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Abstract	We combine consideration of Duverger's Law (*Political parties: Their organization and activity in the modern state.* London: Methuen, 1954) with Demsetz's (J Law Econ 11:55–65, 1968) theory of natural monopoly to provide a novel perspective on the meaning and measurement of electoral competitiveness in a single member district, plurality rule electoral system. In the Duverger-Demsetz view we develop, the degree of competition is determined by the contestability of elections. Contestability declines with party fragmentation, and so an increase in the effective number of parties above the long run level of 2 predicted by Duverger's 'Law' for plurality based single seat elections	

signals a *decline* in competitiveness. This argument runs contrary to the view, sometimes expressed in empirical studies of elections and public policy, that more candidates or parties, each with a smaller vote share reflects a more competitive environment. Using the history of the Canadian parliamentary system, we provide qualified support for the Duverger-Demsetz perspective by studying the relationship between the concentration of vote shares and a new index of electoral contestability. Extension of the argument to proportional electoral systems is also considered.

The Duverger-Demsetz Perspective on Electoral Competitiveness and Fragmentation: With Application to the Canadian Parliamentary System, 1867–2011

J. Stephen Ferris, Stanley L. Winer, and Bernard Grofman

1 Introduction

In this paper we combine consideration of Duverger's Law (1954) with Demsetz's (1968) theory of natural monopoly to provide a novel perspective on the measurement of electoral competitiveness in a single member district, plurality rule electoral system. In the Duverger-Demsetz view, as we shall refer to it, an increase in the effective number of parties, measured using the inverse of the Hirschman-Herfindahl (1945) index of the concentration of candidate vote shares, above the long run level of 2 predicted by the 'Law' for single member plurality rule electoral systems, signals a departure from equilibrium and a *decline* in the degree of electoral competition. This runs contrary to the view, sometimes expressed in empirical studies of elections and public policy, that more candidates or parties, each with smaller vote shares reflects a more competitive environment. Consider, for example,

AQ2

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AQ1

the following recent quote that embraces this perspective while also touching upon 19
other ways of thinking about competition: 20

> Electoral contestation may be defined as the degree of election-based competition in a 21
> political unit. Where contestation is minimal there is little organized opposition, and the 22
> incumbent party captures most of the votes and seats. Where contestation flourishes there 23
> are more competitors than available seats, a tight race for votes and seats, and frequent 24
> turnover in control. Contestation implies ex ante electoral uncertainty (Gerring et al. 2015, 25
> p. 574). 26

The suggestion here that greater fragmentation of vote shares signals more 27
competition is analogous to the conclusion usually reached about an industry when 28
the concentration of output across firms declines. But an electoral system is not a 29
AQ3   private goods market.[1] 30

To fix ideas as we proceed, we illustrate the concepts and associated indexes 31
of competitiveness discussed for the history of the Canadian parliamentary system. 32
In doing so we find qualified support for the Duverger-Demsetz perspective on the 33
measurement of electoral competitiveness. This support appears in the inverse co- 34
movement uncovered between fragmentation and a new index of the contestability 35
of elections, as we measure these dimensions of the Canadian electoral system using 36
the history of regular national elections from the first election in 1867 to the forty- 37
first election in 2011. 38

Strictly speaking, our analysis of the conceptual issues and its empirical appli- 39
cation to Canada applies only to a single member district, plurality rule (SMP) 40
electoral system. However, the argument may also apply to winner take all systems 41
that use forms of voting in which there is only one round, such as the alternative 42
vote system. Towards the end of the paper we consider whether the argument can be 43
applied to systems of proportional representation. 44

We begin in Sect. 2 of the paper by considering in some detail how increased 45
fragmentation may be mistaken for a signal of greater competitiveness when 46
competition is associated with electoral uncertainty and, as a practical matter, 47
indexed by the closeness of electoral contests. This is followed in Sect. 3 by 48
development of the Duverger-Demsetz perspective on electoral competitiveness, in 49
which party governance in an SMP system is interpreted as being analogous to the 50
management of a natural monopoly. Section 4 presents evidence consistent with 51
the Duverger-Demsetz view using data from the history of Canadian parliamentary 52

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[1] Empirical work that uses the effective number of parties (ENP) to measure competitiveness or a closely related index of party or vote fragmentation, such as $1 - 1/ENP$ or one minus the winner's vote share v_1, includes: Ashworth et al. (2014); Alfano and Baraldi (2015)—who use a normalized Hirschman-Herfindahl (HH) index; Gerring et al. (2015)—who use $1 - v_1$ which is practically similar to the HH index of party fragmentation [for Canada from 1867 to 2011, the correlation of $1 - v_1$ with ENP is about 0.89 and with Rae's (1968) measure of fragmentation $1 - HH$ it is about 0.95]. See also Ghosh (2010) for India, among others. We also note other work that associates party fragmentation with 'weak government' and increased public expenditure, a view that is complementary with, but distinct from the Duverger-Demsetz view that we shall develop in what follows. Examples of this literature include Roubini and Sachs (1989), Ricciuti (2004), Chhibber and Nooruddin (2004), Borge (2005) and Geominne et al. (2008).

elections. Here we consider how a new index of the contestability of elections relates to fragmentation of the electoral system. We show that as the effective number of parties rises above 2 and fragmentation increases, competitiveness as judged by our contestability index *declines*. Section 5 discusses the problems of extending the analysis to proportional systems, and Sect. 6 concludes.

Before continuing, it is important to note that our basic interest in what follows is not with an explanation of the effective number of parties or with the testing of Duverger's Law. We are interested in what is meant by political competition and how it can be measured. Competitiveness, as distinct from a given state of perfect or imperfect competition, is undoubtedly complex and difficult to study. In addition to (1) the entry and exit of candidates and parties and (2) the rivalry between them in an election, political competition in an electoral system also includes (3) competition among parties in the legislature between elections, (4) competition among governments and bureaus, and (5) relationships among these forces. In this paper we focus on particular aspects of the first and second dimensions of the process.

2 From the Hirschman-Herfindahl Index of Market Concentration to Uncertainty and Closeness in Elections

A key aspect of economic competition that lies behind the often used Hirschman-Herfindahl (HH) index of economic competitiveness (Hirschman 1945) concerns the ability of firms to affect market price. To the extent that individual firms are unable to influence market prices, the firm has no market power and the industry is said to be highly or perfectly competitive. This feature of a competitive market is usually translated into an index of competitiveness through the logic that if there are more firms, each of which supplies a smaller share of market demand, the ability of any individual firm to influence the market price will be reduced. The HH index is designed to encapsulate this logic and is defined as the sum of the squared market shares of the firms in an industry. That is,

$$HH_j = \sum_{n=1}^{N} s_{nj}^2, \tag{1}$$

where s_{ij} is the output share of the ith of N firms in industry j. The HH index will equal one if one firm supplies the entire market and will approach zero as the number of firms increase and each firm's market share declines.

The Hirschman-Herfindahl measure of concentration has crossed over into political science as the effective number of candidates or parties (ENP), defined as one over an HH index constructed using candidate or party vote (or seat) shares

(Laakso and Taagepera 1979). The national average ENP in election t with $j = 1, 2,$ $\ldots, J$ constituencies is defined as

$$ENP_t = \sum_{j=1}^{J} \left(ENP_{jt} \right) / J, \qquad (2)$$

where $ENP_{jt} = 1/\sum_{i=1}^{I} v_{ijt}^2$ is the effective number of candidates at the constituency level and v_{ijt} is the vote share of candidate i in constituency j in election t. Alternatively, we could employ the vote or seat shares of political parties at the national level to define a national party-based analogue to (2). In either case ENP will equal 2 if two candidates or parties equally share the vote and will rise as the number of candidates or parties increases and their individual vote shares decline.[2]

A closely related measure of the fragmentation or fractionalization of the electorate was proposed by Rae (1968). His measure, *Fragmentation,* is defined as $1 - HH$ or, equivalently, $1 - 1/ENP$, with ENP as in (2) above. At the constituency level, this index can be thought of as a measure of the probability that two randomly chosen individuals will not share the same partisan association. It approaches 1 as voters become more fractionalized.

