

# **10 Downing Street: Who's Next? Seemingly Unrelated Regressions to Forecast UK Election Results**

Philippe Mongrain

*Journal of Elections, Public Opinion and Parties*, accepted

2019

## **Abstract**

In recent years, the British polling industry has encountered difficulties in its attempts to measure voting intentions in important popular consultations, notably the referendum on Scottish independence, the 2015 general election and the EU membership referendum. In such a context, it is extremely valuable to explore how different forecasting models that use political and economic variables can be used to predict the outcome of elections. In this paper, we propose such a model by introducing a political economy equation to estimate the vote share obtained by the incumbent party in UK general elections three months before the vote as well as a set of seemingly unrelated regressions (SUR) to forecast the results of the Official Opposition, the Liberal Democrats and the remaining parties.

## **Keywords**

election forecasting, United Kingdom, British general elections, seemingly unrelated regressions, vote intention polls

## **Introduction**

At the beginning of the 1980s, a small group of political scientists began to develop forecasting equations based on political and economic indicators to predict election results (for example, Lewis-Beck and Rice 1982, 1984; Rosenstone 1983). Election forecasting is now a thriving discipline in the United States, where a large number of different models are being used to forecast the outcome of congressional elections or the fate of presidential candidates. Although researchers today can mobilize a vast array of forecasting methods (such as poll aggregation, citizen forecasting or election stock markets), “structural” models remain the most common approach to forecast election results. Structuralists use simple regression techniques and single equations that usually include a small number of economic and political variables to predict national election results. These equations offer a single forecast of the vote or seat share for a party most typically between three and six months before Election Day (Lewis-Beck 2005; Lewis-Beck and Stegmaier 2014). In comparison to other approaches to forecasting elections, structural equations are generally more strongly embedded in theories of voting.

Recently, forecasting models have gained particular relevance in the United Kingdom. Over the last few years, the polling industry has done rather poorly in forecasting the results of important popular consultations, such as the Scottish independence referendum in 2014, the 2015 British general election and the Brexit referendum (see Barnes 2016; Duncan 2016; Nardelli 2014; Sturgis et al. 2016). Faced with such large polling errors, predictive models emerge as an alternative to polls or, at the very least, as a point of comparison that can be mobilized to put vote intention polls into perspective. With this in mind, we propose a forecasting equation for predicting the incumbent party vote share that is applied to UK general elections between 1959 and 2017. By embedding this structural equation in a set of seemingly unrelated regressions

(SUR), we are able to estimate the vote share for the Official Opposition, the Liberal Democrats (Lib Dems) and the remaining parties.

### **The State of Structural Forecasting in the UK**

In comparison to the United States, the forecasting literature on British elections has remained relatively underdeveloped until the beginning of the 21<sup>st</sup> century. Mughan (1987) was the first political scientist who developed predictive models for elections in the UK. He assessed the performance of three different models dedicated to forecasting the vote share of the incumbent party, the Official Opposition and the alliance of the Social Democratic Party and the Liberals for the 1987 election. The first of these models, qualified by Mughan as “incremental,” considered the vote share obtained by a party as a function of its previous values. The second model was simply based on polling results, the vote share of each party being regressed on its share of the final Gallup vote intentions released prior to the election. Finally, the third model, following the idea of retrospective voting, expressed the influence of macroeconomic conditions on the level of support for the various parties.

After Mughan’s 1987 paper, it took more than 15 years before new election forecasting models for British elections were published. The development of structural models for British elections in recent years is in large part due to the work of two teams of forecasters. The first one, consisting of Lewis-Beck, Bélanger, and Nadeau (2004; see also Bélanger, Lewis-Beck, and Nadeau 2005; Nadeau, Lewis-Beck, and Bélanger 2009), proposed equations that incorporated economic and political indicators. The variables used in these equations aim to capture the notions of retrospective voting and attrition of power as well as the level of competitiveness of the leading parties. The second team of forecasters is made up of Lebo and Norpoth (2007, 2011, 2013, 2016; see also Norpoth 2004). These scholars have opted for the incremental method and

have developed autoregressive equations that are primarily based on the concept of electoral cycles (see Norpoth 2014).

