Article

Measuring Democratic Voice

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Abstract: This paper explores ballot split by type and introduces universal measures of democratic power flow and accountable local representation. These measures allow definitive comparison of electoral systems between countries, and choice of a new electoral system within a country based on existing data and with minimum assumptions.

Keywords: democracy; electoral systems; ballot split by type; legislative empowerment measure (LEM); accountable local representation measure (ALRM); single member district proportional representation (SMDPR)

1. Literature Review, Historical Context, and Acknowledgement

In as much as all new thoughts must appear to arise phoenix-like from the ashes of older ones, a tug of the forelock in the general direction of academe is required for orientation, as well as for publication.

The history of democratic measurement, since the field's post World War II inception as reviewed in Lipset's (1959) paper [1], is one of indices focused on attributes of democracy. This in an effort to discriminate which systems are democratic, and to determine how democratic content correlates with the almost ineffable concepts of freedom, human rights, climate change, etc.[1]

As the review by Giebler et. al. [2] frames it, "What is democracy? What is a good measure of democracy? … do our measures of democracy reflect real world political developments?"

Measures are fact, indices are gossip. If we measure your weight, we have fact about weight. If we measure your height and infer your weight from a table or index, we have gossip about weight; gossip that may or may not be accurate.

This paper is about measuring voice, the defined core element of democracy; all other indices are considered derivatives. The purpose is to provide the tools necessary to choose a new electoral system in Canada within constitutional constraints, but these tools have a much broader context and application within the field of measuring democracy.

The idea of focusing on a purposive definition of democracy seems to have been suffocated by debate following Riker's (1965) [3] comment, "… democracy is a form of government in which the rulers are fully responsible to the ruled" and Dahl's (1971) [4], "… a key characteristic of a democracy is the continued responsiveness of the government to the preferences of its citizens."

Since then, identification and measurement of the core element of democracy as determined by its historical evolution has been notable by its absence from the canonical literature.

[1] See Bollen (1980) [24], Coppedge and Reinicke (1990) [27], Inkeles (1991) [30], Vanhanen (1993) [33], Jaggers and Gurr (1995) [32], Alvarez et. al. (1996) [23], Gasiorowski (1996) [28], Coppedge (1997) [26], Collier and Adcock (1999) [46], Munck and Verkuilen (2002) [22], Shapiro (2003) [35], Pickle Coppedge et. al. (2008) [25], Munck (2009) [31], Hill and Jones (2014) [40], Pickle et. al. (2015) [29], Geißel et. al. (2016) [34], Hill (2016) [39], Lührmann, et. al. (2018) [41], Lauth and Schlenkrich (2018) [42], Elff and Ziaja (2018) [43], Skaaning (2018) [44], Escher and Walter-Rogg (2018) [45], Landman (2018) [38], Fuchs and Roller (2018) [36], Mayne and Geißel (2018) [37].

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We therefore begin with a fresh and purposive definition of democracy based on the broad sweep of parliamentary government history, for which the distribution and exercise of power is central [5, 6]. Fundamental to this approach is the concept that democracy exists because of a peoples' mindset (See [7, 8] for the Canadian context). Such mindset existed in ancient Greece and greeted European settlers in North America as embodied by thousands of years of indigenous tradition, eventually grafting itself on to British parliamentary governance and less successfully to the American 'experiment'.[2]

The thoughts and concepts presented here are a direct result of a mathematician's assessment of Canadian jurisprudence concerning the right to vote as enshrined in the Canadian Charter of Rights and Freedoms. Much reliance has been placed on the brilliant mind and rulings of former Chief Justice of the Supreme Court of Canada, Beverly MacLachlin [9, 10], the courage of the framers of Section 3 of the Canadian Constitution, and a reverence for the actualization of democratic mindset through parliamentary governance.

Speaking for the majority, MacLachlin ruled [10] that the purpose of the right to vote enshrined in Section 3 of the Charter of Rights and Freedoms is to provide each voter with equal "voice in the deliberations of government". The Court abjured overly legalistic language in interpretating the right to vote, enjoining purposive focus on those represented with due affirmation of the inherent dignity of the individual.

The mathematical tool typically used in the field of democracy-measures is statistics. Years of electoral abuse by political operatives through its misuse suggests statistics should be eschewed in general as a wonderful way for liars to prosper. Be assured, there is nothing mathematical in this paper more complicated than the concepts of arithmetic, proportion, and GINI coefficients as gauges of disparity.

2. Concepts and Electoral Systems

Democracy may be defined broadly, generously, and purposively as a system of government in which all exercisable power is equally and independently reserved to all citizens.

Representative democracy in turn may be defined as a democracy in which democratic power or voice is fairly and faithfully transferred from all equal and independent citizens to equal and independent representatives.

The above are obviously conceptual definitions speaking directly to democratic voice expression. Voice is foundational to most if not all democratic rights, principles, and institutions for without equality of voice for all democracy does not exist, no matter what the trappings. For example, freedom of speech is distinguished from voice in that speech does not require anyone to listen, while voice does. Voice is the power of law; speech is an attribute of democracy.

Both the above definitions arise from [9, 10], and are distinguished by showing appropriate respect for the dignity of the citizen, whereas the usual definition of democracy based on majority rule concerns only the exercise of power, not its origin. Majority rule shows respect for the legislature, not citizens, and merely defines a limit on the expression of voice in the face of failure to agree; plus, it only works where both majority and minority adhere to the democratic contract, by which all accept the majority rules but does not oppress the minority.

Division is a generic term for riding, constituency, borough, precinct, comté, ward, etc., depending on the specific country.

[2] This topic is voluminous. One approach to obtaining a feel for the field is through biography and historical commentary on key players in developing parliamentary democracy, such as Æthelstan, Kings Henry II and John, Champlain, Franklyn, Jefferson, Washington, John Adams, Lafontaine and Baldwin, Lincoln and Grant, Teddy and Franklin Roosevelt to name a few. Another is through the writings of Locke, Hume, Burke, Montesquieu, Rousseau, Kant, Pepys, Condorcet, Macaulay, Churchill, the Founding Fathers in the U.S., the Fathers of Confederation in Canada, and a host of others, and North American indigenous traditions.

