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Do Rival Political Parties Enforce Government Efficiency?
Canada, 1867 - 2021*

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Abstract

This paper investigates the role of inter-party rivalry in enhancing federal government efficiency in post-Confederation Canada. It tests and finds confirmation in the data for two hypotheses. The first is that the ex post size of the first versus second seat share margin is a useful metric of the effectiveness of political parties in policing the incumbent's spending behaviour over its period of tenure. The second is the hypothesis that incumbent party shirking is decreased by greater electoral contestability and contestability is related to the expected number of competing parties nonmonotonically.

1. Introduction

In democratic political systems, the overriding importance of elections for bringing about the convergence of what governments do with what its electorate wants has led the analysis of political competition to focus primarily on what might more accurately be called electoral competition (Winer and Ferris, 2022). That is, the more competitive is an election, the more incentivized are political parties to promise programs that respond to the wishes of voters (Downs, 1957; Dahl, 1971; Alvarez and Nagler, 2004), the more accountable will political parties be for full-filling their program and performance promises (Ferejohn, 1986; Persson et al, 1997; Dash and Ferris, 2021), the higher will be the quality of representatives and decision makers within government (Buchler, 2011), and the more likely that special interest politics will result in policies that benefit, rather than opportunistically disadvantage, the overall electorate (Becker, 1983; Hillman and Ursprung, 2016). To test these hypotheses, different measures of government responsiveness, accountability, size and composition have been related to measures of electoral outcome used to proxy electoral competitiveness ex ante (Rogers and Rogers, 2000; Skilling and Zeckhauser, 2002; Ferris et al, 2008; Besley et al, 2010; Dash et al, 2019; Winer et al 2021).

This paper is concerned not with electoral competition nor the size of government per se but with the economic performance of governments between elections and the role of political parties and electoral contestability in monitoring the degree of shirking that arises in government behaviour and is reflected in excessive spending (Alchian and Demsetz, 1972; Persson and Tabellini, 2000 chp. 4). Here shirking is interpreted broadly as the use of government resources to further personal and party interests that are in addition to those valued by voters. To test these hypotheses we use the ex post closeness of an election as a metric of the extent to which political party rivals in the legislature can monitor the behaviour of the incumbent party effectively and so minimize the ongoing dissipation of governance rents coming through higher levels of spending.[1] While narrower electoral outcomes increase the opportunities to monitor incumbent behaviour, the effectiveness of that monitoring will depend on the degree to which rival criticism is accepted by the electorate, that is, on the degree to which the upcoming election is expected to be contestable. Duverger's view that electoral competition in winner-take-all elections will lead the effective number of parties (ENP) to converge on two also implies an increase in the credibility of a rival party as a feasible alternative to the incumbent (Demsetz, 1968; Dash

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[1] The outcome of an election can be highly uncertain ex ante and hence competitive but result in an ex post outcome that is one-sided because of the realization of unanticipated random determining influences.

et al, 2019)). On the other hand, as the number of viable competitors fall, the remaining few have a greater opportunity to collude at the expense of the electorate. Together these considerations raise the possibility of a nonmonotonic relationship arising between excessive government size and ENP.

The idea that the effect political competition has on economic performance through government policy may be nonmonotonic is not new and has been argued by Acemoglu and Robinson (2006) and tested for (and confirmed) by authors such as Leonida et al (2015) and Alfano and Baraldi (2015). In these cases, the relationship between the number and/or effective number of political parties and economic growth is found to be U shaped; that is, political competition is less effective in its effect on growth when it is either too limited or too intense. In our case a similar relationship is expected to arise between the degree of electoral contestability and government size.

The paper proceeds in section2 by outlining in more detail the hypotheses to be tested on data collected for the 44 post-Confederation federal elections held in Canada between 1867 and 2021. Section 3 describes the variables used to model the fundamentals underlying federal government size, their time series characteristics and then outlines how these measures are used to test the between-election role that political competition plays in minimizing political shirking. Section 4 presents the linear and quadratic regression results of these tests before testing the possibility that contestability may not be monotonically related to government size. To this end the best fitting fractional polynomial is used to model the relationship arising between electoral contestability and excessive government size and presents its resulting shape. A nonparametric robustness test is presented as an appendix. Section 5 summarizes and presents our conclusion.

