Aggregate Level Forecasting of the 2010 General Election in Britain: The Seats-Votes Model

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Abstract

The Seats-Votes model forecasts party seat shares in the House of Commons using data from general elections and opinion polls between 1945 and 2009. The model is built on a generalisation of the cube rule which provided a fairly accurate method of translating votes into seats when Britain was effectively a two party system prior to the 1970s. It combines past information on seat shares in the current Parliament with voting intention data six months prior to the general election to forecast seat shares. Applied to the task of forecasting the outcome of a general election in early May of 2010, it predicts a hung Parliament, with the Conservatives as the largest party. The relatively small sample used to estimate the model means that predictions about the size of the parties in Parliament are quite tentative, though predictions about the likelihood of a hung Parliament are more certain.

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Introduction

Election forecasting has a long pedigree with the first theoretically based contribution to the subject were made in Britain in 1950 (Kendall and Stuart, 1950). Since then there have been a number of papers both in Britain and the United States which have contributed to the field (Sigelman, 1979; Whiteley, 1979; Rosenstone, 1983; Lewis-Beck and Rice, 1984; Lewis-Beck, 1985; Mughan, 1987; Campbell and Garand, 2000; Lewis-Beck and Tien, 2005; Belanger, Lewis-Beck and Nadeau, 2005). Roughly speaking forecasting models can be divided into to three types; those concerned with election night forecasting which largely use exit polls and early voting results from general elections to predict the results a few hours before they are known (Brown and Payne, 1975); the second type rely on monthly poll data to model the relationship between voting intentions and other measures, particularly economic variables (Sanders, 1991, 1993, 2005); and finally, those based on voting data from actual elections (Whiteley, 2005, 2008).

The common problem with all forecasting exercises is to determine if past data from opinion polls or elections carries enough information to make sensible predictions about how people will behave in the future. Needless to say if past opinions or behaviour are a very poor guide to the future, with large numbers of individuals frequently changing their minds then forecasting would be very difficult. Equally, on the plausible assumption that information decays over time, an attempt to forecast too far into the future is likely to be very error prone, given that unforeseen events occur and change the way that people behave.

This paper uses a modified vote function to forecast the 2010 general election in Britain. The key modification involves turning the vote function into a seat function – a model which predicts the number of seats in the House of Commons captured by the major parties. This Seats-Votes model was first applied to the task of forecasting the number of seats won by the three major parties in the 2005 general election (Whiteley, 2005). As Table 1 shows at that time the model had a fairly good track record in forecasting that election, the Labour forecast being just two seats out. The mean weighted absolute error in the forecast for all three parties was nine seats.

-- Table 1 about here --

The paper repeats that forecasting exercise for a general election which is assumed to take place in early May of 2010. It begins with a theoretical discussion of the model before examining estimates derived from voting and opinion poll data between 1945 and 2005. A subsequent section then presents the forecasts and examines the robustness of the estimates. In a final section we consider the implications of the forecasts for British Electoral politics.

The Seats-Votes Model

The Seats-Votes model is based on the so-called 'Law of Cubic Proportions' of elections. The statistical properties of this law were examined by the leading statisticians Kendall and Stuart (1950), and they attributed its origins to James Parker Smith, an expert witness who testified to the 1909 Royal Commission on electoral systems (Cmnd. 5352). They explained the law in the following terms:

> 'The law, briefly, states that the proportion of seats won by the victorious party varies as the cube of the proportion of votes cast for that party over the country as a whole.' (Kendall and Stuart, 1950: 183).

They illustrated this with the example of the general election of 1950 in which Labour won 46.1 per cent and the Conservatives 43.5 per cent of the vote. The cube law predicts that the two party seat ratio should be the vote ratio cubed, that is, $(46.1/43.5)^3$, and a quick calculation shows that this would have given Labour 333 seats and the Conservatives 274 seats in that election. In fact Labour won 313 and the Conservatives 294 seats, and so there was an error of 20 seats or 3.2 per cent of the total for each party (Kendall and Stuart, 1950: 193). Since the law translates vote shares into seats, the vote shares must be obtained from opinion polls prior to the election if it is to be of any use for forecasting purposes. They used poll data on voting intentions published two or three days before the election and the results were very close (Kendall and Stuart, 1950: 194).

