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RESEARCH NOTE/NOTE DE RECHERCHE

Do Household Political Campaign Signs Help Win Vote Share?

Gillian K. Maurice[1], Pat Barclay[1], Tamara A. Small[2] and Benjamin Giguère[1]

[1]Department of Psychology, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1, Canada and [2]Department of Political Science, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1, Canada
Corresponding author: Gillian Maurice, Email: gmaurice@uoguelph.ca

Abstract

Canadian election campaigns often see a proliferation of political signs at the start of an election, but are they worth the effort? We examined official results at the poll level (N = 785) from elections agencies and the quantities of household signs recorded in internal political party databases (Green Parties of Canada, Manitoba, and Ontario). Overall, the results suggest that the use of household signs is an effective form of political campaigning in Canada for nongoverning parties. Analyses suggest that every sign placed per 100 registered electors is associated with an increase of 0.5–1.5 per cent vote share. The presence of household signs was associated with an increase of 1.5–3.4 per cent vote share. Further, preliminary evidence also suggests a possible diminishing returns trend: the per-sign rate of increase in vote share may slow down at higher densities. We discuss the implications of the results, including the possible curvilinear trend.

Résumé

Les campagnes électorales canadiennes sont souvent caractérisées par une prolifération d'affiches politiques au début d'une élection, sans qu'on connaisse si l'effort vaut la peine. Nous avons examiné les résultats officiels à l'échelle des bureaux de vote (N = 785) provenant des organismes électoraux et les quantités d'affiches enregistrées dans les bases de données internes des partis politiques (Partis verts du Canada, du Manitoba et de l'Ontario). Dans l'ensemble, les résultats indiquent que l'installation de pancartes est une forme efficace de campagne politique au Canada pour les partis non gouvernementaux. Les analyses suggèrent que chaque pancarte apposée pour 100 électeurs inscrits est associée à une augmentation de 0,5 à 1,5% de la part de voix. L'affichage de pancartes domiciliaires entraîne une augmentation de 1,5 à 3,4% de la part de voix. En outre, les données préliminaires suggèrent également une tendance possible aux rendements décroissants : le taux d'augmentation de la part de voix par pancarte peut ralentir à des densités plus élevées. Nous discutons des implications de ces résultats, y compris de l'éventuelle tendance curviligne.

Keywords: lawn signs; household signs; campaigns; political communication; multilevel modelling

Mots clés: pancartes électorales; pancartes domiciliaires; campagnes; communication politique; modélisation multiniveau

Introduction

Political campaign signs are a commonly used persuasion tool in Canadian elections. The overnight appearance of political parties' campaign signs is often the public's main cue that an election campaign has begun. Despite this common practice, neither practitioners nor researchers are sure whether campaign signs are related to election outcomes, particularly in Canada. Indeed, campaign signs are considered understudied by US-based researchers (Green et al., 2016), and we could find no empirical research on campaign signs in Canadian political campaigns.

Campaign signs can be divided into two categories: household signs and road signs. Household signs are placed on private property, in yards or windows. Road signs are placed on public property, by the edges of roads. Since road signs do not reflect party support but rather how many signs the party places, the current study focuses on household signs. A large portion of local campaign budgets often goes to household signs, so understanding their efficacy is of great value to campaign practitioners.

Theorized psychology of household signs

Household signs provide a public communication of vote choice that enables other voters to see higher levels of support than they may have presupposed, contributing to the formation of a social norm. Signs provide neighbour-to-neighbourhood political communication (Makse and Sokhey, 2014), intentionally providing a visible cue of the otherwise private behaviour of party choice and vote. In a US study by Makse and Sokhey (2014), 46 per cent of survey participants believed that household signs were effective in influencing other people's vote choices. Makse et al. (2019) further observed that people who display signs have more favourable attitudes toward them. Although the latter work offers a comprehensive discussion of how community norms affect the social acceptability of signs, it does not address the possibility that signs themselves may form emergent political norms of influence.

The present study was based on a supposition that household signs help form a descriptive social norm. Social norms are informal guidelines that govern human behaviours. Descriptive norms are a subtype of social norms that involve perceptions of what other people typically do in a certain setting. Displaying a household sign makes the otherwise private behaviour of vote choice publicly visible. Past research across a variety of domains has observed that descriptive norms are learned by observing the behaviour of others who constitute the groups and communities that people interact with (for example, Kashima et al., 2013; Smith and Louis, 2009).

Signs, as a visual indicator of vote choice, enable other voters to see levels of support that may or may not reflect their inner perceptions of whether a candidate/party is viable. As the number of signs increases, the aggregate of individual choices may contribute to the formation of a neighbourhood-level or riding-level norm.

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The influence of social norms is well documented in social psychology (for example, Cialdini, 2005; Smith and Louis, 2009). In politics, this phenomenon has been referred to as the "bandwagon effect" (Green et al., 2016). If signs represent emerging social norms, a neighbourhood full of signs for one candidate/party may provide a powerful form of influence, particularly given the flexibility of Canadian partisanship (Gidengil, 2022).