2.   Hypotheses to be Tested

If government size can be viewed as being excessive, in relation to what measure of size is it excessive? Following Ferris et al (2008), the political system of a long established democracy such as Canada's is viewed as embodying a level of competitiveness sufficient to produce the convergence of government size onto an equilibrium time path reflective of the country's underlying fundamentals (the tastes of its voters, its resources, and underlying technology). Such an equilibrium will incorporate a level of political and administrative shirking that is consistent with voters' expectation of 'typical' government behaviour. However, in any particular governing interval, political and economic shocks along with unexpected changes in a country's fundamentals will result in period specific variations to both the degree of competitiveness and the level of government spending. For example, the timely revelation of political

scandal, the unexpected performance of a new party leader, the unanticipated arrival of a financial crisis or pandemic can all be expected to produce an election outcome and/or government size that differs from what was expected. The hypothesis that is tested below is that these two sets of departures will be related such that ex post closeness, measured as the size of the elected party's seat share winning margin (WinMargin), will be related positively to the size of the discrepancy between actual and expected long run government size. The larger is the winning margin, the smaller will be the opposition's representation on parliamentary committees, the less loud will opposition voices be in question period and the fewer opportunities will there are for opposition parties to present their case to voters. Because the meaning of any winning margin depends upon how easily that margin can be overcome, the history of party seat share volatility (Volatility) is used as a control on the meaning of the winning margin and, perhaps, as its own independent measure of intertemporal competition (Ashworth et al, 2014; Dash and Ferris, 2021). The larger is the volatility of party representation and the smaller is the winning margin, the greater will be the ability of the opposition to monitor the government effectively and hence the smaller the deviation of actual from long run government size is expected to be over the upcoming administration.

The degree to which inter-party criticism of current governing practice and new proposed policies can affect the behaviour of the current government also depends on how credible rival parties are as challengers to the incumbent and hence on the contestability of the upcoming election. That is, a rival party's criticism will be less meaningful to voters if its proposed alternatives are unlikely to be implemented. Because of the winner-take-all nature of plurality elections and the associated unwillingness of voters to waste their vote on an unlikely winner, political competition works to winnow party numbers towards 2 (Duverger, 1954). This implies that the more fragmented is the opposition (the larger is the expected number of political parties, hereafter ENPSeats), the less effective will be inter-party monitoring and the larger will be incumbent shirking and government size. On the other hand, as the number of effective competitors falls towards 2 and below, the smaller number of remaining competitors enables dominant parties to collude, facilitating greater partisan spending in areas that are less visible to voters.[2] This will be reflected in the mutual acceptance of certain institutionalized perks that can be enjoyed to a greater extent when in office. That is, as ENPSeats continues to fall, the less intensely will the dominant parties choose to police incumbent shirking.

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[2] As Adam Smith writes "[p]eople of the same trade seldom meet together, even for merriment or diversion, but the conversation ends in a conspiracy against the public…" (*The Wealth of Nations*, Vol 1 Book 1 Chp 10 Part 2)

Combining these reasons, the relationship between (excessive) government size and ENPSeats is expected to be nonmonotonic, initially falling as ENPSeats approaches two from below before rising again as ENPSeats increases somewhere above 2.

3. The Data and its Characteristics

The data used in this paper is collected for the years associated with the 44 federal government elections taking place in Canada between 1867 and 2021. The dependent variable, the size of the Canadian federal government, is measured as the proportion of federal government expenditure in gross domestic product (GovSize). To model its long run size, variables are required that proxy its underlying economic, sectoral, demographic, and political fundamentals and span the entire post-Confederation time period.[3] Reliable variables that meet these criteria and are comprehensive enough to be meaningful are limited. In our analysis, the evolving scale and sectoral composition of the Canadian economy are represented by the time paths of real GDP per capita (Rgdppc) and the proportion of the labour force in agriculture (Agric).[4] The significant changes that have arisen in political participation over this period are taken to be reflected in the time path of Canada's voting franchise, the proportion of the population registered to vote (Registered).[5] The variable used to represent the demands on government arising through demographic change is the proportion of the population seventy and older (Old70) and, because Canada has experienced several significant waves of immigration, we use the proportion of immigrants in the population (Imratio). To overcome the issues created by proportions being bounded between 0 and 1, we used their logarithm (represented by the prefix Ln). Finally, three election periods featured exogenous events that produced anomalous changes in federal government spending: the extraordinary expenditures associated with the two World Wars (WW1, WW2) as reflected in the 1917 and 1945 election years and the large spending response to covid-19 in the 2021 election (Pandemic). Dummy variables for these election years were used to keep the response to these events from distorting the underlying relationships.

-- insert Table 1 and Figure 1 about here --

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[3] Variables such as the unemployment rate, for example, are available only from the 1920s.
[4] The use of real GDP is suggested by Wagner's Law together with increasing complexity (as implied by the decline in the importance of agriculture). The implied sign of Rgdppc is complicated, however, by the expected presence of economies of scale in federal spending associated with larger population size.
[5] Canada's voting franchise has risen 11 to 78 percent over the post-Confederation time period, with its biggest jump arising between the 13th federal election in 1917 and the 14th federal election in 1921 when women first used the right to vote.

