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Abstract

The effective number of political parties (*ENP*) in a single member plurality rule electoral system is analyzed as a dynamic process whereby the tournament nature of the election contest induces excessive entry and sunk entry costs promote persistence even as Duverger-Demsetz type political competition works to winnow unsuccessful minor candidates and parties. The result is a fringe of parties that continue to circulate in long run equilibrium. The factors hypothesized to affect the entry and exit of candidates and parties are analyzed for Canada from 1870 through 2015 first using an auto-regressive distributed lag (ARDL) model and then allowing for asymmetric adjustment by adapting NARDL panel estimation techniques. After finding evidence of asymmetry at the party level, the *NARDL* results uncover two new stylized facts for *ENP* at the national party level: (i) a continual rise in the short run fringe after 1945; and (ii) a concomitant long run decline in *ENP* to about 1.5 (below Duverger's prediction of 2). The long run time path in *ENP* at the party level is inversely correlated with uncertainty-based measures of electoral competition, suggesting that movements in long run *ENP* closer to 2 are an indicator of *more* rather than less electoral competition.

JEL-Codes: D720, C410, C240.

Keywords: expected number of parties and candidates, contestability, entry and exit, Duverger's Law, political competitiveness, asymmetric adjustment, ARDL and NARDL modeling.

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1. Introduction

Any analysis of the entry and exit of political parties and their effect on the competitiveness of the electoral process must confront the fact that political parties as well as their local candidates differ widely in their ability to win electoral support and compete effectively.[2] In Canada, the country featured in this paper, the majority of federally registered political parties receive relatively few votes and exit the electoral process quite quickly. A smaller number of parties achieve intermediate success, with some lasting as long as twenty elections, while only two have succeeded in surviving for the forty-two elections that comprise Canada's post-Confederation electoral history studied in this paper.[3] Constituencies also differ in their ability to attract good candidates and so generate the level of competition that best promotes local interests. Considerations of size, location and longevity then force recognition that some parties and candidates attain more influence than others. How the support for different parties and candidates is distributed across the electorate will weigh heavily in the structure and competitiveness of an electoral equilibrium.

In part for these reasons, political scientists tend to discuss the party and/or candidate structure of the electoral system in terms of the effective rather than actual number of political parties or candidates (*ENP*).[4] Moreover, *ENP* is usually discussed in the context of Duverger's seminal prediction that in the longer run, ENP will tend towards 2 in a single member plurality rule electoral system like Canada's. And, because an increase in the effective number of parties typically means that there are more alternatives for voters, an increase in *ENP* is often taken to signal that the

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[2] In this paper we consider as political parties all those named and registered in the election results. This excludes independent candidates as a class (unless identified as Independent Liberal etc.) and those candidates whose affiliation was unknown. Through the 2015 election there were 110 such parties participating with 23 remaining (5 new) in the last (42nd) election in our data set.

[3] Our data set includes all constituency and parliamentary level results from Canadian federal elections 1 (1867) to 42 (2015). See Ferris, Winer and Olmstead (2020).

[3] ENP weighs each party (candidate) by its vote share squared in parliament (in each constituency) and is formally defined as one over a Herfindahl Index of vote shares. In what follows we use two *ENP* measures: the first, *ENP_Candidate*, uses the vote share received by each candidate at the constituency level (averaged across all constituencies); the second, *ENP_Party*, uses the vote shares of the 110 named parties in the election rolls plus one (for all other non-party participants, called 'other' (with some aggregation, see appendix). Canada presents a number of challenges in calculating this number, with the early elections featuring a number of acclamations (candidates elected but receiving no votes). In our analysis each candidate elected by acclamation was treated as having received a vote share of 1. For the national party measure, the party vote share received in each acclamation was weighted by the average number of non-acclaimed constituency votes. The correlation between the number of registered political parties and *ENP_Party* across 1870-2011 is small (-.094). Both *ENP* measures were interpolated between election years.

intensity of political competition has also increased (see Lijphart, 1984; Andrews and Money, 2009; Hinchliffe and Lee, 2016; among others). In the case of Canada, party competition within its unchanged Westminster plurality electoral system has resulted in two distinct parties - the Liberals and Conservatives - that have alternated in government (see Cross, 2004; Ferris and Voia, 2019). However, despite the persistence of this duality, *ENP* has varied considerably. This implies that any explanation for the variation in *ENP* must account for the changes in the number of and support for the mid to marginal sized parties/candidates that re-appear in each election (Travits, 2008). To explain the variation in the fringe of smaller parties, we follow Forand and Maheshri (2015) who, agreeing with Chhibber and Kollman (1998), note that "[a]s important features of political environments evolve over time, changes in the number of parties over time should be expected; an issue that existing parties have difficulty capturing can become salient, giving a new party an opportunity for entry, or an existing party can be discredited by scandal, which can lead to the disbanding of this party or its replacement by a new alternative" (p.286). In this way the entry of new parties and candidates serves to promote new ideas and organizational change within the political process (Aldrich, 1995; Bruns, 2011). Whether the concomitant increase in *ENP* is also a signal of greater electoral competition remains to be seen.

In what follows we argue that because the observed levels of *ENP* include in their measure the dynamic process of entry and exit, the actual level of *ENP* may be a biased measure of the long run structure of its evolving equilibrium. This is because the conditions governing entry and exit may vary across time and the factors determining the rate of convergence back to equilibrium from random shocks may not be symmetric. To separate the adjustment process from the longer run evolution of our measures of *ENP* across time, we use auto-regressive distributed lag (ARDL) modelling. This allows estimation of separate long and short run effects arising from the benefits and costs of entering the political process (Cox, 1997; Lewis-Beck and Stegmaier, 2000) and the separation of both from the movements in the data that describe convergence back to the long run equilibrium. ARDL modelling is then applied to Canada over the long 1870 - 2015 time period.

Implicit in the use of ARDL modeling is the presumption that the short run changes in *ENP* at either the local candidate or national party levels in response to variations in their conditioning variables and external shocks will be symmetric on either side of the longer run equilibrium time path. However, the all-or-nothing nature of the political contest in a single member district, plurality rule political system (SMP) with sunk entry costs suggests that short run adjustment may respond differently to factors triggering entry versus exit. To examine this possibility, we treat entry and exit changes as generating different states of the world and adapt the asymmetric ARDL panel data techniques (NARDL) of Shin, Yu and Greenwood-Nimmo (2014) to assess whether candidate and/or political party measures respond differently, and if so, the effect that asymmetry has on the implied measure of the long run. Should the adjustment process be found to be asymmetric about the long run, with greater persistence and less rapid convergence following entry as opposed to exit, the long run will be revealed to be lower than otherwise. Once the appropriate separation of the long and short run is established, we can consider the related questions of whether the observed evolution of *ENP* mimics its underlying long run, and whether an increase in the long run level signals an increase or decrease in the competitiveness of the political system.

Following these steps, we find that *NARDL* estimation results indicate that the observed time path of ENP *defined over partie*s incorporates slower adjustment to positive as opposed to negative shocks, while *for candidates* we observe symmetric adjustment about the long run trend in ENP. This difference in results for *ENP* at the constituency and national party levels is consistent with the all-or-nothing nature of competitive elections and the presence of higher fixed costs for party formation than for candidate entry. In addition, we uncover two new stylized facts concerning *ENP* at the national party level: (i) the fringe of parties - the difference between the actual and the estimated long run - circulating in the shorter run about the longer run equilibrium continually rises after 1945; and (ii) the calculated long run trend declines to about 1.5, that is, below Duverger's long run prediction of 2. This long run trend in ENP at the party level is inversely correlated with uncertainty-based measures of electoral competition, suggesting that a decrease that brings long run *ENP* closer to 2 is an indicator of *more* rather than less electoral competition.

The paper proceeds in section 2 by introducing Duverger's Law and illustrating, through the historical evolution of Canada's *ENP* measures, why Canada is considered as an exception. In section 3 we reinterpret Duverger through the lens of Demsetz's (1968) work as a proposition about electoral contestability, which is one important dimension of electoral competitiveness. Consideration of the tournament nature of first-past-the-post elections with sunk party setup costs adds the presence of a short run fringe of parties to the Duverger-Demsetz convergence process that will bias actual *ENP* as a measure of its underlying equilibrium size. In section 4 we present our version of Cox's (1997) model and the data used to model it as a dynamic process. Section 5 uses ARDL modeling to separate the long run from the short run process of adjustment and convergence while section 6 presents our re-interpretation of the NARDL extension to test for the presence of asymmetry in the adjustment process surrounding the long run time path. Section 7 examines whether an increase in actual ENP signals a corresponding increase in the long run and which measure represents a better signal of a changes in electoral competitiveness.

2. Duverger's Law, Equilibrium and the Fringe of Political Parties

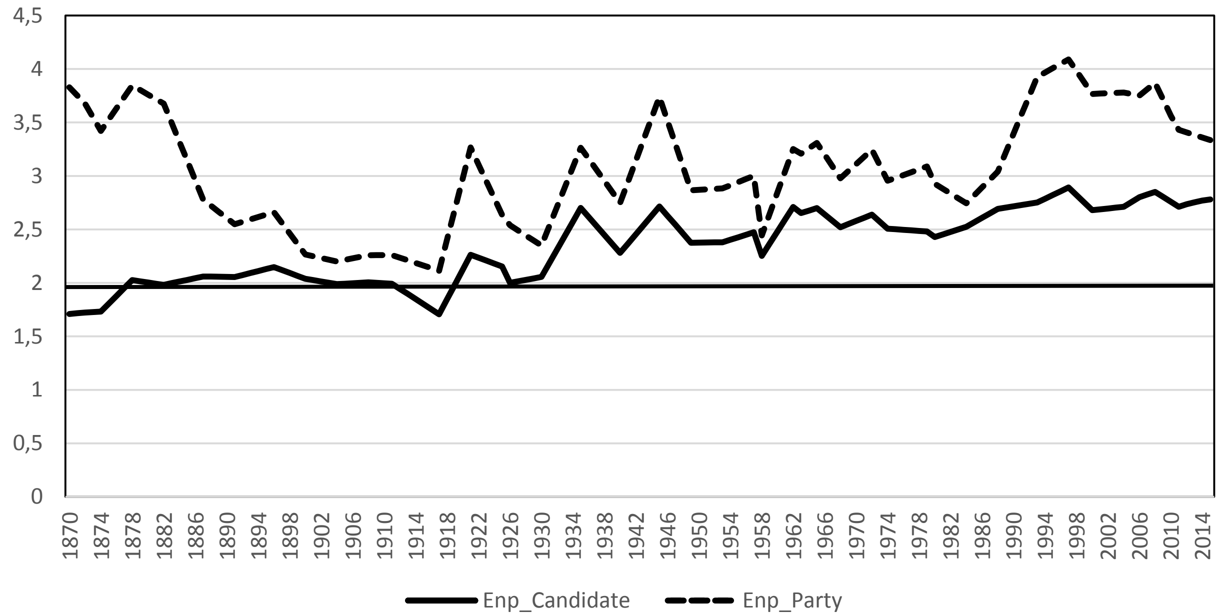
The starting point for any discussion of *ENP* is Duverger's Law (1959) -- the hypothesis that the expected number of parties in a SMP political system will tend towards 2.[5] As Grofman, Bowler and Blais (2009, p. 1) write, "this seemingly straightforward statement, made over 50 years ago, has become perhaps the most famous theoretical generalization in political science." As a positive statement about the equilibrium structure produced by competition among political parties, Duverger's Law is much more precise than anything offered in economics, where the number of firms producing private goods under perfect competition is indeterminate.[6] This degree of precision makes for a seemingly straightforward test of the predicted structure of equilibrium in a political party system and the long term stability of Canada's Westminster parliamentary system provides an excellent setting for its test against the data. When this has been done, however, the typical finding has been that *ENP* measured at either the local candidate or national party level are both greater than 2 and rising (Chhibber and Kollman, 2004; Johnston and Cutler, 2009). This is illustrated in Figure 1 below where the two *ENP* measures using, respectively, national or constituency level votes as weights and built up from the constituency level -- *ENP_Party* and *ENP_Candidate* – are presented from 1870 to 2015. As Duverger also predicted, and as is seen to be the case here, the candidate-based *ENP* measure is smaller than the party-based measure. In both cases, however, *ENP* had risen above 2 by the 14th election (in 1921) and both have continued to rise until recently.