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An **allocation Division** is an entity, usually geographic, within which seats are allocated to political parties, while a **matching division** is one within which seats are matched to political party candidates.

Under **ballot split by type**, ballots democratically intended to provide voice universally split into three types: essential, surplus, and losing. Essential are referred to as efficient; losing and surplus as inefficient.

Losing ballots have no voice in the deliberations of government. Any voice attributed to surplus ballots reduces the voice of associated essential ballots, so it's six of one and half a dozen of the other to say essential ballots have all the voice and surplus have none.

For comparison's sake, we will use nine **electoral systems**:

- France's two round system (TRS) fills a legislature of 577 seats, each representative chosen by majority. Only the top two candidates of a plurality in the first round go on to the second round. Each seat is both an allocation and a matching division.
- Canada's single member plurality (SMP) system comprises 338 ridings, each with one representative, in a federation of 13 unequal Provinces, Nations, and Territories. Each riding is an allocation division as well as a matching division.
- The Unites States House elects 435 members, each elected using SMP rules and representing one constituency in a federation of 50 unequal states. There is a presidential veto override of two-thirds. Each constituency is an allocation division as well as a matching division.
- Australia's instant run-off vote (IRV) system has 151 seats/constituencies, each with a single representative, in a federation of 8 unequal States. Each constituency is an allocation division as well as a matching division.
- Japan's parallel system has 295 SMP seats/constituencies, plus an additional 11 blocks with 180 seats decided by D'Hondt list proportional. Each constituency is an allocation division as well as a matching division: the list/block system forms a second allocation division, with the blocks as 11 matching divisions. The average number of representatives *per* block division is 16.
- Ireland's single transferable vote (STV) system has 40 constituencies and 157 seats. There is one national allocation division: each constituency is a matching division. The average number of representatives per riding is 3.93.
- New Zealand's mixed member proportional representation (MMPR) system relies on 71 seats/constituencies and a list division deciding an additional 49 seats using Sainte-Laguë applied to all 120 seats. The constituencies are single-member matching divisions only, with a single national allocation division; overhangs are allowed to stand, thus both allotting and allocating seats by electoral system while reducing proportionality.
- Sweden's party-list system uses a modified Sainte-Laguë method, to fill 349 legislative seats in 29 constituencies. The constituencies are matching divisions only, with a single national allocation division, overhangs being handle by losing pluralities. The average number of representatives per riding is 8.59.
- Single member district proportional representation (SMDPR) would have thirty-three allocation divisions in Canada, each consisting of ten to fifteen existing provincial or sub-provincial ridings, each riding being a matching division with one and only one representative. SMDPR as sketched below is a version of the Swedish system.

3. Methods

Raw data used can be found at [11]. Data was sourced from Constituency Level Elections Archive (CLEA) or the relevant official national websites for electoral data. Storage and analysis were performed in Excel.

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Data was first screened for possible errors and corrections made, some with the aid of 4th Dimension; calculations were then separated from the screened data. Original screened data appears against a light blue background, with calculations and manipulations against light beige.

4. Results and Discussion

Figure 1 shows ballot split by type in specific example elections for nine electoral systems, representative of the major types in world use.

The proportional systems (New Zealand's MMPR, Sweden's party-list, and Canada with SMDPR) provide the highest efficiency of ballot.

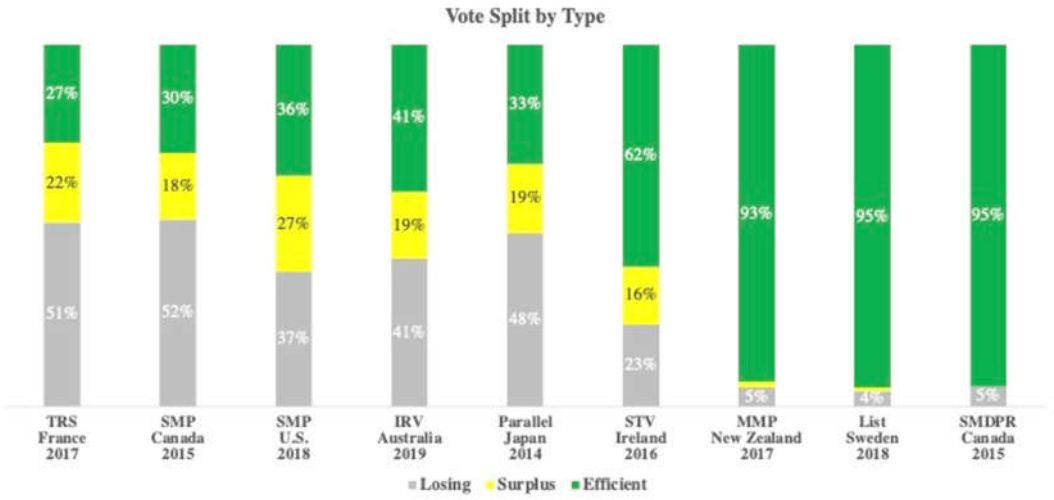

Figure 1. Ballot Split by Type.

Although much else could be said about Figure 1, ballot split by type is also useful in understanding the liabilities of SMP systems. For example, the panels of Figure 2 show aggregate ballot split by type from three perspectives for all forty-four Canadian federal general elections.

The leftmost panel shows seventy percent of voters have been voiceless in the deliberations of government; the ballots of only thirty percent being essential and accountable in forming the Canadian House of Commons.

