CEWP 20-18

What aggregate data can tell us about voter turnout in Canada; did changes in the distribution of income matter?

Stephen J. Ferris
Carleton University

Marcel-Cristian Voia
University of Orleans

October 11, 2020

CARLETON ECONOMICS WORKING PAPERS

Carleton University
Department of Economics
1125 Colonel By Drive
Ottawa, Ontario, Canada
K1S 5B6

What aggregate data can tell us about voter turnout in Canada; did changes in the distribution of income matter?*

by

J. Stephen Ferris
Department of Economics,
Carleton University,
Ottawa, Ontario K1S 5B6 Canada
(SteveFerris@cunet.carleton.ca)

and

Marcel-Cristian Voia
Department of Economics
University of Orleans
(marcel.voia@univ-orleans.fr)

October 11, 2020

Abstract

Canada, like many developed economies, has experienced a decline in voter turnout since the early 1990s. This paper examines the extent to which aggregate data can explain the movement of voter turnout over time. Time series concerns suggest that OLS results indicating that changes in constituency size, the proportion of the population registered to vote, the degree of wealth inequality, the degree of political competition and the evolving interests of younger voters can all help to explain a good portion voter turnout over the post 1976 time period may be spurious. ARDL re-estimation re-establishes a narrower form of cointegration, confirming a number of hypotheses while rejecting the hypotheses that changes in the proportion of young people in the electorate and voter alienation, as proxied by the Gini coefficient, have played a significant role in affecting voter turnout in Canada.

Key words: voter turnout,
JEL: D72, D78, H62

* This paper uses Canadian data collected under a 2007 Social Sciences and Humanities Research Council of Canada grant and forms part of a larger project on political competition in Canada undertaken with Stanley L Winer. On this and other projects we have benefited from the research assistance of Haizhen Mou, Alexandre Couture-Gagnon, Derek Olmstead, Sarah Mohan, Beatriz Peraza, Samira Hasanzadeh and Jerome Archambault.

1. Introduction

In this paper we use aggregate data to test a series of hypotheses designed to explain voter turnout in Canada, defined in this paper as the aggregate outcome of the choices made by registered voters whether or not to turnout and vote in an election.[1] To do so, the individual's decision whether to vote or not is broken into two separate but related parts: the decision whether to participate in the vote and second, the decision over which candidate to support once voting is chosen.[2] In many statements of the turnout problem, however, the two stages of the voting decision are conflated and so encounter the Downsian voting paradox (1957), why does an individual choose to vote when the likelihood of influencing the election outcome in their favour is close to zero?

To see the problem raised, the typical voting paradox problem starts by decomposing the decision to vote into three parts: the gain that could be received from voting, the probability that your vote will achieve the result desired and the cost of voting. The first is the gain in benefit that would be received from electing your preferred candidate over the most likely alternative (instrumental voting) and the second is the probability that your vote will be decisive in achieving that result. The voting paradox then argues that the latter is so small that the product of the two, the expected benefit from voting, approaches zero. Hence any type of inconvenience, time or transportation cost of voting makes voting inefficient (nonrational). Written in equation form, Down's voting paradox represents the return from voting, R, as

$$R = PB - C < 0, \tag{1}$$

where P is the probability that your vote will be decisive, B is the benefit received by having your preferred candidate win and C is the cost of voting.

A number of scholars have suggested ways around the voter paradox. Riker and Ordeshook (1968) have developed the most widely used approach, arguing that there are a number of benefits when voting that are not dependent on whether your preferred candidate wins or not, such as your ability to affirm your allegiance to the political system, express a partisan preference or fulfill a civic duty. Representing these additional benefits by D, the return from voting now becomes

$$R = PB + D - C < or < 0. \tag{2}$$

Strom (1975) takes a different approach by arguing that the B that is too narrow by ignoring other benefits that can be gained from voting for your preferred candidate, in particular, the

---

[1] In Canada voter registration is automatic at the age of 18.

[2] In some studies voter turnout is defined as the proportion of the eligible population who chose to participate by voting rather than the proportion of those registered who choose to vote, in part because there is often more reliable historical data on eligible voters than on enrollment. See Vowles (2010) for the case of New Zealand. When enrollment is not automatic, explanations for the movement of voter turnout through time need to deal with the two-stage choice problem of whether to register and then whether to vote given registration.

elimination the disutility that would be experienced if an inferior candidate wins without your opposition. In this case, the Strom approach can be represented as

$$R = P(B + D) - C > or < 0. \tag{3}$$

Geys (2006) surveys a number of alternative approaches including those based on minimax regret (Ferejohn and Fiorina, 1978), game theory (Palfrey and Rosenthal, 1985), bounded rationality (Matsusaka, 1995) and adaptive learning (Kanazawa, 2000) and finds various weaknesses, concluding that while approaches such as adaptive learning are promising more research is required.