[5] Two parties each receiving half of the vote would result in an *ENP = 2*. References that expand upon Duverger's classic work include: Riker (1976), Cox (1997), Taagepera (1999), Chhibber and Kollman (2004). See Gaines and Taagepera (2013) for alternatives to *ENP* that are not explored here.

[6] In a perfectly competitive atomistic industry producing private goods under constant cost, the expected number of firms is indeterminate. The more general definition perfect competition--price equals marginal cost—is equally precise but untestable since marginal cost is typically unobservable to the outsider.

This apparent contradiction of Duverger's prediction for a majoritarian electoral system is often referred to as 'Canadian exceptionalism' (Rae, 1971; Riker, 1976, p. 760; Gaines, 1999).

Figure 1
Candidate versus Party Measures of ENP: Canada 1870-2015



While the growing departure of *ENP* from 2 is often taken to be the most striking feature of Figure 1, what is also interesting is the pattern of similarity and difference in the two *ENP* time paths. In the first thirty years following Confederation in 1867, for example, *ENP_Party* fell rapidly towards 2 while *ENP_Candidate* began below 2 in 1867 and rose rapidly to meet it. This early pattern of convergence on 2 has, of course, been noticed before, and while the specific reasons given for consolidation within and between the two major political parties may differ (see, for example, Cox (1987) and Godbout and Hoyland (2013)), all concur that the early post-Confederation period for *ENP_Party* represents one of national party consolidation. The rise in *ENP_Candidate*, on the other hand, reflects the spread of electoral competition within constituencies as the large number of acclamations taking place in early elections for Parliament slowly fell with the extended reach of national parties and the entry of constituency specific rivals.[7]

[7] Roughly 25 percent of the members of the first parliament were acclaimed (46 of 180 in 1867) and this had fallen to 2 percent by 1896 (4 of 206). There was one anomalous election in 1917 (WW1 election) when acclamations

While the early period may be somewhat anomalous in reflecting the different formative stages of national party and constituency life, the long period that follows 1900 is characterized more by the co-movement of the two *ENP* measures (their correlation equals .91 through 2015). In large part this reflects the fact that party politics in Canada has been dominated by the interchange of governance between two evolving major political parties, which we call for convenience, the Liberal and Conservative Parties.[8] An implication of the virtual monopoly of governance by these two parties is that the observed changes in *ENP* will reflect to a large extent changes in the size and/or voting strength of the small and mid-sized parties and candidates that enter and exit the political area. One measure of the significance of third parties can be seen from Figure 1 as the deviation between the two *ENP* measures. That is, while the two *ENP* measures have typically varied together in the time period following convergence, they have also moved ever further apart, a process that represents a growth in the effective number of parties relative to the effective number of candidates. In Canada, the departure in the two *ENP* measures shown in Figure 1 has been called multipartyism (Johnston and Cutler, 2009) and its growth is often attributed to the emergence and success of regionally specific federal parties.

Our interest in what follows is on variations in the size of the fringe of political parties or candidates - the difference in each case between the observed or actual level of ENP and our predicted long run or underlying trend - and the meaning of these calculations for judgements about the competitiveness of elections in Canada and for SMP political systems generally.

3. Political Competition, Tournaments and Political Party Equilibrium in SMP systems

While initially developed by Laakso and Taagepera (1979) as a means of testing Duverger's Law, *ENP* is often used in the political and economic literatures as a measure of the competitiveness of the political system (see Aidt and Eterovic, 2011; Drazen and Eslava, 2010; and Boulding and Brown, 2014 for recent examples). Analogous to the use of a Herfindahl index of output shares among firms in an industry to measure market power and thus market competitiveness, a less concentrated arena of political parties - a larger *ENP* - is viewed as an indicator of greater choice for

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rose to 31 of 230 members. However there have been virtually no acclamations since, with the last acclamation arising in 1957.

[8] The Conservative party has existed under different but similar names over time. Third parties, such as the Bloc Québécois, the Reform and the New Democratic parties, have occasionally served as the official opposition but have never formed a government.

voters among parties, and hence evidence of greater competition in the political context. But an electoral system is not a private goods market where multiple firms sell a single output to consumers at a constant price. Rather the right to govern an electorate is more analogous to a public good, where a single governing authority sets the policies and programs that are consumed concurrently by all voters. Given the relative efficiency of one governing coalition and the ability of the electorate to replace incumbent governments in regularly recurring elections, then, as Demsetz (1968) has argued in another context, parties will compete for the right to govern by offering to provide alternative sets of policies and programs. Competition among political parties for the right to govern when combined with voters' ability to choose between program offerings for the one that most closely approximates their preferred set of outcomes can then lead to an equilibrium in which government policies reflect and are responsive to voters' demands.[9]

For party competition to enhance welfare, however, alternative parties must not only promise superior programs, they must present themselves as credible alternatives. The contending party must be seen to be able to step in and perform should the level of performance promised by the incumbent not be forthcoming or the programs promised be reneged upon. Hence contestability in the sense developed by Demsetz and Baumol et. al. (1982) -- the ability to replace credibly the incumbent producer -- is necessary for the benefits of competition to be realized effectively by the community. Because the greater fragmentation signalled by a higher *ENP* means that any particular contending party is less likely to win a majority of the seats and because party coalitions are difficult to maintain over time in SMP systems, the promises made by opposition parties become more problematic to voters and make each opposition party less of a credible threat to the incumbent government. In the SMP system, then, the greater is party fragmentation, the less effective will second or third placed parties be as constraints on the performance of the governing party. It is this inability to provide meaningful contestability in a fragmented SMP political system that underlies the importance of the winnowing process highlighted by Duverger. Convergence of *ENP* upon 2,

[9] For a more extended development of what we refer to as the Duverger-Demsetz perspective, see Ferris, Winer and Grofman (2016) and Dash, Ferris and Winer (2019).

from the 'Duverger-Demsetz' perspective we are presenting, maximizes the contestability that forms one necessary part of a fully competitive political equilibrium.[10]

At the same time that the Duverger-Demsetz competitive process works to winnow the number of existing political parties, the tournament nature of a SMP election works to increase the active number of political competitors. This is because a first-past-the-post voting system has all the characteristics of a winner-take-all tournament whose distinguishing feature, in the presence of open entry, is overcrowding.[11] That is, in contests where there is the possibility of winning a large prize, but only if the contest is won, the number of contestants typically attracted into the contest will be larger than the number (one) that can ultimately be successful.[12] In choosing to enter, each entrant weighs the expected benefit from winning relative to the cost of entry and depending upon the size of the perceived benefit, entry can keep occurring even if the probability of winning is very low. In the absence of political barriers to entry, new parties and candidates will continue to enter until the expected benefit of winning falls into line with the cost of entry. The result is a larger number of political parties participating in each election than can succeed in the longer run. They form a fringe of political contenders that may ultimately find success in having their organization, innovative policies or novel programs absorbed by one or more major party before Duverger type competitive pressures lead to their disappearance over the longer run (Bruns, 2011).

For political parties the costs of entry relate primarily to party formation and gaining initial electoral status. They are often large, fixed in size and must be incurred prior to entry. Once a party has an established organizational form and won electoral status, these costs become sunk and hence irrelevant when considering whether to continue or not. The set-up situation is somewhat different

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[10] We note here that contestability - the presence of a credible government in waiting - is only one of several dimensions that characterize political competitiveness. Other dimensions include the greater uncertainty of local electoral outcomes, and a larger proportion and more uniform distribution of marginal seats across major contending parties in the country as a whole. We consider how these measures of competition as uncertainty in elections at the constituency and national party levels relate to *ENP* in Section 7 below.

[11] See Lizzeri and Persico (2005) and Fischbacher and Thoni (2008). Vandegrift, Yavas and Brown (2007) provide experimental evidence on how the degree of participant overcrowding is a function of the way that the tournament prizes are proportioned, with winner-take-all tournaments generating the most overcrowding.

[12] A classic early application is by Harris and Todaro (1970) who used this equilibrium concept to explain why in many lesser developed countries farm workers voluntarily leave the farm to become part of a large pool of unemployed urban workers in the competition for scarce but high paying jobs in the city. Other examples include the large number of unsuccessful artists and actors working as waiters in New York and Los Angeles. (at least before the pandemic!!!)

for individual candidates because nomination filing deposits are often returned and campaign expenses are often provided publicly or by the party.[13] It follows that sunk entry costs can create an asymmetry for the decision to stay relative to entering, particularly for the political party. This implies that even as the Duverger-Demsetz process introduces greater realism into the perceived benefit of electoral participation, the lower cost of continuing may allow even minimally successful parties to stay in the electoral process longer than their lack of electoral success might indicate.[14] In the absence of entry restrictions, ongoing changes in the composition of the electorate and their ideological and policy preferences create continuing entry opportunities for new parties and candidates that will perturb any tendency to long run equilibrium. In addition, negative shocks to political party equilibrium, such as those arising from new leaders and/or political scandal, can often be quickly offset by standby participants. This implies that with the continual arrival of new party hopefuls and the grudging exit of previous entrants, the Duverger-Demsetz tendency for party numbers to converge back towards 2 following entry shock can be postponed. For *ENP_Part*y in particular, sunk entry costs in combination with the tournament nature of the SMP political contest can produce an asymmetry in which unsuccessful entrants typically outstay their welcome and the observed effective number of parties exceed the number that can survive in long run equilibrium. We turn next to model the long run before seeing whether there is evidence of such an asymmetry in either *ENP* measure.

4. Modeling strategy and the factors affecting the *ENP_Candidate* and *ENP_Party*

Cox (1997) provides the methodology most often used to explain the entry/exit decision of political parties and their candidates. Under this approach a potential candidate or party makes an initial assessment of the expected benefits and costs of entry and chooses to enter the electoral arena as long as the benefits they expect to receive exceed the expected cost of entry. With multiple potential parties and candidates, entry will continue until for the marginal entrant the net benefit falls to zero. With initial success, political parties and candidates continue to participate only as

[13] In Canada a candidate's $1000 nomination deposit is returned once the candidate complies with election return filings. Additionally, all election and personal campaign expenses are paid up to a maximum of 60 percent of the ridings established expense limit provided the candidate receives at least 10 percent of the valid votes cast.

[14] The dynamic implication of this aspect of the entry/exit decision faced by political parties in plurality electoral systems has been modelled more formally by Forand and Maheshri (2015). Their focus is on how the fixed entry cost creates a 'barrier to exit' if there remains an expectation of electoral success in the future.

long as their revised expected benefits of continuing exceeds the ongoing cost of maintaining voter support in upcoming elections.

While the two decision rules seem intuitively plausible, the hypotheses become testable only if a set of factors can be identified that represent the probability of electoral success, the expected benefit of continued participation, setup and continuation costs. What makes this more difficult is that the benefits of electoral participation as perceived by the candidates and parties themselves are unobservable. This implies that operationalizing the theory for Canada requires finding a set of variables that both span our entire time period and capture changes in the other three components (ideally, with unchanged perceptions of the benefit of participating).

To implement a test of this hypothesis we follow the established literature in assuming that the expected number of political parties competing in an election, *ENP_Party*, and the expected number of candidates, *ENP_Candidate*, are a function of the different demographic, institutional and organizational features of the Canadian political environment. In particular,

ENP_X = f(Electoral space, voter heterogeneity, incumbency success, pecuniary rewards and costs of participation, institutional characteristics of the electoral voting system) + error, (1)

where *X = {Candidate, Party}*.