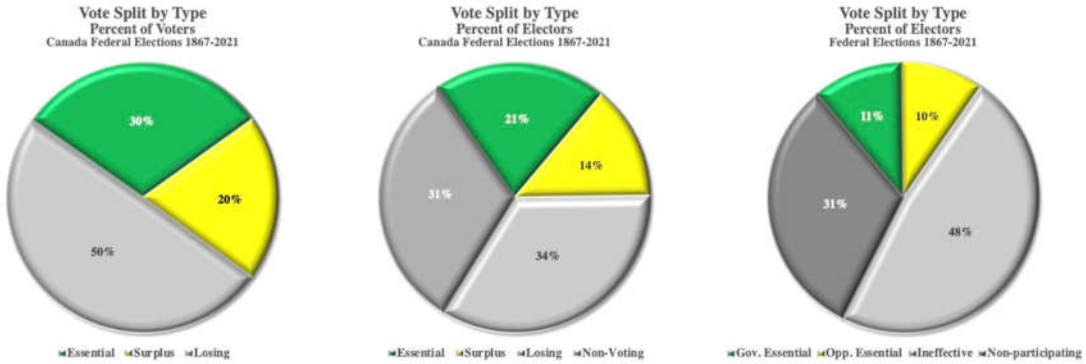

Figure 2. Ballot split by type for Canada 1867-2021.

The center pane shows the same data in the context of everyone who is eligible to vote; the ballots of only twenty-one percent of these electors have a voice in the House. This matters because the cheapest way to achieve political party success under the plurality rule is to maintain base support while supressing opposition support, making political

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manipulation of the non-voter category important to understanding the magnitude of democratic deficit.

The rightmost panel shows that the twenty-one percent of electors possessing voice in the House is narrowly split between the two parties of a Two-Party system: Government and Opposition.

Conclusions from this data are that a) SMP Government is democratically weak, b) Government policy is unstable, and c) the one percent of electors deciding who has power possesses disproportionate voice.

The targeting of that one-percent group, using accurate polls, detailed databases, social media, and patronage, abets SMP's toxic politics, resulting in agonarchy[3] not democracy.

The following five charts present longitudinal ballot split by type for Canada's forty-four SMP elections. Each trendline is a sixth degree-polynomial, which minimizes boundary effects.

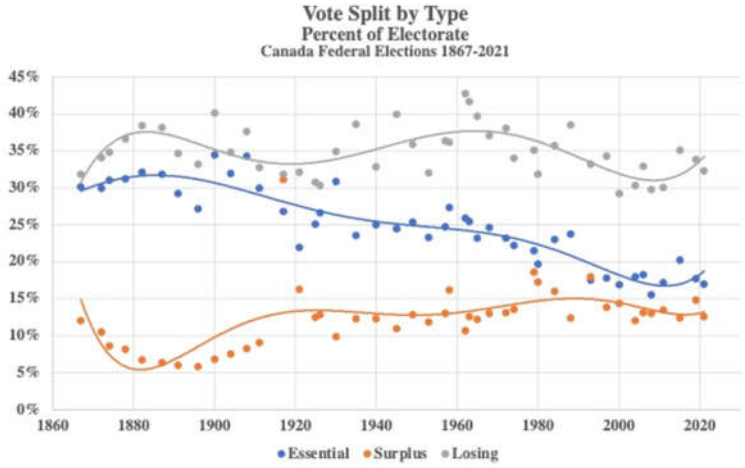

Figure 3. Ballot split by type as percent of electorate.

Ballot-split-by-type values as shown in Figure 3. change only because of political considerations, e.g., number of political parties, concentration of political support, ballot inefficiency, and because of political manipulation of the plurality rule. Level of enfranchisement itself has no effect on ballot split by type, given the size of raw numbers involved; however, any political bias of the newly enfranchised would have effect.

These charts are a visual representation of political reality under the plurality rule.

Any new party first polls losing ballots until it reaches sufficient popularity to poll a plurality, at which point losing ballots make a quantum switch to being essential/surplus. Growth in number and strength of political parties increases surplus ballots even as the number of essential ballots dwindles.

This effect is manifest in Figure 4. after Borden's WW I Union Government. Previous to this there were only two significant parties, the trendlines shaped most likely by the political effects of emerging public opinion through familiarity with Confederation, improved travel and education, and availability of cheap media.

[3] Agonarchy is an arena of conflict for spectacle in which winning and losing is decided by an arbitrary rule.

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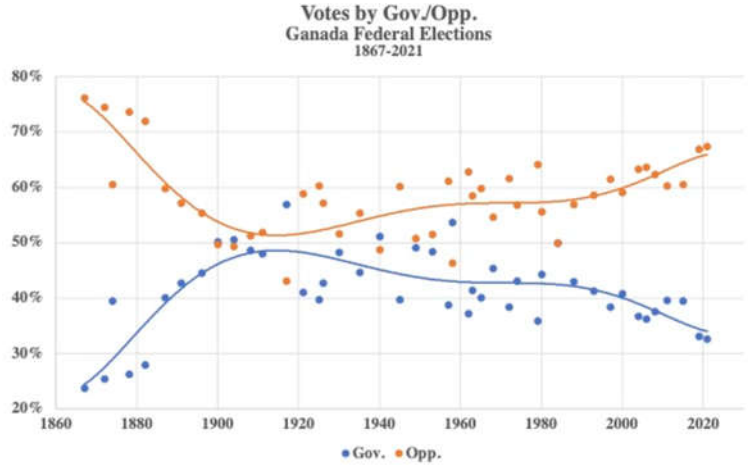

Figure 4. Ballots by Government/Opposition.

During the1925-80 period, overall ballots gradually decreased for Government and increased for Opposition. This correlates with the electorate becoming less cohesive and more metropolitan over the Depression, war years, and with the impact of the Great Society.

Government has seldom polled more ballots than Opposition.

There is however a suggestion of something else happening in the post 1980 period. We therefore look at ballot-split-types individually.