One of the weaknesses of the cube law, as Kendall and Stuart pointed out, is that it can only be applied to a two party system, and so the above calculation ignores seats not won by either Labour or the Conservatives. This was not such a problem in 1950 since there were only nine Liberals and two independents returned in that election. But it increasingly became a problem as Britain evolved into a multi-party system in the 1970s. By the time of the October 1974 election, for example, 26 MPs from minor parties were returned to the House of Commons.

As a consequence of these trends, researchers began to suggest modifications to the cube rule. Edward Tufte (1973) suggested a '2.5 rule' as an alternative, with the power term being 2.5 instead of 3. Laakso (1979) showed that this appeared to work quite well for UK elections between 1900 and 1974, but not so well after that. A quick calculation with aggregate data from 1945 to 2005 shows that Britain now has an approximate '2.1 rule' rather than a cube rule. The implication of this work is

that the cube rule can be modified to deal with the complexities of the British party system and this is the basis of the Seats-Votes model.

The model contains two components for predicting the number of seats won by the three major parties. Firstly, it includes the seats won by each of them in the previous general election, to take account of the long-term association between successive elections in the House of Commons. Secondly, it takes into account recent voting intentions data from opinion polls, to capture the more short term influences on the vote. The opinion polls are likely to be most accurate immediately prior to polling day, but forecasts based on these are not much use in predicting the election well in advance. So part of this exercise is to determine how far ahead of the election the polling data can be used to make an accurate forecast. In the 2005 version of the model voting intention data from polls six months prior to the general election were used (Whiteley, 2005). One of the issues explored in this paper is the optimal lag, or the forecast which is most effective for the longest period prior to the election. This exercise focuses on the 17 general elections since 1945, since it is difficult to extend the model further back to the pre-war period because of the lack of available poll data.

The Theoretical Model

The theoretical forecasting model is given by the following expression:

$$S_{it} = \alpha(S_{it-1})^{\gamma i} . \prod_{i=1}^{k} (P_{it-m})^{\beta i} . \varepsilon_i$$

where

S_{it} is the seat share of party i at the election at time t

P_{it-m} is the vote share for party i out of k parties, in the polls m months prior to the election

α, β^j, γ^i are parameters to be estimated

ε_i is an error term where $E(\varepsilon_i)=0$, $var(\varepsilon_i) = \sigma^2$

The model combines past information from seat shares in earlier elections with more recent information on vote shares from the polls to forecast seat shares in a subsequent election. Instead of assuming that the power term is 3.0 which is the cube rule, the model estimates this empirically. The theoretical model cannot be estimated using vote shares from all of the parties since this would be perfectly collinear, so the empirical model estimates future seats for a party from its past seats and also from poll data for the party and its main rival.

For example, the Labour seat model in log-linear form is:

$$\ln(LabS_t) = \ln \alpha + \beta_1 \ln(LabS_{t-1}) + \beta_2 \ln(LabP_{t-m}) + \beta_3 \ln(ConP_{t-m}) + \ln.\varepsilon$$

where:

$LabS_t$ is the number of Labour seats won at election t

$LabP_{t-m}$ is the Labour vote share in the polls m months prior to the election

$ConP_{t-m}$ is the Conservative vote share in the polls m months prior to the election

The Conservative seat share model has the same specification as the Labour model but with the lagged Conservative seat shares as a predictor. Finally the Liberal Democrat seat share model has the lagged Liberal Democrat seat share as the predictor and the Liberal Democrat and Conservative vote shares in the polls. The Liberal Democrat model concentrates on these two parties because the competitive situation between the Liberal Democrats and Conservatives is greater than that between the Liberal Democrats and Labour (Whiteley, Seyd and Billinghurst, 2006: 138-143). All three empirical models contain a dummy variable designed to capture the split in the Labour party in 1981 when the Social Democratic Party was formed. This huge shock to the party system arose from Labour's defeat in 1979 and had a

very strong impact on the party's performance in the subsequent 1983 election. So the variable scores one in 1979 and 1983 and zero otherwise.