Three variables that have often been used to describe the electoral space available to parties wishing to participate in the political arena include: the relative size of the electorate (*REGISTERE*D), the voter turnout rate (*TURNOU*T); and the voting size of the average constituency (*CONSTITUENCY_SIZE*).[15] An increase in the proportion of the population eligible to vote and the proportion of those eligible who chose to vote will both increase electoral participation which in turn increases the range of programs and policies that a more diversified electorate will consider of value. A greater participation rate is then expected to increase the likelihood of new party and candidate success and provide greater support to the existing variety of parties. Both factors work to increase *ENP* (Berrington, 1985). In a similar way the larger the voting size of each constituency,

[15] In Canada the voting franchise grew from 8.3% of the population in 1867 to 76.7% by 2011, with the biggest jump coming in the extension of the franchise to women which began in 1917 and became fully effective in the election of 1921. Greater detail on the specific definition and data source of each variable is given in the Data Appendix at the end of the paper.

the larger will be the expected number of different candidates that can be supported (Clark and Golder, 2006). Larger constituency sizes allow voter heterogeneity to achieve a scale sufficient to support more candidates and parties, “to allow social divisions to be mobilized and expressed electorally” (Singer and Stephenson, 2009, p. 480). For a party to become successful, however, a sufficient degree of homogeneity in interests must exist across a sufficient number of constituencies to establish a viable network.

For any given level of electoral participation and district size, greater voter heterogeneity would also be expected to support a larger number of candidates and/or political parties (Singer and Stephenson, 2009). Here we use two measures of diversity, the proportion of the population that is young (YOUNG) and the proportion of the labour force that is in agriculture (*AGRIC*). To the extent that the fall in AGRIC reflects the rise of urban versus rural life, with an associated more diffuse range of problems and interests, a fall in *AGRIC* would be expected to create greater space for new candidate and/or party participation and hence increase *ENP*. An increase in the proportion of the population 16 and below, on the other hand, signals greater diversity in the demands being placed on government and hence provides opening for new candidates and parties. A metric that has sometimes been used as an index of heterogeneity is the proportion of the population that are recent immigrants (Ordeshook and Shvetsova, 1994).[16] Under this hypothesis a larger inflow of immigration in the period leading into an election (IMRATIO) diversifies the interests of the electorate, opening more policy space for the participation of additional candidates and/or the expansion of previously marginal political parties (Carty, 2002). A counter hypothesis, suggested by Ferris and Voia (2019) argues that recent immigrants are more conservative in their political choices and more concentrated in location allowing for easier capture by more established parties. In such a case *ENP* would fall with a rise in *IMRATIO*. We have no strong prior on whether the relationship between immigration and the expected number of candidates or parties in Canada should be positive or negative.

One organizational or institutional feature of the electoral system that makes the entry of new candidates and parties and their continued participation more difficult is the competition of candidates who have already been elected as members of parliament. Kendall and Rekkas (2012)

[16] Acquisition of Canadian citizenship takes three consecutive years of residence and confers voting rights at the municipal, provincial and federal level.

find that an incumbency advantage exists for local candidates in Canada. It follows that the larger is the proportion of incumbents running again for office, *INCUMBENTS*, the lower will be the entry of new candidates and a larger exit rate of existing candidates. Either makes *ENP* smaller than otherwise.[17] Another convention of Canadian election practice affecting entry has been the suspension or relaxation of electoral competition between the two main political parties during the two world wars (Berrington, 1985, p.447). In general, the relaxation of regular party completion during a war and the introduction of new issues and concerns arising during the world wars would be expected to give more opportunities for new party entry. However, Canada's WW1 experience was somewhat different, characterized by an extended period of coalition government and the passage of the Wartimes Election and Military Voters Acts that successfully skewed the 1917 vote towards the 'Government' and away from its 'Opposition' and the potential for new parties. We allow for the presence of different signed wartime period effects on *ENP* by including separate dummy variables (1 versus 0) for time periods involving *WW1* and *WW2*.

The benefits received by candidates, political parties and their supporters for participating in the political process and achieving electoral success are primarily nonpecuniary and typically unobservable. This inability to quantify means that changes in their value will appear in the empirical work below as exogenous shocks impacting our system of equations. On the other hand, successful candidates and their parties benefit directly in pecuniary ways and the expectation of winning these benefits can influence the decision to participate. We use the wage received by members of parliament relative to outside alternatives, *RELATIVE_MP_WAGE*, to measure the pecuniary benefit received by a candidate who wins his or her election. The greater is the financial reward from participating in the political process, the greater is the likelihood that a marginal candidate will participate and the lower is the cost to the political party of recruiting competent representatives. An increase in *RELATIVE_MP_WAGE* is then expected to increase both *ENP* measures.

Finally, in 1974 the public funding of political parties (*FUNDING1974)* was introduced in Canada eliminating corporate and union contributions and substituting the subsidization of electoral

[17] We recognize that candidate incumbency may be codetermined with *ENP* in general political equilibrium. This underscores the point that the empirical relationships presented need not be interpreted as causal in the direction implied by the order of covariates in the test equation, but rather as a cointegrating relationship among the variables to form a long run equilibrium time path. It is the calculation of the long run path that is important.

expenses and permitting tax credits to individual contributors.[18] For a short period, 2004– 2011, subsidization also included a per-vote subsidy (*VOTE_SUBSIDY*).[19] Providing candidates and parties funds for election activities would be expected to encourage electoral participation, expand the number of political parties and candidates and thus increase both *ENP* measures. However, to qualify for public support a political party must be registered and must have received at least 2% of the valid votes in the preceding general election or 5% of the valid votes in the electoral districts in which it had a candidate. In addition, only political parties (rather than independent candidates) receive research and staffing support in parliament and only if they maintain party status, i.e., hold a minimum of 12 seats in the House of Commons. It follows that while all parties receive some benefit, established mid to large size parties will benefit more than parties that receive relatively few votes and independent candidates who will receive no support at all. On the other hand, by supporting established parties and their candidates, public funding disadvantages the candidates of small parties and particularly independent candidates.[20] Hence the presence of *FUNDING1974* and *VOTE_SUBSIDY* is expected to affect the two ENP measures differently, decreasing *ENP_Candidate* and increasing *ENP_Party*.

The long run equilibrium relationship expected from this analysis, written in linear form, is:

$$\begin{aligned} ENP\_X = {} & c_0 + c_1\, RELATIVE\_MP\_WAGE + c_2\, REGISTERED + c_3\, TURNOUT + c_4\, CONSTITUENCY\ SIZE \\ & + c_5\, INCUMBENTS + c_6\, IMRATIO + c_7\, YOUNG + c_8 WW1 + c_9\, WW2 + c_{10}\, FUNDING1974 \\ & 4 + c_{11} VOTE\_SUBSIDY, \end{aligned} \tag{2}$$

where X = *{Candidate, Party}* and where the expected coefficient signs are: positive for c_1, c_2, c_3, c_4, c_6, c_7, c_9, and both c_{10} and c_{11} (for *Party*) > 0; negative for c_6, c_8 and both c_{10} and c_{11} (for *Candidate*) < 0; and c_6 is ambiguous in sign ex ante.

[18] Public funding in 1974 introduced two key types of electoral support: for individuals, a political contribution tax credit for up to 75% for small contributions then falling; and for parties and their candidates, parties that spent at least 10% of their spending limit could get 22% refunded and candidates who got at least 15% of the vote could get 50% back. The percentages and forms of support have varied through time. See Jensen and Young, 2011.

[19] *FUNDING1974* = 1 for the years 1974 – 2015, 0 otherwise; *VOTE_SUBSIDY* = 1 for the years 2004 – 2011, 0 otherwise.

[20] The literature suggests that the terms on which state support is given are critical to its effect on entry. For example, Mendilow (1992: 94) has shown that the low electoral threshold set for state support (1%) by Israel was insufficient to produce Katz and Mair's (1995) "cartelizing effect" of excluding potential new parties. Rather the introduction of public funding in Israel resulted in a proliferation of start-up parties.

5. ARDL tests and symmetric short run adjustment

The time series processes that describe *ENP_Candidate* and *ENP_Party* and the political and the election variables considered as their determinants are a mixture of stationary, I(0), and nonstationary, I(1), variables.[21] To handle the time series issues raised by such a combination of variables, the autoregressive distributed lag approach (hereafter ARDL) of Pesaran, Shin and Smith (2001) has proven to be particularly useful.[22] The advantage of the ARDL method is that it is designed to assess whether or not a cointegration (long run equilibrium) relationship exists among a group of variables when the orders of integration are ambiguous and when the sample size is small. If cointegration is found (as indicated by the bounds test), the ARDL method generates not only the long run equilibrium path but also the short run convergent process that surrounds the long run equilibrium. In describing the dynamic processes that generate this outcome, the method also allows for lags of differing length to capture the varying degrees of persistence exercised by each of the interrelated variables. For our purposes the ARDL approach and the later use of its nonlinear NARDL extension by Shin, Yu and Greenwood-Nimmo (2014) are relevant because we suspect that the observed evolution of *ENP* may reflect the confluence of a long run equilibrium process and a short run convergence process is asymmetric in responding to the disturbances that shock the political system and induce entry and exit. The conceptual ability to separate these influences is critical for assessing whether or not a long run equilibrium relationship exists and, if so, how its time path differs from what is actually observed. As part of this process, the analysis also allows us to determine which variables are associated with long run size and whether or not these variables are significant in the short run.

A dynamic ARDL model of symmetric *ENP* adjustment can then be written as:

[21] Much of the empirical work on new party entry and party longevity has been cross country (Hamel and Robertson, 1985; Hug, 2001; Travits, 2008; Nishikawa; 2010) where varying institutional detail—differences in electoral rules, threshold petition requirements, other entry conditions and registration costs/subsidies—provide the observables to explain why entry occurs more often in one country than others. Here we follow authors like Happy (1989) and Lucardie (2007) and apply the analysis to a single country where the institutional framework for elections and governance has been largely unchanged. In such cases the econometric issues become ones of cointegration and convergence among time series.

[22] In the political science literature, de Boeuf and Keele (2008) propose a similar method for modelling dynamic political (stationary) processes. The advantage of the ARDL/NARDL framework is that there exist a set of formal tests to establish the presence and stability of the long run and dynamic processes, often packaged as part of a statistical time series program. The time series packages used here are Eviews 10 for ARDL and the Blackburne and Frank (2007) series of commands written for panel ARDL in Stata 13.

$$ENP_t = \alpha + \sum_{i=1}^{i=4} \gamma_i ENP_{t-j} + \sum_{j=1}^{k} \sum_{i=0}^{4} \beta_{j,i} Z_{j,t-i} + \epsilon_t, \quad (3)$$

where the Z_j are the k explanatory variables shown in equation (2) and where each variable can have up to four lagged terms. ϵ_t is a white noise random variable. Before estimation was initiated, the Adjusted Dickey Fuller test statistics of each variable were calculated to ensure that no variable was I(2). After finding that all our variables were either I(0) or I(1), the combination of all potential autoregressive distributed lagged equations were estimated allowing for a maximum of 4 lags for each variable, where the Schwartz criterion was used to select the optimal combination of lags. The resulting ARDL estimates for *ENP_Candidate* and *ENP_Party* are presented in Tables 1 and 2 respectively, in the form of their implied long run cointegrating equation and the associated error correction equation. The final ARDL equations then were subjected to two stability tests: the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares (CUSUM of Squares). In each case the recursive sums remained within the 5 percent bounds.[23] The values found for the Bounds test are presented in the bottom line of each table and are consistent with the existence of a long run cointegrating relationship among the I(1) variables. This provides evidence consistent with the existence of a long run equilibrium time path on which departures from equilibrium will converge.[24] In forming this separation of the long run from the short run adjustment process the ARDL model assumes that convergence will be symmetric on either side of the long run equilibrium.

The two sets of results presented in Tables 1 and 2 are interesting for both their similarities and differences. In both *ENP* cases the set of variables perform well as a test of the explanatory power of our representation of the Cox hypothesis. The adjusted R^2s tell us that the full ARDL models explain virtually all of the observed variation in both candidate and party-based measures over our

Table 1

ARDL (2,0,1,0,0,2,0,0,0) Model of *ENP_CANDIDATE*: Canada: 1870 – 2015

(standard errors in brackets)

ENP_Candidate **Predicted Sign (+/-)**	**Long Run Model** ***ENP_Candidate***	**Error Correction** ***D(ENP_Candidate)***	**Model**
		D(ENP_Candidate(-1))	0.581

[23] To economize on space the ADF statistics are included in the descriptive statistics table in the appendix. The recursive residual CUSUM and CUSUM_SQ diagrams are not included but available upon request.