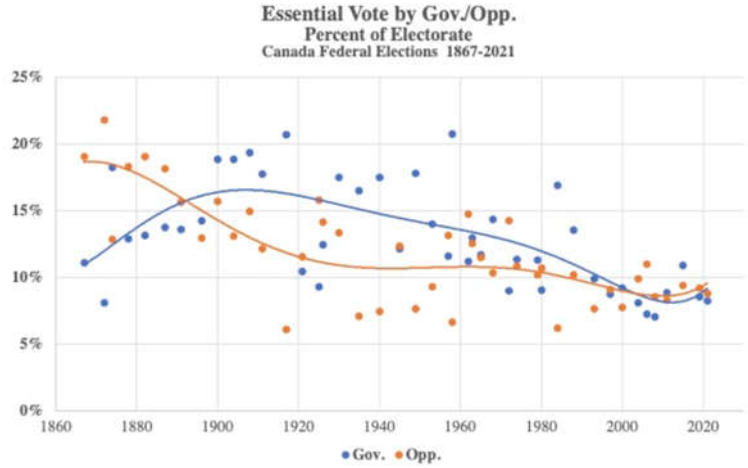

Figure 5. Essential ballots by Government/Opposition.

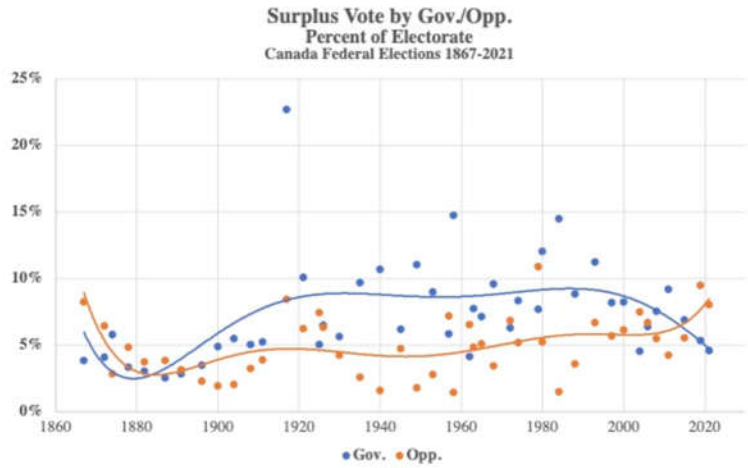

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Figure 6. Surplus ballots by Government/Opposition.

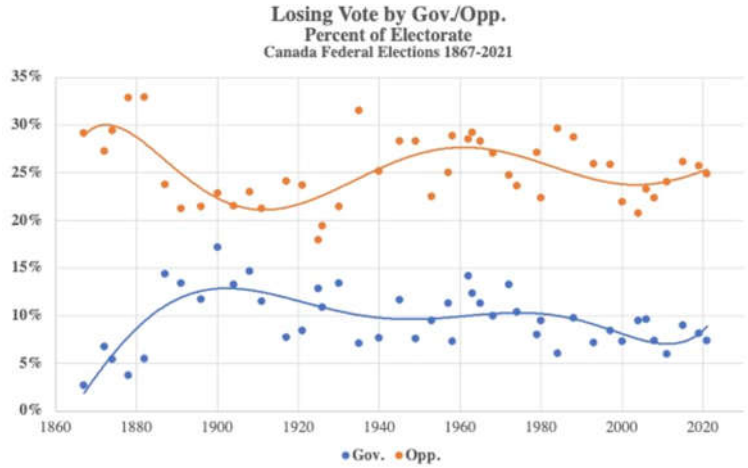

Figure 7. Losing ballots by Government/Opposition.

Figure 5 shows essential ballots only, and there is indeed evidence of accelerated change in the latter twenty years or so of the 20th Century, followed by an actual reversal of trendline positions in the early 21st Century.

Surplus ballot trendlines, as shown in Figure 6, also converge and cross toward the end of the 20th Century and into the 21st.

The losing-ballot trendlines shown in Figure 7 are fairly stable throughout the post-WW I period.

Because essential and surplus ballots for Canadian Governments have actually crossed over the trendlines for Opposition during the last forty years, Government now typically has fewer essential ballots than Opposition, which means a minority of voices expressed through ballots-cast controls the majority voice of the House; SMP provides majority rule by minorities.

The 1980s and '90s therefore mark an accelerated departure from democracy toward agonarchy. The expected outstanding characteristic of increasing agonarchy would naturally be depressed turnout, which finding is confirmed by Figure 8.

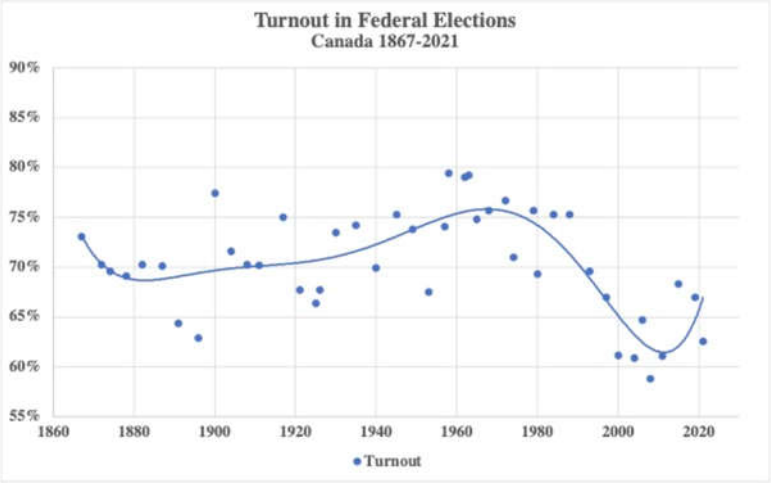

Figure 8. Turnout in Canadian federal elections.

Ballot split by type in SMP democracies shows corruption of democracy is happening not just through denial of democratic voice, but with the enthusiastic participation of major federal political parties, presumably motivated by self-interest, not democracy.

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4.1. Creating Measures

Comparing SMP to other electoral systems requires universal and comprehensive measures of democratic performance. The assumption that all exercisable power is reserved to citizens allows construction of a legislative empowerment measure (LEM) calculating how much citizens' power is voiced in the legislature.