Alternatively, signs may act through a mere exposure effect that increases candidate name recognition (Kam and Zechmeister, 2013). Similarly, signs may signal to voters that the candidate/party is viable, in that they are financially and organizationally capable of producing and sharing signs (Green et al., 2016). A viable party with an increased number of signs may then be perceived as a competitive party.

Sign deliveries are believed by practitioners to be driven by campaign contact (Maurice and Small, 2022). Although some signs are requested by supporters on their own initiative, most sign deliveries are reported to occur when a poll is canvassed. To the best of our knowledge, Canadian research has not examined the linkages between canvassing efforts, sign presence and the outcomes of votes and vote share. However, studies have examined the associations between vote share and other campaign predictors.

Local campaign predictors: spending, volunteers, mail drops

British studies on local constituency campaigns established the importance of local campaign spending as a reliable predictor of election outcomes (see Fieldhouse and Cutts, 2009). Canadian studies also suggest that local campaign spending predicts vote outcomes; these effects may be stronger for nongoverning, nonincumbent parties and candidates (Carty and Eagles, 1999; Eagles, 2004). Carty and Eagles (1999) predicted that in a Conservative-won election, one additional dollar "per elector . . . would have contributed another 6.64 per cent to the Liberal vote share" (82). The same calculation for the New Democratic Party (NDP) revealed "an almost 17 per cent increase in the party's riding vote share" (82). Eagles (2004) also showed local spending impacts were highest for a nondominant party. Per dollar, the Conservatives (then out of favour) showed a 0.09 per cent point increase in vote share, the NDP candidates showed a 0.05 per cent point increase, and the Liberals (re-elected to a majority that year) only a 0.04 per cent point increase. Campaign spending is linked to signs, as large portions of the campaign budget may be allocated to purchasing signs.

The effect of local volunteers was also examined across parties by Carty and Eagles (1999). High numbers of volunteers were found to have strong predictive coefficients in regression models. Contrariwise, mail drops were found to have marginal effects only on higher income polls' vote outcomes (Brown et al., 2010). The relationships between campaigning efforts and vote share are thus even more complex.

Empirical evidence of the effects of campaign signs

The evidence on the effectiveness of campaign signs is limited and does not generalize to the Canadian context. Sommer (1979), using observational counts and election results, compared the number of signs of winning versus losing candidates in

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eight researcher-defined "districts" within a city during the 1978 gubernatorial election in California. Sommer observed that winning candidates had a greater proportion of signs in a district compared to losing ones. Green and colleagues (2016) conducted four randomized field experiments but only one on household signs. They used a consistent number of signs and presence/absence of signs within a precinct to test the effect on vote share, while also calculating spillover effects in adjacent untreated precincts. Their household sign experiment in a Democratic primary mayoral race found a small effect for the presence of signs: a 0.9 per cent point increase in vote share. Overall, they found that the presence of road or household signs produced a 1.7 per cent point increase in vote share. Huckfeldt and Sprague (1995) observed that the concentration of visible indicators of support (including yard signs) had a unique effect on voter perceptions of who would win the election. The results of these few studies suggest a positive contribution of signs, but most relied upon a dichotomization of measures that prevents generalizing to a multiparty context.

Overview of the present study

Using extant data from the Green Parties of Canada, Manitoba and Ontario across six Canadian electoral districts (EDs), we analyzed household signs and vote share using government-defined within-district polls in order to (a) model and quantify the relationship between the number of household signs and vote share and (b) examine if the presence/absence of household signs is associated with vote share. Both analyses are correlational, and inferences of causality cannot be drawn, as there was no way to control for other influential factors.

Methods

Data sources/collection

The data comprised a convenience sample[1] from the Green Parties of Canada, Manitoba and Ontario, spanning four general elections between 2015 and 2019. The Green Party of Canada shared sign counts from two ridings that were composed of three analytically distinct electoral districts; the Green Party of Manitoba shared sign counts from one riding but two analytically distinct electoral districts; and the Green Party of Ontario shared sign counts from one electoral district. One federal riding was redistricted between elections (internal polls were decreased between elections from 221 to 196). The riding shared by the Green Party of Manitoba was also redistricted (internal polls were decreased from 44 to 38, and the district's overall area increased). Official elections results were downloaded from poll-level datasets publicly posted by governmental elections agencies.

The unit of analysis was land-based internal polling districts ($N = 785$), hereafter referred to as "polls." Advanced polls and special polls were excluded from the dataset, as they are not land based and therefore could not have signs associated with them. Apartment-based polls were excluded because of the impracticality of displaying signs and limited campaign access. Long-term-care-home-based polls were also excluded due to regulations limiting political campaign access to these facilities. Similar approaches excluding multiresidential districts were taken by Makse and colleagues (2019).

All electoral districts were aggregated and analyzed as a whole, then disaggregated and analyzed individually, for a predictive relationship between signs per elector and vote share. Some electoral districts had polls without signs, allowing for a categorical analysis of presence versus absence of signs. The presence/absence of signs in a poll was not assigned by the researchers but based on the available data.