[24] Note that the two error correction terms, in the bottom of right-hand corner of both tables, are both negative and significantly different from zero. This signifies the stability of the longer run cointegrating relationship as shocks producing departures from the long run converge back to long run equilibrium.

			(0.049)
RELATIVE_MP_WAGE (+)	0.009 (0.004)		
REGISTERED (+)	0.001 (0.003)	*D(REGISTERED)*	-0.004 (0.001)
TURNOUT (+)	0.005 (0.004)		
CONSTITUENCY SIZE (+)	0.008 (0.005)		
INCUMBENTS (-)	-0.214 (0.124)	*D(INCUMBENTS)*	-0.176 (0.035)
		D(INCUMBENTS(-1))	0.104 (0.036)
IMRATIO (?)	-0.059 (0.023)		
YOUNG (+)	0.011 (0.010)		
AGRICULTURAL SHARE (-)	-0.007 (0.004)		
		FUNDING1974 (-)	-0.047 (0.008)
		VOTE_SUBSIDY (-)	0.001 (0.013)
		WW1 (-)	-0.105 (0.018)
		WW2 (+)	0.041 (0.012)
CONSTANT	2.39 (0.688)	**Error correction Term** (-)	-0.220 (0.022)
(ardl) Adj R^2 Observations Bounds Test: 1% I(1) 1% upper bound 3.77	.990 144 9.18		0.732 144

Notes: D() signifies first difference. The Schwartz criterion was used for automatic lag length selection (up to 4 lags) and includes a break at 1958/9.

time period. Similarly, the bounds test indicates that both ARDL models incorporate a long run cointegrating relationship among the I(1) variables. The data is then consistent with the existence of an equilibrium time path that is surrounded by a short run process that incorporates convergence back to the equilibrium path. With one exception (agriculture in the *ENP_Party* long run), the long run coefficient estimates of *ENP_Candidate* and *ENP_Party* conform in sign to the predictions of the earlier analysis, but with interesting differences arising in coefficient significance across the two measures. Hence significantly larger values of *ENP_Candidate* are associated with relatively high MP wages, larger constituency sizes, fewer incumbents, lower immigration inflows and a smaller share of the labour force in agriculture. Similarly, significant increases in *ENP_Party* are associated with higher pecuniary compensation for MPs and larger constituency sizes but also with larger proportions of population that are young and smaller numbers of incumbents. While the coefficient estimates on *REGISTERED* and *TURNOUT* are positive as expected in both *ENP* cases, none of the coefficient estimates are significantly different from zero.

Table 2

ARDL (2,0,1,0,1,1,0,1,0) Model of *ENP_Party* (with Acclamations): Canada, 1870 – 2015

(standard errors in brackets)

ENP_Party	**Long Run Model**	Error Correction **Model** *D(ENP_Party)*	
		D(ENP_Party(-1))	0.529 (0.048)
RELATIVE_MP_WAGE (+)	0.038 (0.014)		
REGISTERED (+)	0.006 (0.008)	*D(REGISTERED)*	-0.009 (0.002)
TURNOUT (+)	0.017 (0.012)		
CONSTITUENCY SIZE (+)	0.077 (0.016)	*D(CONSTITUENCY SIZE)*	0.052 (0.009)
INCUMBENTS (-)	-0.803 (0.327)	*D(INCUMBENTS)*	-0.314 (0.073)
IMRATIO (?)	-0.024 (0.063)		
YOUNG (+)	0.119 (0.030)	*D(YOUNG)*	0.148 (0.022)
AGRICULTURAL SHARE (-)	0.034 (0.016)		
		WW1 (-)	-0.088 (0.032)
		WW2 (+)	0.209 (0.028)
		FUNDING1974 (+)	0.075 (0.015)
		VOTE_SUBSIDY (+)	-0.023 (0.025)
CONSTANT	-6.16 (2.27)	Error Correction Term (-)	-0.141 (0.016)
Adj R^2 (ardl)	.991		.781
Observations	144		144
Bounds Test: F-statistic (I1 1% upper bound 3.77)	7.28		
Durbin-Watson	2.02		1.94

D() signifies first difference. The Schwartz criterion was used for automatic lag length selection (up to 4 lags). Includes break at 1958/9.

The error correction models describing changes in *ENP* both exhibit considerable persistence. The coefficients on the lagged dependent variable are both relatively large in size with the candidate coefficient only slightly larger than its party counterpart (.581 versus .529). On the other hand, while converge back to the equilibrium time path is slow, convergence is considerably slower for ENP_Party--its error correction term (-.140) being two thirds of the size of *ENP_Candidate's* (-.220). In both cases, however, the models predict a long slow adjustment back to the long run equilibrium time path. Other variables that feature significantly in both ENP measures include *REGISTERED* and *INCUMBENTS*. Although the proportion of registered voters, *REGISTERED*, is found to have no long run effect on either *ENP* measure, both are significantly affected in the short run. Increases in the proportion of the population registered are associated with short run transitory reductions in the change in *ENP.* On the other hand, increases in *INCUMBENTS* are associated with short run changes in *ENP* that begin the process of contractionary adjustment towards a smaller long run size. For changes in both *ENP* measures, the expected positive effect of *WW2* is significant while the special circumstances associated with WW1 are found to be significantly negative as expected. Of the two public funding variables, only *FUNDING1974* is found to be significant in its effect. The presence of Canada's public funding program is associated with offsetting changes--an increase in *ENP_Party* and a decrease in *ENP_Candidate*--consistent with the hypothesis that the program encourages established parties at the expense of candidates.

Finally, short run changes in *ENP_Party* are related to two additional effects not found for *ENP_Candidate*. Changes in constituency size and the percentage of the population that is young. Increases in both are associated with increases in *ENP_Party*, short run changes in line with the long run movement to larger *ENP_Party* size.

The time paths associated with the ARDL model estimates and their equilibrium time paths are shown in Figures 2 and 3. The tight convergence of observed *ENP* values (dashes) and their *ARDL* model forecasts (dots) reflects the strong explanatory power of these models in being able to explain virtually all of the variation in *ENP* over our time period. The long run 'equilibrium' time paths implied by the models' cointegrating equations appear as solid lines on the two diagrams and show a somewhat different pattern of covariation. In Figure 2, for example, the long run variation

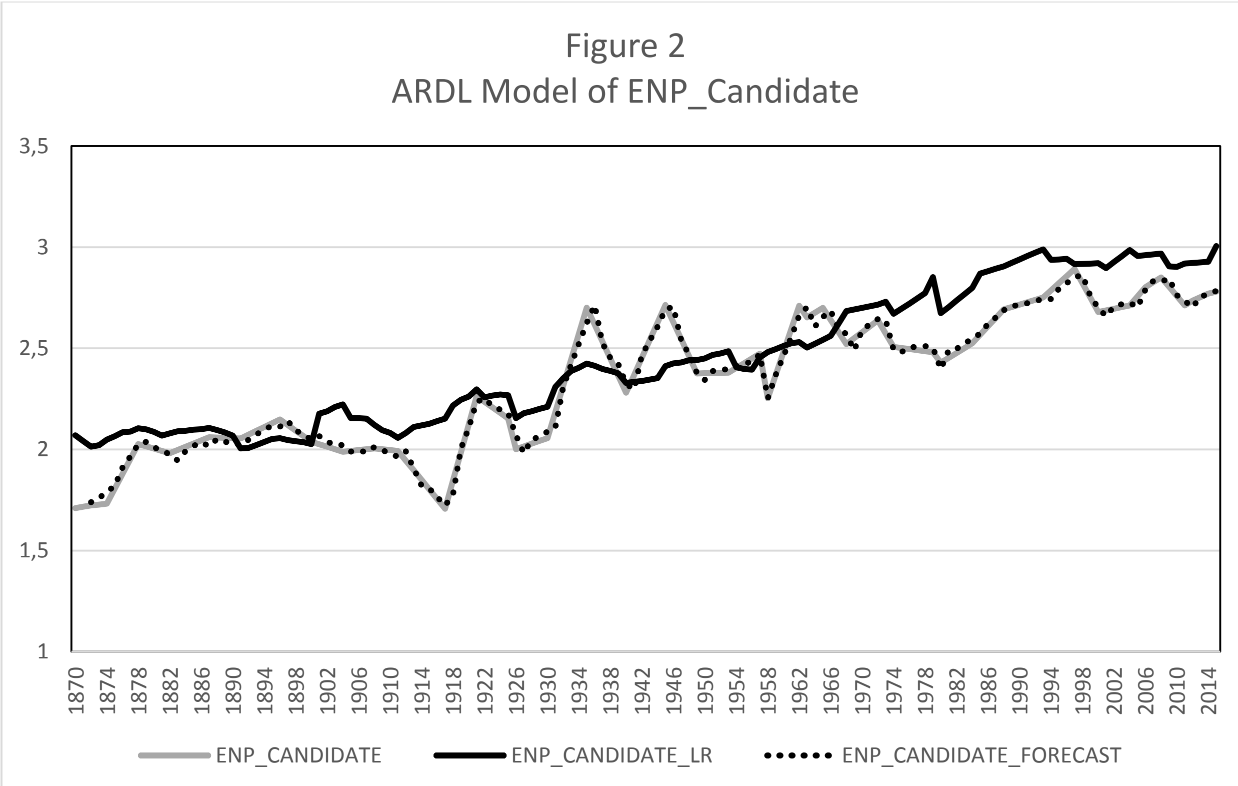


Figure 2
ARDL Model of ENP_Candidate
3,5
3
2,5
2
1,5
1
1870
1874
1878
1882
1886
1890
1894
1898
1902
1906
1910
1914
1918
1922
1926
1930
1934
1938
1942
1946
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
ENP_CANDIDATE
ENP_CANDIDATE_LR
ENP_CANDIDATE_FORECAST