■ Table 2 about here –

The seat data for the model estimates comes from Butler and Butler (2000, 2006) and the poll data comes from King, Wybrow and Gallup (2001) up to the 2005 election, and thereafter from Poll of Polls data[1]. The model estimates appear in Table 2 where the lag in the polls of six months used in an earlier version of the model is repeated (Whiteley, 2005). All three models use variables measured in natural logarithms, apart from the split dummy variable.

In the Labour model the lagged seat variable has a strong impact on current Labour seats, indicating that it is important to take into account seats won in the previous election. The Conservative and Labour vote intention scores have highly significant impacts on Labour seats, with the Labour effect being slightly stronger than the Conservative effect but with the expected opposite signs. Thus a one per cent increase in Labour's voting intentions produces an increase in its seats by 0.46 per cent, and a one per cent increase in Conservative vote intentions decreases Labour seats by 0.35 per cent. In addition, Labour was clearly damaged by the split which occurred in 1981, since the split variable is highly significant and negative. None of the diagnostic tests in the Labour model are statistically significant, indicating that the model is well specified and has no problems of autocorrelated errors, functional form or heteroscedasticity.

In the Conservative model past seats are also strong predictors. But the impacts of Conservative and Labour vote intentions are stronger than in the Labour model, particularly the former. A one percent increase in Conservative vote intentions increases the Conservative seat share by 0.68 per cent, and the same

increase in Labour vote intentions reduces the Conservative seat share by 0.47 per cent. The party was helped by Labour's split in the early 1980s just as Labour was harmed. The diagnostics are all non-significant with the single exception of the functional form test[2].

The Liberal Democrat model is again different from that of the other parties. Once again past seats are very important for predicting future seats, but in this case Conservative vote intentions were more important than Liberal Democrat vote intentions as predictors of Liberal Democrat seats. The Conservative vote intention coefficient is more than five times larger than the Liberal Democrat vote intentions coefficient, which indicates how important Conservative unpopularity is for Liberal Democrat electoral success. This has implications for the forecast of the 2010 general election as we shall see below. Finally, there is weak evidence that the Liberal Democrats benefited from Labour's split more than the Conservative did, since the coefficient on this variable is larger than in the Conservative model. Once again the model diagnostics are all non-significant with the weak exception of the functional form test. Overall, the model is well-behaved.

Figure 1 about here --

Figure 1 contains plots of the actual and fitted seat estimates from the Labour model, indicating that the latter tracks the Labour seat total over time fairly accurately. The model has difficulty capturing extreme outcomes such as the results of the 1983 and 1997 general elections. In both cases Labour's seats totals changed rather dramatically in comparison with the previous election, and the change in the fitted series is less than the actual series. However, a very high goodness of fit means that the model can be used effectively to forecast future seats.

As the earlier discussion indicated one important issue concerns the lag length of the vote intention data in the forecasting models. It is desirable to have as long a lag length as possible, since this means that effective forecasting can take place well in advance of the election. On the other hand it is likely that the forecasts will become more inaccurate the further back in time the polling data goes. This trade-off is examined in Table 3, which looks at the goodness of fit statistics of the models with the same specifications as in Table 2, but with varying lags on the poll data. It appears that as the model incorporates earlier poll data there is no significant loss of fit until seven or more months prior to a general election. At the point at which the lag lengths are extended beyond six months the fits of the models are significantly reduced and the error in forecasting increased. Table 3 suggests that a lag of six months is the ideal compromise between the need for an early forecast combined with accuracy, and so this is used in the subsequent analysis.