Contextual factors: party status and marginal gain/loss

Table 1 shows the relative party status in each of the electoral districts, alongside the margins of gain or loss for each campaign. These factors were unable to be examined statistically because analyses were conducted at the poll level. Furthermore, the small district-level sample size (6) prevented any rigorous statistical analyses of competitiveness as operationalized by past support, gain/loss margins, or changes in party status. The context provided may help in interpreting the results.

Analytical variables (predictor and outcome)

Signs per 100 electors on list (EOL)—predictor variable

Sign counts were defined as the number of signs delivered per household during the campaign writ period. Delivered signs to supporter households lacking a poll (from incomplete data entry) were not included. Raw data were manually culled for duplicate sign deliveries. Electors on list (EOL) for each poll represents the records of registered electors and was reported by each elections agency as part of the election results data. Because each poll had different elector population counts, the sign count variable was converted to a ratio of signs per 100 EOL for each poll.

Vote share—outcome variable

Vote share at the poll level for the party in question was calculated by dividing the vote count for the party by the total number of valid votes cast for all parties/candidates, and thus also controlled for poll population size effects. Vote share is expressed as a percentage.

Modelling the data—aggregate or disaggregate?

Rather than aggregate all poll-level data at one level, we theorized that the different grouping levels of data—riding, electoral district, province, jurisdiction, election year—could have effects on the outcome. Exploration of an aggregated dataset indicated severe statistical heterogeneities when all polls were characterized as a single group (that is, at one level). Furthermore, upon disaggregation, the scatterplots of the electoral districts had differing lines of best fit, with some indicating a possible curvilinear relationship (figures in supplemental materials).

Importantly, the polls were not statistically independent of each other. Each poll was made up of voters who move between the polls, thus exposing themselves to signs across polls. Because of this mixed exposure, the number of signs in one poll could influence the number of signs in an adjacent poll, and the number of signs in one poll could influence the vote share in an adjacent poll. Although not a useful construct for interpreting the results, a subdistrict group level of

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Table 1. Party Statuses, Margins and Gain/Loss for the Electoral Districts under Study

Riding (year)	Party status in riding, pre-campaign	Party status in riding, post-campaign	Margin from leading party, pre-campaign	Margin from leading party, post-campaign*	Gain (+) / loss (−)
ED 1 (2019)	fourth	**third**	−47	**−35**	**+12**
ED 2 (2016)	second	second	−41	**−5**	**+36**
ED 3 (2019)	second	second	−5	*−10*	*−5*
ED 4 (2018)	third	**first (elected)**	−22	**23***	**+45**
ED 5 (2015)	fourth	fourth	−37	*−38*	*−1*
ED 6 (2019)	fourth	**second**	−38	**−15**	**+23**

Note: Values marked in **bold** text represent an improvement in place, or a narrowing of the margin, depending on the corresponding column. Values marked in *italics* represent a widening of the margin.
*marks the exception where the margin represents the margin of victory over the second, nonelected party.

neighbourhood was used to cluster polls and model the nonindependent nature of the polls. These clusters are hereafter referred to as the "neighbourhood."

Due to the grouped and nonindependent nature of the data, we used a mixed (random and fixed effects) multilevel model (MLM) based on linear regression. We modelled each electoral district separately in its own MLM. The neighbourhood-level vote share means (intercepts) were presumed to be different (random). The effects of neighbourhood on the relationship between signs per 100 EOL and vote share were presumed to be fixed (that is, were not modelled as random slopes).

In the aggregate MLM, we further theorized that the mean vote share, the mean number of signs per 100 EOL, and the relationship between the two would vary across electoral districts and/or ridings. Thus, the aggregate MLM was presumed to (a) need both random intercepts and random slopes at the riding grouping level and (b) model the intercepts of the other grouping levels as random. Four-level MLMs were tested using the neighbourhood grouping outlined above, within the broader levels of riding, electoral level, and year. These additional three levels were selected as empirically meaningful based on exploratory categorical linear models and intraclass coefficient (ICC) analyses (see supplemental materials). These three levels were also considered theoretically meaningful due to regional political differences and changes in political support over time.

Results

Data were analyzed using the lme4 (Bates et al., 2015) and lmerTest (Kuznetsova et al., 2017) packages in R. Graphical analyses were produced using ggplot2 (Wickham, 2016). Descriptive statistics for both the predictor and outcome variables, separated and aggregated, can be found in the supplemental materials.

MLM results by electoral district

All electoral districts shared the grouping variable of neighbourhood; the results reported below all control for nonindependence of observations by modelling the group-level effect of neighbourhood using random intercepts. To assess model

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fit, we used both Akaike's information criterion (AIC) and the Bayesian information criterion (BIC) to compare predictive MLMs to null models, as each have their limitations when assessing complex models (Vallejo et al., 2014; Vrieze, 2012). Both AIC and BIC provide indices of the amount of error unaccounted for in a model; therefore, smaller numbers for each are considered indicative of better model fit. BIC is more conservative than AIC and counteracts against error inflation due to model complexity. We used chi-squared statistics to assess whether the across-model differences in fit were statistically significant.