The descriptive statistics of these variables are presented in Table 1 and graphs showing the variation in GovSize, ENPSeats and WinMargin across Canada's 44 federal elections follow in the two graphs of Figure 1.[6] In the tests that follow the most important of the data series characteristics is the Adjusted Dickey Fuller statistic (ADF), used to indicate the time series property of each variable. Note that all of the variables used to represent government size and its fundamentals are nonstationary or integrated of order one, I(1).[7] This means that their variation across elections cannot be considered to be random drawings from a stationary distribution so that inferences from classical statistical theory cannot be applied. Because federal government size and its proposed determinants vary stochastically, a linear regression of these variables cannot generate a meaningful long run model of federal government size unless that combination of variables is cointegrated. That is, in the special case when the residuals of the OLS regression are stationary, that combination of I(1) variables is found to move together providing evidence of the existence of a long run equilibrium relationship among these variables over time. While the coefficients of the individual covariates cannot be interpreted as implying causality, the set of relationships is itself stationary through time and hence evidence of a long run equilibrium relationship.

Finding the existence of cointegration among the variables used to represent government size and its long run fundamentals is important for our analysis because the political variables used to represent different dimensions of political competition—WinMargin, Volatility and ENPSeats-- are all stationary and cannot otherwise be related meaningfully to nonstationary variables like government size.[8] With cointegration, however, the competition variables can be related to the cointegrated set to produce a meaningful test of whether or not political competition has significantly increased the explanatory power of the cointegrated relationship. Conformity of the sign and significance of the three variables chosen to proxy the monitoring ability of party rivals on government size then provides evidence on whether the data are consistent with the hypotheses relating inter party competition and government efficiency.

With this background, our test of the effectiveness of between-election party monitoring consists of three incremental regression models of government size whose results are presented as columns (1) through (3) of Table 2. The first model tests for the existence of cointegration among the set of I(1) variables: federal government size and its fundamental determinants. The second model adds the three

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[6] The data used is available online at Carleton University's Dataverse site. See Ferris (2022).
[7] The order of integration refers to the number of times that variables need to be differenced before becoming stationary.
[8] This is often called the issue of balance. See Pickup and Kellstedt (2022).

stationary measures of political competition linearly while the third model tests for the presence of a U shaped nonlinearity in the role of contestability by entering ENPSeats quadratically.

Model (3), that nests the other models as truncated cases, can be written as

$$LnGovSize_t = \alpha_0 + \alpha_1 Rgdppc_t + \alpha_2 LnAgric_t + \alpha_3 LnOld70_t + \alpha_4 LnRegistered_t + \alpha_5 LnImratio_t$$

$$+\alpha_6 WinMargin_{t-1} + \alpha_7 Volatility_t + \alpha_8 EnpSeats_t + \alpha_9 ENPSeats_t^2, \quad t = 1 \dots 44. \qquad (1)$$

Note that WinMargin is lagged one election period relative to current government size to capture ex post closeness while the role of contestability is incorporated by using ENPSeats contemporaneously. The hypotheses outlined in section 2 imply that between-election monitoring reduces the variation of actual about long run government size and generates the predicted coefficient signs: $\alpha_6 > 0$, $\alpha_7 < 0$ and then $\alpha_8 < 0$ and $\alpha_9 > 0$. All tests but the first also include the dummy variables WW1, WW2 and Pandemic.

4. Results

Column (1) of Table 2 presents a linear regression model of Canadian federal government size determined solely by its significant fundamentals.[9] The regression equation as a whole works well with the fundamentals explaining approximately three quarters of the variation in government size over time and with the ADF statistic indicating that the equation's residuals are stationary. Hence the data imply that the five covariates in model (1) are cointegrated, providing evidence of a long run equilibrium relationship arising among these covariates.

-- insert Table 2 about here --

Viewed as a determinant of government size, the expected sign of Rgdppc is ambiguous. Wagner's Law (1893), the hypothesis that public expenditure will expand with income growth and societal complexity, suggests that the relationship should be positive while the hypothesis that population scale economies exist in the provision of public goods suggests that it could be negative. While its sign is indeterminant a priori, all models in Table 2 find significant negative coefficients suggesting that over this time period, the scale effect of rising population on the publicness of public expenditure in Canada has overcome the

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[9] The median voter theorem suggests that an expansion of the franchise should increase the demand for government services such that α_4 should be found to be positive. However, in Canada's case the effect of the expanding franchise, LnRegistered, on government size is found to be insignificant in all forms of our tests and so is not included in the presented form of the test.

income effect. As is true of most developed economies, the relative decline in the employment size of agriculture reflects the growth of in size and complexity of Canada's industrial and service sectors. Consistent with Wagner's Law, then, the coefficient estimate on LnAgric is found to be consistently negative and significantly different from zero. The gradual aging of Canada's population is expected to increase the demand for government services and its coefficient estimate is found to be positive, $a_3 > 0$ and significantly different from zero at the 5 percent level. Finally, there is no prior expectation for the effect of immigration flows on government size. In our tests, this effect is found to be consistently negative.[10]