■ Table 3 about here –

Forecasting the 2010 General Election

The earlier discussion shows that the models in Table 2 can reliably be used to forecast the number of seats won by the parties in the 2010 general election, given data from November 2009, six months before a general election in May 2010. There is one complication, however, and that is the number of seats won by parties other than Labour, the Conservatives and the Liberal Democrats. A model which uses other party seats combined with polling data for the two major parties to predict the number of seats won by the Nationalists, Unionists and independents is a poor fit[3]. Thus it is very difficult to accurately model the number of seats won by parties other than the big three, because the number of such seats is relatively unpredictable over time.

There are two solutions to this dilemma; the first is to allow the number of seats won by other parties to be a residual left over from estimating the Labour, Conservative and Liberal Democrat seat shares. The total number of seats up for re-election in 2010 is 650, so the others will capture whatever is left after the three main party seat shares have been estimated. The difficulty with this approach is that this residual seat share measure will contain errors attributable to a failure to forecast the seats of the three main parties as well as errors in forecasting the minor parties. So it is likely to be quite inaccurate. On the other hand the nationalists and possibly other parties are going to win seats, so in order to proceed with the forecast an alternative approach is to assume that the minor parties will win the same number of seats as they did in 2005, namely 31. In this case the seat totals for the three major parties should add up to 619, and any shortfall from this can be adjusted in the light of the seat shares which emerge from the estimates in Table 2[4].

■ Figure 2 about here –

Figure 2 contains the forecasts for a May 2010 general election from the six months out version of the model. The left hand column are the straight forecasts which leaves the other seats category as a residual, and the right hand column calculates the forecast on the assumption that other parties get 31 seats. In fact from a substantive point of view the two methods make very little difference to the outcome, which forecasts a hung Parliament with the Conservative having the most seats, but where the party is well short of a majority of 326 seats. The party is either 44 seats short of an overall majority going by the straight forecast, or 33 seats using the adjusted forecast.

We established earlier that the forecasting models up to six months out can be used because the fit statistics are so high. Given this is it is interesting to see what

forecasts emerge from the data using poll data with shorter lags than six months out. This is a test of the sensitivity of the models to the poll data. The first point to make in examining this issue is to track the vote intentions data from the poll of polls data between November 2009 and February 2010. This is done in Figure 3.

■ Figure 3 about here –

Figure 3 shows that vote intentions varied from November 2009 to February 2010, with Conservative support increasing by a percentage point a month up to January 2010 and then falling back in February. The full March 2010 figures were not available at the time of writing, but the evidence from the poll of polls data from the first week of March is that the Conservative lead has narrowed further[5]. Figure 4 translates these vote intention figures into seats using the seats-votes model and they all produce a hung Parliament with the sole exception of January 2010, where the Conservative lead delivers an overall majority of twelve seats for that party. Clearly the narrowing of the polls after February would, if sustained, produce a hung Parliament with a distinct possibility that Labour could be the largest party.

Conclusions and Discussion

Overall the Seats-Votes model suggests that the general election of 2010 will produce a hung Parliament. At the time of writing the Conservatives appear likely to capture the largest number of seats in the House of Commons, but that could easily change if their support continues to slide in the opinion polls. Of course the Seats-Votes model provides a forecasting mechanism rather than a theoretical explanation of why the parties are winning or losing support over time. Other research suggests that the economy is a major factor in explaining changes in vote intentions over time (Lewis-Beck and Tien, 2005), and it is evident from the Continuous Monitoring survey of the British Election Study that economic optimism has been increasing over the past

year[6]. This should help the government to recover in the polls as the election approaches and electors start to focus on the choices they actually face on polling day. Equally, factors relating to the election campaign are likely to be influential in winning or losing support for the three major parties between now and polling day, not least the leadership debates (Clarke, Sanders, Stewart and Whiteley, 2004; 2009).

It would of course be desirable to incorporate such factors in a forecasting model. However, there are real difficulties in doing this because of the paucity of measures data going back to 1945, and because of the restricted number of cases available for estimating a seat function. We rapidly run into degrees of freedom problems if the model is extended beyond a few variables. A more promising route for incorporating such factors into a forecasting model is provided by estimating popularity functions with monthly data. These can be estimated over a shorter period than 1945 to 2010, and they can incorporate additional indicators. But for the moment, the Seats-Votes model should provide real guidance into the outcome of the next general election, and therefore the shape of British politics in the years to come.

