Appendices

1. Are the series stationary?

For a series to be stationary, it must satisfy the "stability" condition and it must exhibit no trending, periodicity or structural breaks.

For a series to be stable there must be a value on which it converges, in the absence of further shocks. The key is the value of δ, the auto regressive component. If $|\delta| < 1$, the system converges. If $|\delta| > 1$, the system explodes, and the "equilibrium" is $\pm \infty$, which in this paper is to say that Liberals either cover the entire landscape or simply disappear. If $|\delta| = 1$, then no equilibrium is identifiable; the system has a unit root and the trajectory is a random walk.

The fact that each series in Table 2 has an autoregressive term less than one suggests that both are stable. The difficulty is that the conventional t test in this context underestimates the variance in the estimate, such that the system may seem convergent when it is not. To remedy this, I resort to Augmented Dickey-Fuller tests. As the boundary for convergence is a δ with the absolute value of one, the null hypothesis for the test is that the system has a unit root. To make the null a coefficient with a value of zero, the test is performed on the coefficient for the shift from t -1 to t, rather than for the level at t. By definition, the lag term for the setup in changes is 1 - δ. Results of the test for each series are in Table A1.

[TABLE A1 ABOUT HERE]

For the rest of Canada, the picture is clear: the chance that the series is a random walk is vanishingly small. This is true for both the full series and the truncated one. For Quebec, however, we cannot definitively reject the hypothesis that the series is a random walk. The conventional t-test would suggest that the full series is *not* a random walk. The augmented values suggest that the chance of this is actually between 5% and 10%. The MacKinnon combined estimate suggests that the series just misses the conventional threshold for rejection of the null. Nonetheless, I believe I can proceed, as the other indicators for stationarity send rather clearer signals. For the truncated Quebec series, the possibility seems real that the system is not stable, and estimates need to be treated with caution.

On the matter of trend, the plots in Figures 1 and 2 suggest the following:

- The Quebec series exhibits a positive trend to 1917, the conscription election, and a negative trend thereafter. Overall, a negative trend is discernible but barely so: a slope of Liberal share on consecutive observations of -0.24 but with a standard error, 0.19, almost as large as the slope. Awkwardly, the slope is steeper in the later years than in the earlier ones.
- For the rest of Canada, the Liberal party colonized the landscape about a decade ahead of that in Quebec, and its share then rode a negative trend from virtually the start of the 20th century. Its downward drift is steadier than in Quebec, but is also shallower: a slope of

-0.16 and a standard error of 0.09. Fortunately, the slope is especially shallow after World War Two.

Visually, short-term departures from trend are at least as prominent as the long-term patterns.

For neither series is there any suggestion of cyclicity. Parties win elections, often in sequence, and then lose them, again often in sequence. But there is no suggestion of some underlying wave.

Finally, there is the matter of structural breaks. In Table A2 I present "supremum" Wald tests for the Liberal leader variable and for the lagged dependent variable in each series. Although this is a weaker test than some alternatives, it represents the most comprehensive set of tests (Perron 2006). And none of the other tests suggests a fundamentally different result.

[TABLE A2 ABOUT HERE]

In three of the four situations, there is clearly no break in the series. The possible exception is for the lagged dependent variable in the Quebec series. A plot of test values does not suggest a significant break in 1917, where we might expect it to occur, but rather between 1972 and 1974. The attendant circumstance of this period do not obviously suggest an interpretation and a test for the equivalence of the LDV coefficient between the pre-1974 and post-1972 series does not indicate a significant difference. Substantively the value is 0.60 for the earlier estimation and 0.68 for the later one. Given the fact pattern, I have opted to use the full series. The supremum test is not calculable for the 1949-2015 series.

2. Can we estimate coefficients with OLS?

One issue is whether serially correlated disturbances further bias our estimates of standard errors. This happens when residuals exhibit runs of consistently positive and negative values. Another issue is whether disturbances exhibit autoregressive conditional heteroscedasticity, that is, that their size (as distinct from their direction) varies systematically with time. Table A3 presents evidence from various tests. Although my use of the Koyck-lag scheme is motivated by theoretical considerations, the lag term can also soak up serial correlation in the disturbances. For this purpose, however, does the parsimonious setup with one lag suffice? For Quebec, it clearly does. By Durbin's "alternative test," the null hypotheses of no AR(1) correlation cannot be rejected. Similarly, by the Breusch-Godfrey test, higher-order correlations are also rejected. For the rest of Canada, however, things are more complicated. By both tests, the single-lag setup appears to harbour serially correlated disturbances. Adding a second lag in the dependent variable seems to take care of the problem. The other worry, about heteroscedasticity, does not seem warranted. By the ARCHLM test, the null hypothesis of homoscedasticity is never rejected.