Both ENP and *Fragmentation,* defined as national averages over constituency level values based on vote shares, are shown in Fig. 1 below for Canadian national elections 1 through 41 (1867–2011). (We shall ignore the middle line in the figure for now.) Both indexes indicate increasing fragmentation over the entire history, though *Fragmentation* appears to flatten out after the 25th election.[3] Here and in subsequent figures, elections during world wars and the great depression (1917–1945) are shaded, and note is also made of the extraordinary 35th election in 1993 when the incumbent party in power (the Conservatives) lost (to the Liberals), falling from 169 seats out of 295 to just 2.

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[2]For extensive discussion of ENP see Taagepera (2007). Gaines and Taagepera (2013) consider some of the problems associated with the use of ENP to measure the number of parties.

[3]Many early Canadian elections featured acclamations, particularly in elections 1 (1867: 46/181), 2(1872:51/200), 3(1874:54/206) and 13(1917:31/235). In these cases, we set $v_1 = 1$ in a constituency with an acclamation in the case of ENP defined for constituencies. The presence of 2-seat constituencies (123 before the 28th election in 1968) makes little difference to the averages over all constituencies that form the basis for the measures discussed in this section. It is interesting to note in this respect, however, that for one-seat constituencies, the mean for all elections of the constituency level ENP = 2.4, while for the two-seat constituencies, mean ENP = 4.0. We also note that there are 10,247 regular individual constituency elections in elections 1 through 41. The maximum number of candidates in any one constituency election from 1867 to 2011 (general elections 1–41) is 13. The maximum number of parties in any one election (taking self-named parties as a party without judgement of its success), independent candidates and candidates of unknown affiliation is 27, in the 19th election in 1940. On the development of the party system in Canada up to 1908, see recently Godbout and Hoyland (2013).
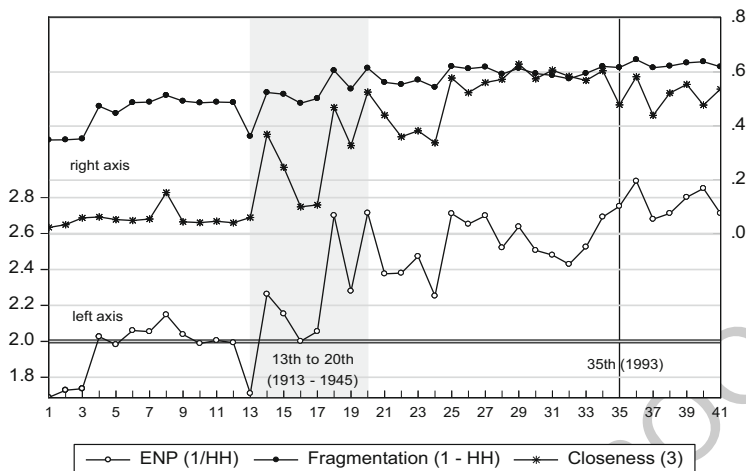
Fig. 1 ENP, fragmentation and closeness (3), Canadian General Elections 1–41, 1867–2011

To a considerable extent the use of the HH index in political science derives from the desire to test the predictions by Duverger (1954) about the effective number of candidates and parties that will arise in a long run electoral equilibrium.[4] Duverger argues that in a single member district, plurality rule electoral system, the number of political parties at the district or constituency level tends towards 2 in the long run.[5] Cox (1997, p. 271) interprets this as an upper bound on what he refers to as the carrying capacity of the electoral system. In a majoritarian parliamentary system, in Duverger's view, factions are forced together into two parties *before* the election by the winner take all aspect of the electoral system. This contrasts with the formation of coalition government *after* the election in a system of proportional representation. Cox (1997, p. 30) attributes the Law to elites—opinion leaders, contributors, party officials, etc—who do not want to waste their influence on hopeless candidates, and to strategic choices made by individual voters for the same reason, with uncertainty in the process introduced by the problems for elites and voters of coordinating to decide who is, and who is not, a serious candidate.

It should be emphasized that Duverger's Law is in the first instance a statement about two party competition at the district or constituency level. Even if the Law holds there, the two parties competing at the local level may differ across regions, thus leading to more than two at the center. (See for example Riker 1982; Gaines 1999; Chhibber and Kolman 2004; Grofman et al. 2009, in addition to Cox and Taagepera). To go from localized two-party competition to national

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[4]Cox (1997) and Taagepera (2007) provide extensive discussions of Duverger's work and references to the associated literature.

[5]The Law is not a point prediction, but a statement that there cannot typically be more than 2 candidates (Cox 1997, p. 271). So in the long run there could be less than 2.

competition between the *same* two parties requires additional assumptions. Despite this qualification however, Duverger's Law is far stronger than any result in economics concerning the number of firms in a competitive market equilibrium. In a perfectly competitive market, the number of firms is indeterminate. We shall return to the differences between indexes of fragmentation and competition defined at the constituency level and at the national level later. Here we wish to explain why it is tempting, though probably misleading, to use an HH-related index such as the average constituency value of ENP to measure the degree of electoral competition.

How could a rise in ENP or in *Fragmentation* be associated with increased electoral competitiveness despite the absence in elections of an analogue to a market price that can be manipulated by participants?[6] One influential argument is that fragmentation of vote shares may serve as a proxy for political competitiveness when competition is associated with electoral uncertainty. The reasoning begins with the view that as a practical matter, electoral uncertainty can be metered by the closeness of elections in terms of candidate or party vote shares. Then, because greater fragmentation of the party system often leads to splitting of the vote among the contenders for office, it usually results in closer and thus more uncertain and competitive election contests.

The idea that an election is competitive when its outcome is highly uncertain or 'too close to call' is a sensible one that is widely employed. See, for example, Franklin (2004), Blais and Lago (2009) and Grofman and Selb (2009) as well as the earlier U.S. literature on 'vanishing marginals' originating with Mayhew (1974). Whether fragmentation of vote shares is a useful proxy for electoral uncertainty via its correlation with closeness of electoral outcomes is a separate empirical matter. In the remainder of this section, we consider how concentration of vote shares at the constituency level and indexes of closeness are actually related for the history of Canadian general elections.[7]

2.1 Electoral Uncertainty as Closeness in Elections and Its Relationship to Fragmentation

One measure of the closeness of an election at the constituency or district level that appears in the literature is that proposed by Endersby et al. (2002). Their index of the closeness of the election in constituency j in election t, $CL_{jt}(K)$, is

$$CL_{jt}(K) = K^K \prod_{i=1}^{K} v_{ijt}, \tag{3}$$

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[6]See for example, Drazen and Eslava (2010), Aidt and Eterovic (2011), Aidt and Mooney (2014).

[7]There is perhaps some danger that we are setting up a 'straw person' in the rest of this section. However even if generalizing from the particular overstates our case, this exercise leads in interesting directions.

where Π denotes the product of terms following, v_{ijt} is the vote-share of candidate i in jurisdiction j *in election t*, and K is taken by Endersby et al. to be equal to the integer value of the effective number of parties in the constituency, ENP_{jt}. $CL_{jt} = 0$ if there is an acclamation ($v_{1jt} = 1$); and it is $=1$ if K candidates have equal vote shares.

In our implementation of this index we set $K = 3$ because, historically, the sum of the first three vote shares (in elections 1–41) constitutes on average 0. 97 of the vote and has never been less than 0.90 of the vote with a small standard deviation of 0.026. As with ENP, this measure is aggregated up to the national level by averaging across constituencies.

It is important to note that because CL is designed to measure closeness, it must differ from ENP to some extent. For example, ENP treats the outcome (.5, .5; ENP = 2) as inherently different than (.33, .33, .33; ENP = 3), while both cases can be said to be examples of equally close or highly competitive elections and are treated as such by the CL index. Even so, it may still be that ENP as a measure of fragmentation may serve as a rough proxy for closeness defined by (3).