The approach used to test the voting hypotheses below follows that taken by Riker and Ordeshook in (2) above. It should be noted, however, that solving the voter paradox by adding a benefit to instrumental voting has been widely criticized as making the result tautological. That is, voting arises because it is assumed that it is beneficial to vote. Hence to transform the tautology into a theory there must be, as Geys writes, "a model that explicitly accounts for the reasons why some people obtain these benefits and others do not" (p.28).[3] In our case the hypothesis advanced is that individuals differ in the benefit they receive from participating in the voting process. This is assumed to be independent of the benefit received from picking the winner. The hypothesis becomes testable by setting out factors that effect the value of voter participation and generating observable predictions for their effect on voter turnout over time.

While, as Riker and Ordeshook use 'civic duty' as the reason why individuals choose to vote, our reason for proposing a non-instrumental reason for voting is more general and can be explained by a simple analogy with gambling. That is, like instrumental voting, the private return from gambling is objectively negative. Yet despite most individuals recognizing that there is a negative payoff to gambling, some individuals still choose to gamble. Moreover, while these individuals could simply watch others winning and losing and thus avoid the expected loss, their enjoyment of gambling does not arise from watching others' results but from actively participating in the activity and experiencing the outcomes associated with gambling. In the same way we argue that in addition to voters benefiting from having their preferred choice win in an election, the B, individuals have different reasons and hence place different values on participating in the activities surrounding voting, the D. Depending on the circumstances that arise in any particular election, some proportion of registered voters who could simply observe election outcomes over which they exercise little control choose to participate in the voting process. Operationalizing the theory involves finding a set of factors that can explain changes in expected benefit of voting for the preferred candidate or changes in the pool of registered voters who place a higher value on participation in the electoral process and thus predict changes in the proportion of registered voters who choose to vote.

---

[3] It has proved difficult to find useful proxies that signal changes in the intensity of civic duty through time. See, however, Blais and Achen (2018) who use survey data and the recent work of Francois and Gergaud (2019) who use blood donations to test the hypothesis that civic duty plays a role in explaining voter turnout.

The paper proceeds in section 2 by outlining the factors expected to influence these two dimensions of voting benefits/costs and the variables used to proxy their presence. Section 3 presents the empirical form and data used to test these hypotheses. Section 4 presents the results of the tests and section 5 summarizes the conclusions.

2. Factors influencing voter turnout and their aggregate proxies

There is a large literature on the factors that have influenced voter turnout (see, for example, the meta-analyses in Cancels and Geys, 2016 and Stockemer, 2017) with a more recent concern centered on the decline in voter turnout that has been observed across many developed countries (Hooghe and Kern, 2017). Much of the voter turnout literature is cross sectional in nature, with cross country differences in political institutions used to explain differences in turnout. Other studies have used longitudinal studies of individual behaviour that can exploit variables like age, years of education, occupation, social class (Smets and van Ham, 2013). Here I focus on those factors affecting turnout that can be represented by aggregate time series variables within a single country, Canada, that has a well developed and largely unchanged Westminster parliamentary institutional setting over the 1976 to 2017 period of study.

We begin with variables that reflect the Downsian influence on instrumental voting and thus on voter turnout. Perhaps the most straightforward is the size of the voting pool on the probability of being a decisive voter (Hansen et al, 1987; Tavares and Raudla, 2018). That is, Downsian reasoning suggests that the larger are the numbers of voters in a constituency, defined below as the average number of eligible voters in electoral constituencies (**size**), the lower is the likelihood that any individual will be decisive and hence the smaller will be the net benefit of voting in the upcoming election. Extending the unit of analysis from the constituency to the nation, the larger is the proportion of the population that is registered to vote (**registered**), the smaller will be the influence of any eligible voter on their preferred party winning and hence the smaller will be the likelihood that a representative voter turns out to vote. A third factor that will decrease the instrumental value of voting is if the probability of party outcomes become less certain so that the expectation of being decisive can be held with less conviction (Tavits 2008). Here I use the historical volatility of party vote shares (**Volatility**) as a proxy for the uncertainty surrounding the expectation that any particular party will win the upcoming election.

There are a number of other aggregate variables that may be associated both with making participation in the election more interesting/valuable and with influencing the probability of being decisive. For example, an increase in the number of political parties competing (**Parties**) in the election means the introduction of a wider range of choice among party ideologies and/or party platforms. By fragmenting the vote, more parties also reduce the number of votes needed to win an election, making the likelihood of being a decisive voter larger. The closeness or competitiveness of the party/candidate race within the constituency (**Competition**) has a similar effect on both interest in the election and the probability that an individual's vote could be decisive (Eichorn and Linhart, 2020). Average constituency competitiveness is measured using a multi-party constituency-based measure of electoral competitiveness (Przeworski and Sprague, 1971).[4]

Given a cost to voting, the decision not to participate in the election by voting may arise simply because the voter is content enough with the current state of the economic and political system and hence has little motivation to vote. If this is the case for some set of voters, then, a change in the status quo, particularly for the worse should generate political dissatisfaction and hence elicit a greater participation response.[5] Here we focus on two aggregate indicators of voter unhappiness. First, increases in the unemployment rate (**Urate**) are expected to decrease support for the party in power and increase the demand for alternative programs and parties (Nadeau and Blais, 1993). This should increase voter participate and thus voter turnout. Second, if voters become more alienated with the political system, voter turnout should fall. It has been argued recently that one factor increasing voter alienation has been a growing inequality in the distribution of income (Nadeau et al, 2019; Polacko et al. 2020)). Here we use the after-tax Gini Coefficient as a measure of income inequality and proxy for voter alienation (**Gini**).