[TABLE A3 ABOUT HERE]

The corresponding values for the 22-observation 1949-2015 series appear in Table A4. These are associated with the estimations in Tables 3 and 4. Hetereoscedasticity remains unproblematic for all estimations. Serial correlation is not a problem for the baseline estimation in Quebec but clearly is an issue for the estimation that also includes unemployment. For the rest of Canada,

roughly the opposite is true. Durbin's alternative measure signals first-order autocorrelation but gives reassurance for higher orders. Once unemployment is added, however, autocorrelation is washed out of the system.

[TABLE A4 ABOUT HERE]

3. Influential Observations

Are any single observations worrisomely influential? For example, one alternation that produces an exceptionally big shift will drag up the average. A basic test for the influence of individual observations is *dfbeta*, which shows how much and in what direction an excluded observation would pull the overall estimated effect, expressed in units of the estimated standard error of the coefficient. The conventional threshold for concern is an absolute dfbeta $> 2/\sqrt{N} = 0.309$. The leader variable of special interest is the Liberal one.

By this criterion, three elections might be worrisomely influential for Quebec. Two are the last elections for Laurier. In 1911, the party received its worst share since 1887 and in 1917, its best ever. These are partly offsetting, although the absolute value for 1917 is roughly twice that for 1911. The other observation of note is for 2011. Here the combination is the absence of a Quebec leader and the party's all time worst result.

[TABLE A5 ABOUT HERE]

Three observations stand out for the rest of Canada. The 1940 and 2008 elections pull the estimated effect down. In 1940, the conjunction is of a non-Quebec leader and an exceptionally strong result; this is the snap election called to give the incumbent Liberals a mandate for fighting World War Two without conscription for overseas service. The 2008 election conjoined a Quebec leader with the party's worst result to date since 1867, worse even than 1917. Pulling the coefficient in the other direction is 2015, with a Quebec-based leader and a strong result following the 2011 low point. On balance, the outliers slightly weaken the rest-of-Canada result.

4. Equivalence of 1949-2015 Baseline Estimations to 1867-2015 Values

Tests of the equivalence of baseline coefficients to those in the original estimations appear in Table 1. Without exception, the coefficients are statistically indistinguishable between the full-period and the truncated estimations. This is true for both Quebec and the rest of Canada.

[TABLE A6 ABOUT HERE]

5. Alternative Dynamic Specifications

It is possible that the history in the system is better represented by lagging an independent variable rather than the dependent one. Although I see no particular theoretical warrant for any such move, the most plausible candidate is the Liberal leader variable.

For Quebec, no setup suggests that lagging the term makes sense. In a setup in which both the leader variable and the dependent variable are lagged, impact from the LDV remains essentially undisturbed while estimated impact from the contemporaneous term of the IV is compromised.

Lagging only the IV does not help matters. Where the lagged IV is entered along with the contemporaneous indicator, the former steals just enough impact from the latter to push it below the conventional significance threshold even as the lag coefficient is only half the size of its standard error. If only the lagged term is entered, it captures some of the effect but only as a pale shadow, not much larger than its standard error. Both setups that omit the LDV have massively serially correlated errors, in contrast to the case with the LDV included. For Quebec, the case is clear: the system is autoregressive in the dependent variable.

The same is true for the rest of Canada, but the story is more complicated. As I mention in the main text and in Appendix section 2, above, an LDV setup with one lag does not suffice for the rest of Canada. The starting point for comparing lags in the leader variable, then, is with the two-lag LDV setup. Adding a lag term for the Liberal leader variable leaves most of the architecture intact. The one-period lag on the vote is essentially as before. The two-period lag is eliminated, in effect, and it impact apparently absorbed by the leader terms. This setup leaves the error pattern undisturbed. The lagged leader effect is about the same size as the instantaneous one but

with the opposite sign; the implication is that choosing a Quebec leader sets in train an oscillating effect in the rest of Canada.

If we then drop the lag terms for the dependent variable, the oscillating structure in the leader terms remains as before. Statistics on the disturbances do not send warning signals, although each moves closer to the 0.05 threshold.

If we drop the contemporaneous leader term, impact from the lag term remains negative but is appropriately smaller. The autocorrelation statistics all go into the danger zone: disturbances appear to be correlated at multiple lags and are conditionally heteroscedastic.

