Information Flows, Expectation Formation, and Tactical Voting

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Abstract

Electors' propensities to vote tactically is the main component of what Duverger calls the "psychological effect" of electoral systems. Electoral research has therefore given considerable attention to the amount of tactical voting and its consequences for electoral results. In much of this literature, tactical voting has been analysed in terms of the influence of the performance of parties' candidates in prior elections, taking for granted that voters form expectations about candidates' chances accordingly. The formation of such expectations and whether they actually guide voting decisions has rarely been empirically investigated. We fill this gap by analysing the role of information flows expectation formation during the campaign for tactical voting in the United Kingdom general election of 2010. To this purpose we employ a novel approach to the analysis of tactical voting that uniquely allows to directly estimate the amount of tactical voting in a sample of survey respondents. We find that information flows indeed were relevant for the formation of expectation and for patterns of voting. Voters do use incoming information judiciously to form expectations and to vote tactically. Yet we also find that information flows lead to better estimates about the level of tactical voting than respondents' explicit statements about their expectation. A further finding is that a while a proportion of voters showed an avoidance of a hung parliament early in the campaign, that this waned after the televised leadership discussion of 15 April. Finally, we summarise the implications of from our results for information processing during an electoral campaign and for the outcome of the UK general election of 2010 in particular.

Keywords: *Strategic Voting; Latent Class Models; FPTP; Britain*

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1 Introduction

"a once-in-a-lifetime opportunity ... to enhance the democratic rights of all" ...[and] "[v]ote for a hung parliament, and a better, fairer, greener Britain"

The Independent on Sunday,
2nd May 2010

"Vote Clegg, get Brown"

David Cameron,
April 2010

The United Kingdom general election of 2010 is the first in post-war British history that lead to the formation of a cabinet resting on a coalition of two parties in the House of Commons. Surely, the coalition between the Conservative Party and the Liberal Democrats was not the first coalition government in British history. But coalition governments before were mainly considered as an arrangement to deal with exceptional circumstances that required a wider than usual support for government action that would transcend the traditional dualism between HM Government and HM Most Loyal Opposition – as in the cases of the "National Governments" led by Asquith and Lloyd George during the First World War and by Churchill during the Second World War. Neither was it the first time in British history that a general election led to a "hung parliament", a situation where neither of the main contending parties could reach a majority of seats in the House of Commons. For example, the general election of February 1974 also lead to a hung parliament: The Labour Party under Harold Wilson gained a plurality of the seats in the House of Commons (but not of the popular vote) yet fell short of a majority. This however did not lead to the formation of a coalition government but to a short-lived minority cabinet that was followed by a Labour majority government after another general election in October of the same year. But not

only did the 2010 election result in a hung parliament but the possibility of such an outcome was a topic both of the parties' campaign activities and of published opinion.

This unique situation may have created new opportunities and incentives for tactical voting. The "classical" conception of tactical voting is related to single-member plurality electoral systems or "first-past-the-post" (FPTP) systems, where voters may try to avoid "wasting" their vote for a candidate or party without any real chance to win the constituency seat thereby increasing the chances of a candidate or party they do not like (Duverger, 1965). While this type of tactical voting may bring about the "psychological effect" of an electoral system that enhances the "mechanical effect" to the disadvantage of third parties, it is nevertheless targeted at the level of the electoral district (or "constituency" in British parlance). The likelihood of a "hung parliament" however may lead voters to vote tactically with respect to the outcome at the *national* level: to avoid a hung parliament they may refrain from voting for any other party than those two with a real chance to gain a majority in the House of Commons. That is, while it usually assumed in the literature that strategic voting targeted at the national level is a feature of proportional-representation systems, this national-level perspective may also have played a role in the 2010 general election. That this is not a mere theoretical figment is borne out e.g. by recommendations by newspapers how to avoid a hung parliament (e.g Waghorne, 2010)

There is another way in which the UK general election of 2010 was unique: It was the first occurrence of a televised leadership debates, which involved not only the leaders of the Conservative and the Labour Party, but also the leader of a third party, the Liberal Democrats. In the widespread perception the leader of this party, Nick Clegg, turned out to be the winner of the first leadership debate televised on 15 April, which lead to a sudden boost of the popularity of the Liberal Democrats in the opinion polls (Shirbon, 2010). Thus the campaign phase of 2010 potentially changed the informational environment relevant for tactical voting.

The present paper examines the role of information flows for the formation of expectations about the outcome of an election, both at the level of individual voting districts and on the national level, and of the role of this information and the expectations for tactical vot-

ing. If tactical voting is a phenomenon with a reality outside the world of formal modelling of electoral behaviour, one should be able to find an influence of information contained in previous electoral results and current opinion polls on the formation of expectation about electoral outcomes and on tactical voting, because voters will need such information to assess whether a party's candidate has a real chance to win a constituency seat or a party to win the election overall. We will thus analyse tactical voting not only as a (static) feature of a electoral system but also as a dynamic feature of electoral competition.