Finally, it is well known that younger cohorts in the age distribution turnout to vote with lower frequency than older parts of the distribution (Barnes, 2010; Dassonneville, 2017). The effect of changes in the relative size of the younger voting pool is tested for by using the proportion of eligible voters who are between the ages of 18 and 25 (**Youth**).[6]

We conclude this section by presenting in Figure 1 voter turnout in Canada's federal elections between 1976 and 2017, together with Canada's after-tax Gini coefficient.[7] In it the commonly experienced decline in voter turnout can be observed, in Canada's case falling from roughly 75 percent of those registered to vote in the 1980's and early 1990's to roughly 60 percent throughout in the 2000's before rising back into the upper 60's in the most recent elections of 2015 and 2019. Inspection of Figure 1 also suggests that voter turnout and the Gini coefficient vary in opposite directions, as such providing some initial support for the idea that increases in the dispersion of income (greater income inequality) may alienate politically eligible voters and so discourage voting. In the following pages we examine this relationship more closely.

-- Figure 1 about here --

3. Data and OLS Testing

---

[4] For greater detail on the derivation of this measure see Dash et al (2019, pp.7-8).

[5] A number of writers have noted that voters respond more to bad versus good economic outcomes. See, for example, Nannestad and Paldam (1997); Dassonneville and Lewis-Beck (2014) and Dash and Ferris (2020).

[6] In Canada the voting age was lowered from 21 to 18 in 1970 and has remained unchanged at that level since.

[7] The time period for this analysis was set by the short time period for which annual values of the after-tax Gini coefficient are available.

The election data for this paper were collected from the Elections Canada website while the data on the unemployment rate and after-tax Gini coefficient were taken from the Statistics Canada database, Cansim II. Observations on the concepts proxied by election data variables were viewed as point observations of ongoing political processes and so were interpolated between election years. The descriptive statistics of the variables described above are presented in Table 1 along with their time series characteristics and the dataset used in the paper will be made available online at Carleton University's Dataverse site (Ferris, 2020). What is important to note is that most of the variables used in the tests are integrated of order one, I(1), meaning that the levels of the variables trend stochastically and become stationary, I(0), only when first differenced. Two of the variables, the proportion of eligible voters in the 18 to 25 age group and the number of political parties are I(2) in nature and hence must be first differenced before they can be linked to the other I(1) variables.

-- Table 1 about here –

The discussion of section 2 suggests the hypotheses advanced to explain voter turnout could be tested for by estimating an ordinary least squares (OLS) regression that relates voter turnout linearly to the variable proxies. However, an interpretation of the results of such a regression test faces two obstacles: not all of the time series are integrated of the same order and, second, none of the time series are stationary. To interpret a regression of nonstationary variables as a long run equilibrium relationship (as cointegrated), all variables need to be I(1) or lower and the residuals of the OLS regression need to be stationary. The first of these problems can solved by using the first differences of the two times series that are I(2)--the number of parties and the proportion of young voters (between 18 and 25). Hence the OLS regression test for a long run relationship between voter turnout and the proposed explanatory variables uses the change in the number of parties (Parties) and the change in the proportion of eligible voters who are young (Youth). Voter turnout is predicted to be larger with a larger is the increase in the number of parties and the bigger is the fall in the proportion of voters who are young. The regression test becomes

$$Voter\ turnout = \alpha_0 + \alpha_1 Size + \alpha_2 Registered + \alpha_3 Volatility + \alpha_4 Urate$$
$$+\alpha_5 Gini + \alpha_6 Competitiveness + \alpha_7 D(Youth) + \alpha_8 D(Parties) + \varepsilon, \quad (4)$$

where $\alpha_1, \alpha_2, \alpha_3, \alpha_5$ and α_7 are expected to be negative in sign while α_4 and α_8 are expected to be positive and ε is a white noise random variable. The results of this OLS regression are presented in Table 2 below where the two differenced variables are introduced separately before being used in combination.