As Figure 2 shows, the forecasts suggest that both the Conservatives and Labour will be a long way from winning an overall majority in the House of Commons. This will make it difficult for either of these parties to take office as minority government. Such a government would be vulnerable to a vote of no confidence in the House of Commons at any time. This suggests that a formal coalition will have to be negotiated between one or more political parties in order to provide a majority government. If we take the six months out forecast as the guide, then neither a Labour-Liberal Democrat coalition nor a Conservative-Liberal Democrat coalition will furnish an overall majority if we go by the raw forecasts. If on the other hand minor parties get only 31 seats, the only two-party coalition which

furnishes a working majority is a Conservative-Liberal Democrat coalition. Obviously in the new Parliament the number of seats won by minor parties is going to be a crucial factor in determining the formation of a new government.

The overall implication of the forecasting model is that it is going to be difficult to form a new government and a government with a working majority may need at least three parties to be viable. Given this, it is unlikely that such a government can make difficult decisions to cut public spending or to raise taxes in order to begin dealing with the consequences of the financial crisis. This inability to govern effectively is likely to precipitate a further crisis in financial markets, and quite possibly bring about a second general election within a matter of months. When Labour became the largest party in the House of Commons in February 1974 with a minority government, it was obliged to call another election eight months later in October 1974 to try to win a working majority. If these forecasts are correct then a similar scenario is likely to be played out after the May general election in Britain. Such an outcome is going to be bad for effective government, although it should be good news for the polling industry.