The impediments to voice expression of all citizens $\boldsymbol{c}$ are five in number: some citizens are not allowed to vote (disenfranchisement $\boldsymbol{d/c}$), some that can vote don't (non-participation $\boldsymbol{n/c}$), not all districts have the same number of electors (malapportionment $\boldsymbol{m/c}$), not all political parties run candidates in all districts (partisan structure $\boldsymbol{p/c}$), and some ballots have no voice (inefficient $\boldsymbol{I/c}$). What remains after accounting for impediments is effective ballots $\boldsymbol{E/c}$.

$$\boldsymbol{LEM} = \frac{\boldsymbol{E}}{\boldsymbol{c}} = \frac{(\boldsymbol{c} - \boldsymbol{d} - \boldsymbol{n} - \boldsymbol{m} - \boldsymbol{p} - \boldsymbol{I})}{\boldsymbol{c}} = \mathbf{1} - \left(\frac{\boldsymbol{d}}{\boldsymbol{c}} + \frac{\boldsymbol{n}}{\boldsymbol{c}} + \frac{\boldsymbol{m}}{\boldsymbol{c}} + \frac{\boldsymbol{p}}{\boldsymbol{c}} + \frac{\boldsymbol{I}}{\boldsymbol{c}}\right)$$

Equation 1: Legislative empowerment measure defined

As mentioned in the introduction, measures have greater inferential value than indices. A Gallagher index, measuring the separation between seats won and partisan ballots polled, can be accidentally perfect for any electoral system; a measure such as LEM cannot.

Since the obverse of essential is accountable, LEM *per* representative is a universal accountable local representation measure (ALRM).

Voice expression of a legislature may be further impeded by veto-power. However, the emphasis in this paper is on voice-expression in, rather than of, legislatures. Veto power will therefore be ignored here but can be calculated as $\boldsymbol{v} = (\mathbf{1} - \boldsymbol{o}) * \boldsymbol{LEM}$ where $\boldsymbol{o}$ is the override threshold.

4.1.1. Disenfranchisement and Non-participation

As indicated above, disenfranchisement and non-participation are simple counts $\boldsymbol{d}$ and $\boldsymbol{c}$ expressed as fractions or percentages of all citizens.

4.1.2. Malapportionment

Malapportionment can be determined by using the GINI coefficient $\boldsymbol{g}$ of an elector's cumulative distribution curve, calculated in the same way wealth disparity is characterized in economics. We define $\boldsymbol{g} = \boldsymbol{A}/(\boldsymbol{A} + \boldsymbol{B})$ as the ratio of areas shown in Figure 9, where $\boldsymbol{A}$ is the area between Max Lorenz's straight-line equality line and Corrado Gini's cumulative distribution curve, and $\boldsymbol{B}$ is the area under Gini's distribution curve. Then $\boldsymbol{m} = \boldsymbol{g} * (\mathbf{1} - \boldsymbol{d} - \boldsymbol{c})$ where $\mathbf{1} - \boldsymbol{d} - \boldsymbol{c}$ is just the number of valid votes cast.

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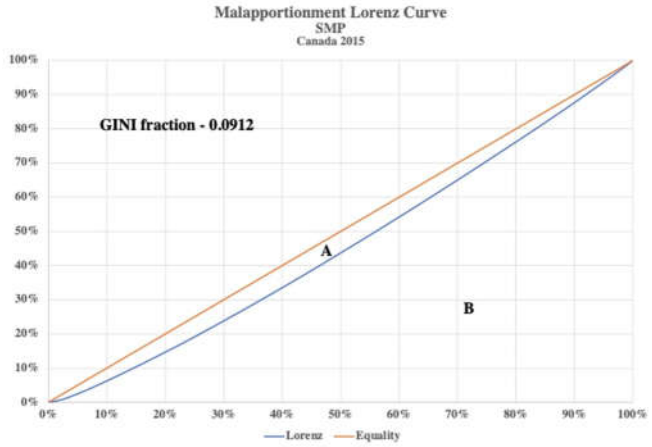

Figure 9. Maldistribution GINI fraction.

4.1.3. Partisan Structure Disparity

Partisan structure disparity captures the effects of maldistribution of partisan voice over district structure. For instances: a voter is denied voice if their preferred party does not run a candidate in the voter's district; certain electoral systems create safe and sacrificial ridings, debasing voice expression.

Calculating the effect of partisan structure on democratic voice-flow is an extension of how malapportionment is handled. Plot two GINI distribution lines: one each for political sentiment expressed locally $\boldsymbol{g_1}$ and globally $\boldsymbol{g_2}$, as shown in Figure 10.

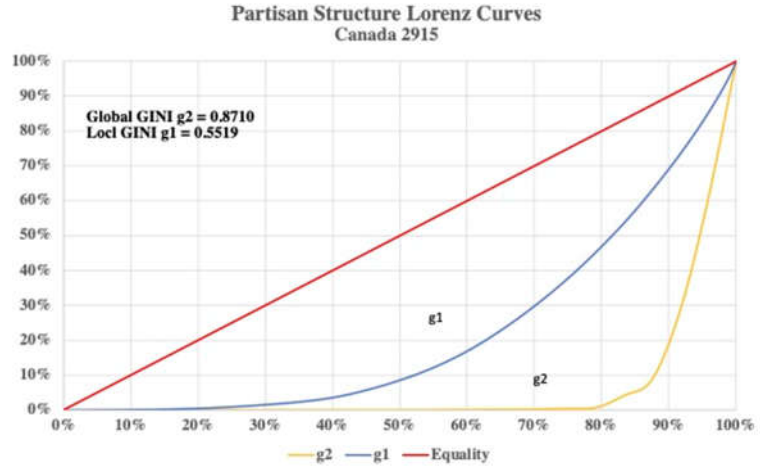

Figure 10. Political disparity GINI values.

The portion of local disparity not caused by global political voice disparity $\boldsymbol{g = g_1 - (g_1 * g_2)}$ is the combined effect of ridings and politics on voice-expression. Then, $\boldsymbol{p = g * (1 - d - n - m)}$.