We ran stepwise linear mixed models and curvilinear (quadratic, log and cubic) mixed models and compared them for all districts. We only present the results of the models with the best fit (full regression tables are available in the supplemental materials). In all models, linear slope represents the relationship between signs and vote share when the neighbourhood grouping variable is accounted for. In models with both linear and curvilinear terms, the linear slope represents the relationships between signs and vote share when both the neighbourhood grouping variable and the curvilinear terms are accounted for.

Slope coefficients on polynomial terms (log, x^2, x^3) are not interpreted in the same way that a linear slope is. Simply put, these terms describe a rate of change of the slope rather than quantifying the relationship between the predictor and outcome variable. The type of term and the sign of the term indicate different shapes of the curve. To demonstrate how the best-fitting model predicts the relationship changing in the curvilinear models, we included scatterplots of outcome values predicted using the models, with lines of best fit.

Electoral district 1

We tested multiple curvilinear models[2] ($n = 168$) and found a best model fit for a model that included linear, quadratic and cubic terms, $B_{lin} = 8.56$ ($SE = 3.45$), 95% CI[1.78, 15.25], $t(161.08) = 2.48$, $p = .014$; $B_{quad} = -6.44$ ($SE = 2.84$), 95% CI [−11.95, −0.85], $t(160.97) = -2.27$, $p = .025$; $B_{cubic} = 1.80$ ($SE = 0.66$), 95% CI [0.50, 3.08], $t(160.85) = 2.72$, $p = .0073$. This cubic model (AIC = 886.80, BIC = 905.55) showed significantly better fit compared to the null (AIC = 945.53, BIC = 954.90; $\chi^2(3) = 63.966$, $p < .00001$) and linear models (AIC = 896.75, BIC = 909.25; $\chi^2(2) = 12.62$, $p = .0018$). The partial linear slope suggests that for every 1 sign per 100 electors, vote share increased by 8.56 per cent points, with a plausible population range of 1.78 to 15.25 per cent points.

The negative quadratic and positive cubic curvilinear terms are shown, respectively, in the shape of the line in Figure 1. The cubic term describes the sharp uptick of the curve when higher sign densities are reached. The negative quadratic describes the flattening of the mid and lower parts of the curve, where a trend best described as stagnation seems to take place at sign densities ranging from 1 to 2 per 100 electors on the list.

Since ED 1 had 168 polls where signs were deployed ($M_{present} = 13.23$, SD = 4.54) and 67 polls where no signs were deployed ($M_{absent} = 10.22$, SD = 3.88), we ran a categorical MLM analysis ($N = 235$) using the presence of signs as the predictor. Compared against a null model (AIC = 1333.76, BIC = 1344.14), the predictive model found a positive relation to vote share, $B = 2.97$ ($SE = 0.55$), 95% CI[1.89, 4.05], $t(230.21) = 5.39$, $p < .0001$, AIC = 1307.58, BIC = 1321.42, $\chi^2(1) = 27.61$,

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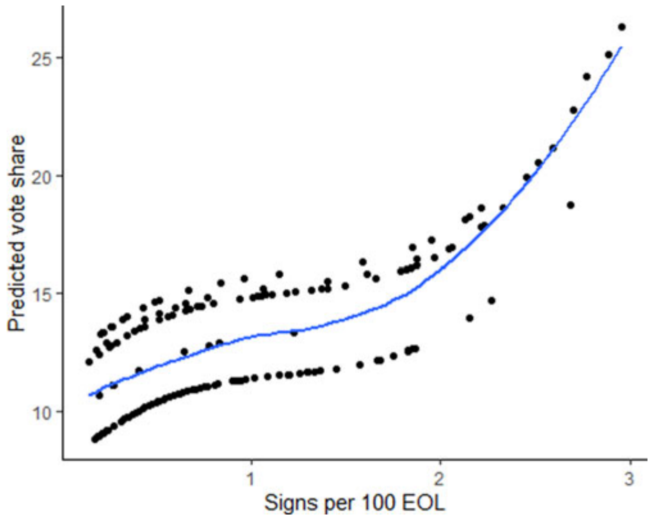

Figure 1. Model-estimated vote share using best fit curvilinear model for ED 1

$p < .0001$. These results suggest that in the absence of other confounding predictors, the presence of signs, compared to having no signs, predicted a vote share increase of 2.97 per cent points, with a plausible population range of 1.89 to 4.05 per cent points.

Electoral district 2

The linear model showed a nonsignificant partial fixed effect of signs per 100 EOL on vote share, $B_{lin} = -0.20$ ($SE = 0.79$), 95% CI[−1.78, 1.54], $t(41.70) = -0.255$, $p = .80$. The predictive model fit (AIC = 334.51, BIC = 341.65) was slightly worse than the null model (AIC = 333.93, BIC = 339.29). The predictive model results suggest that every 1 sign per 100 electors vote share could show a possible 1.54 per cent points increase in vote share to a possible decrease of 1.78 per cent points in vote share. As the 95% CI includes 0, there is also a possibility of no relation of signs in ED 2. However, the null model being a better model means that the neighbourhoods predicted vote share slightly better than signs for ED 2. This evidence lends to the interpretation that ED 2's vote share is better predicted by other variables outside the scope of this study.