To see if that is so, Fig. 1 above also provides the national average values of $CL(K = 3)$ for Canadian parliamentary elections running from Confederation in 1867 until the 41st election in 2011 along with the corresponding national averages over constituencies of ENP and *Fragmentation*. Inspection of that figure, together with the correlations provided in Table 1, makes it apparent that fragmentation may indeed serve as a proxy for this measure of closeness in the Canadian case, provided we ignore the dissimilarities across indexes of short run election to election fluctuations.[8]

A second, somewhat more sophisticated measure of the closeness of elections turns out to be much less complementary to the use of fragmentation as a proxy. Following Mayhew (1974) and many others, this alternative measure of closeness embodies the idea that a close or competitive election is one in which the winning vote margin, $(v_1 - v_2)$, is 'small'. What small means in this context is not unambiguous. However, any attempt to define it must take into account the potential for voting patterns to change, since a relatively small margin can be quite 'safe' (a concept which will play a key role in measuring electoral contestability later on) if the party's vote in that riding varies little across elections, while even a large margin may be unsafe in a constituency with many voters that switch their vote from one election to the next.[9]

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[8]The downward trend in Closeness(3) after about the 30th election is not picked up by the fragmentation indexes.

[9]The idea of adjusting vote margins for volatility is analogous to standardizing scores by dividing the differences by a standard deviation. In the usual difference of means test, whether a difference is large or small is defined in terms of the normalized value of that difference in standard error units, with the standard error of the mean simply a specialized version of a standard deviation. In this way, any conclusion about the existence of a "meaningful" difference will reflect the level of uncertainty as to whether any observed difference might be due to chance alone.

Table 1 Correlations

	ENP	ENP12party	Fragmentation	Closeness(3)	$V_1 - V_2$	$1 - V_1$	$(v_1 - v_2)$/volatility	PS	AMS
ENP	1.00	0.88	0.98	0.91	0.02	0.87	−0.49	−0.40	−0.37
ENP12party	0.88	1.00	0.82	0.76	0.25	0.65	−0.43	−0.30	−0.27
Fragmentation	0.98	0.82	1.00	0.91	−0.11	0.92	−0.44	−0.39	−0.39
Closeness(3)	0.91	0.76	0.91	1.00	0.18	0.73	−0.57	−0.56	−0.44
$V_1 - V_2$	0.02	0.25	−0.11	0.18	1.00	−0.47	−0.27	−0.36	−0.18
$1 - V_1$	0.87	0.65	0.92	0.73	−0.47	1.00	−0.30	−0.18	−0.26
$(v_1 - v_2)$/volatility	−0.49	−0.43	−0.44	−0.57	−0.27	−0.30	1.00	0.53	0.22
PS	−0.40	−0.30	−0.39	−0.56	−0.36	−0.18	0.53	1.00	0.27
AMS	−0.37	−0.27	−0.39	−0.44	−0.18	−0.26	0.22	0.27	1.00

Definitions:

ENP ENP calculated over candidates at the constituency level using vote shares (maximum of 13 candidates in any one constituency)

ENP12party ENP12party ENP calculated at the national level using party vote shares for 12 parties—see the Appendix for definition of parties

Fragmentation $1 - HH = 1 - 1/ENP$, where HH is the Hirschman-Herfindahl index defined using vote shares

v_i vote share of the candidate in the ith place

Closeness(3) an index of the closeness of candidates' vote shares v_i, assuming $ENP = 3$, as in Endersby et al. (2002)

$(v_1 - v_2)$/*volatility* the winner's vote margin $v_1 - v_2$ at the constituency level relative to historical volatility for that constituency

PS the Przeworski-Sprague (1971) volatility adjusted vote margin, defined by constituency and party

AMS an asymmetry adjusted measure of marginal seats, using an historical volatility and a one standard deviation test to define when an incumbent's seat is safe

Thus to reflect the relevant margin facing candidates, constituency vote margins 197
must at least be adjusted for an estimate of the potential for voters to switch 198
between parties from one election to the next. This point has been recognized for 199
some time, highlighted in such works as Przeworski and Sprague (1971) whose 200
index of closeness in elections is implemented immediately below, in Elkins (1974) 201
who also discusses elections in Canada, and in Bartolini and Mair (1990), among 202
others. It is important to note that the CL index is not adjusted for vote volatility, 203
while in the Canadian case the adjustment matters significantly; the correlation 204
of the average unadjusted margin, $(v_1 - v_2)$, with the volatility adjusted margin, 205
$(v_1 - v_2)$ / *volatility,* over elections 1 through 41 (1867–2011) is $- 0.27$. (The 206
calculation of *volatility* here is not without its own complications, and is discussed 207
at length shortly.) That is, the correlation is *negative* as well as low. Hence in 208
the Canadian case, the simple vote margin, which is widely used as a measure of 209
closeness in elections, is unreliable as a measure of volatility adjusted closeness. 210
We suspect that this problem with the unadjusted vote margin arises in many other 211
cases. 212

The Przeworski and Sprague (1971) version of the volatility adjusted vote 213
margin—hereafter, the PS index—is an especially interesting example of the class 214
of measures of electoral uncertainty that incorporates vote volatility. As well as 215
allowing for volatility, the PS index has embedded in it a specific view of the 216
objectives of the losing candidates: namely that the primary objective of every 217
candidate is to overcome his or her vote deficit vis a vis the incumbent. 218

To construct the PS volatility adjusted vote margin index for Canada, the lagged 219
vote deficit faced by each party or candidate p in constituency j at election time t, 220
$(v_{1jt-1} - v_{pjt-2})$ is adjusted for the potential volatility of the vote to form the ratio 221
h^t_{pj}: 222

$$h^t_{pj} = \frac{(v_{1jt-1} - v_{pjt-1})}{Volatility_{st-1,i}}, \tag{4}$$

where volatility in the denominator is calculated across superconstituencies as 223
$volatility_{st-1} = \sum_{p=1}^{12} |v_{pst-1} - v_{pst-2}| / 2$ and where for the incumbent, $p = 1$ and 224
$h = 0$. Note that the ex ante-ex post issue always faced when using actual election 225
outcomes is explicitly dealt with in (4) by using a lag of one election in both 226
numerator and denominator. 227

Two particular issues that arise in calculating volatility in the denominator of (4) 228
should be noted: (1) To allow for changes in constituency boundaries as constituen- 229
cies are added and/or redrawn over time, it is necessary to derive vote and volatility 230
measures for what we call superconstituencies. These are small aggregations of 231
individual constituencies defined on an unchanging geographical basis. (We define 232
80 of these). We then assign to each party in each constituency in each election the 233
average constituency level vote of that party in the superconstituency. This allows 234
us to measure changes in votes across elections for each party, and thus to derive 235
volatility measures despite the continual redistricting that has occurred over the 236

decades; (2) A second issue that must be faced is how to define political parties. 237
We also require that a 'party' win at least one seat in at least two general elections 238
to be considered as such; thus the data are defined for 11 political parties (see the 239
Appendix) plus an Other or residual category. Exploration of the consequences of 240
using other definitions are left for the future, as are the effect of using alternative 241
definitions of the superconstituencies.[10] 242

The following index for party p in constituency j is then calculated as: 243

$$c_{pj}^t = \begin{cases} 1 \ if \ 0 \leq h_{pj}^{t-1} \leq 1 \\ \frac{1}{h_j^{t-1}} \ if \ h_{pj}^{t-1} > 1 \end{cases} . \tag{5}$$

For a highly competitive party, $c = 1$ because the distance to go to become the 244
winner is less than the floating vote or portion of the electorate that switched parties 245
last time. Otherwise, the index is less than one and falling as the margin to be 246
overcome by a party grows relative to volatility. 247

Aggregating across all the parties in each constituency j using as weights the vote 248
share of the party in the constituency gives: 249

$$C_j^t = \sum_{p=1}^{P} c_{pj}^t \ v_{pjt-1}. \tag{6}$$

$C_j = 0$ indicates no competition in the constituency and, accordingly, for ridings 250
where there was an acclamations we set $C_j = 0$. National average competitiveness 251
across all constituencies for each election, the completed PS index, is then given by 252
the national weighted average 253

$$PS_{NJ}^t = \sum_{j=1}^{J} C_j^t \ adj\_vw_{jt}, \tag{7}$$

where adj_vw_{jt} is the adjusted (for acclamations) vote weight of each constituency 254
in the national election.[11] 255

Figure 2 below shows the PS index along with ENP and *Fragmentation*. Each 256
of the indexes exhibits a concave shape before the outbreak of the first world war, 257
likely reflecting an increasing degree of competition as the number of acclamations 258
declined sharply after the 3rd election, and then a declining degree of competition as 259
the party system developed. But both ENP and *Fragmentation* show upward trends 260
over the remainder of electoral history, while the PS index remains more or less 261

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[10]After 1945, the issue of how to define a party is not problematical if one sticks to analyzing the major parties in Parliament plus a residual. Earlier decades are a different matter.