-- Table 2 about here --

The results in Table 2 are broadly consistent with these hypotheses advanced to explain voter turnout. Fully 21 of the 22 coefficients in the three versions of the test in columns (1) through (3) have their predicted sign and all three regressions explain roughly ninety percent of the variation in voter turnout in our 1976-2015 time period. Moreover, of the 21 coefficients that have their predicted sign, only five are found to be insignificantly different from zero. That is, the only prediction that did not receive some significant support from the data was the prediction that unemployment rates would be positively associated with voter turnout rates. To highlight some of the more significant relationships found, the data is consistent with party vote volatility at the national level, consistency sizes, the relative weight of younger voters and the Gini coefficient all being inversely related to voter turnout as predicted.[8] On the other hand, greater candidate and party competition within the constituency and increases in the number of political parties are both associated with increases in voter turnout.[9]

As is well known, however, OLS regressions of nonstationary variables that exhibit a high R^2 and have a low Durbin Watson statistic (as is the case here) are prone to producing spurious correlations through unrelated co-movements of the variables. Hence while the standard errors may suggest the presence of a significant causal relationship, those relationships could result from their separate independent responses to a common stochastic trend. The test for whether the set of coefficients capture a long run relationship among the variables (whether the variables are cointegrated) is whether the residuals of the equation are stationary in nature. In Table 2 the augmented Dickey Fuller (ADF) test statistics for the three versions of the voter turnout test are not sufficiently small to allow rejection of the presence of unit root in the residuals of an equation with seven or eight covariates. It follows that while the OLS coefficient estimates themselves are super consistent, the standard errors are likely biased so that the seeming strong results of Table 2 must be viewed with some degree of skepticism. At least some of the hypotheses that seem to be confirmed by the data are likely to be spurious.

4. Dynamic re-estimation: An ARDL model of voter turnout

To handle the time series issues raised by combinations of variables whose order of integration is somewhat ambiguous, the autoregressive distributed lag approach (hereafter ARDL) of Pesaran, Shin and Smith (2001) has proven to be useful. Its advantage is that it is designed to assess whether or not a cointegration relationship exists among a group of variables and is particularly useful when the sample size is small. If cointegration is found (as indicated by the Bounds test), the ARDL method generates not only the long run equilibrium path but also the short run convergent process that surrounds the long run equilibrium. In describing the dynamic processes that generate this outcome, the method also allows for lags of differing

[8] There is a suggestion in the data that the relationship between constituency size and voter turnout might be nonlinear. When size was introduced quadratically, the regression resulted in a positive coefficient on the level term and a negative coefficient on the squared term, neither of which, however, was significantly different from zero.

[9] Because voter turnout is bounded between 0 and 1 with variation within a narrow range, the model of column (3) was re-estimated using a fraction logit model. The marginal effects of that model are presented in column (4). The similarity in size and significance of the coefficients in columns (3) and (4) suggest that the use of OLS is not misleading so that the residuals of the OLS equation can be used to test for cointegration.

length to capture the varying degrees of persistence exercised by each of the interrelated variables.

A dynamic ARDL model of voter turnout can then be written as:

$$Voter\ turnout_t = \alpha + \sum_{i=1}^{i=3} \gamma_i Voter\ turnout_{t-i} + \sum_{i=0}^{i=3} \delta_{ji} Z_{jt-i} + \epsilon_t, \quad (5)$$

where the Z_j are the J=7 explanatory variables from equation (4) that form the cointegrating relationship. Each of the covariates is allowed to have up to three lagged terms and ϵ_t is a white noise random variable. The ARDL model then assesses all combinations of current and lagged terms and generates the coefficient estimates that provide the best fit with the data. The error correction version of the ARDL model is the one presented in Table 3 below.

While Table 3 presents the final results of the ARDL modeling process, the analysis began by including all seven of the equation covariates in the ARDL estimation. However, while the best fitting estimate of that long run cointegrating equation passed the Bounds tests for cointegration, the dynamic process itself was found to be unstable, producing increasing oscillations about the estimated long run path.[10] Experimentation with the model by dropping insignificant covariates revealed that of the three covariates that were found to be insignificant in the initial estimates, the removal of the proportion of the population that was registered to vote, Registered, removed the instability. Table 3 then begins in column (1) with this shortened version of the model. It includes the two remaining covariates that were originally found to be insignificant, the after-tax Gini coefficient and the change in the proportion of voting pool that is young, D(Youth). Because one focus of the analysis is to determine the effect of income distribution on voter turnout, column (2) presents the re-estimated model with only D(Youth) dropped. Column (3) then forms the final version of the ARDL model, where the model includes only the significant covariates.

--insert Table 3 about here –

The results in Table 3 are quite striking both in their own right and in relation to those found in Table 2. First, as a description of the dynamic process that connects voter turnout with constituency competitiveness, party vote volatility at the national level, changes in the number of participating parties, constituency voter size and the unemployment rate the model is quite successful. The final error correction model explains over ninety percent of the variation in voter turnout about the equilibrium time path (with an adjusted R^2 of .867). Unlike the residual tests for the OLS results of Table 2, the values found for the Bounds test, presented in the bottom line of each column, clearly reject the hypothesis that there is no levels relationship and thus are consistent with the presence of a cointegrating relationship among the model's remaining I(1)

[10] That is, the coefficient estimate on the lagged value of voter turnout was -1.30. To economize on space, the estimate of the full version of this model is included with the replication data on Carleton's Dataverse website (Ferris 2020).

variables. The Canadian data then provide evidence of a long run equilibrium time path arising among the remaining variables towards which short run departures from the path converge through time.