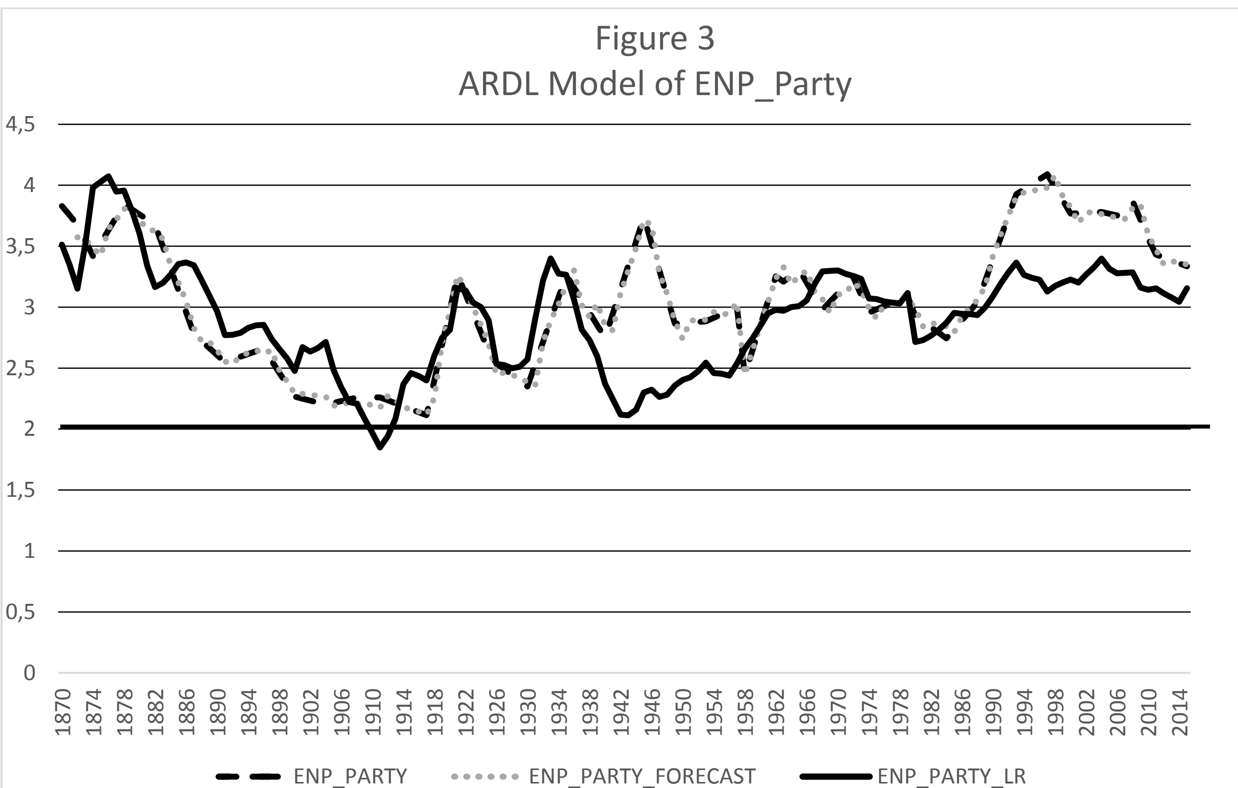
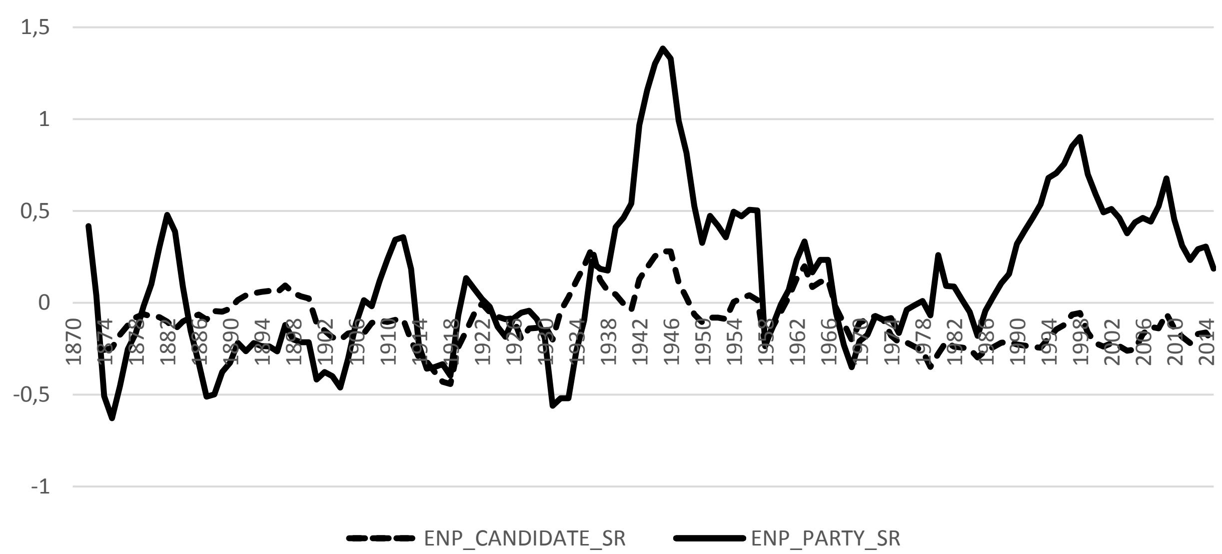


Figure 3
ARDL Model of ENP_Party
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
1870
1874
1878
1882
1886
1890
1894
1898
1902
1906
1910
1914
1918
1922
1926
1930
1934
1938
1942
1946
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
ENP_PARTY
ENP_PARTY_FORECAST
ENP_PARTY_LR

in *ENP_Candidate* exhibits a relatively smooth upward trend, with changes that are typically more moderate than the larger variations in the actual and forecasted values. In addition, the long run is often above and below the actual and forecasted values for extended periods of time. Variations in long run *ENP_Party* in Figure 3, on the other hand, appear to be both sharper and less synchronized with both *ENP_Party* and *ENP_Party Forecast*. Nevertheless, Figure 3 exhibits a similar pattern of having relatively long periods when the long run is either persistently above or below actual and forecasted values. The difference in the two short runs, defined as the difference between the forecasted and long run values, is shown in Figure 4 and illustrates these points quite dramatically. While not dissimilar in the timing of their variation, the short run variations in *ENP_Party* are considerably larger than their *ENP_Candidate* counterpart with positive changes that are both larger and more persistent than negative changes.[25]

Figure 4
ARDL Short Run Fringes



An important cautioning note to this interpretation of the short run is suggested by our earlier discussion of the all-or-nothing nature of the election contest in combination with sunk entry costs. Together they suggest that the short run adjustment process may be asymmetric. Such reasoning also suggests that, particularly for political parties, positive shocks or other changes that encourage

[25] The long run variance in *ENP_Party_SR* is over seven times larger than the long run variance in *ENP_Candidate_SR* (0.693 to 0.0918).

new party entry may have larger and more persistent effects than similar sized negative shocks. If such an asymmetry is present, not only will the ARDL's short run symmetric coefficient estimates and their standard errors be biased, but because the long and short runs are estimated together, bias will also appear in the long run coefficients and their standard errors. In the following Section we explore this possibility.

6. Nonlinear ARDL (NARDL) Estimation and Results

Although the previous results do imply the existence of a cointegrating relationship for both ENP measures, our estimates of the long run equilibrium time path and corresponding short run can be improved upon if an asymmetry in the adjustment process is present and allowed for in our estimates. Here we present a test for asymmetry in the adjustment/convergence process by using an asymmetric variant of the ARDL model (NARDL). In this test we follow Shin, Yu and Greenwood-Nimmo (2014) and allow for the possibility of asymmetry by first breaking all the covariates into their positive and negative partial sums to allow for the possibility that there is a different short run process of adjustment to positive versus negative changes.[26] We then form separate sets of the partial sums grouped by whether they are predicted by theory to produce either a positive change in *ENP* or a negative change.[27]

Treating these groupings as separate states, panel estimation using the pooled mean group (PMG) estimator was used to generate separate short run coefficients and error variances for the two states while constraining the long run coefficients to be equal across the states. The process also generates separate error correction terms. The PMG results were then compared to those arising using MG panel estimation where the panel coefficients generated are the mean group values of the coefficients generated for each state separately.[28]

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[26] As defined by Shin et al (2014, 285), a series x_t can be decomposed into partial sum processes of positive and negative changes, $x_t = x_0 + x_t^+ + x_t^-$ where $x_t^+ = \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} \max(\Delta x_j, 0)$ and $x_t^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} \min(\Delta x_j, 0)$. In our case, all partial changes that were hypothesized to produce positive changes in *ENP* were grouped together as state 1 while all partial changes that were expected to produce negative changes were grouped together as state 2. Both states together are then treated as a panel.

[27] For covariates for which we have no prior predicted sign for the hypothesized relationship to *ENP* we use the sign of the relationship found in the symmetric ARDL estimates of Table 1 or 2 for our predicted relationship.

[28] In panel estimation, the MG method estimates separate long run, short run and error correction coefficients for each group and then calculates panel coefficients as the group mean. The PMG panel method is similar except that the long run coefficients in all groups are constrained to be the same. In our case we use the separate short

It follows that should a Hausman test not reject the hypothesis that there is no systematic difference between the long run coefficients generated by the PMG estimator and the average of the long run coefficients generated by the separate mean group (MG) estimating procedure, we can use the PMG estimates as the more efficient representation of the two states and thus their separate error correction and short run coefficients. On the other hand, if the Hausman test does reject the hypothesis that the long run coefficient estimates are not systematically different, then estimation that imposes the same long run coefficients for each state is inconsistent and the separate short run coefficients and error correction terms generated by the PMG approach can easily be biased. In this case, we reject the hypothesis of a common long run with short run asymmetry and fall back on the symmetric results presented in the previous section.

The NARDL model described above and used in the estimations below can be written as

$$ENP_t = \sum_{i=1}^{i=4} \gamma_i^+ ENP_{t-i}^+ + \sum_{i=1}^{i=4} \gamma_i^- ENP_{t-i}^- + \sum_{j=1}^{k} \sum_{i=0}^{4} \beta_{j,i}^+ Z_{j,t-i}^+ + \sum_{j=1}^{k} \sum_{i=0}^{4} \beta_{j,i}^- Z_{j,t-i}^- + \epsilon_t, \quad (4)$$

where the variables are defined as before and where ENP_t and $Z_{j,t}$ are decomposed as $ENP_t = ENP_{t-1} + ENP_t^+ + ENP_t^-$ where ENP_t^+ and ENP^- are partial sum processes of positive and negative changes in ENP_t; while $Z_{j,t} = Z_{j,t-1} + Z_{j,t}^+ + Z_t^-$, where $Z_{j,t}^+$ and $Z_{j,t}^-$ are the partial sum processes hypothesized to produce positive or negative changes in ENP_t. The γ's and $\beta's$ are the corresponding coefficients.

After running the NARDL model for both *ENP_Candidate* and *ENP_Party* and applying the Hausman tests, it was found that only in the case of *ENP_Party* does the model generate coefficient estimates consistent with a common long run and separate short runs, allowing in the *ENP_Party* case for the short run coefficients and error correction terms to indicate the degree of asymmetry arising in the two short runs about the common long run cointegration time path.[29] The NARDL results for *ENP_Party* are shown in Table 3. Before proceeding to discuss the new findings, it is important to note that the rejection of asymmetry in the case of *ENP_Candidate* supports the relevance of the

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run and error correction estimations for the two groups rather than their group mean because we are interested in showing the short run differences across states. The Hausman test questions whether or not the assumption that the long run coefficients are the same can be rejected.

[29] The Hausman test of the hypothesis that the differences between the long run coefficients of the MG and PMG versions of the panel ARDL model for *ENP_Candidate* are not systematic can be rejected: Chi2(8)= 23.27 and Prob>chi2 = 0.003. The corresponding result for *ENP_Party* is: Chi2(8)= 2.93 with Prob>Chi2= 0.94.

symmetric results found earlier. This increases our confidence that the cointegrating equation estimated for *ENP_Candidate* (the results in Table 1 in Section 5) is a meaningful representation of an equilibrium long run time path. Rejection of asymmetry for *ENP_Candidate* and provisional acceptance of asymmetry for *ENP_Party* is consistent with our earlier discussion based on the inspection of Figures 2, 3, and 4. There the smaller smooth response of the long run to both temporary and permanent changes in *ENP_Candidate* stands in dramatic contrast to the large stochastic changes in the long run equilibrium path implied by the imposition of short run symmetry on *ENP_Party*.

Table 3

NARDL (3,3,3,3,3,3,3,3,3) Model of ENP_Party: Canada 1870-2015

(standard errors in brackets)

Level **Predicted sign (+/-)**	**Long Run Level**	**First Difference (D)**	**Short Run Positive**	**Short Run Negative**
		D(ENP_PARTY(-1))	0.679 (0.082)	0.384 (0.075)
		D(ENP_PARTY(-2))	-0.047 (0.077)	0.140 (0.075)
RELATIVE_MP_WAGE (+)	0.051 (0.007)	*D(RELATIVE_MP_WAGE)*	0.001 (0.002)	0.004 (0.005)
		D(RELATIVE_MP_WAGE(-1))	0.001 (0.003)	-0.014 (0.006)
		D(RELATIVE_MP_WAGE(-2))	0.004 (0.002)	-0.012 (0.006)
REGISTERED (+)	0.047 (0.009)	*D(REGISTERED)*	-0.006 (0.002)	-0.011 (0.006)
		D(REGISTERED(-1))	0.0002 (0.002)	0.015 (0.006)
		D(REGISTERED(-2))	0.0002 (0.001)	-0.010 (0.006)
TURNOUT (+)	0.0009 (0.014)	*D(TURNOUT)*	0.005 (0.002)	0.007 (0.004)
		D(TURNOUT(-1))	-0.001 (0.002)	-0.001 (0.004)
		D(TURNOUT(-2))	0.004 (0.002)	0.002 (0.003)
IMRATIO (?)	0.115 (0.031)	*D(IMRATIO)*	-0.0001 (0.01)	-0.022 (0.022)
		D(IMRATIO(-1))	0.001 (0.01)	-0.072 (0.022)
		D(IMRATIO(-2))	0.009 (0.01)	-0.026 (0.023)
CONSTITUENCY SIZE (+)	-0.028 (0.029)	*D(CONSTITUENCY SIZE)*	0.060 (0.01)	-0.090 (0.067)
		D(CONSTITUENCY SIZE(-1))	-0.024 (0.014)	0.077 (0.088)

		D(CONSTITUENCY_SIZE(-2))	0.001 (0.011)	0.007 (0.071)
INCUMBENTS (-)	-0.926 (0.353)	*D(INCUMBENTS)*	-0.341 (0.178)	-0.077 (0.087)
		D(INCUMBENTS(-1))	0.169 (0.228)	0.182 (0.088)
		D(INCUMBENTS(-2))	0.025 (0.181)	0.163 (0.088)
YOUNG (+)	-0.020 (0.025)	*D(YOUNG)*	-0.162 (0.078)	0.113 (0.079)
		D(YOUNG(-1))	0.222 0.096)	-0.001 (0.021)
		D(YOUNG(-2))	0.041 (0.010)	-0.088 (0.073)
ARICULTURAL SHARE (-)	0.031 (0.025)	*D(AGRICULTURAL SHARE)*	-0.007 (0.009)	0.004 (0.022)
		D(AGRICULTURAL SHARE(-1))	-0.006 (0.009)	0.005 (0.021)
		D(AGRICULTURAL SHARE(-2))	0.015 (0.009)	0.006 (0.022)
WW1 (-)				0.018 (0.032)
WW2 (+)			0.075 (0.022)	
FUNDING1974 (+)			0.037 (0.019)	
VOTE_SUBSIDY			-0.003 (0.19)	
CONSTANT			0.021 (0.029)	-0.333 (0.294)
ERROR CORRECTION TERM *(-)*			-0.018 (0.008)	-0.201 (0.034)
Number of Observations Log Likelihood	286 479.4			

Notes: Test of error correction term (state1) = error correction term (state 2) = 0; chi2(2) = 38.5; Prob > chi2 = 0.00.