[11]The adjusted vote weight attributes an average vote to constituencies where there was an acclamation, and then adjusts vote share weights of all constituencies accordingly.
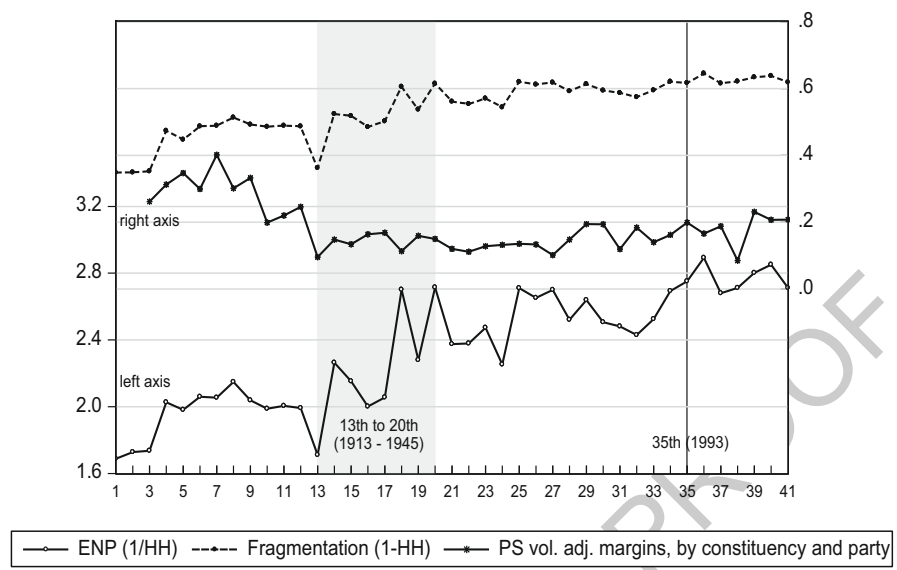
Fig. 2 ENP, fragmentation and the PS volatility-adjusted margins, Canadian General Elections 1(3)–41, 1867(1874)–2011

flat. This impression is confirmed by the correlations in Table 1: over elections 1 through 41, both indexes of fragmentation are *negatively* correlated with the PS index of volatility-adjusted vote margins at about −0.4.

For the Canadian case then, fragmentation does not serve as a good proxy for electoral competitiveness when it is measured with an index that is designed to reflect the average closeness of individual electoral contests, taking vote-volatility into account. We hypothesize that for single member district, plurality rule electoral systems, this conclusion holds more generally.

3 The Duverger-Demsetz Perspective on Electoral Competition

There is a conceptual as well as an empirical basis for rejecting the view that rising fragmentation signals the greater competitiveness of elections. To develop this argument, we turn first to consider Demsetz's (1968) view of natural monopoly. The discussion here begins with the first theorem of welfare economics linking competition with economic efficiency before turning to Demsetz's contribution and its applicability to Duverger's Law and SMP elections. The implication of Demsetz's contribution for party governance is operationalized via the notion of a contestable election, an idea developed more fully in the economic context by Baumol (1982) and Baumol et al. (1982).

In any economic product market, social welfare is maximized when the difference between the total social benefit created by that product and the total social cost of producing that product is maximized. This, in turn, implies that production should be increased as long as the marginal social benefit exceeds its marginal social cost, and when the two are equalized, the market is conventionally described as being efficient. When the product in question is a private good (i.e., a good that cannot be consumed simultaneously by more than one individual), two conditions are often invoked to ensure efficiency. First, the firms producing the good under increasing cost must be individually too small to influence the market selling price so that each firm becomes a price taker. Under these circumstances the firm's incentive to maximize profit means that each will produce where the market price equals its private marginal cost, and realize profits if the market price exceeds average cost. Second, there can be no barriers to new firm entry. This implies that firms will enter the market as long as profit can be made which in turn raises industry output, lowers the market price and reduces incumbent profit. In this way competition among established firms and potential entrants guarantees that only the lowest cost firms will survive and that all such firms will equate price to private marginal cost. It follows that if private and social costs are identical, competition among firms in the presence of these two conditions—price taking and the absence of barriers to entry—are sufficient for market output to be efficient and for social welfare to be maximized.

The sufficient conditions described above include two important caveats: first, that cost conditions allow atomistic firms to be the low cost option and, second, that the goods produced are not public goods that are nonrival in consumption. In most industries, however, firm-level fixed costs are present. This means that firms are typically not atomistic in size and to the extent that time and space allow some degree of market segmentation, firms will retain some degree of market power and control over price in the short run. To the extent that barriers to entry exist, such market power can persist over the longer run. In either case the ability to raise the selling price without losing all market share leads the profit maximizing firm to reduce its output and raise its price above marginal cost. The degree to which price diverges from marginal cost depends upon the degree of effective competition that arises from the firms' rivals. All other things equal, the larger the market share held by any firm, the more market power it has and the less competitive will be that industry.

Recognition that the conditions for perfect competition do not exist has led economists and policy makers to look for ways to assess how far any particular industry departs from perfect competition. Here the inability to observe directly either marginal social cost (as opposed to private average cost) or the level of economic (as opposed to accounting) profit has required the development of alternative measures to proxy the degree of competition. This has been done through observable market shares. Hence it is argued that in private markets, more firms with smaller market shares will have less market power which, in turn, will result in a smaller divergence between price and marginal cost. As noted earlier, the HH index is designed to reflect just such a tendency.

While the use of the HH index has been important in areas such as competition policy, the second caveat to the sufficient conditions discussed above means that the competitive implications of this index will not apply in a market with public good characteristics. That is, unlike a market for private goods, net social value is not maximized by equalizing the market price for each consumer and the marginal cost of each producer. Rather social welfare is maximized when marginal social cost is equated to *the sum of* the (potentially different) marginal social benefits of each individual. Such markets—light from a lighthouse, knowledge generated by a new idea, a television program for communal viewing—are often described as being natural monopolies where concurrent consumption and cost minimization combine to imply a single producer. In such cases, competition among consumers and competition from incumbent producers and potential entrants cannot be relied upon to induce efficiency.[12] Because the absence of effective competition allows the monopolist to reduce output and raise price, many economists have advocated regulation. Hence in many communities public utilities are granted a monopoly right to produce in return for a commitment to satisfy market demand at regulated prices. The latter, in turn, are designed to allow the utility only normal profits. To the extent that the regulator can determine the appropriate set of market prices, greater efficiencies can be realized.

In a provocative article entitled "Why regulate utilities?", Demsetz (1968) argued that the fact that there can be only one efficient producer does not preclude competition from being used to improve upon the welfare generated within a natural monopoly. By the splitting of two usually conjoined rights, the right to own industry assets, and the right to determine the use of these assets, competition among potential managers over the dimensions of industry output and the prices at which output is marketed can be used to better approximate an efficient solution. That is, encouraging competition among potential managers over promised levels of industry output and the prices to be set can be used to achieve better market outcomes. In essence, the competitive process will end up revealing the insider information that would be needed by regulators to set the appropriate output and pricing terms. Market competition can in this way be refigured to meet the challenge of a single producer of a public good and to overcome the information problems facing public regulators.

Suppose then that Duverger's Law is true and that 2 is the long run competitive equilibrium in an SMP system such as Canada's. The interpretation of Duverger's Law as a long run competitive equilibrium fits easily into Demsetz's (1968) re-interpretation of competitive equilibrium in economic markets served

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[12]If concurrent consumers cannot be excluded from consuming, competition among consumers for the lowest (zero) price will result in insufficient revenue being generated to support the efficient level of production. On the other hand, if concurrent consumers can be excluded, efficiency could be achieved by a producer setting the Lindahl (individual) prices needed to realize a level of output at which the sum of the individual marginal values equals marginal social cost. However in the absence of competing alternatives, the sole producer will exploit its market power, raise the set of Lindahl prices and under produce relative to the potentially efficient level.

by a natural monopolist. That is, because governance of the political process has the characteristic of a public good—the policies and programs instituted by the governing party are consumed by all constituents concurrently—the governing party can be seen as analogous to the manager of a public utility. Because providing governance in a collective has the same cost structure as a natural monopoly—a single governing party/management team is the low cost service provider—social benefit is maximized when there is only one manager or governance provider. To avoid the reduction in service and higher cost that comes from the incentives facing the monopoly provider, competition must exist over the right to provide that service. This competition is provided through free and fair elections. However, for such competition to enhance welfare, there must exist not only competing sets of promised policy alternatives, but also a credible alternative manager that can step in and perform should the promised level of performance be reneged upon or not offered.