Despite a difference in vote share means of $M_{absent} = 34.37$, $SD = 14.25$ ($n = 18$) versus $M_{present} = 40.41$, $SD = 9.42$ ($n = 26$), a presence/absence analysis showed no statistically significant effects of signs in ED 2, $B = 2.21$ ($SE = 3.38$), 95% CI [−4.41, 9.30], $t(40.82) = 0.65$, $p = 0.52$, AIC = 331.27, BIC = 338.40. This categorical model, compared against the null model, showed almost no difference (AIC = 333.93, BIC = 339.29, $\chi^2(1) = 0.47$, $p = .49$). These results suggest that the presence of signs in a poll in ED 2, compared to having no signs, could show a possible decrease of 4.41 per cent points in vote share, to a possible increase of 9.30 per cent point in vote share. As the 95% CI includes 0, there is also a possibility of no relation to the presence of signs in ED 2.

Electoral district 3

The best-fitting model in ED 3 ($n = 37$) was a curvilinear model that contained a linear and log term. The coefficients on both terms were nonsignficant. The partial linear fixed effect of signs per 100 EOL on vote share in ED 3 was $B_{lin} = 2.81$ (SE = 1.40), 95% CI[−0.52, 5.055], $t(24.48) = 1.55$, $p = .13$, $B_{log} = -4.07$, ($SE = 4.03$), 95% CI[−12.01, 3.72], $t(27.40) = -1.01$, $p = .32$. The model fit indices suggest that a predictive curvilinear model (AIC = 256.84, BIC = 264.89) had improved fit compared to a linear model (AIC = 260.48, BIC = 266.92) and to the null model (AIC = 261.41, BIC = 266.24), although the differences in fit were not significant (curvilinear to linear model comparison: $\chi^2(1)$ =1.09, $p = .30$; curvilinear to null model comparison: $\chi^2(2) = 2.89$, $p = .24$). These results suggest that every 1 sign per 100 electors could be associated with an increase in vote share of 2.81 per cent points, with a plausible population high of 5.06 per cent in vote share but plausibly also a decrease of −0.52 per cent points.

The curve describing the estimated outcome values in Figure 2 sheds light on the complexity of modelling the data in ED 3. We see a strong dip in the strength of the association around a density of 2.5 signs per 100 electors. There is also a clustering of values, which was hinted at in exploratory analyses that showed bimodal histograms, suggesting possible other confounding grouping variables, such as different subpopulations in ED 3.

There were no polls without signs in ED 3; thus a comparison of polls with signs present to polls with signs absent was not possible.

Electoral district 4

The partial linear fixed effect of signs per 100 EOL on vote share in ED 4 ($N = 51$) was significant, $B_{lin} = 4.14$ ($SE = 1.58$), 95% CI[1.09, 7.34], $t(46.36)$ =2.62, $p = .012$. The partial linear slope on the nonsignificant log term was $B_{log} = 2.70$, (SE = 2.27), 95% CI[−1.73, 7.09], $t(47.86) = 1.19$, $p = .24$. The results suggest that for every 1 sign per 100 electors, vote share increased by 4.14 per cent points, with a plausible population range of a 1.09 to 7.34 per cent point increase. The fit of the predictive model (AIC = 287.39, BIC = 297.05) was better compared both to a linear model (AIC = 290.28, BIC = 298.00) and to the null model (AIC = 341.55, BIC = 347.34) (predictive to linear model comparison: $\chi^2(1) = 1.45$, $p = 0.23$; predictive to null model comparison: $\chi^2(1) = 55.466$, $p < .0001$).

The curvilinear log term in ED 4's model shows up in the form of a slight flattening of the curve at higher values of sign densities (Figure 3), indicating a possible lessening of the relation of signs to vote share at sign densities around 3 to 4 signs per 100 electors.

There were no polls without signs in ED 4; thus a comparison of polls with signs present to polls with signs absent was not possible.

Electoral district 5

The linear fixed effect of signs per 100 EOL on vote share in ED 5 ($N = 221$) was $B_{lin} = 2.97$ ($SE = 0.36$), 95% CI[2.26, 3.70], $t(216.49) = 8.24$, $p < .0001$, AIC = 1131.5, BIC = 1145.09. These results suggest that for every 1 sign per 100 electors, vote share increased by 2.97 per cent points, with a plausible population range of 2.26