Structural models are a dominant approach to forecasting election outcomes, but it is important to note that many other methods, some of them more sophisticated, have been mobilized to predict elections results in the UK and elsewhere. Many such models were applied to the 2010 and 2015 British general elections (see Gibson and Lewis-Beck 2011; Stephen and Lewis-Beck 2016). For example, Hanretty, Lauderdale, and Vivyan (2016) and Prosser (2016) both used, in a different manner, local election results to forecast national electoral fortunes. Lewis-Beck and Stegmaier (2011) as well as Murr (2016) exploited vote expectation surveys in order to produce “citizen forecasts” for the major parties. For their part, Stegmaier and Williams (2016) proposed a set of seemingly unrelated regressions that were estimated by using voters’ economic evaluations and various political variables gathered monthly between April 2004 and February 2015 to predict the vote shares of the Conservatives, the Labour Party, the Lib Dems and the remaining competitors. By using Continuous Monitoring Survey (CMS) data on this 11-year period, Stegmaier and Williams were able to make forecasts based on 118 observations, far more than any regular structural model. Other researchers have relied on synthetic models which combine poll results and a particular set of political and/or economic indicators in the same forecasting equation (see Lewis-Beck and Dassonneville 2015a, 2015b; Lewis-Beck, Nadeau, and Bélanger 2016). For the UK, synthesizers have found that polling information (vote intentions) has more importance than structural information (the economy and governmental approval) in forecasting the incumbent vote share. Despite the variety of existing models, none simultaneously offer a forecast for more than one party by relying mostly on political and economic factors and using data on a period spanning multiple decades. We propose such a model.

## A New Model

Structural (and synthetic) models for the UK and other countries usually focus on the incumbent party or candidate. In a multiparty system such as the United Kingdom, forecasting the incumbent vote share is not enough. Notwithstanding an abrupt decline in the 2017 election (see Prosser 2018), the effective number of electoral parties in the UK has followed an upward trend in the period following World War II. Since the mid-1970s, the combined vote share for third parties usually winds up in the twenties or thirties. In spite of this reality, forecasting models that rely on economic and political variable and/or vote intention data *going back to the 1950s* in order to predict the vote shares of *all* the contenders are few and far between. For this reason, we develop a set of seemingly unrelated regressions (see Zellner 1962) in order to predict the vote shares obtained by the incumbent governing party, the Official Opposition, the Lib Dems and all remaining parties. As Timm (2002, 316) puts it, “[t]he advantage of the SUR model is that it permits one to relate different independent variables to each dependent variable using the correlations among the errors in different equations to improve upon the estimators.” Our SUR model takes advantage of different forecasting methods: the incumbent equation is structural in nature, while the equations for the Official Opposition and the Lib Dems are of the synthetic kind, and the remaining parties’ equation is based on vote intentions only.

At least four conclusions can be drawn from the structural models that have previously been developed to forecast elections, that is: (1) there is a static or cyclical dimension to voting; (2) the outgoing party vote share on Election Day depends on incumbent approval; (3) the level of support for the party in office is influenced by the state of the economy just before the vote; and (4) the longer a party stays in power, the more it loses votes due to citizens’ fatigue and their yearning for change. We take these four points into account for developing the forecasting model presented here.

First, like Lebo and Norpoth (2007), we agree that voting has a certain static or cyclical dimension. That is, the incumbent party can expect to retain a significant share of the support it has received in the previous election, which also means as a corollary that, all things being equal, at each subsequent election the party will almost always lose a few more votes. Second, government approval is a key variable for predicting the vote share received by the party in power. It echoes citizens' global evaluation of the performance of their leaders on a range of issues that include, but are not limited to, the economy. However, in the case of the United Kingdom, we can wonder if the approval of the incumbent party is better reflected by measuring voter satisfaction toward the Prime Minister or the government taken as a whole. According to Lebo and Norpoth (2011, 2013), the approval rate of the Prime Minister is a better predictor of voting (and voting intentions) than the government's approval rate (or a combination of both). Third, the economy influences the incumbent's vote share. According to theories of retrospective voting, a voter's choice is often conceived as a referendum on the state of the national economy. Regardless of what economic measure is used, the basic idea is always the same: the outgoing party can expect to be punished at the polls in times of economic hardships and to be rewarded when the economy is doing well (Lewis-Beck and Paldam 2000; Lewis-Beck and Stegmaier 2013). Fourth, the time spent by a party in government is linked to the notion of attrition of power or time-for-change. That is, after several years under the same administration, it is likely that the electorate will manifest a willingness to replace the incumbent government (Shirayev and Sobel 2016, 242).