In this view, contestability in the sense developed by Demsetz and by Baumol and his co-authors—understood as the ability to credibly replace the incumbent producer—is the key mechanism by which the benefits of competition can be realized effectively by the community. In the political arena, competition in an election arises through the set of policies that competing parties view as better reflecting the wishes of the electorate. However the public good characteristic of governance means that effective competition comes not from the combined set of policy alternatives on offer, but from the set that can be provided by the credible alternative which must include the likelihood that that particular policy set will be implemented. Here the instability of minor parties in SMP systems highlighted by Duverger becomes critical. The incentive not to waste one's vote by supporting a nonviable alternative implies that the greater is the degree of party fragmentation, the less effective will second or third placed parties be as a constraint on the performance of the governing party. Because greater fragmentation means that each of the opposition parties is less likely to win a majority of seats, and since coalitions are difficult to arrange and maintain over time in SMP systems, each of these parties becomes less credible as a threat to the incumbent government. In such a fragmented party system, the pressure on the governing party to make and keep election promises is thus diminished. In short, from the Duverger-Demsetz perspective, a rise in ENP above 2 signals a decline in effective electoral competitiveness.[13]

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[13]There is an additional, conceptually distinct source of inefficiency that may worsen with fragmentation. This stems from the possibility that as the number of parties increases, each party is forced by the division of the electorate to focus its electoral promises on a narrower segment of the electorate, thus moving the public sector towards special interest politics and away from concerns over the provision of general public services. See Lizzeri and Persico (2005) for an interesting exploration of this view. Chhibber and Nooruddin (2004) propose and positively test a similar hypothesis for Indian states. Bueno de Mesquita et al. (2001) present essentially the same view. See also the additional literature cited in the first footnote concerning the weak government hypothesis. A reasonable conjecture is that this source of inefficiency may be a problem in all SMP systems with weak national parties.

In the next section, we attempt to apply the Duverger-Demsetz view to Canada by measuring the contestability of elections. But before we do so, it is interesting to consider how the idea of competitiveness as electoral uncertainty fits with this approach. Is a contestable election also highly uncertain? If we are concerned with the consequences of competition, uncertainty in itself is not a necessary ingredient. That is, in the absence of performance differences across contenting parties, contestability will restrain the options of the incumbent such that replacement would arise only when the incumbent party behaves 'badly' or miscalculates the nature and distribution of voter preferences. On the other hand, if a candidate or party is superior in terms of performance, we may observe long periods of one-party dominance even in a highly contestable system, a point also made by Buchler (2014). Thus in a framework in which contestability is the center of attention, one party dominance and the absence of electoral uncertainty are not reliable indicators of a lack of competition.[14]

4 Analyzing the Canadian Electoral System from the Duverger-Demsetz Perspective

From the Duverger-Demsetz perspective, what matters for competitiveness is whether or not the governing party faces the threat of replacement by an alternative when it doesn't provide what voters wish. The key requirement is that the threat of replacement must be real, which requires the alternative to be credible. When the incumbent can be replaced easily by a credible alternative we may say that the electoral system is highly contestable. In this section we provide some empirical support for the Duverger-Demsetz perspective using the history of the Canadian parliamentary system to measure the contestability of elections at the national level. We show that contestability has tended to be greater when the vote is *less* fragmented.

As is well known, a good electoral strategy in a Westminster system like Canada's is to target marginal constituencies: districts especially susceptible to changing hands in an election (see, for example, Hartle 1985; Persson and Tabellini 2000 chapter 8, among others). This suggests that the proportion of marginal constituencies would be a good indicator of the contestability of an election. If every constituency is perfectly safe for its incumbent regardless of what the challenger may do, there is no competition and the position of the incumbent party in power in

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[14]We use the word 'reliable' here because we are aware that the matter is not straightforward. If the survival of the incumbent was *always* assured (i.e., absolutely certain), there is no political competition. Even if the incumbent is superior, preservation of competition as a principle of governance may require throwing out such an incumbent from time to time, thus introducing uncertainty into the process.

Ottawa is clearly not contestable. On the other hand, if every seat is marginal, 'every seat is a battleground', as Bodet (2014) puts it. 430

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Marginal seats as a measure contestability can be improved upon by incorporating a measure of the asymmetry of safe seats among parties, on the grounds that a party holding relatively more of the safe seats has an important advantage over its opposition. This is because it is able to focus its resources on constituencies that are thought to be marginal to a greater extent than its opposition. In what follows, we construct an asymmetry adjusted marginal seat index and then consider how it is related to fragmentation. 432 433 434 435 436 437 438

To operationalize the idea that the contestability of an election depends on the asymmetry adjusted proportion of marginal seats in an election, we must first define what marginal means. Hartle (1985) suggests that a marginal constituency is one from which economic rents cannot be taken and redistributed to other places without serious risk of electoral defeat. This is attractive as a definition of electoral marginality, but impossible to apply without the ability to measure the distribution of rents across constituencies, data which are as yet unavailable. 439 440 441 442 443 444 445

AQ7 Previous work in Canada on marginal or safe seats includes Lovink (1973) and most recently Bodet (2014). Both of these interesting studies use data for small samples of Canada's electoral history. Bodet defines a safe seat as essentially one that lies in the upper tail of the distribution of vote margins and uses a one standard deviation above the mean based on the distribution of vote margins in the previous election (and some ancillary criteria) as his cutoff. Winning margins larger than that cutoff are considered sufficiently large to provide a substantial cushion of safeness to the incumbent party in that constituency. We also employ the one standard deviation standard in this initial exploration. 446 447 448 449 450 451 452 453 454

To measure a safe, or alternatively, marginal seat by party, we consider the volatility adjusted, winning vote margin for the candidate of each incumbent party p (which won at time $t-1$) in constituency j within superconstituency s in election t, defined as 455 456 457 458

$$IPmargin1_{pjst} = \frac{(v_{1pjst-1} - v_{2jst-1})}{Volatility_{st-1}}. \tag{8}$$

If this *IPmargin* falls in the upper tail of the distribution of all such margins for all parties for the previous three elections—e.g., it is more than one standard deviation above the mean—the constituency is judged to be safe for that party. Incumbent margins for the next election are constructed in the same way by adding the next election outcome and dropping the oldest to form the relevant test distribution. Note that only past election outcomes are used to judge safeness, except when a constituency does not have an incumbent (for *any* reason) in which case it is considered to be marginal or not safe. Once again the superconstituency, defined over an unchanging geographical area, is an important feature of this construction via the measurement of volatility. This is because the distributions of *IPmargins* require measures from four consecutive elections, a long period of time within which many constituencies are born, die and change boundaries. 459 460 461 462 463 464 465 466 467 468 469 470

This algorithm, applied to all constituencies in each election, leads to the number of seats that are considered to be safe in each election, ψ_t. We then compute the proportion of marginal seats (in the total to be elected) in each election, MS_t,

$$MS_t = 1 - \psi_t, \tag{9}$$

as a measure of the competitiveness of the election as a whole. In this case, $MS = 1$ indicates that 100 % of the seats in Parliament are marginal.

As noted earlier, the proportion of marginal or safe seats does not in itself provide a good index of contestability. How safe seats are distributed across parties, and in particular, whether or not there is an asymmetry in their distribution, also matter. Regardless of the number of marginal seats in total, an equal distribution of safe seats across the major parties will result in a highly contestable election compared to a situation in which the same number of safe seats are held predominately by just one party. To acknowledge the importance of the distribution of safe seats to a judgment about the contestability of an election, we adjust the proportion of marginal seats MS_t by the degree of asymmetry in safe seats among the parties to produce a better measure of competitiveness at the national level.