The results of the individual hypothesis tests in Table 3 call for a revision of the perspective suggested by Table 2. That is by finding of a cointegrated long run relationship among the variables our confidence is increased that the standard errors generated under the ARDL model are unbiased. Perhaps unsurprisingly, then, only some of the hypotheses that appeared to be confirmed by the OLS form of the test are reconfirmed by the results of the ARDL model while others are revealed to be relatively weak or insignificant. In addition, some relationships that appeared to be insignificant are now found to be significant.

The covariates in the cointegrating equation that appeared to be significant in the OLS estimates and are now confirmed as significant parts of the cointegrating equation include the degree of party competitiveness within the constituency, aggregate party vote volatility at the national level, the change in the number of parties (entry or exit) at the national level and average constituency size. In addition, the hypothesized positive effect of the unemployment rate on voter turnout that appeared to be insignificant from the OLS results is now revealed to be significantly positive in its effect.

While it is perhaps not surprising that the proportion of the population registered to vote (that had a mixed effect in the OLS regressions) is now revealed to have played no significant part in explaining the time path of voter turnout in the ARDL results, the other two cases of insignificance are more striking. The coefficient of D(Youth) that was both large in absolute size and significantly negative in its effect on turnout is now revealed to have made no significant negative impact on turnout in our time period. Similarly, the after-tax Gini coefficient that was also both large in absolute size and highly significant in the OLS results is now found to be small and insignificant. That is, while the OLS findings suggested that increases in both these factors played a prominent role in discouraging voter participation, the ARDL results imply that these implied results were spurious.

The difference these findings make for interpretating movements of voter turnout can be seen by referring back to Figure 1. In that figure the long run post 1990 decline in voter turnout can be seen to have turned around, at least temporarily, in 2015, jumping from 61.1% in the 2011 federal election to 68.5% in 2015. From that figure it can also be seen that the Gini coefficient was in the process falling from its previous high in 2013 and continuing through 2016. In combination with the empirical results shown in Table 2, the data would seem to suggest that at least some portion of the rise in voter turnout can be attributed to the improvement in the income distribution taking place at the same time and providing evidence consistent with the hypothesis that improvements in the distribution of income have worked to ameliorate voter alienation. The ARDL analysis however has shown that the visual appearance suggesting an inverse causal relationship is misleading and that the OLS results are spurious. From the cointegrating relationship generated by the ARDL model, the rise in voter turnout is more likely attributable to the increase in the competitiveness of the average electoral consistency, the increase in the number of political parties arising in the 2015 election and the decrease in the average voting size of Canada's electoral constituencies (due to the increase in the number of seats in Parliament from 308 in 2011 to 338 in 2015).

5. Conclusion

In this paper we have used aggregate data to test a set of eight hypotheses designed to explain voter turnout in Canada. The results are consistent with five of these hypotheses: voter turnout increases with an increase in both constituency competitiveness and the unemployment rate; and decreases with greater party instability (higher vote volatility) at the national level, increases in the number of competing parties and the average voter size of election constituencies. The set of significant hypotheses as a whole can explain over eighty five percent of the variation in voter turnout.

Perhaps the most surprising finding has been that two factors that are often discussed in relation to voter turnout have played no significant role in Canada over the 1976 to 2017 time period. First the proportion of voters in the 18 to 24 age group has fallen continuously over this time period. But while some rise in voter participation might have been expected from the falling size of the youth vote, changes in its level have produced no significant effect on voter turnout. Second, increasing voter alienation has often been used to explain the ongoing decline in voter turnout and the rise in income inequality is often used as an explanation for why voters can become alienated from the political process. To the extent that changes in the after-tax Gini coefficient proxy changes in voter alienation, the data find no significant effect of a change in the Gini on voter turnout.

As a final cautioning note, it will have been noted that there are not many observations in the Gini coefficient time series to place against the set of other covariates used to test the voter turnout hypotheses. Prior to 1976 there are very few Gini calculations available and what exists has not necessarily been constructed on a consistent basis. For this reason, the findings here must be seen as strictly tentative. On the other hand, the use of what information is available is insightful in cautioning against the use of simple diagrams and/or simple correlations to establish stylized facts designed to reflect long term relationships. While the variation in voter turnout may appear to be inversely related to variations in the after-tax Gini coefficient in Canada over the last four decades, that relationship is more likely to be spurious, arising from two nonstationary variables under the influence of a common stochastic trend.

Data Sources, Figures and Tables:

Data Sources:

Statistics Canada. Table 11-10-0134-01 Gini coefficients of adjusted market, total and after-tax income. Cansim II v96439638 online at DOI: https://doi.org/10.25318/1110013401-eng.
Unemployment rate Cansim II v2062815, monthly average.
Population estimates by age groupings Cansim Table 17100005: v466677, v4666680 v4666683, v4666686.