Figure 1 The Actual and Fitted Seat Estimates for Labour 1945 to 2005

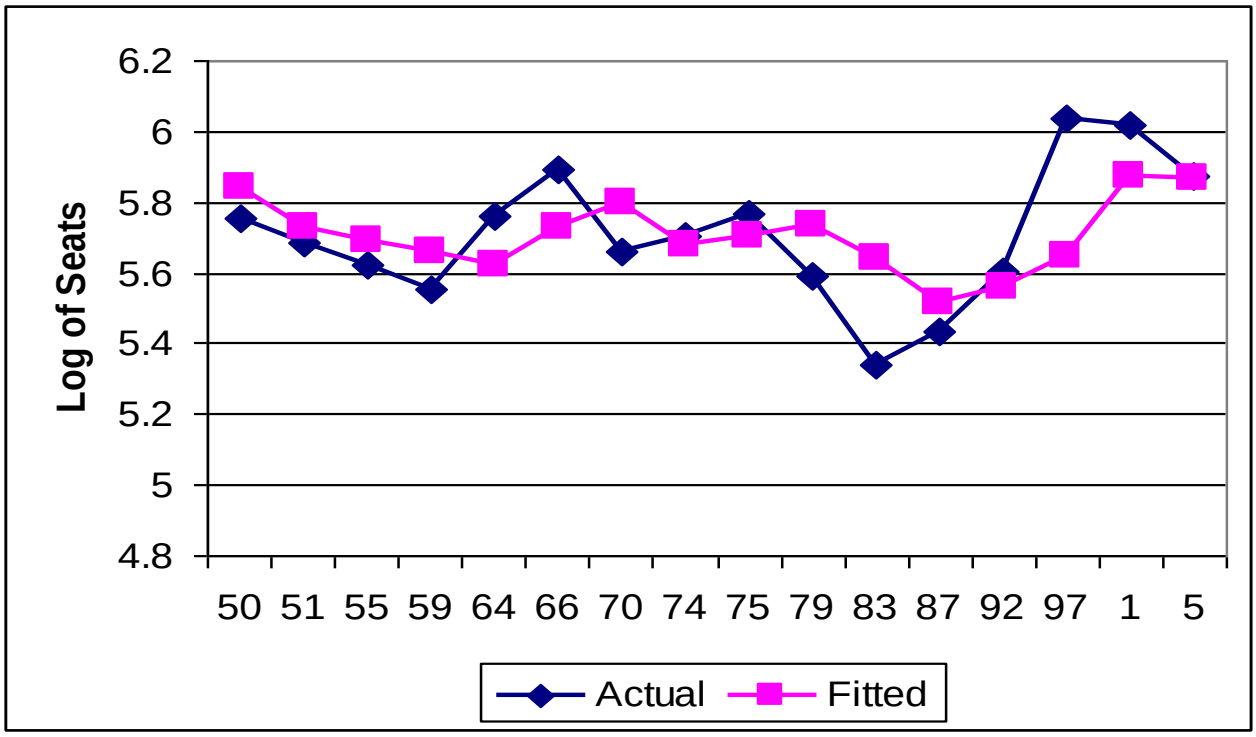
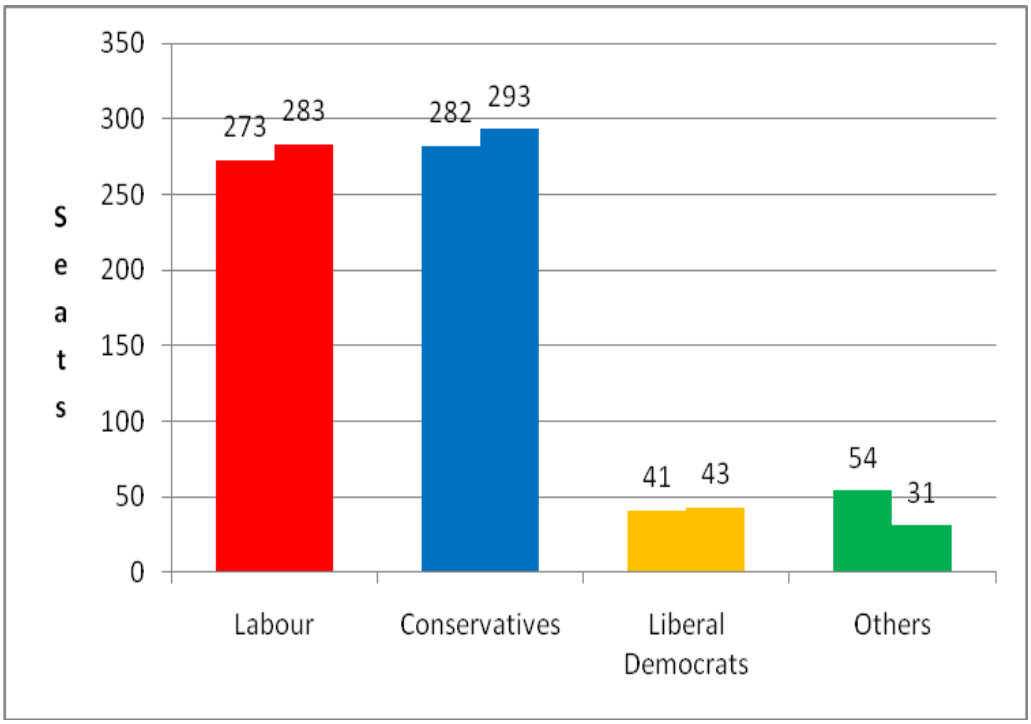


Figure 2 The Forecasts – Six Months Out



Note: the Left hand columns are the raw forecasts and the right hand columns the adjusted forecasts assuming that the other parties get the same number of seats as in 2005.