Using the SUR methodology, we lay out four equations – one for every major player (the incumbent, the Official Opposition and Liberal Democrats) and one for the remaining parties. The equation that we suggest to forecast the incumbent party vote share includes four variables that directly translate each of the above-mentioned conclusions. The chosen variables

are (1) the percentage of the popular vote received by the outgoing party in the previous election; (2) the approval/satisfaction rating of the Prime Minister in the third month preceding the month of the election; (3) the GDP growth rate in the second quarter before the election quarter<sup>1</sup>; and (4) the number of consecutive months spent in office by the incumbent party. In using a three-month lag, we follow a practice that is common in recent American election forecasting (see Nadeau, Lewis-Beck, and Bélanger 2009, 336).

Our equation for the Official Opposition is based on two independent variables, namely (1) the approval rating of the Official Opposition leader and (2) the proportion of vote intentions garnered by the main opposition party in relation to the other opposition parties (the “opposition vote monopoly”). The logic here is that, the more the Official Opposition is able to monopolize the overall opposition vote, the better it will perform on Election Day. The equation for the Lib Dems is based on the vote intentions they received in the third month before Election Day and the vote share they got during the last election. The remaining competitors’ equation is solely founded on their overall vote intentions. Estimating our model for the 16 general elections that took place between 1959 and 2017<sup>2</sup>, we obtain the following estimates listed in Table 1 (all the data used to construct the SUR model as well as detailed results from this model can be found in the online supplementary materials, Appendix A).

Table 1. Seemingly unrelated regressions for British general elections.

	<b>Incumbent</b>	<b>Opposition</b>	<b>Lib Dems</b>	<b>Others</b>
Incumbent previous vote share	0.484*** (0.098)	–	–	–
Prime Minister approval	0.254*** (0.048)	–	–	–
GDP growth	1.458** (0.580)	–	–	–
Months in office	–0.031*** (0.007)	–	–	–
Opp. leader approval	–	0.150** (0.061)	–	–
Opp. vote monopoly	–	0.269*** (0.060)	–	–
Lib Dem previous vote share	–	–	0.246** (0.104)	–
Lib Dem vote intentions	–	–	0.653*** (0.101)	–
Others' vote intentions	–	–	–	0.791*** (0.059)
Intercept	9.846** (3.831)	14.482*** (2.893)	1.901 (1.926)	2.211*** (0.717)
$R^2$	0.883	0.712	0.795	0.800
RMSE	1.808	3.094	2.853	2.526
N	16 (1959–2017)	16 (1959–2017)	16 (1959–2017)	16 (1959–2017)

Notes: Unstandardized coefficients and standard errors (in parentheses) are reported. Significance levels: \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$  (two-tailed).

Focusing on the incumbent vote share first, we find that all of the predictor variables included in our model have the expected sign and achieve statistical significance. The model also has a fairly high explanatory power: it explains about 88% of the variance in the vote share received by the incumbent party. The incremental element of the incumbent equation indicates that the more votes the outgoing party got in the previous election, the higher vote share it can expect to obtain in the current election. The coefficient associated with the approval rating of the Prime Minister suggests that for each additional percentage point on this scale, the incumbent party wins approximately a quarter of a percentage point in popular votes. The effect of GDP growth on incumbent electoral support is substantial: a one point increase in the value of this economic indicator generates a gain of close to 1.5 points in the outgoing party vote share. The

raw number of months in power also shows that the longer a party has been in office, the fewer votes it will obtain on Election Day. Admittedly, the time spent in office has only a small impact on the percentage of the votes received by the incumbent party: it appears that each additional successive month in power reduces the percentage of the outgoing party vote share by about 0.03 percentage point. More concretely, this means that after about 32 months (or just over two years and a half) in power, the party forming the government can expect to lose a little over one percentage point in electoral support, which is a small penalty. But still, this variable has an independent and significant effect on the vote. Also, we have to consider that the rather small effect of time will become quite important when a party remains in power for many years: for example, in the 1997 general election, the 18 years of consecutive Conservative governments seems to have cost John Major's party about 6.7 percentage points, all else being equal.