Our tests of the explanatory power of political competition between elections are presented as the models in Columns (2) and (3). Column (2) introduces the three measures—WinMargin, Volatility and ENPSeats linearly. Doing so can be seen to increase the explanatory power of the regression (the adjusted R^2 rises from .730 to .923) indicating a reduction in the unexplained deviation of government size from its expected level and the Akaike information criteria (AIC) falls indicating that the enhanced model provides a better overall fit with the data. Of the control variables, while all retain their expected sign and the coefficient estimates of two fundamentals (Rgdppc and LnAgric) increase in both absolute size and significance, LnOld70 and LnImratio lose significance. In terms of the political competition hypotheses, ex post competitiveness (as proxied by Lagged_WinMargin) is found to have had a significant positive effect as expected, indicating that the larger is the size of a party's electoral victory, the larger is government size in the next election. On the other hand, while Volatility's presence is necessary for an appropriate interpretation of the winning margin, its coefficient estimate is itself insignificantly different from zero. Finally, the average effect of ENPSeats on government size is found to be significantly negative. That is, for the period as a whole and at covariate means, greater party fragmentation, as represented by a higher value of ENPSeats, is associated with a smaller sized federal government.

Although the linear representation of the effect of ENPSeats on GovSize is negative, that outcome can be consistent with nonmonotonicity in its form across its domain. In the model presented in column (3), ENPSeats is introduced quadratically to test the hypothesis that a U shaped relationship will arise between electoral contestability on government size. The results presented there are consistent with this form and with the quadratic form dominating the linear representation in model 2. First, the

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[10] There is some evidence that immigration into Canada has had other conservative effects on Canada's political structure. See Ferris and Voia (2020).

significant sign ordering of the ENPSeat coefficients--ENPSeats (negative) and ENPSeat_squared (positive)--indicates the presence of a U shaped relationship that falls to a minimum at an ENPSeats value of 2.7 before rising again.[11] Second, the equation's summary statistics indicate that this representation of the contestability hypothesis increases the explanatory power of the model relative to model 2--the adjR^2 rises from .923 in model 2 to .936 in model 3--and provides a better overall fit with the data—the AIC falling from -24.58 to -31.83. Our test for the hypothesized U shaped effect of electoral contestability through ENPSeats is then significant not only in its own right (at a 1 percent significance level) but also in further reducing the divergence of actual and predicted government size.[12] A Wald test of the contribution of the four competitive variables to an explanation of federal government size confirms that their addition to the model does add significant explanatory power (F(4,31) = 7.53 with prob = .0002).

-- insert Table 3 about here --

While the quadratic form found in Table 2 is consistent with the hypothesized U-shaped effect of ENPSeats on government size, the assumption that the nonlinear relationship is quadratic imposes a parametric shape that is symmetric about its minimum point. The quadratic form then restricts the ability of the model from capturing the actual shape if the underlying relationship is not symmetric. To allow greater flexibility in the shapes of the relationships that can be estimated, we use Stata's fractional polynomial (fp) regression package that tests among 44 possible representations of a second-degree fractional polynomial and selects the best fit for ENPSeats. The results of this test are presented in Table 3 and the shape of the best fitting ENPSeats relationship is shown in Figure 2. In Table 3 the successive rows indicate that a search for the best fitting form rejects equations that: omit ENPSeats entirely, include it either linearly or quadratically relative to a second-degree polynomial whose best fitting shape can be plotted from the equation (presented immediately below the table). As Figure 2 illustrates, the optimal fractional polynomial has the hypothesized U shaped relationship between contestability (as proxied by ENPSeats) and government size and can be seen to be asymmetric. GovSize falls more slowly as ENPSeats rises beyond 2 to approach its minimum point (at about 2.7) than it rises as ENPSeats increases beyond the minimum. Expressed in terms of the hypothesized effect of contestability on

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[11] Note that because Canada did not experience an ENPSeats value above 3.22, the upper truncation of the U shaped relationship would result a linear representation to be negative. See, for example, how a linearization of the plotted relationships in Figure 2 and the Appendix would be sloped.

[12] This result is also independent of the partisan affiliation of the party in power. That is, the addition of a Liberal (versus Conservative) partisan dummy variable adds no explanatory power to the model nor is itself significant.

incumbent shirking and excessive government size, the empirics suggest that contestability is lowest when the opportunity for collusion is highest and rises as the effective number of rivals increase. The rise in contestability from greater competition does peak, however, with further increases in ENPSeats reflecting the rapid loss in contestability as party structure continues to fragment. The results also imply that contestability is at its highest at a level of ENPSeats somewhat larger than Duverger's 2 (i.e., 2.7). As the effective number of parties continues to rise party fragmentation rapidly reduces the credibility of rival party challengers and through this their ability to effectively police incumbent shirking.

In the Appendix to the paper we present, as a robustness test, a nonparametric representation of the relationship between GovSize and ENPSeats. As that figure shows, the nonparametric kernel representation indicates the same type of asymmetric U-shaped relationship as that in Figure 2.