Note that with only one riding, $\boldsymbol{g_1 = g_2 = 0}$ and so $\boldsymbol{p = 0}$; whereas with only one party $\boldsymbol{g_2 = 1}$ and again $\boldsymbol{p = 0}$; $\boldsymbol{p}$ does not distinguish between an extremely popular party in a true democracy and autocracy with only one official party.

4.1.4. Inefficiency

Residual voice $\boldsymbol{R}$ is now either efficient or inefficient.

Simple counts $\boldsymbol{e}$ and $\boldsymbol{i}$ of both efficient and inefficient ballot-split types determine the fractions of $\boldsymbol{R}$ each explains; $\boldsymbol{I = (i/(i + e)) * R}$, $\boldsymbol{E = (e/(i + e)) * R}$, and, of course, $\boldsymbol{I + E = R}$.

As defined in Equation 1 above, LEM is $\boldsymbol{E/c}$.

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Ballot split by type describes electoral systems based on votes; LEM and ALRM are based on citizens.

4.2. SMDPR Sketched

As we shall soon see, LEM and ALRM allow comparison of electoral systems as implemented in different countries, but they can also be used to compare different electoral systems in the same country, using existing data and with minimal assumptions. A Canadian implementation of SMDPR is briefly presented to allow demonstration of the latter.

SMDPR is the Swedish party-list system repeated in thirty-three Canadian allocation divisions, each consisting of ten to fifteen existing provincial or sub-provincial districts where possible, each district is a matching division having one and only one representative chosen from a local rather than national party-list.

Allocation of seats within an allocation division is by proportional representation, using D'Hondt to maximize essential ballot count [12] in accord with Canadian jurisprudence [13, 14, 15, 10, 16, 9]. Matching of candidates to allocated seats is by rank based on local performance, i.e., ballots polled divided by riding electors.[4] To be elected a candidate must a) belong to a party allocated a seat, b) rank high enough in their party to claim an allocated seat, and c) out poll any other local candidate achieving a) and b).

Overhangs are decided by losing plurality; this is necessitated by compliance with previously referenced constraints imposed by constitutional jurisprudence, and also by federal structure.

A two-choice-four-option ballot is used as shown in Figure 11. Two un-ranked options[5] are permitted in each of two lists. One list is of local candidates followed by party in parenthesis and the other is of allocation-division parties. Overt party choice takes precedence over parenthetical choice, but a single choice of local candidate would count as two ballots for the candidate and two for parenthetical party, thus preserving optional use of Canada's existing SMP ballot.

Four-options allows nuance of voice without compromising the security of an easily counted paper ballot.

Local Candidates		Regional Parties	
[X]	Suzie Queue (Liberal)	[X]	Liberal
[ ]	John Eh (Conservative)	[ ]	Conservative
[ ]	Les W. E. Forget (Green)	[X]	Green
[X]	Aki Kenosha (N.D.P.)	[ ]	N.D.P.
[ ]	Sam Champlain (B.Q.)	[ ]	B.Q.
[ ]	A. D. Hoc (Independent)	[ ]	Rhinoceros
		[ ]	None of the Above

Figure 11. Two Choice Four Option Ballot.

'None of the above' accompanies mandatory voting, which option is not considered a party but would be reported; essentially, a protest ballot.

4.3. Comparisons using LEM and ALRM

Figure 12 shows LEM for the same nine systems above.

[4] Using riding electors instead of votes cast minimizes gaming of the non-voter category.

[5] No ranking avoids Arrow's paradox [18]

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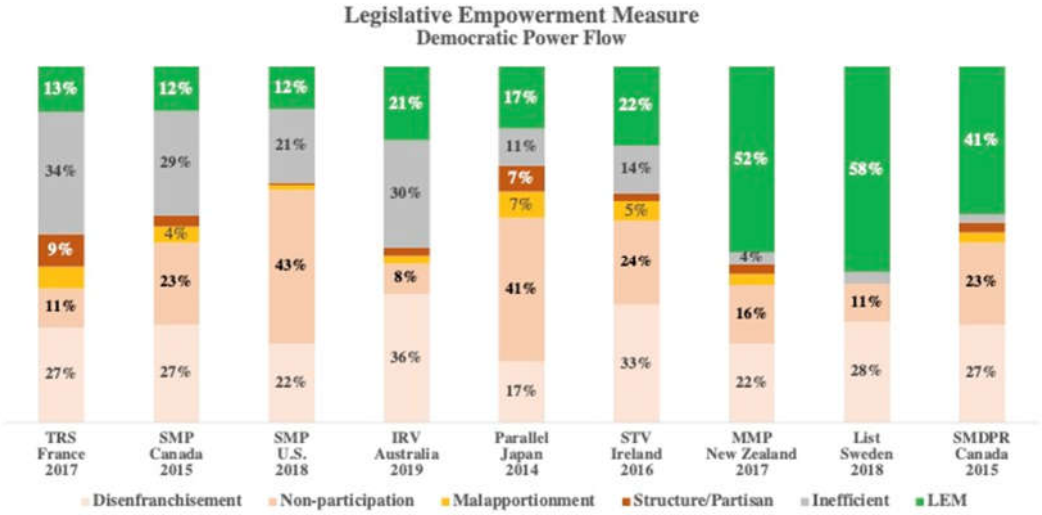

Figure 12. Legislative Empowerment Measure Compared.

SMDPR's LEM was calculated using SMP data. It would be expected to be in the low sixties with expectations of proportionality and mandatory voting. For simplicity of calculations, largest remainder was used for SMDPR's LEM, rather than D'Hondt, the latter also promising a slightly higher LEM.

Japan's elderly population has obvious effect on disenfranchisement.

Note that Australia's mandatory voting, the 'stick' approach, gives overall lowest non-participation, but far from perfect. Sweden's proportional system and France's TRS 'carrot' approaches do almost as well without mandatory voting. Highly proportional SMDPR with mandatory voting should provide better turnout than mandatory voting or proportional representation alone.