The "opposition vote monopoly" variable and the approval rating of the Official Opposition leader explain around 71% of the variance in the vote shares received by the main opposition party. Each additional percentage point in the monopoly variable raises the Official Opposition vote by approximately one quarter of a percentage point. When the leader gains a percentage point in his/her approval rating, the vote share raises by about 0.16 percentage point. Vote intentions three months before the elections and the Lib Dems previous electoral performances explain about 80% of the variance in the Lib Dems vote shares. For the remaining competitors, vote intentions also explain about 80% of the variance in their combined electoral results. Each percentage point of vote intentions garnered by the Lib Dems leads to a gain of about 0.65 percentage point in vote share and of about 0.79 point for the smaller parties grouped together. Also, for the Lib Dems, each additional point garnered at the previous election translates, all else being equal, in a gain of about 0.25 point.<sup>3</sup>

## Diagnostics

Different tests and indicators can be used to assess the general quality of a forecasting model. First, we can use the within-sample forecast, which is the simplest and least demanding test, since all the available data are used to generate predictions. For performing a within-sample forecast, the outcome of an election is “predicted” by taking advantage of all the elections composing our sample – also including the specific election for which the result is forecasted. Second, we can make out-of-sample (or jackknife) forecasts, which consists of removing from the equation the data associated with the election for which we want to estimate the outcome. For that reason, we can see out-of-sample forecast as a stricter evaluative assessment of the model (Lewis-Beck 2005, 153). Third, we can look at step-ahead forecasts which solely rely on data available *before* the election. As such, step-ahead forecasting constitutes an even stricter assessment of a model’s predictive ability. Among the indicators that can be drawn from these tests, the mean absolute error (MAE) is one of the most frequently reported. The MAE represents the difference between the predicted and actual scores, the absolute value indicating that positive and negative errors are equally penalised (see Fair 1984, 261-262).

The diagnostics of our model suggest that it is quite accurate, at least in the case of the incumbent party and for the smaller parties combined. The out-of-sample MAE is 2.28 percentage points for the incumbent and 2.17 percentage points for the small parties respectively. For the Official Opposition and Lib Dems, the out-of-sample MAEs are equal to 2.64 and 2.98 percentage points respectively. The step-ahead MAE for the incumbent is just shy of three percentage points and a little over 2.5 percentage points for the small parties combined. For the Official Opposition and Lib Dems, the step-ahead MAE is about 3.5 percentage points in both cases.<sup>4</sup>

Our model may also constitute an interesting complement to vote intention polls, which continues to be the main forecasting tool in modern democracies. The average absolute errors associated with the mean of vote intentions in favour of the outgoing party, the Official Opposition, the Lib Dems and the remaining parties (retrieved from Mark Pack's PollBase) in the third month before the election month since 1959 are 2.67, 3.33, 3.21, and 2.48 percentage points respectively. Nevertheless, comparing our own model forecasts to raw poll results could be seen as unfair. Survey results cannot be considered as "true" or authentic predictions (see Erikson and Wlezien 2008). In order to form authentic forecasts, poll figures taken at one point or another of the election campaign must therefore be transformed into poll-based projections. We can achieve this by regressing the parties' vote shares on their raw vote intentions. To maximize comparability, we estimated this "poll model" using a SUR methodology.