5. Conclusion

This paper has presented a test of two interrelated hypotheses relating political party competition in the between election period to government efficiency. The first is that in a plurality parliamentary system like Canada's, the larger is the size of the governing party's seat majority in the legislature (controlling for the volatility of party representation) the less effectively can rival parties police shirking by the governing party and hence the larger will be government size. The second hypothesis is that for rival party monitoring to be effective, rival parties must be seen to be credible alternatives to the incumbent implying that the upcoming election must be contestable. Using the effective number of seats as a measure of party fragmentation, Duverger's Law argues that the winner-take-all nature of plurality electoral systems leads competition to drive effective party representation towards 2. When ENPSeats is at 2, the one effective rival has maximum credibility as a rival. On the other hand, as ENPSeats falls towards 2, collusion among the small number of contending parties can be expected to arise at the cost of the electorate, loosening the incentive of rivals to actively police each other's spending behaviour when in government. Controlling for the fundamentals determining long run government size, the combination of these effects is hypothesized to produce a nonmonotonic U shaped relationship between ENPSeats and government size.

These hypotheses were tested against data arising from the 44 federal election periods held in Canada between 1867 and 2021. The results are consistent with ex-post closeness as represented inversely by the lagged value of the first place winning margin being a significant indicator of the effectiveness of rival party monitoring of excessive government spending. The data are also consistent with the electoral

contestability implying a U shaped relationship between ENPSeats and excessive government size. Using the greater parametric flexibility of a fractional polynomial model, the U shaped relationship was found to be asymmetric about a minimum at ENPSeats = 2.7, somewhat larger than Duverger's 2. This shape is consistent with the loss in monitoring effectiveness through the growth of dominant party collusion as ENPSeats falls below the minimum being less powerful than the loss involved with falling contestability as the structure of political party opposition becomes increasingly fragmented above the minimum.

Table 1
Descriptive Statistics by Canadian Federal Election (1867 – 2021)
(44 Observations)

Variable name	Definition	Mean	Standard Deviation	Minimum	Maximum	Adjusted Dickey Fuller Statistic 1% critical (-3.63)
LnGovSize	Ln(Federal government expenditure/GDP)	-2.31	.604	-3.354	-.931	I(0) -2.246 I(1) -8.867***
Rgdppc	Real GDP per capita (1000's)	11.606	9.36	1.705	29.170	I(0) 2.06 I(1) -5.92***
LnAgric	Ln(Proportion of the Labour Force in Agriculture)	-2.103	1.311	-4.20	-.545	I(0) 1.079 I(1) -5.93***
LnOld70	Ln(Percentage of the population 70 or over)	1.522	.512	.683	2.54	I(0) 1.18 I(1) -3.77***
LnRegistered	Ln(Proportion of population registered to vote)	-.795	.580	-2.19	-.250	I(0) -2.57 I(1) -8.26***
LnImratio	Ln(Immigration as a proportion of population)	.01	.01	.001	.051	I(0) -3.34** I(1) -6.54***
Win_margin	difference in seat proportions won by the first versus second place finisher	.241	.160	.008	.606	I(0) -5.87***
Volatility (43 obs.)	Sum of changes in party vote shares across adjacent elections divided by 2	.179	.143	.002	.681	I(0) -6.25***
ENP_Seats	1 divided by the sum of party seat shares squared	2.36	.435	1.545	3.22	I(0) -4.90***