Malapportionment is low in all nine systems; mature western electoral systems have evidently sorted out maldistribution since it was first addressed in Britain's 1832 reform of 'rotten' boroughs.

Structural partisan impediment is good in seven of the nine systems: poorest in France's TRS and Japan's parallel system.

Inefficiency remains high in non-proportional systems: including Ireland's STV, but with TRS and SMP being the most inefficient.

Comparatively, SMDPR's LEM of sixty-plus would provide five-fold better voice than SMP and equal to or better than existing proportional systems. With voice as a central Canadian constitutional issue, LEM solidly disqualifies SMP and STV as electoral choices in the face of alternatives like SMDPR.

Of general interest is how little democratic voice flow there is under TRS and SMP; voice of the legislature under U.S. SMP with presidential veto would be further compromised.

Based on a history of political-party unwillingness to countenance change, low expression of democratic voice is clearly what entrenched powers in SMP countries want.

Figure 13 shows ALRM for the same nine systems. Again, use of SMP data and lack of D'Hondt artificially lower SMDPR's ALRM, which would be expected to be in the low sixties.

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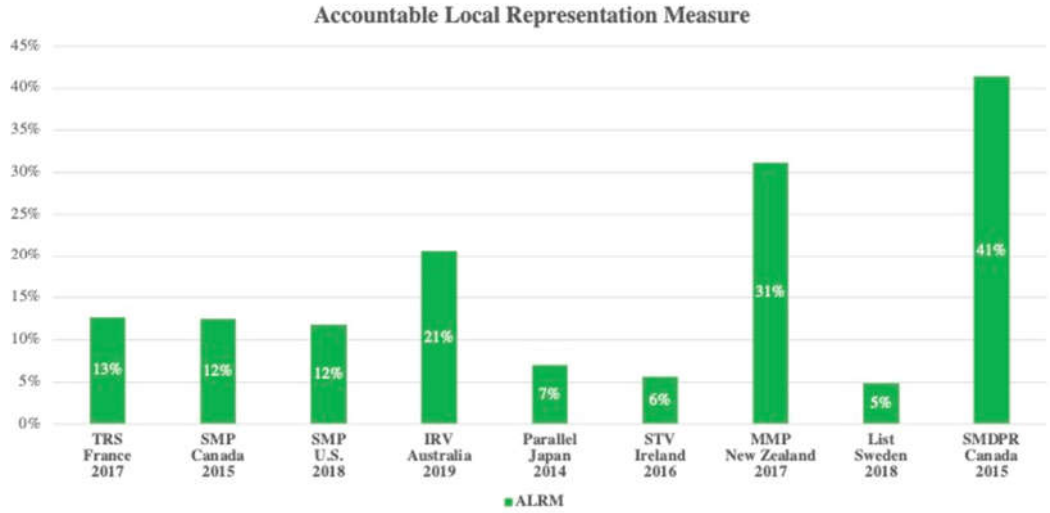

Figure 13. Accountable Local Representation Measure.

An ALRM of sixty-plus shows SMDPR would provide twice the local-representation accountability of New Zealand's MMPR and several factors better than any of the other systems tested.

Together, LEM and ALRM establish SMDPR as the better alternative to SMP for Canada; significantly better than both STV and MMPR. It is important to realize this determination is based on a measure of voice expression or effective representation, ruled to be the purpose of the right to vote enshrined in the Canadian Constitution [10].

Figure 14 is an area chart of longitudinal Canadian LEM for general federal elections from 1925 to 2021.[6]

The most striking feature of longitudinal Canadian LEM is its stability. Roughly ten percent of citizens have decided the structure of the House, regardless of changes in each and every impediment type, and in the face of wars, political turmoil, social upheaval, etc. Clearly, the ruling elite in Canada is firmly entrenched, thanks to the plurality rule. Specifically, focus on parity of ballot-input has not significantly affected lack of democratic voice in Canada's SMP system; future improvements must come from addressing inefficiency of ballot-output through changes to electoral system type.

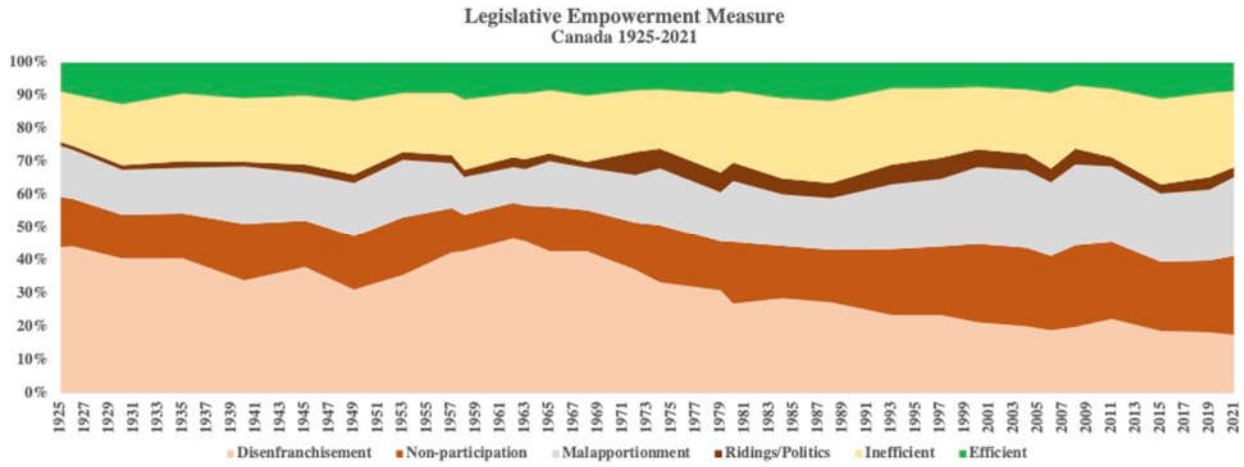

Figure 14. Longitudinal LEM in Canada.