But even compared to such regressions, our model remains more accurate than poll results. Out-of-sample MAEs for the "poll model" are 2.75, 2.99, 3.25, and 2.19 percentage points for the incumbent party, the Official Opposition, the Lib Dems, and the remaining parties respectively (polling data and models can be found in the online supplementary materials, Appendix B) compared to 2.28, 2.64, 2.98, and 2.17 percentage points for the SUR model. In all fairness, those results represent only slight gains in accuracy when compared to poll-based projections (although the gain is more substantial for the incumbent party – about 0.47 percentage point). Nevertheless, it is important to stress that we realize these gains by adding and integrating variables that are important to political science – the state of the economy, the cost of ruling, approval ratings, and election results themselves.<sup>5</sup> Step-ahead forecasts give a more ambiguous picture: the SUR model is as or more accurate than the "poll model" for the incumbent (2.96 vs 2.97 percentage points) and Lib Dems (3.54 vs 4.33) but moderately less accurate for the Official Opposition (3.44 vs 3.16) and the remaining parties (2.55 vs 2.12).

## Discussion

The polling industry has been experiencing difficulties in predicting the outcome of elections and referendums in recent years. For these reasons, it is important to propose new models and methods to demonstrate how elections results (and perhaps the results of other forms of political consultations) come about and, from an epistemological standpoint, to show that political science is not limited to *ex post* explanation of political events. We also believe that a wide range of models is valuable in and of itself. The model we have proposed performs slightly better than poll-based projections but only when we look at out-of-sample forecasts. For the moment, our model remains untested in the context of an actual election campaign: in that sense, we look forward to producing a “step-ahead” forecast for the next British general election. A final consideration on which we have been silent is the conversion of votes into seats, no doubt a challenging enterprise. It is well-known that seats – not votes – are the key to power. Although our goal here was to forecast vote shares, it is important to acknowledge the important works that were realized in the past years specifically geared toward that goal, such as Whiteley et al.’s (2016) seats-votes model and Nadeau, Lewis-Beck, and Bélanger’s (2009) swing ratio. It is unfortunately a subject we could not explore at length in this short research note and consequently this is a task we keep for future research.<sup>6</sup>

## References

Barnes, Peter. 2016. "EU Referendum: Did the polls all get it wrong again?" BBC News, June 28. Accessed 31 March 2018. <http://www.bbc.com/news/uk-politics-eu-referendum-36648769>.

Bélanger, Éric, Michael S. Lewis-Beck, and Richard Nadeau. 2005. "A Political Economy Forecast for the 2005 British General Election." *The British Journal of Politics and International Relations* 7 (2): 191-198. doi:10.1111/j.1467-856X.2005.00181.x.

Campbell, James E. 2017. "A Recap of the 2016 Election Forecasts: Introduction." *PS: Political Science and Politics* 50 (2): 331-332. doi:10.1017/S1049096516002766.

Dassonneville, Ruth and Michael S. Lewis-Beck. 2014. "Macroeconomics, Economic Crisis and Electoral Outcomes: A National European Pool." *Acta Politica* 49 (4): 372-394. doi:10.1057/ap.2014.12.

Duncan, Pamela. 2016. "How the pollsters got it wrong on the EU referendum." The Guardian, June 24. Accessed 31 March 2018. <https://www.theguardian.com/politics/2016/jun/24/how-eu-referendum-pollsters-wrong-opinion-predict-close>.

Erikson, Robert S. and Christopher Wlezien. 2008. "Are Political Markets Really Superior to Polls As Election Predictors?" *Public Opinion Quarterly* 72 (2): 190-215. doi:10.1093/poq/nfn010.

Fair, Ray C. 1984. *Specification, Estimation, and Analysis of Macroeconometric Models*. Cambridge: Harvard University Press.

Fisher, Stephen D. and Michael S. Lewis-Beck. 2016. "Forecasting the 2015 British General Election: The 1992 Debacle All Over Again?" *Electoral Studies* 41 (Mar.): 225-229. doi:10.1016/j.electstud.2015.11.016.

Gibson, Rachel and Michael S. Lewis-Beck. 2011. "Methodologies of Election Forecasting: Calling the 2010 UK 'Hung Parliament.'" *Electoral Studies* 30 (2): 247-249. doi:10.1016/j.electstud.2010.09.003.

Hanretty, Chris, Ben Lauderdale, and Nick Vivyan. 2016. "Combining National and Constituency Polling for Forecasting." *Electoral Studies* 41 (Mar.): 239-243. doi:10.1016/j.electstud.2015.11.019.