**(***) significant at 5% (1%)

Canadian Federal Government Size by Election:
1867 - 2021

ENPSeats and Win_Margin by Election:
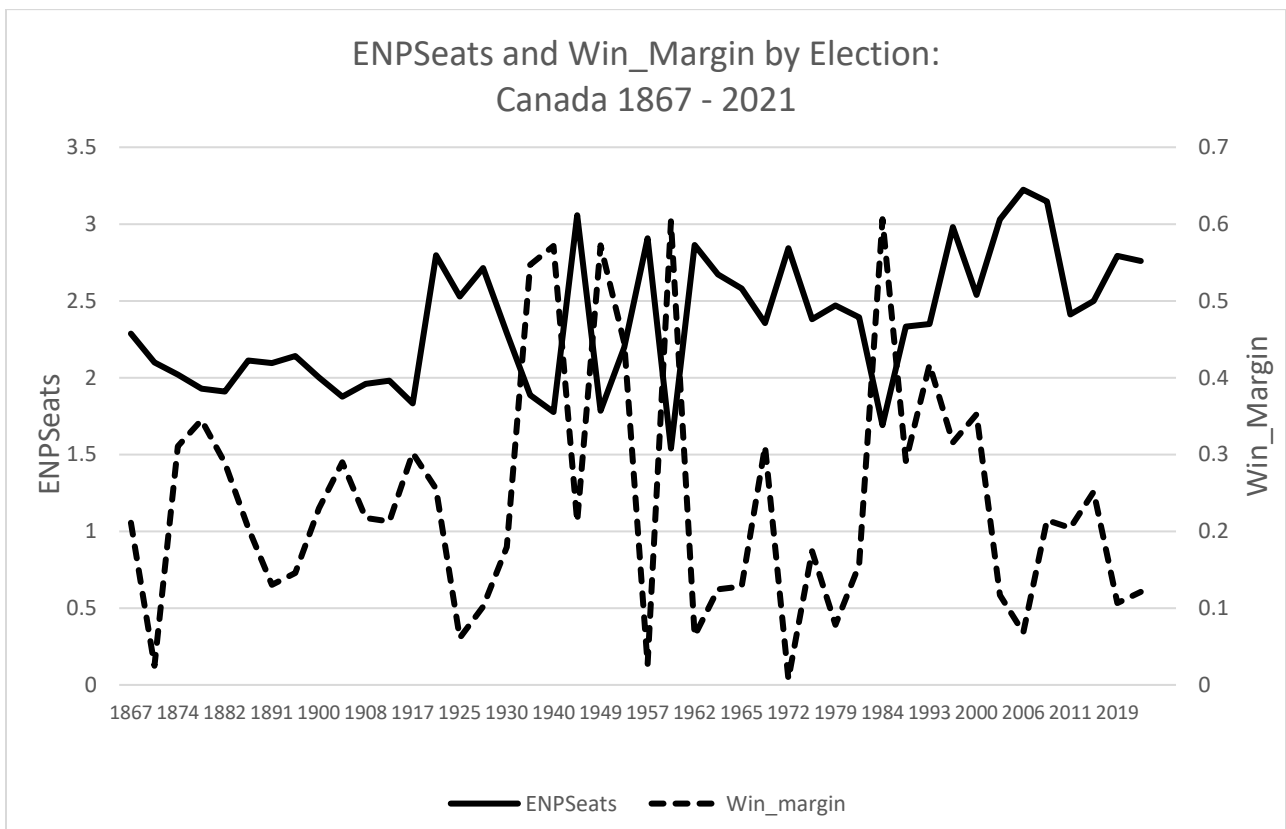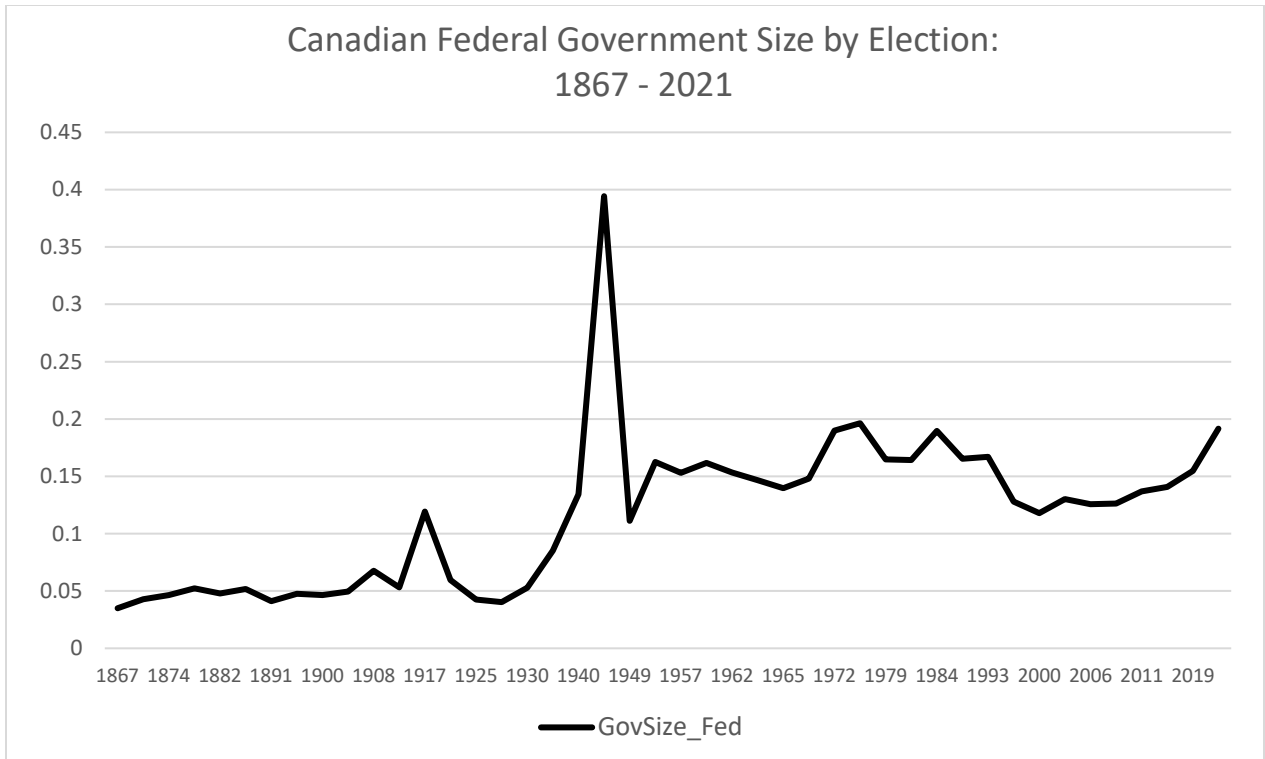Canada 1867 - 2021