What, if anything, should we make of the oscillating indication? In Figure 2, there *is* a suggestion of oscillation. The pattern is not confined to periods with Liberal leaders, although it may have regularized after 1960. In these years, Liberal leaders were Quebeckers more often than not. No mechanism comes to mind, apart from ordinary politics. And all these additional moves seem to be slicing the data more and more thinly. The relatively parsimonious model that was the starting point also seems to be the best place to stay.

Reference

Perron, Pierre. 2006. Dealing with Structural Breaks,"in *Palgrave Handbook of Econometrics, Vol. 1: Econometric Theory*, K. Patterson and T.C. Mills, eds., Basingstoke UK: Palgrave Macmillan, 278-352

Table A1. The stability condition

	Test statistic	Interpolated Dickey-Fuller Critical Value			MacKinnon p-value for Z(t)
		1%	5%	10%	
Quebec, 1867-2015					
Z(t)	-2.74	-3.64	-2.96	-2.61	0.07
Quebec, 1949-2015					
Z(t)	-1.88	-3.75	-3.00	-2.63	0.35
Rest of Canada, 1867-2015					
Z(t)	-4.38	-3.64	-2.96	-2.61	0.0003
Rest of Canada, 1949-2015					
Z(t)	-3.29	-3.75	-3.00	-2.63	0.02

Table A2. Structural Breaks

Series	Variable	Statistic	p-value
Quebec	LDV	11.01	0.02
	Liberal leader	3.80	0.41
Rest of Canada	LDV	3.83	0.40
	Liberal leader	3.26	0.50

Table A3. Characteristics of disturbances, 1867-2015

DV lags	Test	χ^2	$Pr > \chi^2$
	Quebec		
	Durbin	0.23	0.63
1	Breusch-Godfrey	0.27	0.60
	ARCHLM	0.39	0.53
	Rest of Canada		
	Durbin	4.83	0.03
1	Breusch-Godfrey	4.96	0.03
	ARCHLM	0.11	0.74
	Durbin	0.91	0.34
2	Breusch-Godfrey	1.07	0.30
	ARCHLM	0.07	0.80

Table A4. Characteristics of disturbances, 1949-2015

	Baseline	+ Unemployment
	Quebec	
Durbin	2.42 ($p = 0.12$)	5.43 ($p = 0.02$)
Breusch-Godfrey	2.89 ($p = 0.09$)	6.48 ($p = 0.01$)
ARCHLM	1.53 ($p = 0.22$)	0.90 ($p = 0.35$)
	Rest of Canada	
Durbin	10.79 ($p = 0.01$)	2.50 ($p = 0.11$)
Breusch-Godfrey	8.64 ($p = 0.09$)	3.55 ($p = 0.06$)
ARCHLM	1.53 ($p = 0.22$)	1.11 ($p = 0.29$)

Entries are χ^2 and associated p-values.

Table A5. Influential Observations

Election	Quebec	Rest of Canada	Election	Quebec	Rest of Canada
1867 |			1953	-0.03	0.04
1872	-0.04		1957	-0.12	-0.09
1874	0.04	-0.02	1958	0.12	0.19
1878	0.24	0.01	1962	0.08	-0.03
1882	0.09	0.06	1963	-0.08	-0.04
1887	-0.24	-0.28	1965	-0.24	0.06
1891	-0.16	0.06	1968	0.05	0.07
1896	0.02	-0.06	1972	-0.02	-0.16
1900	-0.04	0.28	1974	0.03	0.06
1904	-0.08	0.11	1979	0.06	-0.25
1908	-0.16	0.03	1980	0.06	-0.04
1911	**-0.31**	0.03	1984	0.20	0.19
1917	**0.57**	-0.09	1988	-0.03	-0.10
1921	-0.14	0.04	1993	-0.03	0.19
1925	0.02	0.06	1997	0.24	0.06
1926	-0.13	-0.07	2000	0.02	0.02
1930	0.03	-0.08	2004	-0.09	-0.05
1935	-0.10	-0.06	2006	-0.16	-0.14
1940	-0.21	**-0.33**	2008	-0.07	**-0.33**
1945	0.19	0.09	2011	**0.36**	0.22
1949	0.17	0.13	2015	0.10	**0.43**

Note: Entries are dfbetas for the impact of removing the observation from the estimation. Extreme observations in bold.

Table A6. Equivalence of coefficients, truncated baseline to full-period

	Quebec		Rest of Canada	
	χ^2	$p > \chi^2$	χ^2	$p > \chi^2$
Liberal	0.90	0.34	1.37	0.24
Conservative	1.31	0.25	1.42	0.23
QC Ethnonational	0.11	0.74	0.00	0.96
Votes (t-1)	0.01	0.94	1.09	0.30
Votes (t-2)			0.24	0.63