Reports of the Clerk of the Crown in Chancery (1867-1917); reports of the Chief Electoral Officer (1921-2008); unpublished summary data prepared by Elections Canada; R. Pomfret, The Economic Development of Canada (1987); H.A. Scarrow, Canada Votes (1962); Contact (1985).
Online https://elections.ca/content.aspx?section=ele&dir=turn&document=index&lang=e

The data used in the tests is available online at Carleton's Dataverse site.

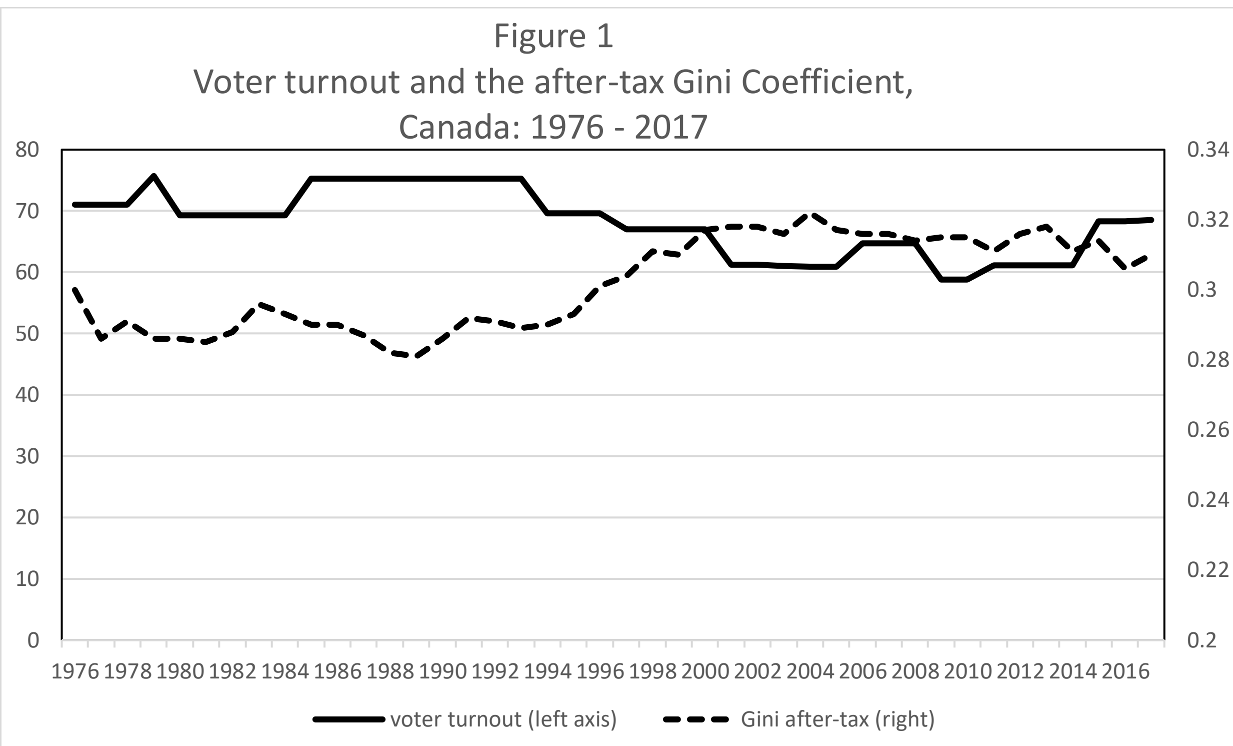

Table 1
Descriptive Statistics: Canada 1976 - 2018

Variable Name	Observations	Mean	Standard Deviation	Minimum	Maximum	ADF - Level -Difference
Voter turnout	44	.679	.053	.588	.757	-1.067 -5.414***
Proportion of the population registered to vote	44	.708	.029	.632	.749	-2.746 -5.693***
Party vote volatility at the National level	44	.330	.637	-1	2	-2.869 -7.935
Constituency Size (in 1000s)	44	67.86	8.72	52.3	80.99	-1.138 -3.546**
Unemployment rate	44	8.177	1.65	5.7	12	-1.626 -4.748***
Gini Coefficient (after tax)	44	.302	.013	.281	.322	-1.160 -8.269***
Average candidate competitiveness at the constituency level	42	.615	.132	.417	.887	-1.591 -3.705***
Change in the proportion of eligible voters between 18 and 25 years old	44	-0.002	.002	-0.008	.003	-0.993 -3.764***
Change in the number of political parties	44	.332	.630	-1	2	-2.904 -7.935***

*** 1% (** 5%) critical value -3.634 (-2.950)

Table 2

OLS Voter Turnout Regressions: Canada 1976 - 2017

(absolute value of t-statistic using robust standard errors)