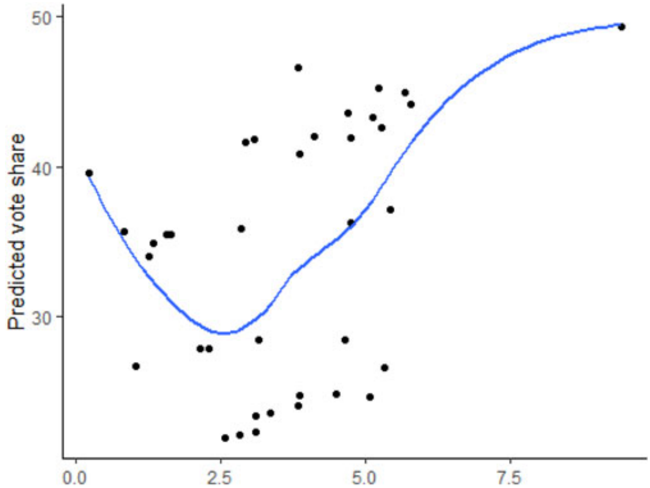

Figure 2. Model-estimated vote share using best fit curvilinear model for ED 3

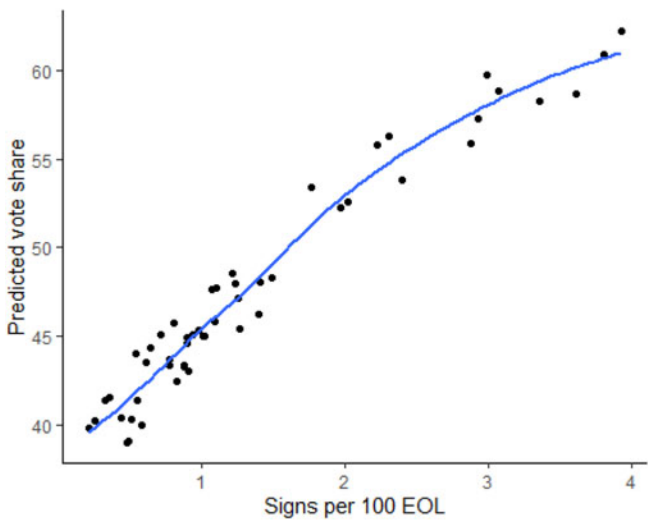

Figure 3. Model-estimated vote share using best fit curvilinear model for ED 4

to 3.70 per cent point increase. Compared to the null model (AIC = 1188.11, BIC = 1198.31), the predictive model had better fit, $\chi^2(1) = 59.31$, $p < .0001$.

ED 5 had enough polls without signs to compare presence versus absence. As with the results of ED 1, the presence of signs in a poll predicted an increase in vote share compared to the absence of signs, $B = 1.95$ ($SE = 0.60$), 95% CI[0.78, 3.13], $t(203.52) = 3.267$, $p = .0013$. The presence of signs in a poll predicted a vote share increase of 1.95 per cent points, with a plausible population range of 0.78 to 3.13 per cent points increase. The difference in model fit between the

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null MLM (AIC = 1188.11, BIC = 1198.31) and the MLM with the presence of signs modelled (AIC = 1178.83, BIC = 1192.43) was statistically significant, $\chi^2(1) = 10.51$, $p = .0012$.

Electoral district 6

The partial linear fixed effect of signs per 100 EOL on vote share in ED 6 ($n = 191$) was $B_{lin} = 0.98$ ($SE = 0.44$), 95% CI[0.12, 1.88], $t(183.07) = 2.24$, $p = 0.026$. The model also contained a significant log term, $B_{log} = 1.92$ ($SE = 0.89$), 95% CI[0.14, 3.66], $t(175.31) = 2.15$, $p = .033$. The model containing the linear and log terms (AIC = 1125.69, BIC = 1141.96) fit better than a linear model (AIC = 1129.82, BIC = 1142.83), χ^2 (1) = 4.48, $p = .034$ or a null model (AIC = 1183.5, BIC = 1193.26), χ^2 (2) = 62.06, p < .0001). The partial linear slope indicates a plausible linear 0.12 to 1.88 per cent point increase in vote share per 1 sign per 100 EOL.

The curvilinear log term in ED 6's model is displayed in the flattening of the curve at higher values of sign densities, indicating a lessening of the relation of signs to vote share, starting around 5 signs per 100 electors (Figure 4). This model's curve also shows a sharp increase beginning at very low sign densities.

There were no polls without signs in ED 6; thus a comparison of polls with signs present to polls with signs absent was not possible.

Aggregated MLM results

A null four-level model with random intercepts of neighbourhood, riding, year and electoral level was used as the basis to introduce the fixed effect of signs. To control for similarities based on the distinct communities, the group level of riding represented not each analytically designated electoral district but the three geographical ridings as described in the methods section.

A four-level MLM ($n = 657$) with linear and log terms was found to have the best fit, and significant linear fixed effects of signs per 100 EOL, $B_{lin} = 1.00$ ($SE = 0.25$), 95% CI[0.51, 1.49], $t(621.45) = 3.99$, $p = .000073$, and a significant log term, $B_{log} = 1.29$ ($SE = 0.39$), 95% CI[0.54, 2.05], $t(603.79) = 3.35$, $p = 0.00084$, AIC = 3855.10, BIC = 3891.00. The model fit statistically significantly better compared to the null (AIC = 3966.91, BIC = 3993.84, χ^2 (2) = 118.09, $p < .0001$) and compared to a linear four-level model (AIC = 3864.19, BIC = 3895.60), χ^2 (1) = 11.20, $p = 0.00082$. Overall, across the ridings under study and including group-level effects for time (year) and jurisdiction (electoral level), the results suggest that party's vote share was 1 per cent point higher for every 1 sign placed per 100 electors, with a plausible population range from a 0.50 to 1.49 per cent point increase.