Table 2

OLS Regressions of Canadian Federal Government Size: 1867 – 2021

(Absolute value of t-statistics in brackets)

	LnGovSize Model (1)	LnGovSize Model (2)	LnGovSize Model (4)
Rgdppc (in thousands)	-0.144*** (4.64)	-0.157*** (9.13)	-.160*** (10.18)
LnAgric	-0.876*** (4.02)	-1.249*** (10.06)	-1.340*** (11.08)
LnOld70	1.168** (2.59)	.634 (1.28)	.416 (1.52)
LnImratio	-0.179** (2.62)	-0.062 (1.59)	-0.061* (1.69)
Lagged_WinMargin		.579*** (3.32)	.638*** (3.97)
Volatility		-0.026 (0.14)	-0.024 (0.14)
ENPSeats		-0.242*** (3.16)	-2.00*** (3.09)
ENPSeats_squared			.368*** (2.73)
WW1		.697*** (3.98)	.636*** (3.94)
WW2		1.645*** (8.32)	1.569*** (8.60)
Pandemic		0.353* (1.86)	.454** (2.56)
Constant	-5.130*** (12.52)	-4.00*** (13.22)	-1.816** (2.15)
Equation Statistics: Elections covered AdjR^2 AIC ADF of residuals	44 .730 27.53 -4.51^S	43 .923 -24.58 -4.94	43 .936 -31.83 -5.41

* (**) [***] signifies significance at 10% (5%) and [1%].

^{S} Significant at 5% using MacKinnon (2010) Critical Values for unit root test with no constant and five covariates.

## Table 3
Fractional Polynomial Comparisons

ENPSeats	Test degrees of freedom	Deviance	Residual Standard Deviation	Deviance Difference	P > F F(df, 30)	Powers
Omitted	4	-34.87	0.184	22.76	0.002	
Linear	3	-46.58	0.163	11.05	0.039	1
m=1	2	-51.58	0.154	6.05	0.105	-2
m=2	0	-57.63	0.146	0.000	--	3 3

Best fitting equation (absolute value of t statistics)

$$LnGovSize = \frac{-3.63^{***}}{(12.29)} - \frac{.166^{***}}{(10.34)}Rgdppc - \frac{1.382^{***}}{(11.72)}LnAgric + \frac{.436^{*}}{(1.87)}LnOld70 - \frac{.059}{(1.46)}LnImratio$$

$$+ \frac{.641^{***}}{(3.32)}Lag\_WinMargin + \frac{.003}{(0.16)}Volatility - \frac{.190^{***}}{(4.24)}ENPSeats_{-1} + \frac{.143^{***}}{(3.97)}ENPSeats_{-2}$$

$$+ \frac{.693^{***}}{(9.31)}WW1 + \frac{1.549^{***}}{(11.37)}WW2 + \frac{450^{***}}{(5.73)}Pandemic$$

Figure 2
Component plot of best fitting fractional polynomial with 95% confidence interval
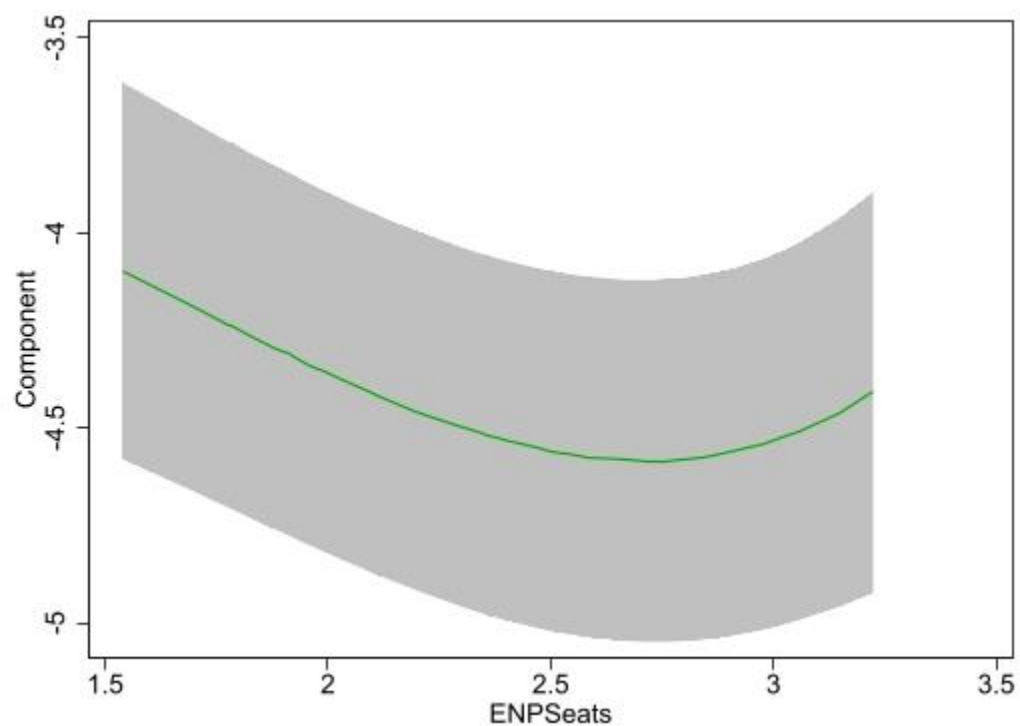
Appendix: A Nonparametric Robustness Analysis