Lebo, Matthew J. and Helmut Norpoth. 2007. "The PM and the Pendulum: Dynamic Forecasting of British Elections." *British Journal of Political Science* 37 (1): 71-87. doi:10.1017/S000712340700004X.

Lebo, Matthew J. and Helmut Norpoth. 2011. "Yes, Prime Minister: The Key to Forecasting British Elections." *Electoral Studies* 30 (2): 258-263. doi:10.1016/j.electstud.2010.09.004.

Lebo, Matthew J. and Helmut Norpoth. 2013. "Forecasting British Elections: The 'PM and the Pendulum' Model Reconsidered." *Journal of Elections, Public Opinion and Parties* 23 (1): 66-85. doi:10.1080/17457289.2012.745083.

Lebo, Matthew J. and Helmut Norpoth. 2016. "Victory Without Power: The PM-Pendulum Forecast." *Electoral Studies* 41 (Mar.): 255-259. doi:10.1016/j.electstud.2015.11.012.

Lewis-Beck, Michael S. 2005. "Election Forecasting: Principles and Practice." *The British Journal of Politics and International Relations* 7 (2): 145-164. doi:10.1111/j.1467-856X.2005.00178.x.

Lewis-Beck, Michael S. and Ruth Dassonneville. 2015a. "Forecasting Elections in Europe: Synthetic Models." *Research and Politics* 2 (1): 1-11. doi:10.1177/2053168014565128.

Lewis-Beck, Michael S. and Ruth Dassonneville. 2015b. "Comparative Election Forecasting: Further Insights from Synthetic Models." *Electoral Studies* 39 (Sept.): 275-283. doi:10.1016/j.electstud.2015.03.018.

Lewis-Beck, Michael S. and Martin Paldam. 2000. "Economic Voting: An Introduction." *Electoral Studies* 19 (2-3): 113-121. doi:10.1016/S0261-3794(99)00042-6.

Lewis-Beck, Michael S. and Mary Stegmaier. 2011. "Citizen Forecasting: Can UK Voters See the Future?" *Electoral Studies* 30 (2): 264-268. doi:10.1016/j.electstud.2010.09.012.

Lewis-Beck, Michael S. and Mary Stegmaier. 2013. "The VP-Function Revisited: A Survey of the Literature on Vote and Popularity Functions After Over 40 Years." *Public Choice* 157 (3): 367-385. doi:10.1007/s11127-013-0086-6.

Lewis-Beck, Michael S. and Mary Stegmaier. 2014. "US Presidential Election Forecasting: Introduction." *PS: Political Science and Politics* 47 (2): 284-288. doi:10.1017/S104909651400002X.

Lewis-Beck, Michael S. and Tom W. Rice. 1982. "Presidential Popularity and Presidential Vote." *Public Opinion Quarterly* 46 (4): 534-537. doi:10.1086/268750.

Lewis-Beck, Michael S. and Tom W. Rice. 1984. "Forecasting Presidential Elections: A Comparison of Naïve Models." *Political Behavior* 6 (1): 9-21. doi:10.1007/BF00988226.

Lewis-Beck, Michael S., Richard Nadeau, and Éric Bélanger. 2004. "General Election Forecasts in the United Kingdom: A Political Economy Model." *Electoral Studies* 23 (2): 279-290. doi:10.1016/S0261-3794(02)00071-9.

Lewis-Beck, Michael S., Richard Nadeau, and Éric Bélanger. 2016. "The British General Election: Synthetic Forecasts." *Electoral Studies* 41 (Mar.): 264-268. doi:10.1016/j.electstud.2015.11.010.

Mughan, Anthony. 1987. "General Election Forecasting in Britain: A Comparison of Three Models." *Electoral Studies* 6 (3): 195-207. doi:10.1016/0261-3794(87)90031-X.

Murr, Andreas E. 2016. "The Wisdom of Crowds: What Do Citizens Forecast for the 2015 British General Election?" *Electoral Studies* 41 (Mar.): 283-288. doi:10.1016/j.electstud.2015.11.018.