Explanatory Variables Predicted sign in brackets		Voter turnout (1)	Voter turnout (2)	Voter turnout (3)	Fractional Logistic Regression Marginal Effects (4)
Size (in 1000's)	(-)	-0.0016* (1.87)	-0.0025** (2.33)	-0.0022* (1.96)	-.0022** (2.30)
Registered	(-)	-0.321** (2.70)	0.007 (0.04)	-0.213 (1.33)	-.236* (1.71)
Volatility	(-)	-0.148** (2.71)	-0.266*** (4.75)	-0.168*** (2.89)	-.159*** (3.17)
Urate	(+)	0.001 (0.47)	0.0035 (1.48)	0.0011 (0.56)	.0007 (0.38)
Gini (after tax)	(-)	-1.397*** (3.22)	-1.935*** (4.63)	-1.320*** (2.86)	-1.231*** (3.08)
Competitiveness	(+)	0.160*** (4.23)	0.242*** (6.17)	0.180*** (4.17)	.169*** (4.64)
D(Youth)	(-)	-6.174*** (3.97)		-5.515*** (3.38)	-6.485*** (4.32)
D(Parties)	(+)		0.011** (2.65)	0.006 (1.37)	.005 (1.43)
Constant		1.343*** (11.11)	1.298*** (8.57)	1.271*** (8.90)	
Regression Statistics					
Observations		42	42	42	42
Adj R^2		.917	.896	.918	
F		77.16	52.31	64.97	Wald(8) 728.7
Durbin Watson		1.10	1.10	1.08	
ADF of residuals: MacKinnon critical value (7, 8 var.) at 10 % = -4.70, - 4.95		-3.645	-3.812	-3.756	

* (**)[***] significantly different from zero at 10 (5) [1] percent.

D(.) indicates the first difference of the variable bracketed.

Table 3
Autoregressive Distributed Lag (ARDL) Models of Voter Turnout (3 lags allowed)
(absolute value of t statistics in brackets)

Explanatory Variables Predicted sign in brackets		D(Voter Turnout) (1)	D(Vote Turnout)	D(Voter Turnout) (3)
Lagged voter turnout	(-)	-.653*** (7.40)	-.667*** (7.97)	-.621*** (7.34)
Long run cointegration:				
Competitiveness	(+)	.584*** (9.32)	.561*** (12.38	.582*** (12.73)
Volatility	(-)	-.879*** (7.32)	-.839*** (9.10)	-.839*** (8.13)
D(Parties)	(+)	.023*** (4.04)	.020*** (4.30)	.031*** (8.82)
Size (1000s)	(-)	.003*** (3.17)	.003*** (3.24)	-.004*** (7.15)
Urate	(+)	.021*** (4.77)	.020*** (5.59)	.015*** (5.13)
Gini (after tax)	(-)	-.051 (0.11)	-.108 (0.24)	
D(Youth, 18-25)	(-)	.835 (0.59)		
Short Run:				
Competitiveness:				
D1		-.212*** (4.79)	-.207*** (4.85)	.168*** (4.15)
LD		-.281*** (7.81)	-.278*** (7.95)	-.245*** (6.85)
Volatility:				
D1		.427*** (6.45)	.418*** (6.58)	-.340*** (5.51)
LD		.266*** (4.82)	.257*** (4.92)	.220*** (4.22)
L2D		.311*** (8.15)	.307*** (8.30)	.298*** (8.48)
D(Parties)				
D1		.003 (0.83)	.003 (0.78)	.0004 (0.13)
LD		.011 (3.65)	.010*** (3.68)	.006** (2.53)
Gini (after tax)				
D1		-.394 (1.08)	-.359 (1.01)	
LD		-.500 (1.06)	-.410 (0.93)	
L2D		-1.01** (2.79)	-.991** (2.80)	

Urate			
D1	-.010***	-.010***	-.007***
	(5.05)	(5.13)	(4.22)
LD	-.004**	-.003*	-.003
	(2.12)	(2.06)	(1.70)
Constant	.311**	.338***	.357***
	(2.44)	(2.90)	(4.49)
Observations	39	39	39
Adj R^2	.887	.891	.867
Bounds Test: No levels relationship			
F (k=7 1% lower bound 3.74 upper 5.06)	19.63***	23.15***	21.81***
t (k=7 1% lower bound -3.43 upper -4.60)	-7.40***	7.91***	-7.33***

Notes: D1(2) refers to first (second) difference; L1(2), one (two) lags; LD, the lag of the first difference, etc.
* (**)[***] significantly different from zero at 10 (5) [1] percent.

References

Barnes, A. (2010) *Youth Voter Turnout in Canada* No. 2020-19-E, Ottawa: Library of Parliament

Blais, A. and C.H. Achen (2019) 'Civic duty and voter turnout' *Political Behaviour* 41: 473-497.

Blais, A. and A. Dobrzynska (1998) 'Turnout in Electoral Democracies'*, European Journal of Political Research*, 33(2): 239–61.