The curvilinear log term in the aggregate model shows in the flattening of the curve (Figure 5) at higher values of sign densities, indicating a lessening of the relation of signs to vote share starting around sign densities of 4 or 5 signs per 100 electors. This model's curve also shows a sharp increase beginning at very low sign densities, such as those less than 1 sign per 100 electors.

A presence ($n = 657$) versus absence ($n = 128$) of signs analysis was conducted on the $N = 785$ dataset. The results suggest that presence of signs is associated with higher vote share, even when modelled within the four-level MLM accounting for the group-level effects of riding, year and electoral level, $B = 2.46$ ($SE = 0.47$),

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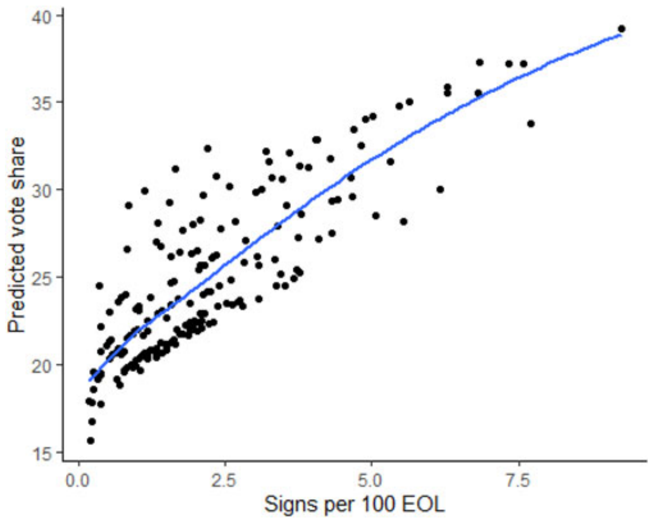

Figure 4. Model-estimated vote share using best fit curvilinear model for ED 6

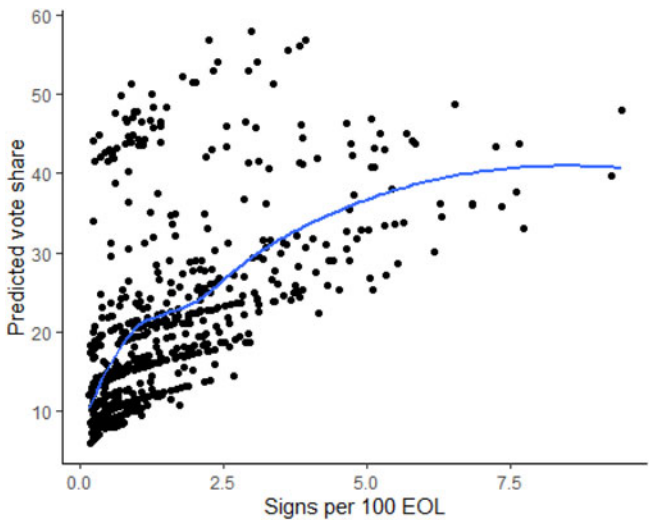

Figure 5. Model-estimated vote share using best fit curvilinear model for aggregated dataset

95% CI[1.53, 3.40], $t(735.48) = 5.19$, $p < .0001$ ($M_{present} = 21.22$, $SD = 12.6$, $M_{absent} = 13.73$, $SD = 10.52$). This predictive four-level categorical model (AIC = 4755.17, BIC = 4787.83) showed better fit compared to a null four-level model (AIC = 4780.03, BIC = 4808.02), $\chi^2(1) = 26.58$, $p < .0001$. When all polls were pooled and grouping levels accounted for, the presence of signs was statistically significantly associated with a 2.46 per cent point vote share increase per 1 sign per 100 EOL,

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with a plausible population range of 1.53 to 3.40 per cent point increase, compared to polls with no signs.

Contextual factors and patterns

A mix of sharp increases, diminishing increases, and some absence of trends: the patterns in the results are hard to reconcile. In ED 1, a positive cubic trend was identified, meaning the trend line had an up-curve in addition to the flattening indicated by the quadratic trend. The presence of the positive cubic term and the large size magnitude of the partial linear both indicate a steep increase in vote share. Correspondingly, the margin of loss narrowed considerably and the party moved up to third status. EDs 2 and 3 showed a hugely narrowed and slightly widened margin, respectively, but maintained second-party status and showed little to no relation with signs. ED 4, which represented a move from third to winning, showed a strong yet mostly linear relation with signs. ED 5 showed little change in party status and support but a moderate relation with signs. ED 6 moved up in party status but, alongside the general increase that signs had with vote share, also had a flattening curve.