Nadeau, Richard, Michael S. Lewis-Beck, and Éric Bélanger. 2009. "Election Forecasting in the United Kingdom: A Two-Step Model." *Journal of Elections, Public Opinion and Parties* 19 (3): 333-358. doi:10.1080/17457280903074276.

Nardelli, Alberto. 2014. "Were Scottish independence opinion polls misleading?" *The Guardian*, September 19. Accessed on 5 April 2018. <https://www.theguardian.com/politics/2014/sep/19/scottish-independence-opinion-polls-referendum-vote>

Norpoth, Helmut. 2004. "Forecasting British Elections: A Dynamic Perspective." *Electoral Studies* 23 (2): 297-305. doi:10.1016/S0261-3794(02)00070-7.

Norpoth, Helmut. 2014. "The Electoral Cycle." *PS: Political Science and Politics* 47 (2): 332-335. doi:10.1017/S1049096514000146.

PollBase (opinion polls database from 1943-today; accessed March 10, 2018). <https://www.markpack.org.uk/opinion-polls/>.

Prosser, Christopher. 2016. "Do Local Elections Predict the Outcome of the Next General Election? Forecasting British General Elections from Local Election National Vote Share Estimates." *Electoral Studies* 41 (Mar.): 274-278. doi:10.1016/j.electstud.2015.11.008.

Prosser, Christopher. 2018. "The Strange Death of Multi-Party Britain: The UK General Election of 2017." *West European Politics* 41 (5): 1226-1236. doi:10.1080/01402382.2018.1424838.

Rosenstone, Steven J. 1983. *Forecasting Presidential Elections*. New Haven: Yale University Press.

Shirayev, Eric and Richard Sobel. 2016. *People and Their Opinions: Thinking Critically About Public Opinion*. New York: Routledge.

Stegmaier, Mary and Laron K. Williams. 2016. "Forecasting the 2015 British Election Through Party Popularity Functions." *Electoral Studies* 41 (Mar.): 260-263. doi:10.1016/j.electstud.2015.11.011.

Sturgis, Patrick, Nick Baker, Mario Callegaro, Stephen Fisher, Jane Green, Will Jennings, Jouni Kuha, Ben Lauderdale, and Patten Smith. 2016. *Report of the Inquiry into the 2015 British General Election Opinion Polls*. London: Market Research Society and British Polling Council.

Timm, Neil H. 2002. *Applied Multivariate Analysis*. New York: Springer.

Whiteley, Paul, Harold D. Clarke, David Sanders, and Marianne C. Stewart. 2016. "Forecasting the 2015 British General Election: The Seats-Votes Model." *Electoral Studies* 41 (Mar.): 269-273. doi:10.1016/j.electstud.2015.11.015.

Zellner, Arnold. 1962. "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias." *Journal of the American Statistical Association* 57 (298): 348-368. doi:10.2307/2281644.

## Endnotes

---

<sup>1</sup> GDP is preferred to other measures since it constitutes the most global economic indicator there is (see Dassonneville and Lewis-Beck 2014).

<sup>2</sup> The necessary quarterly GDP data were not available for the elections prior to that of 1959.

<sup>3</sup> Contrary to our expectation, the previous vote share variable produced a negative (and statistically significant) coefficient for the remaining smaller parties. It was not used for this equation because there is no logical explanation for why this should happen.

<sup>4</sup> With a total of 16 cases and a maximum of five parameters to be estimated (for the incumbent equation of the SUR model), we were able to make step-ahead forecasts for the 10 general elections held between 1979 and 2017.

<sup>5</sup> Additional comparisons were made with four existing models as well as with a SUR model using vote intentions for each party collected during the last week of the campaign. The main finding from these supplementary analyses is that existing models – with the exception of Bélanger, Lewis-Beck, and Nadeau's (2005) – and our own SUR model show substantially similar levels of accuracy both within- and out-of-sample as well as step-ahead. A SUR model using the vote intentions of the last week of the campaign is more precise than our own model (see appendices C to G in the supplementary materials).

<sup>6</sup> Appendix H in the supplementary materials proposes more information on the subject as well as an empirical application of Nadeau, Lewis-Beck, and Bélanger's (2009) swing ratio.