenue to GNP ratio was projected back through 1867 to develop a proxy for GNP. Prices were assumed constant over the period.
2. The 1912-1917 Borden government lasted 6 years (longer than its constitutional limit). Hence to avoid distorting the estimate of the hazard function beyond the constitutional limit of 5 years, the 1912 government was treated as lasting only 5 years and recognized formally as an anomaly by treating it as an uncensored election episode (as was the case for the 2006 Harper government).

1. Economic variables and data sources:

Borden = 1 for 1912 Sir Robert Borden government; 0 otherwise.

D = first difference operator

GNP = gross national product in current dollars. 1870-1926: Urquhart (1993: 24-25) (in millions); 1927-1938: Leacy et al. (1983: 130); 1939–1960 *Canadian Economic Observer* (Table 1.4), CANSIM D11073 = GNP at market prices. 1961-2001 CANSIM I D16466 = CANSIM II V499724 (aggregated from quarterly data). Note GNP data is not available before 1870 so that GNP numbers were calculated by assuming that the tax size of government remained constant between 1867 and 1869. Since data is available on federal government tax revenue, a value for GNP was implied.

GROWTH = LnRGNP – LnRGNP(-1)

GOV = total federal government expenditure net of interest payments.1870-1989: Gillespie (1991: 284-286); 1990-1996: Public Accounts of Canada 1996-97: 1997-2000: Federal Government Public Accounts, Table 3 Budgetary Revenues Department of Finance web site, September 2001. To this we add the return on government investment (**ROI**) originally subtracted by Gillespie for his own purposes.

Expenditure is net of interest paid to the private sector. Data on **ROI**: 1870 to 1915: Public Accounts (1917: 64); 1915-1967: Dominion Government Revenue and Expenditure: Details of Adjustments 1915-1967 Table W-1; 1916-17 to 1966-67: Securing Economic Renewal - The Fiscal Plan, Feb 10, 1988, Table XI; 1987-88 to 1996-97: Public Accounts 1996, Table 2.2. Interest on the Debt (**ID**) was subtracted out (with adjustment for interest paid to the Bank of Canada (**BCI**) ultimately returned to the government). Data on **ID**: 1870-1926: Leacy et al. (1983: Series H19-34): Federal Government budgetary expenditures, classified by function, 1867-1975; 1926-1995: Cansim D11166. 1996-2000: Cansim D18445. Finally, data for **BCI:** copied by hand from the Annual Reports of The Bank of Canada, Statement of Income and Expense, Annually, 1935-2000. Net Income paid to the Receiver General (for the Consolidated Revenue Acct). Note: all government data are converted from fiscal to calendar years, and allows for a change in the definition of the fiscal year in 1906/07, as described in Gillespie (1991: Appendix C).

GSIZE = non-interest federal government, direct public expenditure, calculated as: **GOV/GNP.**

Ln = the log operator.

LnDeficit = lnGsize – LnTaxsize (because the difference, Gsize – Taxsize, is often negative).

MB = Money Base. Metcalfe, Redish and Shearer, New Estimates of the Canadian Money Stock 1871-1967; 1967-2006, Cansim B1646 (annual average of monthly data).

GROWTHMB = LnMB – LnMB(-1)

P = GNP deflator before 1927 and GDP deflator after (1986 = 100). 1870-1926: Urquhart, (1993), 24-25; 1927-1995 (1986=100): Cansim data label D14476; 1996-2006 Cansim D140668. All indexes converted to 1986 = 100 basis. The price level was assumed to be constant for the years 1968 and 1969 (to calculate RGNP).

RGNP = real GNP = GNP/P

TAXSUM = the sum of the fourteen different categories of taxes collected in Canada. The fourteen categories include: 1. Custom Duties - Customs Import Duties (in Public Accounts); 2. ExciseDuties - Excise Duties (in Public Accounts), included in ExciseTaxes after 1990; 3. Sales Tax - Sales Tax (in Public Accounts). GST replaces Sales Tax from 1991; 4. Excise Taxes - Other (in Public Accounts), includes Excise Duties after 1990; 5. Personal Income Tax - Income Tax, Personal (in Public Accounts); 6. Corporate Income Tax - Income Tax, Corporate (in Public Accounts); 7. Non Resident - Non-resident Income Tax (in Public Accounts), included in Other Income Tax Revenues after 1994; 8. Excess Profits - Energy Taxes (in Public Accounts); 9. Estates Taxes - 0 after 1977; 10. Post Office Revenues - 0 after 1983; 11. Misc. Revenues - Other Non Tax Revenues (in Public Accounts); 12. Special Recipient and Other Credits - Refunds of previous year's expenditure, Services and service fees, Privileges, licences and permits, Proceeds from Sales, Bullion and coinage. Excludes premium and discount on exchange. This category listed as Misc.Revenues after 1989; 13. UIC Taxes - Unemployment Insurance Contribution, Government Contribution (in Public Accounts); 14. Old Age Security - 0 after 1977; Sources: 1868-1989: W. Irwin Gillespie, *Tax, Borrow and Spend: Financing Federal Spending in Canada, 1867 - 1990*, Carleton University Press, 1991, pp.284-286; 1996-97, Public Accounts of Canada; 1997-2000: Federal

Government Public Accounts, Table 3 Budgetary Revenues Department of Finance web site, September 2001.

TAXES = **TAXSUM + ROI**;

TAXSIZE = TAXES/GNP

Weighted_growth = GROWTH*exp(.7*year)

2. Political variables and data sources:

The effective dating of each election year was chosen to reflect the first year that each governing party was in power, allowing for a period of about one quarter for the new government to settle in office and begin to alter previously established spending patterns (if it so chooses). If an election was held between January and June 30, the election was assigned to the actual calendar year in which the election occurred. If the election was held between July and December, it was attributed to the following year. There are only two elections in July in the sample period, little is accomplished in the summer, and elections in the fall or early winter do not leave enough time for a new government to alter spending programs before years end - the effective date of these late in the year elections is assigned to the following calendar year.

We note that data concerning SEATS and MINORITY differ from the official parliamentary web site for the period before 1945. We have followed Beck (1968) who makes a sensible decisions about which small parties always supported the government and hence which should be counted as part of it. On this basis:

ELAPSE = the number of years since the last election; DURATION = years in government = 1 + ELAPSE.

ELECTIONYEAR = 1 if an election year; = 0 otherwise.

Year = 1 for the first year in power, 2 for the second year,…5 for the fifth year in power.

LIBERAL = 1 if governing party was the Liberal Party; = 0 if any other (more conservative) party.

MINORITY = 1 if the governing party was part of a minority government; = 0 otherwise.

SEATS = percentage of the seats won (or effectively controlled) by the governing party.

Majority Seats = (1-MINORITY)*SEATS

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