To capture the notion of asymmetry, we borrow an idea used by Gaines and Taagepera (2013) in a somewhat different context to define the Euclidean deviation from a three party equal sharing of safe seats:

$$\phi3_t = \sqrt{3/2} \, * \, \sqrt{\left(1/3 - S_{p1t}\right)^2 + \left(1/3 - S_{p2t}\right)^2 + \left(1/3 - S_{p3t}\right)^2} \tag{10}$$

where $S_{pkt} =$ the seat shares in Parliament of the party in kth place in terms of seats. Then $\phi3_t = 0$ if the safe seats are symmetrically distributed; and $\phi3_t = 1$ if one party has all the safe seats. In Canada's case the third 'party' is a residual consisting of all other parties except the two major parties in Canada, the Liberals and Conservatives (which are broadly defined as part of our 12 party aggregation).

An asymmetry index based on the proportion of marginal seats that acknowledges the asymmetry in their distribution may then be defined as:

$$MSadj_t = MS_t * (1 - \phi3_t). \tag{11}$$

$MSadj_t$ (the proportion of marginal seats adjusted for asymmetry) $= MS_t$ if safe seats are symmetrically distributed among the parties, and is 0 if one party has all the safe seats.

There is one further adjustment to make before the contestability index is finished. The formulation in (11) may overweigh asymmetry. For example, if there are only 3 safe seats in 300 held by only 1 party, $MSadj = 0$. To correct this problem, we first adjust safe seats for asymmetry in their distribution:
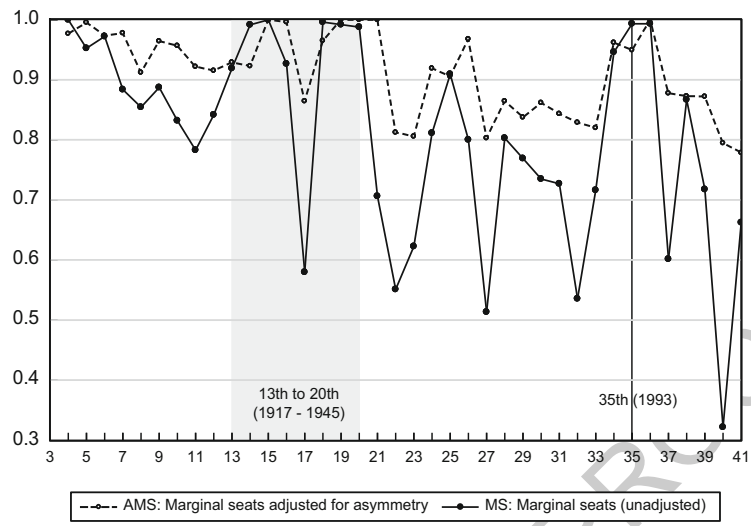
$$AS_t = \{\psi_t\phi3_t\}.$$

Fig. 3 Asymmetry adjusted marginal seats vs marginal seats Canadian General Elections 4–41, 1878–2011. One standard deviation criterion

$AS = 0$ if safe seats are symmetrically distributed and $AS = \psi_t$ (the proportion of safe seats) if one party has all the safe seats. We then use AS_t to define an adjusted asymmetry index of marginal seats:

$$AMS_t = 1 - \{\psi_t \phi 3_t\}. \tag{12}$$

This is our metric of electoral contestability. $AMS = 1$ if all safe seats are symmetrically distributed, and $AMS = 1 - \psi_t$ (the proportion of marginal seats) if one party has all the safe seats.

In Fig. 3 below we show the AMS index for Canada in comparison to the corresponding symmetry unadjusted series MS. It can be seen that in seven or eight elections with a relatively small number of marginal seats, the asymmetry adjusted index is much higher than the unadjusted one. This pattern indicates that in these elections there is an important degree of symmetry in the distribution of safe seats even though their absolute number may be small, and illustrates the necessity of integrating the symmetry of the distribution of safe seats into the index of electoral contestability (12).

4.1 Fragmentation and Contestability in the History of Canadian General Elections

We can now consider the relationship between fragmentation and our measure of electoral contestability in a manner that sheds light on the Duverger-Demsetz perspective. To do so, it is instructive to begin by looking at a scatter diagram that relates both the AMS and PS indexes to the ENP Ratio = 2/ENP, with ENP define defined as a national average over constituency level values based on vote shares of candidates. This will be followed by regressions that confirm what a visual inspection of the data appears to indicate.

Using ENP in the form of a ratio is convenient transformation because in the Duverger-Demsetz view, the ENP Ratio will equal 1 in the long run of an electoral system that is highly contestable and will decline as the number of parties increases above 2. Recall that it is also the case that the AMS and PS indexes take a value of 1 when reflecting the highest degree of competitiveness and decline in value as competitiveness decreases. It follows that if increases in each of these indexes measure greater competiveness, all three measures should be positively related.

As the regression lines on the scatter diagram of Fig. 4 suggest, the ENP Ratio is positively related to both competitive measures, implying that fragmentation has a *negative* association with competitiveness. In the upper portion of the figure it can be see that as ENP Ratio rises towards 1, so does contestability as indicated by a rise in the values of the asymmetry adjusted marginal seat index AMS. Here, then, is qualified support for the Duverger-Demsetz view. We say 'qualified support'
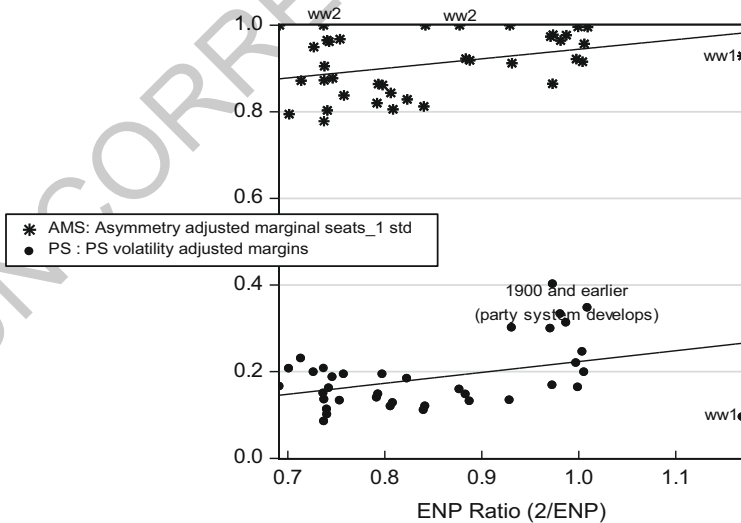
Fig. 4 AMS and PS indexes versus the ENP Ratio, Canadian General Elections 4–41, 1878–2011

because of the potential sensitivity of our conclusion to alternative assumptions that could be made in the construction of our index that have yet to be explored.

We can also see in the figure that the PS index of volatility adjusted vote margins is also positively related to the ENP Ratio, indicating that fragmentation and our preferred measure of competitiveness as closeness are negatively related. This is further evidence that in the Canadian case at least, fragmentation is not positively correlated with competitiveness.

Closer inspection of Fig. 4 indicates that there are some episodes in which observations tend to cluster off of the regression lines. These clusters suggest controlling factors that can be used in regressions to remove anomalies that distract from the underlying relationships. Two groupings of elections are of interest in this respect: first, elections during the world wars, which likely saw the introduction of elements that would not be present under normal circumstances; and, second, elections in the period before 1900 when the party system in Canada was maturing.

The relationship between fragmentation, represented by the ENP Ratio, and the competitiveness indexes AMS and PS, as well as the role of the dummy variables for war and the early years of the party system, are explored in the regressions presented in Table 2 on the following page.

The general appearance of positive, significant coefficients on the AMS and PS indexes across the first three columns representing different versions of the equation for 2/ENP confirm what visual inspection of the scatter diagram in Fig. 4 suggests, namely that more fragmentation is associated with less contestability (see the coefficient on AMS), and less competition defined as closeness (and uncertainty) of electoral contests.