A quick scan of the long run coefficient estimates in Table 3 indicates that most of the model's covariates, and all of the model's significant covariates, exhibit coefficient signs consistent with those predicted by the underlying theory. While the overall results for the long run are broadly similar to those indicated in the symmetric case of Table 2, the asymmetric results do suggest a number of interesting differences. First, the magnitudes of the estimated effect on *ENP_Party* of the pecuniary incentive to party formation/continuation (relative salaries), proportion of the population that is registered to vote, the immigration rate and incumbency are all increased substantially under asymmetric modelling. On the other hand, the estimated effects associated with constituency size, the proportion of the population that is young and the agricultural share of the labour force are now found to be insignificantly different from zero. The NARDL estimates confirm the earlier symmetric finding that the introduction of subsidized election funding in 1974 is consistent with the enhancement of established mid to large sized established political parties at the cost of smaller parties and independent candidates. That is, the coefficient estimate associated with *ENP_Candidate* is significantly negative (-0.047) while the corresponding coefficient estimate for *ENP_Par*ty is significantly positive (0.075). There is a suggestion in the data that the vote subsidy program worked in the opposite direction, but neither coefficient estimate is significantly different from zero.

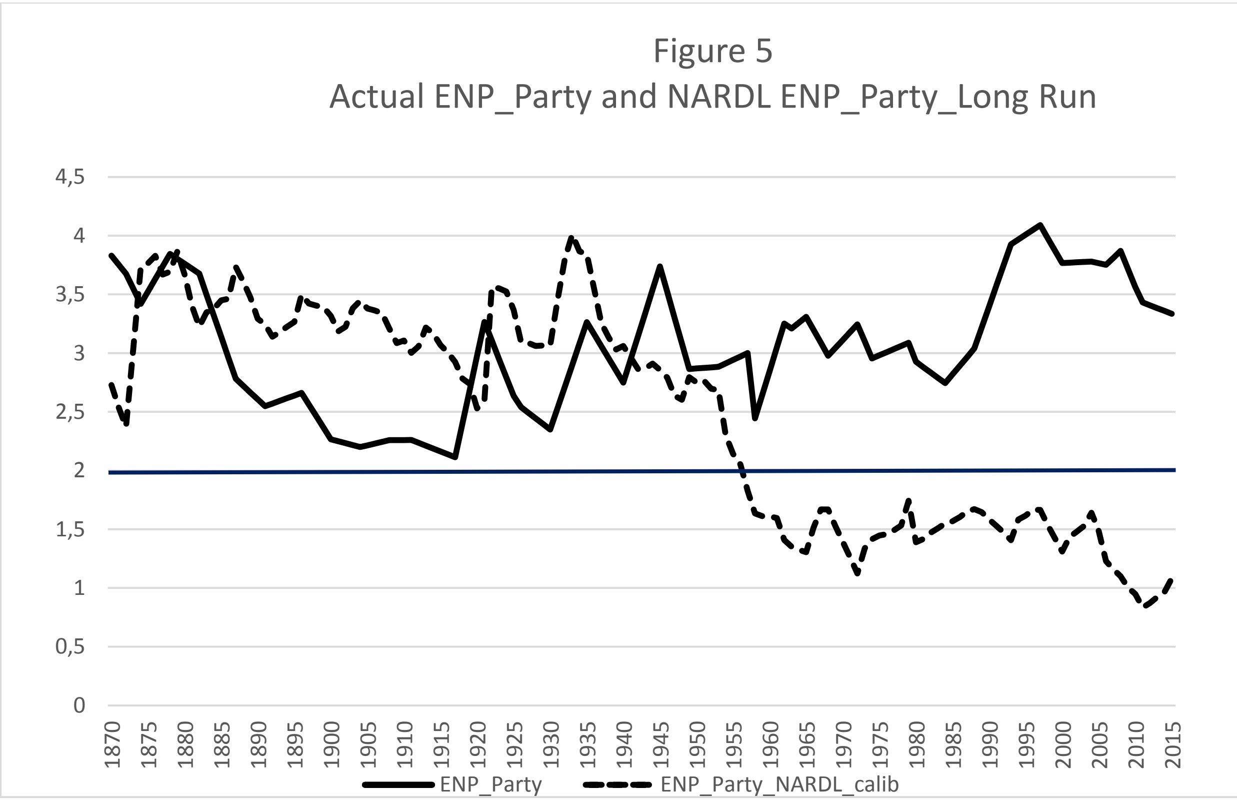
When we turn to the short run, two things are notable. First, two of the covariates that were found to have had no significant long run relationship with *ENP_Party* are now found to have a significant relationship in the short run. More specifically, although an increase in constituency size is not associated with any change in *ENP_Party* over the long run, a significant positive relationship is found arising in the short run that dissipates only slowly through time. Similarly, although the percentage of the population that is young has no estimated long run effect, changes in *YOUNG* are found to be associated with significant effects on *ENP_Party* in the shorter run. The multiplicity of short run sign reversals over the lagged changes in this and other covariate cases, together with the intermittent appearance of significant findings, implies a short run that is both complex and specific to the incidence of change and type of shock.

Second and from the perspective of our test for asymmetry, the estimation results find that the short run adjustment processes have been quite different depending upon whether the shock and/or the variable change is associated with a predicted positive versus a negative change in *ENP_Par*ty. This arises from two factors. First, the error correction terms associated with positive versus and negative departures from the equilibrium time path are significantly different (-0.018 for positive shocks versus -0.201 for negative shocks), with the probability that the two coefficient estimates are equal less than one percent. The smaller absolute size of the error correction term for positive changes implies that any unexpected positive departure from the equilibrium time path will be corrected at a significantly slower pace than the correction of negative departures. The second factor underlying asymmetric short run adjustment is the difference in the persistence following an initial change in *ENP_Party*. The results indicate that positive changes to *ENP_Party* (for whatever reason) generate larger and more persistence changes to *ENP_Party* than do similar sized negative shocks. The lagged first difference coefficients (0.679 and 0.384) stand on either side of the coefficient estimate of the symmetric case (0.529) and imply a convergence path that takes a longer time to converge back to the long run path from above rather than below.

The asymmetric pattern of adjustment implied by these estimates then complements our earlier theoretical discussion. In particular, the data is consistent with the hypothesis that the winner-take-all election structure induces overly optimistic political party entry in response to positive changes in the likelihood of electoral success at the same time as sunk party setup costs encourage an excessive number of parties the delay exit in the hope of better future results. The combined result is an asymmetric adjustment process under which the observed time path will differ from its longer run equilibrium more often on the up side. This in turn implies a long run equilibrium time path that can lie below the actual level of *ENP_Party* observed in the data. Just such a result can be seen in Figure 5 where the long run equilibrium time path estimated for *ENP_Party* (constructed from the long run coefficient estimates of Table 3) is plotted as the dotted line relative to relative to the solid line that plots actual *ENP_Party*.[30] Following an early period of convergence in party structure where long run *ENP_Party* adjusted for asymmetry lagged behind the fall in *ENP_Party,* the long run increased again following the granting of the franchise to Canadian women (fully implemented in the 1921 federal election) and through the turmoil of the Great Depression and WW2. The period following WW2 however, began a period where the long run fell dramatically to stabilize at a much lower level, remaining both below *ENP_Party*, and increasing so, through the end of our time period. The implied fringe of short run transitory parties in our model appears in Figure 5 as the gap arising between actual and long run *ENP_Party*. What appears particularly striking has been the dramatic growth in size of the fringe that began with *WW2* and continued into the early 1960's. This period can be seen as transitioning two periods of relative constancy in long run *ENP_Party*: the first running from about 1875 through *WW1* where *ENP_Party* varied about 3 and the second following about 1960 where *ENP_Party* had fallen to vary about 1.5. While the

[30] Note that the long run cointegrating vector has no constant to represent the effect of other long run influences on *ENP_Party* making its height on the diagram somewhat arbitrary. To represent the long run diagrammatically, the cointegrating vector was calibrated to make the long run and actual values equal about the third election. This adds a small constant to the long run relationship (not negating its fall below 2). It also means that what matters more are the changes in direction on the diagram rather than its height.

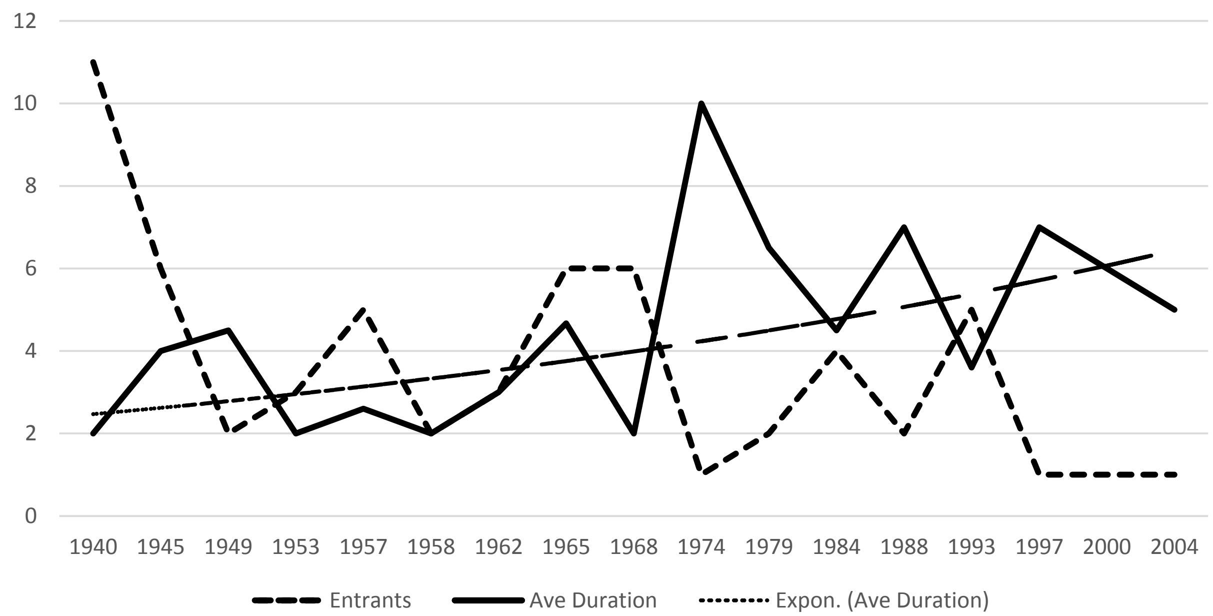
removal of the short run fringe *ENP_Party* in Canada has indeed moved the long run value of asymmetry adjusted *ENP_Party* downwards closer to the value 2 predicted by Duverger, its removal in this way has now created a new challenge: how to explain a long run value consistently below, rather than above 2?