Figure 3 The Poll of Polls Vote Intentions Data November 2009 to February 2010

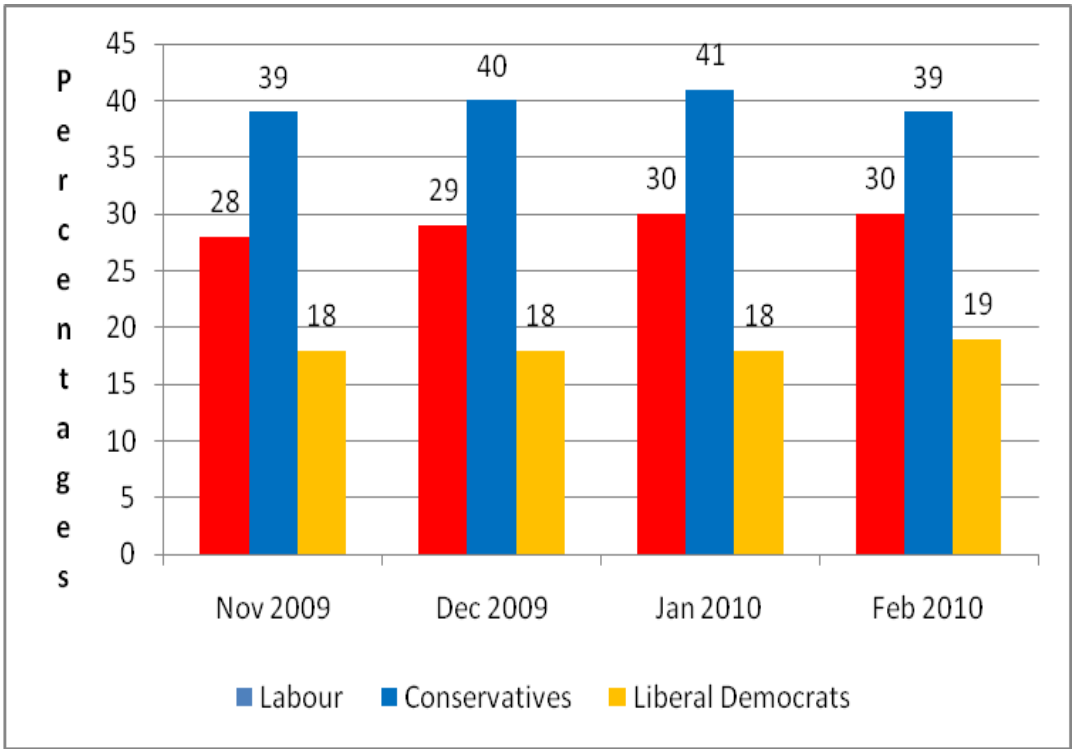


Figure 4 The Seat Forecasts from November 2009 to February 2010

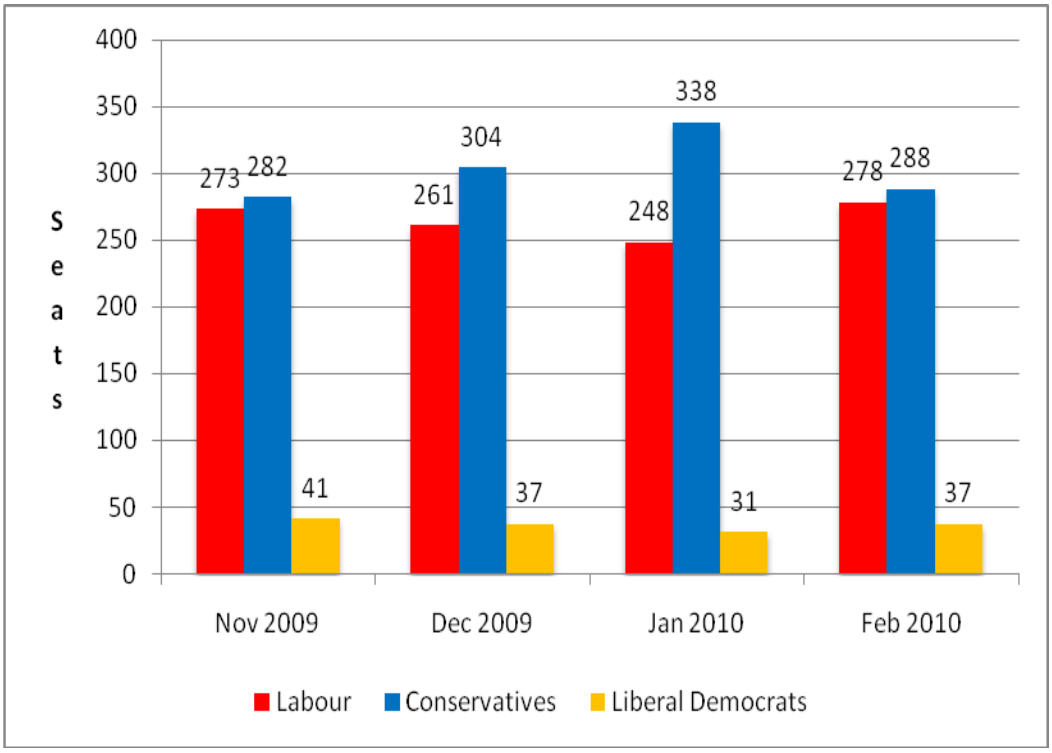


Table 1 The Seats-Votes Model Forecasts of the 2005 Election

Party	***Forecast Seats***	***Actual Seats Won***	***Absolute Error in Seats***
Labour	358	356	2
Conservatives	213	197	16
Liberal Democrats	47	62	15

(Source: Whiteley, 2005)

Table 2 Estimates of the Seats-Votes Model from 1945 to 2005 – Six Months Out

	Labour Seats	Conservative Seats	Liberal Democrat Seats
Constant	2.50***	1.86*	6.41***
	(3.4)	(1.9)	(4.3)
Labour Seats (t-1)	0.49***	___	___
	(5.8)		
Conservative Seats (t-1)	___	0.54***	___
		(6.0)	
Liberal Democrat Seats (t-1)	___	___	0.64***
			(6.6)
Labour Poll Share	0.46***	-0.47**	___
	(4.0)	(2.9)	
Conservative Poll Share	-0.35***	0.68***	-1.69***
	(4.3)	(5.7)	(5.3)
Liberal Democrat Poll Share	___	___	0.29*
			(2.0)
Split in the Party System, 1979-83	-0.19***	0.15**	0.35*
	(3.9)	(2.1)	(2.1)
Adjusted R-square	0.89	0.88	0.91
Serial correlation test	0.09	0.001	0.29
Functional Form test	0.61	5.8**	2.8*
Normality test	0.10	0.68	0.44
Heteroscedasticity test	0.01	0.07	0.15

Note: All variables except Split are in natural logarithms; $p<0.10$ = *; $p<0.05$ = **; $p<0.01$ = ***.

Table 3 The Goodness of Fit of Models with Varying Time Lags on Vote Intentions.

	Adjusted R-Square Statistics		