By using the ENP Ratio as the dependent variable in Table 2, we do not mean to imply that the equations in the table represent a causal relationship running *from* the AMS or PS indexes *to* ENP. Rather the regression equations represent a long run equilibrium relationship in which the number of parties, their vote shares and degree of competitiveness are all simultaneously determined. Accordingly, the dynamic least squares (DOLS) estimation in columns four and five of the table treat the model tabulated as a cointegrating relation, and allow for the possibility that standard errors of the OLS regressions may be biased by correlations across time arising among the three variables ENP, AMS and PS.[15]

Consider the DOLS results in the fourth or second to last column in Table 2. The stationarity of the residuals of this model and the fact that the coefficient estimates on AMS and PS retain their sign and significance compared to the OLS results further supports the view that contestability as well as electoral uncertainty are on average both *negatively* related to party fragmentation over the history of parliamentary elections in Canada.

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[15]It does this by adding leads and lags of all three variables into the equation, so that, in principle, the calculated residuals are orthogonal to the entire process despite the mutual interdependence of the three variables.

Table 2 The relationship between the ENP ratios and competitiveness indexes

	ENP Ratio			ENP12party Ratio	
	OLS	OLS	OLS	DOLS (long run)	DOLS (long run)
AMS	0.71*** (2.91)	0.47** (2.04)	0.46** (1.92)	1.41*** (3.09)	1.54** (2.43)
PS		0.64*** (3.07)	0.55* (1.78)	0.83* (1.77)	0.78 (1.20)
ww1	0.31*** (3.05)	0.37*** (4.03)	0.37*** (3.91)	0.20** (2.20)	−.0001 (0.001)
ww2	−0.10 (1.38)	−0.06 (0.85)	−0.06 (0.80)		
party_formation			0.03 (0.40)		
Constant	0.20	0.29	0.32	−0.58	−0.82
R^2 (adjusted)	0.31	0.44	0.43	0.75	0.64
Prob (F-statistic)	0.001	0.000	0.000		
n	38	38	38	31	31
ADF (MacKinnon 1996, tau test)			−4.31* (SIC; constant and trend)	−6.56*** (SIC; no constant, no trend)	−2.79 (SIC; no constant, no trend)−7.52*** (with const. and trend)

*, **, *** significant at 10 %, 5 % and 1 % respectively. Absolute value of t-statistic in brackets
Notes:
1. Dependent variables: ENP Ratio = 2/ENP with ENP calculated at the constituency level, OR ENP12party Ratio = 2/ENP12party with ENP calculated at the national level using party vote shares for 12 parties—see the Appendix for the definition of parties
2. *AMS* the asymmetry adjusted marginal seat index of electoral competition as closeness or electoral uncertainty, *ww1* (*ww2*) dummy variable equal to 1 of electoral contestability, *PS* the Przeworski-Sprague index of electoral competition as closeness or electoral uncertainty, *ww1* (*ww2*) dummy variable equal to 1 if an election was held during world war one (two), 0 otherwise, *party_formation* dummy variable equal to 1 if the election is in 1900 or before, 0 otherwise
3. *OLS* ordinary least squares, *DOLS* dynamic least squares, maximum three lags and leads, three selected, *AIC* criterion. Only the long run DOLS equation is shown. All estimation using other default options in Eviews 9

Before turning to consider the extension of our ideas to proportional repre- 578
sentation systems, it is useful to consider how the statistical relationship between 579
fragmentation and contestability carries over to a situation in which fragmentation 580
is measured at the national party level, as indicated by ENP measured using vote 581
shares of (12) parties at the national level, labeled ENP12party in Tables 1 and 2. As 582
Table 1 shows, in Canada this measure of the effective number of parties is highly 583
correlated with ENP defined over candidates at the constituency level, at 0.88, and 584
is generally larger that the constituency based ENP.[16] 585

We expect that a high degree of contestability at the national level will put 586
pressure on third and fourth place parties in the constituencies. In extreme cases, 587
it is conceivable that one party will dominate in a particular region, and another 588
party in another, with contestability remaining high at the center where there 589
are then two (or even more) major opposing parties, each of which has many 590
candidates that are 'safe' in their own region of dominance. While our measure 591
of contestability—the AMS index—can handle such situations, ENP defined as an 592
average over constituencies may not. In the example outlined, average fragmentation 593
at the constituency level will be low, while at the national level it remains more 594
robust. 595

To allow for such situations, we also include the fifth column in Table 2, where 596
the left side variable is now ENP12party Ratio, which is 2 divided by ENP defined 597
at the national level using vote shares of 12 parties that have existed over Canadian 598
parliamentary history.[17] Despite the complications of going from the constituency 599
to the national level, we see that the statistically significant inverse relationship 600
between fragmentation and the contestability index AMS still remains in the DOLS 601
estimates, though not with quite the same statistical strength. The PS index of 602
closeness or electoral uncertainty at the constituency level is now insignificant, 603
perhaps reflecting situations in which contestability remains at the national level 604
even though there are parties that have carved out for themselves safe seats that are 605
regionally concentrated. 606

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[16]In Canada from 1867 to about the start of the first world war, the number of parties as reflected by ENP12party declined steadily to about 2 at the outbreak of the war. Thereafter, both ENP12party and ENP defined as an average over the constituencies began to rise, with ENP12party being uniformly higher than ENP. Since Duverger's Law is a long run result, it is not clear whether or not either enp index is systematically greater than 2 in the long run. Investigation of that issue requires a dynamic empirical model of enp, which to our knowledge has not yet been constructed for Canada or elsewhere.

[17]Again, see the Appendix for the definition of party used here.

5 Does the Duverger-Demsetz Perspective Extend to Proportional Systems?

To complete our analysis of electoral competition from the Duverger-Demsetz perspective, we consider whether our ideas about the importance and role of contestability in SMP electoral systems can be extended to proportional representation in multi seat elections (PR)? Here we are of two minds.

On the one hand, if there is a single party in government, the exact argument given earlier for why two parties produce a highly contestable electoral system in the plurality setting will also apply to the PR setting. As we have argued earlier, the greater is the degree of party fragmentation, the less effective will be the second or third placed parties as a constraint on the performance of the governing party. Moreover, the work that has been done on extensions of Duverger's Law for proportional representation systems is based on the argument that the carrying capacity of a PR system (defined in terms of ENP at the district level) will be a function of the district magnitude, M, in that system, i.e., the number of seats being contested in a given district (or the size of median district overall). The carrying capacity of the system is either expected to have an upper bound of $M + 1$ (Cox 1997) and will thus be above 2 for $M > 1$, or expected to be, on average, the square root of $M + 1$ (Taagepera and Shugart 1989), which is above 2 for $M > 4$. Because values of $M > 1$ mean that, for PR systems, we expect to see more than 2 winning parties, this means that the likelihood of there being a single party majority tends to diminish with M (Rae 1967).

Since coalitions are likely to emerge in PR systems and because coalitions are difficult to arrange and maintain, there will sometimes be minority governments. It may therefore appear to be the case that a PR system is more contestable since it is easier to displace a minority government. However, the opposition is also likely to be fragmented under PR for the same reasons, regardless of whether there is a minority or a majority in government, and the opposition coalition, if there is one, will also tend to be difficult to maintain over time. Hence, a rise in *ENP* above 2 can also signal a decline in effective electoral competitiveness in a PR system.

From the Duverger-Demsetz perspective, the 'best' situation would be one where there is a strong coalition in government to provide public services, and a strong coalition in opposition threatening to replace it, the same situation that leads to a high degree of contestability (and efficiency) in an SMP system. In general, then, fragmentation of the party system under PR is not conducive to contestability because of the costs of forming and maintaining party coalitions, and the best outcome under PR mimics that for the SMP system. Hence we arrive at essentially the same assessment as for SMP, though by a different route.[18]

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[18]There is an additional, conceptually distinct source of inefficiency that may worsen with fragmentation under PR. This stems from the possibility that each party in a PR system focuses its electoral promises on a narrower segment of the electorate than does a party under SMP. If so, the public sector under PR will be driven more by the demands of special interests and pay less

On the other hand, if we approach competition in terms of the measures used by Blais and Lago (2009) or Grofman and Selb (2009), we can think of competition increasing with M, because the *threshold of exclusion*—the largest vote share that a party can achieve and still be denied even a single seat—declines with M for all PR electoral rules. Thus entry of new parties is generally easier under PR than in an SMP system, and entry is another important dimension of competitiveness. Moreover, while the check on the behavior of the governing party generated by a truly viable single competitor, emphasized as the root of electoral contestability in a plurality system, does not apply in the PR context, what may apply is a growing multiplicity of viable alternatives to the present governing coalition that include some but not all elements of that coalition joined to other parties not in the present coalition.