To the extent that larger departures from 2 represent via Duverger/Demsetz lower levels of electoral contestability by parties and hence lower levels of electoral competitiveness, the rapid fall in long run ENP_Party between 1945 and 1960 initially represented less fragmentation and greater contestability. This is reflected in the growing strength of the Progressive Conservative Party under Diefenbaker that finally overcame 22 successive years of Liberal Party rule in 1957. However, the stabilization of long run *ENP_Party* at a level below 2 suggests that the consolidation of effective opposition went too far and has resulted in too little fragmentation. This is reflected in the period of alternative one-sided majority victories that followed: Diefenbaker's Progressive Conservative Party's victory in 1958 produced the largest winning majority in Canadian federal electoral history, followed by the successive string of Trudeau Liberal Party governments of the 60s and seventies, followed by the huge Mulroney Progressive Conservative victory in 1984 and, in turn, by the decimation of the Progressive Conservatives by Chretien and the Liberals in 1993.

The hypothesis that the post war period was one of a contraction in electoral contestability as represented a long run decline in effective number of parties below 2 implies that there was a accompanying growth in the size of the fringe of smaller parties that remained in contention despite achieving relatively little electoral success. Some reflection of this can be seen in Figure 6 where the number of new parties in each election and their average electoral duration is plotted for elections arising between 1940 and 2004.[31] The upward sloping exponential trendline indicates that over this time period the new parties that have entered Canadian federal elections have stayed and increasing longer length of time. Their electoral presence increases *ENP_Party* without necessarily increasing electoral contestability or effective party competition.

Figure 6
Entrant Numbers and Average Entrant Duration by Election



Note: No entry in the 1963 election

7. What do changes in long run *ENP* tell us about contestability and political competition?

Earlier in the paper we made the case on theoretical grounds that an increase in ENP would more likely signal a decrease rather than increase in electoral competition. That is, the use of the analogy

[31] The series is terminated in 2004. The reason is that the average duration of parties entering in the later years becomes increasingly understated as an increasing number of parties entering continued beyond the end of our time period in 2015. There were no entrants in the 1963 election.

to link the competitive conditions of a private economic goods markets to the conditions needed for effective political competition—larger values of ENP reflecting more variety in party and policy choice for voters and hence more political competition—is misguided. Rather competition in SMP political systems arises across political parties in the form of a winner-take-all tournament for the right to govern, more analogous in economics to winning temporary the right to produce a concurrent consumption good. From this perspective, Duverger-Demsetz reasoning views effective electoral competition as providing a credible alternative to the incumbent party and contestability as the mechanism that leads the incumbent and contesting parties between them to provide the policies and programs desired by the voting public. In such circumstances, the greater fragmentation of the vote produced by more parties results not in more meaningful voter choice but in a reduction in the credibility of party challengers and hence a reduction in the incumbent's incentive to perform effectively. Movements in *ENP* closer to 2 reflect a more credible party alternative, greater contestability and a more competitive political system.

Nevertheless, because political competition has many dimensions, an alternative interpretation of *ENP* can be given when a more competitive election is viewed as one in which the winning outcome is more uncertain. An election in which the expected outcome is closer so that the party and/or candidate winner becomes less predictable is, under this interpretation, more competitive. From this perspective, then, a larger *ENP* that represents a greater fragmentation of the vote among the contending candidates/parties can reduce the likelihood that any single candidate/party will win. In this sense the identity of the winner becomes less predictable and the election more competitive. In this section of the paper, we examine whether the data are consistent with this interpretation of *ENP* by examining whether there is a degree of common movement between changes in ENP and two distinct forms of electoral uncertainty: the average degree of electoral closeness among candidates in constituencies and among the major contending parties at the national level.[32]

We begin by first asking whether the actual measures of *ENP_Candidate* and/or *ENP_Party* are sufficient statistics for their underlying long run values; does a rise in *ENP* signal a rise in long run *ENP*? By examining the correlations arising between actual and long run measures we find two quite different answers. That is, the correlation coefficients, ρ_i, for *i* = {Candidate, Party} are,

[32] We note that both of our long run ENP measures are nonstationary over time while our measures of electoral uncertainty or closeness are not.

respectively: ρ_c =.906 and $\rho_p = -.408$. It follows that changes in *ENP_Candidate* are a good reflection of changes in the underlying values of *ENP_Candidate_LR* while changes in *ENP_Party* are not. An observed increase in *ENP_Party* does not necessarily signal a corresponding increase in its long run trend, *ENP_Party_LR*.

We turn next to examine whether there is independent evidence that departures in long run ENP from Duverger's 2 will imply less rather than more electoral competitiveness. To do so we note that many writers have viewed a greater degree of uncertainty over the outcome of constituency level elections and/or a greater symmetry among parties in the distribution of safe seats in the upcoming election as positive indicators of electoral competitiveness (see, for example, Cox et. al. (2019) and Persson and Tabellini (2000, chapter 8). Then because the contestability of an election need not involve either of these forms of electoral uncertainty, we can use the extent to which a competitive election reflects these dimensions of competitiveness to test the hypothesis that the closer is long run *ENP* to Duverger's 2, the more competitive is that election.

To operationalize this test we use two measures from the literature that reflect these specific aspects of electoral uncertainty: i) the Przeworski/Sprague (PS, 1971) measure of the average competitiveness of multi-party constituency level elections, *PS_Hist_Cons;* and ii) the proportion of seats in an election in the country as a whole that are electorally marginal for the major contending parties, adjusted for any asymmetry arising in the distribution of safe constituencies among the major contending political parties, *Adj_AMCons*.[33] The PS index is a multi-party measure of the volatility adjusted electoral margins that non-incumbent candidates must overcome to displace the incumbent in the upcoming election, constructed such that an increase in the index indicates an increase in the average competitiveness of elections *at the constituency level*. The marginal seat index adjusted for asymmetry among parties of seats considered safe in the upcoming election is a measure of how uncertain the upcoming election is *from the perspective of the parties in the country as a whole*. It depends on the proportion of all seats that are electorally marginal and on how those marginal seats are divided among the major contenting parties, with a party having a

[33] See the Data Appendix and Dash, Ferris and Winer (2019) for greater detail on the construction of these measures. Indices built from election data are viewed as offering point estimates of an evolving political environment so that the annual observations used to represent competition measures are interpolations between election years.

preponderance of safe seats enjoying an electoral advantage, and is also defined so that a larger index number represents a greater degree of competition.[34]

Table 4 presents the OLS coefficient estimates of regressing the uncertainty-based measures of competition in elections against the actual and then long run values of both *ENP_Candi*date and *ENP_Party* over the full period from 1870 to 2015. Doing so it can be seen that all eight coefficient estimates in the first four rows of Table 4 (changes in actual and long run values for both *ENP_Candidate* and *ENP_Party*) are negative. Since an increase in these two indices representing

Table 4

OLS Regression Coefficients of *ENP* actual, *ENP_Long Run* with Indexes of Political Competition

(standard errors in brackets)

ENP Candidate Measures	*Adj_AMCons* 1870-2015 (1)	*PS_Hist_Cons* 1870-2015 (2)
D(*ENP_Candidate*)	-0.025 (0.114)	-0.173 (0.115)
D(*ENP_Candidate_LR*) ARDL measure	-0.095 (0.095)	-0.214 (0.095)
ENP Party Measures		
D(*ENP_Party*)	-0.310 (0.224)	-0.263 (0.227)
D(*ENP_Party_LR*) NARDL measure	-0.097 (0.260)	-0.609 (0.262)
D(*ENP_Party_LR* - 2) NARDL measure	0.044 (0.255)	-0.717 (0.255)

D() signifies first difference. Estimating Equations for both ENP and ENP_Long Run:
D(ENP_CANDIDATE) = C(1) + C(2)*PS_HIST_CONS + C(3)*ADJ_AMCONS + C(4)*D(ENP_CANDIDATE(-1)) + C(5)*PS_HIST_CONS(-1) + C(6)*ADJ_AMCONS(-1)
D(ENP_PARTY) = C(1) + C(2)*PS_HIST_CONS + C(3)*ADJ_AMCONS + C(4)*D(ENP_PARTY(-1)) + C(5)*PS_HIST_CONS(-1) + C(6)*ADJ_AMCONS(-1) + C(7)*DUM1922

aspects of uncertainty in electoral contests indicate an increase in electoral competitiveness, the results are consistent with decreases rather than increases in *ENP* signalling a more competitive election. Of the eight coefficient estimates in the first two columns, however, only two are significantly different from zero and relate long run (rather than actual) *ENP* measures to

[34] These indexes are explored for Canada from 1867 in Ferris, Winer and Grofman (2016), and for Indian states in Dash, Ferris and Winer (2019).

uncertainty in constituency level elections, *PS_Hist_Cons*. In the case of *ENP_Candidate,* even though we have seen that changes in *ENP_Candidate* and *ENP_Candidate_LR* are likely to present similar signals of change in the degree of electoral competitiveness (because they are highly correlated), it is the change in *ENP_Candidate_LR* that is found to be significantly related to *PS_Hist_Cons*, making the long run the more reliable indicator of electoral competitiveness. In the case of *ENP_Party* a similar message emerges. That is, it is the change in *ENP_Party_LR* (not the change in *ENP_Party*) that is significantly related to *PS_Hist_Cons* and through this to competitiveness. There is in the data, however, only a suggestion that long run changes in *ENP* might be inversely related to *Adj_AMCons*. While both coefficient estimates are negative in sign, neither is significantly different from zero at conventional levels of significance.

Even though the height of NARDL *ENP_Party_L*R as portrayed in Figure 5 is somewhat arbitrary, the diagram does indicate that there was a significant fall in *ENP_Party_LR* in the immediate post-WW2 period, followed by a period of stabilization at a new lower level. Using Duverger's 2 as a measure of a competitively contestable election, the NARDL analysis also suggests that *ENP_Party_LR* has gone from a value indicating too little electoral contestability because of excessive party fragmentation to one of too little contestability because of insufficient effective contestability. To test these additional hypotheses, we first break our time period into two parts: the pre-ww2 period from 1870 to 1940 and then the post-ww2 period from 1953 through 2015. The results of regressing actual and long run *ENP_Party* measures over these separate periods are presented in columns (3) and (4) for 1870–1940 and in columns (5) and (6) for 1953-2015. The results indicate a significant change in the relationship between the change in *ENP_Party_LR* and *PS_Hist_Cons.* While the coefficient estimates are still found to be negative in both periods, the early period coefficient estimate (-1.57) has increased in both size and significance from its overall estimate (-0.605) while the later period estimate (-0.045) has fallen in size to become insignificantly different from zero. The data is then consistent with a change in the reliability of the change in ENP_Party_LR as an inverse indicator of electoral competitiveness.

A test of the stronger hypothesis, that it is a change in the departure of long run *ENP* from 2 that matters more for indicating the direction of change in competitiveness than the level of *ENP* itself, can be undertaken by regressing our competition indices against the change in the departure from

2, D(*ENP_Party_LR* – 2), over the entire 1870-2015 time period. This treats further departures on either side of 2 symmetrically in signalling decreases in contestability and competitiveness, allowing *ENP_Party_LR* to enter differently as it falls below 2 in the post WW2. The result of doing so is presented as the last row of Table 4 and indicates a larger sized and more significant negative relationship arising between the departure of *ENP_Party_LR* from 2 and *PS_Hist_Cons* than for *ENP_Party_LR* and *PS_Hist*_Cons (-0.717 versus -0.609) over the period of our study. The larger sized, more significant coefficient estimate then helps to explain why such widely different coefficient estimates are found for the two subperiods (-1.57 versus -0.045) when *ENP_Party_LR* is used alone. In this sense the data are not inconsistent with the hypothesis that it is the departure of long run *ENP* from 2 rather than the level of ENP itself that matters more as an indicator of electoral competitiveness, but only weakly so.[35]

8. Conclusion

In this paper we have examined the dynamic nature of the political candidate and party structures in Canada with a view to answering the question of whether there has been a true upward trend in *ENP* away from Duverger's 2 and, if so, whether that increase signals an increase or decrease in political competition. The argument we have presented is that the actual candidate and party *ENP* measures are likely biased measures of their underlying equilibrium structures, and that symmetric ARDL and asymmetric NARDL modeling can be used to separate empirically (respectively) the long run to which candidate and party selection processes would evolve from the short run adjustment and convergence processes. Doing so reveals a cointegrated long run equilibrium path for both *ENP* measures, but a short run that is asymmetric only in the case of *ENP_Party*. This short run asymmetry, we argue, reflects a growing short run party fringe after WW2, a growth in the share of the vote going to small and mid-sized parties that are less successfully competing in (overcrowded) first-past-the-post tournament elections. Having overcome the relatively large setup costs that become sunk upon entry, parties tend to persist despite realizing outcomes which would have prevented entry if known earlier. The result is an observed outcome in which the actual number of electoral participants consistently outnumber the number of parties that can feasibly survive in long run equilibrium.