Discussion

Overall, our results provide strong evidence that household signs are associated with a political party's vote share, using a large poll-level sample. The results further suggest that the presence of signs is associated with increased vote share and that the amount of household signs can positively predict vote share in a Canadian context.

Categorical analysis of presence of household signs and vote share

The analyses of the presence of signs within the electoral districts and in the aggregated model showed an association with vote share, compared to an absence of signs, with plausible 1.5 to 3.4 per cent point increases in vote share compared to areas with no signs. These effect sizes were comparable to prior presence/absence research, which ranged from 0.34 to 3.07 per cent points (Green et al., 2016). The present study's results are more refined, as they are restricted to household signs and use a more granular level of association (polls) with a larger sample size, increasing the precision of the measure. Thus, the present research found further associative evidence of the potential effectiveness of household signs and validated past findings in a Canadian context.

Quantitative predictive relationship between household signs and vote share

Household signs placed by a party throughout a campaign are effective predictors of the support the party achieves on election day. The magnitude of the association means household signs are worth the money spent, especially when compared to per cent increases (0.09, 0.05, 0.04) per dollar in earlier research (Eagles, 2004). At higher volumes, a typical sign costs less than CAN$6.00, so the 0.36, 0.30 or

0.24 per cent point increases predicted by the dollars spent on a sign are eclipsed by a single sign per 100 electors, predicting a 0.78 or up to a 4.05 per cent point increase in vote share.

Curvilinear relationship of signs and vote share

The curvilinear relationships suggest that the strength of the relationship between signs and vote share may vary depending on the amount of signs displayed. Specifically, two districts and the aggregate model showed evidence of a sharp vote share increase at low sign densities. We theorize that at lower levels of competitiveness, signs were able to increase the local-level viability of the party, having a dynamic effect on the effect of signs themselves, and vote share correspondingly showed a strong increase. The idea that signs may be a stronger viability signal at lower values aligns with Carty and Eagles' (1999) finding of stronger returns on campaign spending for nongoverning parties.

The aggregate model also showed a clear diminishing trend at higher densities of signs (3 to 5 signs per 100 electors): the large gains in vote share began to decrease. These findings could mean that large increases in support at low sign densities are not sustained and may reach a potential saturation point at which a decrease in returns begins. Signs exhibiting a diminishing returns trend may also explain the Green and colleagues' (2016) study on household signs, which saw smaller effects for the victor in a noncompetitive landslide victory.

From a practical viewpoint, campaigns could use this knowledge to know when and where to shift their canvassing efforts. Since household signs seem to be decent reflections of actual support, polls with exceedingly high densities of signs would not need to be revisited, and voter contact efforts could be redirected toward polls that have yet to meet the threshold of diminishing returns.

Limitations and future directions

The present study's first limitation is that the analytical approaches were correlational. To infer causality, presence and absence in a poll should be determined using random assignment prior to an election. This precaution guards against differences on potential confounding causal variables. However, the present study represents a novel model using poll-level and quantity-based measurements to predict vote share in multiparty first-past-the-post elections. Future studies should incorporate random assignment and spillover controls (as in Green et al., 2016) and measures of baseline support to test if signs influence vote share.

The other limitation of the present study is that the dataset was drawn from a single nondominant party (the Green Party) and comprised only three communities, reducing the generalizability to other communities and incumbent parties. To increase generalizability, future research should use the present model but sample from more ridings and multiple parties. Increasing the riding-level sample size could also allow for more rigorous analyses of the contributions of party status and competitiveness. The nonindependent competitiveness of a campaign's sign efforts could also be incorporated into the model by using latent variable techniques (for example, Fieldhouse and Cutts, 2009). Such modelling would help control for a party putting out more signs due to a proliferation of competitors' signs.

Further research could corroborate the curvilinear trends and investigate whether the diminishing returns represent a saturation point on sign density, where the number of signs passes a threshold of influence, or a ceiling effect on vote share, where support levels are too high to be pushed any higher by the potential influence of signs.

Conclusion

The present study helped to quantify, using a Canadian multiparty context, the predictive relationship that household signs have with vote share for nongoverning political parties. In addition, higher vote share in areas with signs compared to no signs supported past findings of a mere presence effect of political household signs. Curvilinear modelling showed potential diminishing returns trends that were uncaptured in previous research. Household signs deserve a place of study alongside other electoral predictors in Canadian electoral studies. Campaigners may also feel less uncertainty when it comes to household signs, with our evidence that, overall, more signs are associated with an increase in vote share.

Supplementary Material. To view supplementary material for this article, please visit https://doi.org/10.1017/S0008423923000501

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Notes

1 The authors relied on existing inside relationships with the parties and drew up data-sharing agreements with available representatives to be allowed to use internal data for research purposes. Other parties were assumed not to be willing to trust a competing party's insider and were not approached to share data.

2 Curvilinear models tested included log, quadratic and cubic terms alongside the linear term. Polls with sign values of zero were excluded from these datasets to allow for the log term to be computable.

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