By throwing up what is likely to be a wider range of alternatives, a fact that is sometimes taken to be a major failing of PR systems, namely the relative fragility of multiparty coalitions in terms of durability, may be given a positive interpretation from the economic perspective we have offered in this paper. To put this another way, we may say that the analysis of PR and, by implication, of SMP is not complete without considering the entry dimension of electoral competition, a dimension that is not identical to contestability.

6 Conclusions and Suggestions for Further Work

We have considered a number of distinctive ways to think about electoral competition in SMP systems, focusing on the issue of whether fragmentation or concentration of the electoral landscape in terms of vote shares, electoral uncertainty as measured by the closeness of contests, and the overall contestability of elections as indexed by asymmetry between major parties in the number of marginal seats stand as equivalent or even complementary indicators of greater electoral competition. The Duverger-Demsetz perspective, which emphasizes the contestability of elections, suggests these are not equivalents.

For SMP systems in particular, logic suggests that contestability will diminish with party fragmentation—in other words, that an increase in the effective number of parties (or in other related measures of fragmentation) is associated with reduced

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attention to the provision of public services, compared to an SMP system which effectively blocks some interests that are not regionally concentrated. (For example, the Greens in Canada may have 5 % of the vote in every constituency, but they elect only one member of parliament from a place known for voters who have a strong taste for the environment). On the other hand, some argue that candidates who must appeal to voters within a small geographic area and who can differentiate themselves from their competitors by making promises for narrowly targeted pork barrel items are more likely to arise in a SMP system than in a PR system (Carey and Shugart 1995; Persson and Tabellini 2000, 2005). We cannot resolve this debate over the role of electoral systems in the link between fragmentation, special interests and inefficiency here.

electoral competition. Evidence that this view has merit was provided by showing 676
that the effective number of parties and a new index of electoral contestability—the 677
asymmetry adjusted index of marginal constituencies—are inversely related for the 678
history of the Canadian parliamentary system. Robustness of the empirical work to 679
alternative assumptions, for example about the exact way to formulate expectations 680
of electoral success using ex post electoral data and the standards used to measure 681
the safeness of seats, remains to be studied. 682

In looking to future research, there is the challenge of setting the Duverger- 683
Demsetz perspective (or any other perspective on electoral competition) in a wider 684
context in which various dimensions of electoral competition, including competition 685
in legislatures between elections, are all considered together. The theory and 686
measurement of electoral contestability in PR systems, considered only briefly here, 687
also remains to be explored. 688

A.1   Appendix: The Data, Definition of Variables, 704
and Measuring Vote Volatility Using Superconstituencies 705

A.1.1   Data 706

Data on votes by constituency, by candidate and by party for regular parliamentary 707
general elections 1–41 were collected for each election from series supplied by 708
Elections Canada. This data is available online through the Parliament of Canada 709
website at: http://www.parl.gc.ca/About/Parliament/FederalRidingsHistory/HFER. 710
asp. 711

The 12 party classification employed throughout the paper is based on three 712
criteria: A party exists as such if it gained at least 4 % of the popular vote in at 713
least one election and contested at least 1 % of the seats in at least one election— 714
there are 23 parties satisfying these two criteria—*plus* it must have won at least 1 715
seat in at least two elections. There are 11 parties satisfying all these criteria over 716

the history of the modern state: Liberal, Conservative, Labour, the National Party, 717
the Bloc Quebecois, Social Credit, Reform-Alliance, the CCF_NDP, Raillement 718
Creditiste, the Progressives, and the United Farmers of Alberta, with a residual 719
category denoted as 'Other'. Liberal and Conservative include small groups that 720
voted with the major party at various times as is the usual custom. 721

A.1.2 Variables 722

ENP = ENP calculated over candidates at the constituency level using candidate 723
vote shares (max. 13 candidates in any one constituency). 724

ENP12party = ENP calculated over 12 parties (11 plus Other) at the national 725
level using party vote shares. 726

ENP Ratio, ENP12party Ratio = 2 divided by the corresponding ENP number. 727

Fragmentation = 1 − HH = 1 − 1/ENP, where HH is the Hirschman-Herfindahl 728
index defined using vote shares. 729

v_i = vote share of the candidate in the ith place. 730

Closeness(3) = an index of the closeness of candidates' vote shares v_i, assuming 731
ENP = 3, as in Endersby et al. (2002). 732

(v_1 − v_2) / volatility = the winner's vote margin $v_1 − v_2$ at the constituency level 733
relative to historical volatility for that constituency. 734

PS vol-adj. margins = the Przeworski-Sprague (1971) volatility adjusted vote 735
margins by constituency by party. 736

AMS_1std = an asymmetry adjusted measure of marginal seats, using an histor- 737
ical volatility and a 1 standard deviation test to define when an incumbent's seat is 738
safe. 739

ww1 = 1 for election number 13 (1917); 0 otherwise. 740

ww2 = 1 for election numbers 19 and 20 (1940 and 1945); otherwise 0. 741

party_formation = 1 for elections between 1 and 9 (1867 until 1900); 0 other- 742
wise. 743

A.1.3 Volatility 744

Adjusting vote margins for volatility is not easy to do over long periods of time 745
because of redistricting. For a country like Canada that has had consistent growth 746
in the number and frequent changes in the size of individual constituencies, new 747
ridings appear in many elections. Without a past, a constituency can have no 748
history of vote variability and cannot be included in the construction of a volatility 749
adjusted vote margin. To circumvent the loss of information on winning margins 750
through growth and redistricting, we construct a large number of regional super- 751
constituencies—80 in total—based on geographic regions that persist throughout 752
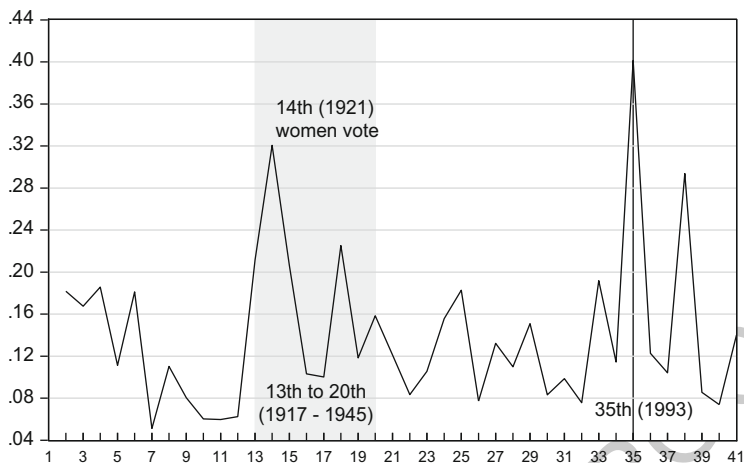Canada's election history and that can be used to establish small area vote volatility 753

The Duverger-Demsetz Perspective on Electoral Competitiveness. . .

Fig. 5 Historical volatility of party vote shares using superconstituencies Canadian General Elections 2–41

in the period when a new constituency is created or an old one is reshaped. The 754
number and name of individual constituencies in a superconstituency may change 755
over time, but its geographical boundaries remain fixed. To give one example, the 756
area around Ottawa was used as the base for one of Ontario's 29 superconstituencies. 757
Electorally it consisted of 1 riding in 1867 and rose to include 7 ridings by 2011.[19] 758

Aggregate volatility is then computed as follows: Average vote shares by party 759
over constituencies within a superconstituency for each election are computed. 760
For each superconstituency in each election, the absolute value of the changes in 761
these (party-specific) average vote shares across adjacent elections is computed, 762
summed and divided by 2. Each of these superconstituency specific differences in 763
vote shares is then weighted by the relative number of constituencies inside each 764
superconstituency, and summed to derive an aggregate volatility number for each 765
election. 766

Volatility so computed is shown in Fig. 5 for the 2nd to 41st election (1869– 767
2011) in Canada. The peaks in the 14th and 35th elections are noticeable. Whether 768
there is a trend in volatility or not is difficult to determine. 769

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[19]Note that the use of one past period to construct our volatility measure means that the index can begin only in the second election. This also implies the unavoidable loss of some information when new provinces are added to the country, such as Newfoundland's entry into Canada in 1949.

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