Table 1950. to 1970, which nonetheless had no effect on LEM, as expected.

[6] Women did not have the franchise in elections before 1921.

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Figure 15 repeats data points and trendline for turnout at Canadian federal general elections from 1867 to 2021, plotted together with the matching data for structural political disparity impediment and its component GINI coefficients of local and global political disparity.

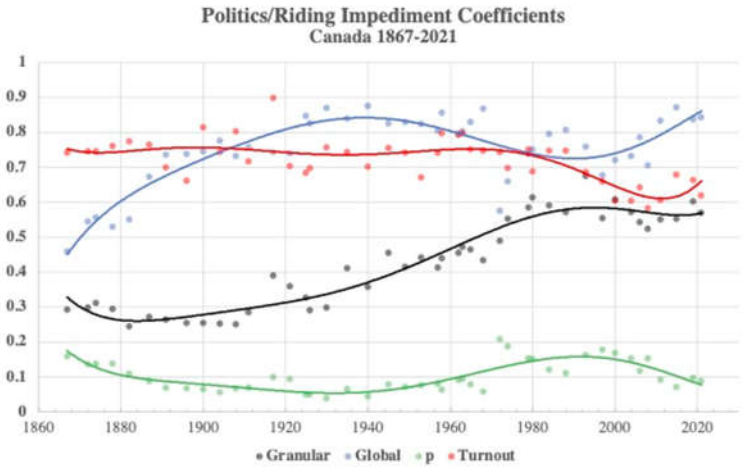

Figure 15. Turnout and GINI coefficients of riding/politics disparity.

Local or granular political disparity (black) had accelerated rise from inception of Canada to about the 1980s when it levelled out despite continued growth in voting population. Global political disparity (light blue) grew until the 1960s and then began a decline until the 1980s when it fairly sharply began to increase. The overall effect of the GINI coefficients (green) on the impediment of structural political disparity decreased until the 1960s and then rose, reversing to a sharper decrease in the 1980s.

Turnout (red) remained remarkably stable until the 1980s; thereafter a decrease set in, only to reverse correlated with rejection of the campaigning/governing style of Conservatives by 2015, and perhaps due to a boundary effect of smoothing.

The 1980s are significant because of concomitance with the availability of accurate polls and cheap, detailed databases. As intimated previously, these enabled targeting through divisive gaming of SMP's plurality rule of the one or two percent of citizens who decide Government under SMP. The changes from the 1980s on may reflect initial asymmetry in party-use of gaming tactics, followed by a catch-up period toward equality, and then revulsion on the part of the electorate due to cynicism over Conservative damage to mores, parliamentary democracy, and the country, possibly combined with mathematical boundary effects.

5. Conclusions

Ballot split by type, a universal measure of a legislature's democratic voice expression (LEM), and a universal measure of accountable local representation (ALRM) shift the focus of debate away from the minutia of this-versus-that-electoral-system arguments and emphasize the human dignity inherent in the concept of democracy.

These measures allow statements such as:

- SMP's plurality rule is destroying democracy in the U.S., U.K., and Canada.

This statement is supported by the preponderance of electoral-data evidence in the U.S. and Canada. Qualitatively, the process is already manifest at the highest levels of forming and maintaining Government-confidence in these countries, as well as in latent and/or overt disdain for the sanctity of electoral processes, particularly in the United States.

SMP produces democratically weak Governments, unstable Government policy, and affords one or two percent of the electorate excessive power over deciding Government, thus promoting division in the country and apathy of the electorate.

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Contrary to the usual political cant, SMP does not produce strong democratic Government, it produces weak democratic Government but strong Government by and for small, self-interested minorities.

- In view of the Charter of Rights and existing jurisprudence, SMP, STV, and MMPR would be unconstitutional in Canada in the presence of alternative systems such as SMDPR, which provides voice equivalent to a list system and the highest measured accountable local representation, while respecting federal, parliamentary, and constitutional constraints and paying due respect to historical precedence
- Of the nine electoral systems tested in this paper, the most democratic LEMs are claimed by Sweden's party-list, New Zealand's MMPR, and Canada with SMDPR; the least democratic is the United States

As a final thought, democracy like morality is aspirational; arguably, no system of governance has ever achieved democracy, nor likely can. Direct democracy combined with Demeny voting[7] in a single district with one-hundred percent turnout would provide an LEM of 1.

6. Thoughts for Further Research

If I wanted another career, other than ridding Canada of its sad farce of a democratic electoral system, I would next proceed along the following lines, aside from further exploring ballot split by type, LEM, and ALRM.

Create a vector $\boldsymbol{V_i} = (\boldsymbol{v_1}, \boldsymbol{v_2} \ldots, \boldsymbol{v_n})$, each component of which is the value of a different democratic index/measure normalized to the interval [0,1], for each of some number $\boldsymbol{i = 1 \ldots c}$ of countries, with each index occupying the same component position in each vector; overall order of indices/components is immaterial.

Because there is no reason to think component indices are independent of each other, orthogonalize components using vector projection; the average angle between pairs of components can be estimated from vectors of component-pair values across all countries. Then, equalize the components using the norm $\|\boldsymbol{V_i}\|$ of $\boldsymbol{V_i}$; the equalized component value $\tilde{\boldsymbol{v}}_{\boldsymbol{i}}$ provides a canonical representation of $\boldsymbol{V_i}$.

Each $\tilde{\boldsymbol{v}}_{\boldsymbol{i}}$ represents the democratic character of a country in a single number in the interval [0,1] determined by the independent influences of the indices/measures used. Now explore comparisons of canonical representations across countries, and longitudinally within a single country.

As a further thought, seeking a measure space in which a discriminant separates systems in a dichotomous fashion as democratic or not is probably best approached through machine learning.

But of what use would this be? And with only a couple hundred countries there would likely never be an appropriate teaching set to form a discriminant that detects any more unbiased information than that which is already known. This approach is intriguing; but might just be mathematics for its own sake.

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