Cancela, J. and B. Geys (2016) "Explaining voter turnout: A meta-analysis of national and subnational elections", *Electoral Studies* 42: 264-275.

Dash, B.B. and J.S. Ferris (2020) 'Economic Performance and electoral volatility: Testing the economic voting hypothesis on Indian States, 1957-2013' *Party Politics* online at DOI: 10.1177/1354068820923706.

Dash, B.B., J.S. Ferris and S.L. Winer (2019) 'The measurement of electoral competition, with application to Indian states', *Electoral Studies* 62: 1-21.

Dassonneville, R. and M.S. Lewis-Beck (2014). Macroeconomics, economic crisis and electoral outcomes: A national European pool. *Acta Politica*, 49(4): 372-394.

Dassonneville, R. (2017) 'Voter turnout and age', in Arzheimer, K., J. Evans and M.S. Lewis-Beck (eds) *The Sage Handbook of Electoral Behaviour* Los Angeles: Sage Publications (Chapter 7, 137-158).

Downs, A. (1957) *An Economic Theory of Democracy*. New York: Harper & Row

Eichorn, K. and E. Linhart (2020) 'Estimating the effect of competitiveness on turnout across regime types' *Political Studies* online at DOI: 10.1177/003232172094645./

Ferejohn, J. A. and Fiorina, M. P. (1974) 'The Paradox of Not Voting: A Decision-theoretic Analysis', *American Political Science Review*, 68: 525–36.

Francois, A. and O. Gergaud (2019) 'Is civic duty the solution to the paradox of voting', *Public Choice* 180: 257-283.

Geys, B. (2006) 'Rational theories of voter turnout: A review', *Political Studies Review* 4(1): 16-35.

Hansen, S., T.R. Palfrey and H. Rosenthal (1987) 'The Downsian model of electoral participation: Formal theory and empirical analysis of the constituency size effect' *Public Choice* 52(1): 15-33. https://doi.org/10.1007/BF00116941.

Hooghe, M. and A. Kern (2017) 'The tipping point between stability and decline: trends in voter turnout, 1950-1980-2012' *European Political Science* 16: 535-552.

Horn D. (2011) 'Income inequality and voter turnout'-evidence from European national elections' *Gini Discussion Paper 16*, Amsterdam, AIAS, Kanazawa, S. (2000) 'A new solution to the collective action problem: The paradox of voter turnout', American Sociological Review, 65: 433–42

Matsusaka, J. G. (1995) 'Explaining Voter Turnout Patterns: An Information Theory', Public Choice, 84, 91–117.

Matsusaka, J.G. and F. Palda (1999) 'Voter turnout: How much can we explain?' *Public Choice* 98: 431-446.

Nadeau, R. and A. Blais (1993) "Explaining Election Outcomes in Canada: Economy and Politics," *Canadian Journal of Political Science* 26(4): 775-90.

Nadeau, R., M.S. Lewis-Beck and M. Faucault (2019) 'Wealth and Voter turnout: Investigating twenty eight Democracies', *Polity* 51(2): 261-287.

Nannestad, P., and M. Paldam (1997). The grievance asymmetry revisited: A micro study of economic voting in Denmark, 1986-1992. *European Journal of Political Economy*, 13: 81-99.

Palfrey,T. R. and H. Rosenthal (1985) 'Voter Participation and Strategic Uncertainty', *American Political Science Review*, 79: 62–78

Pesaran, M.H., Y. Shin and R.J. Smith (2001) 'Bounds testing approaches to the analysis of level relationships' *Journal of Applied Econometrics* 16(3): 289-326.

Polacko, M., O. Heath, M.S. Lewis-Beck and R. Dassonneville (2020) 'Policy Polarization, Income Inequality and Turnout' *Political Studies* online at DOI:10.1177/0032321720906581.

Przeworski, A., and L. Sprague (1971) 'Concepts in search of an explicit formulation: A study in measurement', *Midwest Journal of Political Science*. 15(2): 183-218.

Scarrow, H.A. (1961) 'Patterns of voter turnout in Canada' *Midwest Journal of Political Science* 5(4): 351-364.

Smets, K. and C. van Ham (2013) 'The embarrassment of riches? A meta-analysis of individual-level research on voter turnout' *Electoral Studies* 32: 344-359.

Stockemer, D. (2017). 'What affects voter turnout? A review article/Meta-analysis of aggregate research', *Government and Opposition* 52(4): 698-722.

Tavares A.F. and R. Raudla (2018) Size, density and small-scale elections: A multi-level analysis of voter turnout in sub-municipal governments' *Electoral Studies* 56: 1-13.

Tavits, M. (2008) 'On the linkage between electoral volatility and party system instability in Central and Eastern Europe' *European Journal of Political Research* 47(5) DOI: 537-555.

Vowles, J. (2010). 'Electoral System Change, Generations, Competitiveness and Turnout in New Zealand' *British Journal of Political Science* 40(4): 875-895.