[35] This is perhaps another reflection of the ambiguity associated with the scaling ENP_Party_LR making the changes in its measure more meaningful than its size and its relationship to 2 less clear.

In implementing this analysis, the data suggest two new stylized facts for Canada: first, the dramatic fall in long run *ENP_Party* as the country moves into the post WW2 period and, second, the rapid growth in numbers and duration of small and mid-sized political parties forming the fringe over the same time period. While our analysis cannot fully explain the circumstances leading to these changes we can speculate that the first development reflects the sporadic ability of the Progressive Conservative Party to attract the soft nationalist vote from Quebec, first under John Diefenbaker in 1958 and then under Brian Mulroney in 1984, both of whom won historically large numbers of seats. The rapid disintegration of the Progressive Conservatives and the rise of the separatist Bloc Quebecois following failure to reform the constitution led to an almost equally large sized Liberal Party win in the election of 1993 when the seats held by the Progressive Conservatives fell from 169 to 2. These outcomes combined with the long period before the center-right regrouped as the Conservative Party of Canada may explain the succession of large victories and defeats that characterize the one-sided results of this period and the decline in long run *ENP_Party.*

We suspect that the second feature - the growth and persistence of the fringe of small to mid-sized parties that also arises after 1945 - most likely reflects an income effect: the ability that rising post-war incomes gave to experimentation with political innovation and novelty. How else can one explain the ongoing success of the Rhinoceros, Marijuana and the Natural Law Parties?

Our findings with respect to the long run size of the two *ENP* measures also confirm a number of hypotheses advanced in the literature for party structure more generally. For example, increases in pecuniary returns, the voting franchise and constituency size are all associated with higher levels of *ENP*. On the other hand, increases in the proportion of candidate incumbents are associated with lower *ENP* values. The public funding of political parties, initiated in Canada in 1974, is found to have had the interesting effect of reducing the long run participation of candidates (decreasing *ENP_Candidate_LR*) while increasing the long run vote shares received by mid sized established parties (increasing *ENP_Party_LR*). The data also confirm the differential significance of the political measures introduced during WW1 in Canada to reduce competition as opposed to those undertaken in WW2.

To ask whether an increase in electoral contestability as represented by a decrease in long run *ENP* signals an increase or decrease in political competition, we regressed our long run estimates of *ENP* against two indicators of electoral competitiveness reflecting electoral uncertainty at constituency and national party levels, and find that it is the decrease in long run *ENP* that is associated with an increases in these indices of electoral competitiveness, suggesting in accordance with what we have called the Duverger-Demsetz perspective that a rise in the number of political parties does not lead to an increase in political competition.

We concluded the analysis by examining the possibility, suggested by the time path of *ENP_Party_LR*, that the meaning indicated by a change in *ENP_Party_LR* might have changed dramatically in the period following WW2. Examining the two subperiods before and after the war does suggest a break about WW2 that can be resolved by recognizing that the long run can vary on either side of Duverger's long run predicted value of 2, and that a greater departure of ENP_Party_LR on either side can indicate less contestability and a fall in electoral competitiveness.

DATA APPENDIX

a. Description and sources: Economic and Political Variables

AGRIC = percentage of the labour force in agriculture 1870-1925 M.C. Urquhart (1993) Gross National Product, Derivation of Estimates, p.24; 1926-1975 Cansim D31251/D31252; 1975-2011 Cansim II v2710106/v2710104;
POP = the population size of Canada, 1870 – 1926: M.C. Urquhart (1993), Gross National Product of Canada 1870-1926, The Derivation of Estimates p. 24-25 (in thousands); 1927 – 1955: CANSIM data label D31248; 1996-2011 Cansim Table 051-0005: Estimates of population, Canada, provinces and territories; Canada D1 Average of quarters.
IMMIGRATION: 1870 1953 O.J. Firestone Canada's Economic Development 1867-1953 Table 83, Population, Families, Births, Deaths (in thousands); 1954-1995; Cansim D27; 1996-2011 Cansim II v16.
IMRATIO = Immigration/POP where POP = Canadian population size.
P = GDP deflator: 1870-1926: Urquhart, (1993), 24-25; 1929-1960 (1986=100), Cansim data label D14476; 1961-2011, Cansim II V1997756. All indexes converted to 1986 = 100 basis.
REGISTERED = fraction of the population registered to vote. Source: Elections Canada web site, www.elections.ca/past elections/A History of the Vote in Canada: Appendix.
TURNOUT = fraction of registered voters who voted. Source: Elections Canada web site, www.elections.ca/past elections/A History of the Vote in Canada: Appendix.
MINORITY = 1 when election resulted in a minority government.
WW1 = 1 for 1914 – 1917, 0 otherwise; *WW2* = 1 for 1940-1945, otherwise 0.
ENP= Expected Number of (registered) political parties collected by election from Elections Canada online at: http://www.parl.gc.ca/About/Parliament/FederalRidingsHistory/HFER.aspsee where *ENP_Candidate* = (1/Herfindahl index of vote shares by candidate across constituencies) = 1/national mean of $\sum(1/\sum v_{ij}^2)$, where v_{ij} is the vote share of candidate i in constituency j. *ENP_Candidate* uses constituency candidates independent of party affiliation (where 13 is the maximum number of candidates running in any constituency). *ENP_Party* uses the national vote share received by all 124 registered political parties (plus other) with the following exceptions. The Liberal Party is defined to include: the Liberal Party in all general elections plus Opposition Liberals in the 13th general election (WWI, 1917). The Conservative Party is defined to include: a) Conservatives--old party (before 1942, and new party, (after 2003)--and Progressive Conservatives in all intermediate elections; Unionists in the 13th general election (WWI, 1917); and National Government for the 19th general election (WWII, 1940). Reform-Alliance ("Reform Alliance") is defined to include: Reform ("Ref") for the 35th and 36th general elections; and, the Canadian Alliance ("CA") for the 37th general election. CCF-NDP ("CCF_NDP") is defined to include: the Co-operative Commonwealth Federation ("CCF") for the 17th through 24th general elections; and, the New Democratic Party ("NDP") for the 25th through 40th general elections. In constituencies with acclamations candidates were given a vote share of 1 while the acclaimed party was given the average consistency vote share as part of a recalculation of national party vote shares.

INCUMBENTS = proportion of incumbent candidates running for election, interpolated across elections
CONSTITUENCY_SIZE = average number of electors across constituencies, in thousands, interpolated across elections.
RELATIVE_MP_WAGE = REAL_Adj_MP_Salary/RGDPPC (MP salaries are adjusted for allowances).
PENSION_PARAMETERS = MP accrual rate/MP contribution rate (beginning in 1952).
PUBLIC FUNDING 1974 = 0 from 1870 – 1993; 1 from 1974 onward.
VOTE_SUBSIDY = 1 from 2004-2011; 0 otherwise.

Political Competition Variables:
AMCons = Asymmetrically adjusted marginal constituencies = 1 - $\psi_t\phi_t$, where ψ_t is the proportion of safe constituencies in the previous election and ϕ_t is a Euclidean distance measure of asymmetry across the shares of safe seats. Safeness is defined using a three-year moving measure of volatility and a 1 standard deviation test. Lower values of $\psi_t\phi_t$ indicate either that more constituencies have become marginal or that the distribution of marginal constituencies across parties has become more symmetrical. In either case the election outcome has become less predictable ex ante.
Adj_AMCons is *AMCons* also adjusted for constituency redistributions. Because redistricting and the addition of new constituencies were frequent in Canada's electoral history, large numbers of constituencies will have no past history and hence no clear basis for assigning safeness. However, since some new constituencies will be formed out of constituencies that were previously safe, we defined the safeness of new constituencies (at the aggregate level) as the proportion of all current constituencies that would otherwise have been treated as safe. That is rather than simply treating all redistributed seats as marginal or as equivalent in safeness to the proportion of safe seats in the ongoing constituencies that did have incumbents, the set of redistributed constituencies were treated as being between these two extremes.
PS_Hist_Candidate = the Przeworski and Sprague measure of competitiveness at the constituency level is the sum of a weighted measure of the volatility adjusted vote margin that each candidate must overcome at the constituency level relative to the incumbent winning candidate. The candidate measure is aggregated by the constituencies vote share of the national vote. To avoid the loss of data arising from acclamations and redistricting, the following conventions were adopted. A candidate winning by acclamation was given a vote-share of 1 and awarded the national constituency average number of votes to weigh their significance relative to other constituencies. This resulted in a larger adjusted national vote as the new base for the calculation of adjusted constituency vote shares. Redistributions were handled by creating pseudo-predecessor constituencies using the average vote shares of those parties of the constituencies (within the same super-constituency) that had been lost due to the redistricting. If the constituency was entirely new (no old constituencies were lost), the previous super-constituency average was used and if the super-constituency itself was new (as in the case of Newfoundland), the national average was used. The PS index runs between and 1 with higher values indicating a more competitive constituency. The PS version used in the text uses historical candidate outcomes.

Volatility. Because a vote margin has meaning only in relation to the volatility of the constituency's vote margin, we needed a measure of vote volatility over time. Then to avoid the loss of information when new constituencies were added or reformed (and hence have no past), we constructed a number of regional super-constituencies - 80 in total - based on geographic regions that persist throughout Canada's election history for measures that required past election outcomes. These established regional specific vote volatilities for use in periods when a new constituency was created or an old one reshaped. To give one example, the area around Ottawa was used as the base for one of 29 Ontario super-constituencies. Electorally it consisted of one 1 riding in 1867 and had risen to include 7 ridings by 2011. A super-constituency volatility for each area and election was then computed as follows. First the average vote shares by party over the constituencies within a superconstituency were computed. Next the absolute value of the changes in these (party-specific) average vote shares across adjacent elections was computed, summed and divided by 2. Each of these super-constituency specific differences in vote shares were weighted by the relative number of constituencies inside each superconstituency and summed to derive an aggregate volatility number for each election. This volatility measure was then applied to vote margins whether a constituency was new or not.

Statistical Properties of the Data:

Variable	Mean	Maximum	Minimum	Standard deviation	ADF statistic Level-constant (Difference)	
Constituency Size (000's)	32.304	78.758	2.002	25.223	Level First Difference	1.99 -5.19
Incumbent proportion	.524	.935	.207	0.168	Level	-3.55
ENP_Candidate	2.34	2.89	1.71	0.330	Level First Difference	-2.12 -7.11
ENP_Party	3.05	4.09	2.11	0.525	Level First Difference	-2.73 -6.74
Immigration Rate	1.023	5.25	0.068	0.918	Level First Difference	-3.30 -4.81
Relative wage of MP's	13.44	43.06	2.89	10.45	Level First Difference	-2.78 -10.34
Registered	48.60	74.87	11.18	21.16	Level First Difference	-1.38 -12.09
Turnout	70.59	79.4	58.8	4.86	Level First Difference	-3.17 -11.97
Young	35.10	48.5	19.3	7.94	Level (trend)	-4.57
Agricultural Share (of labour force)	25.63	58.3	1.6	19.75	Level First Difference	-1.66 -7.79
PS_Historical_Cons	0.654	0.885	.414	.108	Level	-4.94
Adj_AMCons_SD	0.902	1.00	0.494	0.131	Level	-3.89

Notes: MacKinnon critical 1% value = -3.48; 5% value = -2.83.

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