	Labour Model	Conservative Model	Liberal Democrat Model
Three Months Out	0.86	0.91	0.92
Four Months Out	0.85	0.82	0.90
Five Months Out	0.86	0.89	0.91
Six Months Out	0.89	0.88	0.92
Seven Months Out	0.65	0.65	0.82
Eight Months Out	0.67	0.74	0.90
Nine Months Out	0.73	0.71	0.84

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Endnotes

[1] This is derived from http://ukpollingreport.co.uk/blog/voting-intention.
[2] If the model is estimated without logs the functional form test is no longer significant, but this form has the undesirable consequence of making the same test significant for the Labour model and lowering the goodness of fit.
[3] A model with the same specification as Table 2 but with other party seats as the dependent variable included has a goodness of fit of only 0.55 and it contains only one statistically significant predictor, Conservative vote intentions. This cannot be used for forecasting because the errors are likely to be very large.
[4] If 31 seats are captured by minor parties this means that 619 seats will be distributed among the big three parties. Their share of these extra seats is assumed to be proportional to their share of the forecast seats and added to the totals.
[5] The eight polls published between the first and fifth of March produced voting intentions of 38.1 per cent for the Conservatives, 32.3 per cent for Labour and 17.7 per cent for the Liberal Democrats.
[6] See http://bes2009-10.org for the data supporting this point.