In this appendix we present a robustness check of our different parametric specifications by allowing the data to provide the information on the relationship arising between the log of government size ($LnGovSize$) and the expected number of political parties ($ENPSeats$). To do so, we use nonparametric spline-based methods as found in Li and Ullah (2003), Li and Racine (2004, 2007), and Ma and Racine (2013) and assume that the conditional mean of $LnGovSize$ depends on $ENPSeats$ and the controls adopted earlier and follows a non-linear, unknown function approximated by the best-fit B-splines that allows for heteroskedasticity of an unknown form. That is, we assume

$$LnGovSize_t = f(ENPSeats_t, Controls_t) + \sigma(ENPSeats_t, Controls_t)\omega_t \qquad (2)$$

where σ and ω_t are unknown. Readers interested in a more technical description of the method used and the generation of the graphical representations of the fitted function and the partial effects associated with each covariate are referred to Ferris and Voia (2015, Appendix C). The results of using these nonparametric methods are shown in Figure 3 where the solid line shows the predictive margins of the conditional mean function $LnGovSize_t = f(ENPSeats_t)$. The graphical representation confirms the U-shaped relationship between the government size and the expected number of political parties in Canada and its asymmetry, pointing out to a minimum value at 2.8. This number is also confirmed by the marginal effects of ENPSeats on LnGovSize (conditional on the means of the other covariates) presented numerically in Table 4, for different values of ENPSeats beginning at 1.8 and increasing by increments of .2 to a maximum of 3.2. Table indicates that the marginal effect reaches its minimum at a value of 2.8.

ENPSeat values	Marginal Effects
1.8	-2.17468
2.0	-2.237301
2.2	-2.27677
2.4	-2.302672
2.6	-2.317321
2.8	-2.318914
3.0	-2.298536
3.2	-2.249607

Figure 3

Predictive Margins with 95% CIs
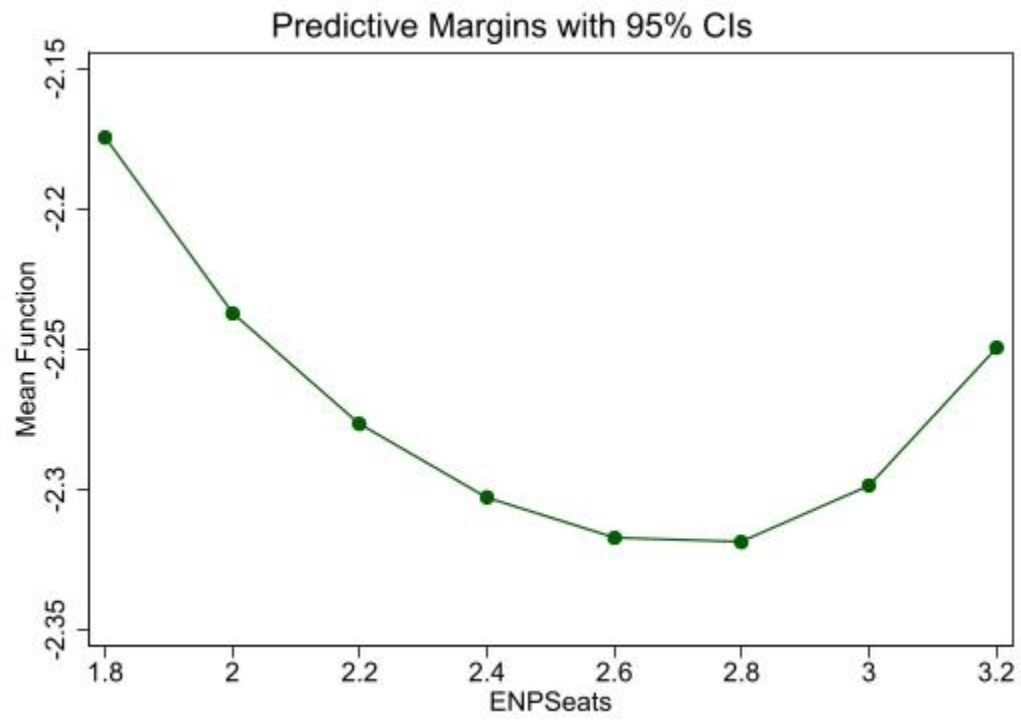
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