The next section gives a brief review of the literature relevant for tactical and strategic voting targeted at the level of voting districts and at the national level. That section is followed by a closer look at the particular incentive structure for tactical voting presented by the campaign phase of the 2010 general election in the UK, which calls for a dynamic analysis of expectation formation and tactical voting. In the fourth section such a dynamic analysis is conducted using structural equation modelling based on data from the British Election Campaign Internet Panel Survey (CIPS). The fifth section introduces a novel latent class model of tactical voting, that is not only able to reconstruct tactical voting independent from respondents stated reasons for their voting decision, but that also allows to disentangle different the different types of tactical voting that may have occurred in the 2010 general election. In the sixth section we apply the latent class model to analyse the role of information flows for tactical voting, were tactical voting is defined as resting on objective information from past electoral results and current opinion polls. The seventh section applies the latent class model where tactical voting is defined in terms of the voters expectations about parties chances to win a constituency seat or the election in general. In the eighth section the findings from these two approaches to the application of the latent class model are contrasted and discussed. A last section provides a summary and conclusion.

2 Scholarly Perspectives on Strategic/Tactical Voting

In first past the post systems strategic (or tactical) voting refers to the voters' instrumental deviation from their ranked nominal preferences (Tsebelis, 1986; Fisher, 2004). It has been

regarded as the "natural" consequence of single-member plurality systems (Duverger, 1965) in which voters might choose a party other than their most preferred if that is expected to be only third- or lower-placed in terms of the vote share in the constituency (see Downs, 1957; McKelvey and Ordeshook, 1972; Tsebelis, 1986; Fisher, 2004). Instead, they choose the party they prefer among the two most viable ones in the constituency, thus maximising their utility by affecting the outcome of the election.

Much of the literature on tactical voting in British election has been focusing on the problems of definition and measurement. Tactical voting is commonly measured through the "reasons of voting" questions included in British Election Study (BES) questionnaires. Here respondents were allowed to choose a response category that explicitly states: "I really preferred another party but it had no chance of winning in this constituency". The overall proportion of tactical voters is then calculated as the sum of respondents who chose the above response category or clearly stated that they voted tactically in the open ended category available in the survey question (Heath et al., 1991, e.g.).

Niemi et al. (1992) however maintain that when looking at open-ended reasons of voting the objective conditions of qualifying a voter as tactical changes the commonly reported proportion and that their strictness biases the final proportion of tactical voters downwards.[1] Therefore they decide to combine open-ended responses from four measures and identified motivations to vote tactically and constructed an index of tactical voting in which voting for a party other than the one really preferred would qualify as tactical voting. Evans and Heath (1993) in return criticise this strategy as deviating from the original theory. In a subsequent research note Franklin et al. (1994) attempted to bridge that inconsistency by discussing the possibility of instrumental and expressive tactical voting. An expressive tactical vote corresponds to a deliberate message sent by a voter to her party by not voting for it (Franklin et al., 1994). In general, however, self-reporting estimates of tactical voting have been criticised on the basis that voters are often inclined to rationalise or report their support for the winner of the election (for a discussion see Alvarez et al., 2006).[2]

[1] Niemi et al. (1992) argue that actually *"one out of six voters voted tactically"* compared to the modest estimates of other studies for the 1987 election.

[2] Other scholars have used aggregate constituency electoral returns to measure tactical voting (e.g. Johnston and Pattie, 1991). While it can be argued that his strategy may suffer from a ecological fallacies, thire estimates

In order to overcome the dependence on potentially biased self-reports Alvarez and Nagler (2000) propose a method for analysing tactical voting, built on a multinomial probit model that accounts both for the attributes of the choice and voter characteristics. The attributes of the choice would vary in response to the constituency a voter is eligible to vote in and her ranked preferences. The main idea of this approach is to assess the deviations of ranked political preferences from actual behaviour (Bartels, 1988; Alvarez and Nagler, 2000). Like the preceding work, the Alvarez and Nagler (2000) study overlooks the influence of strategic context. This is addressed by a more recent article by the research group (Alvarez et al., 2006) where it is argued that researchers should also examine incentives and the context for strategic considerations: Ignoring the incentive structure for tactical voting can lead to underestimating tactical voting because in safe seats have no reason to vote tactically even if they otherwise would do so.

And while the translation from votes to seats has been central in the study of strategic considerations in FPTP systems, recent literature has examined similar incentives in PR systems with coalition governments. According to this line of research, voters make up their mind more on the basis of how they feel about potential coalitions and their prospective policies and less on how they feel about individual candidates or parties. Blais et al. (2006) offers one of the first empirical studies of strategic incentives in PR systems and demonstrates that for one out of ten voters coalition considerations were a decisive factor to cast a vote. In more recent work it is shown that the degrees of strategic voting in PR and majoritarian systems are comparable (Abramson et al., 2010). These findings are premised on the work by (Cox, 1997) who demonstrates that in PR systems with low district magnitude voters might also engage in strategic voting.

Recent research has focused on the importance of potential coalition's policy outcomes and how voters maximize their utilities in terms of policy (see e.g. Austen-Smith and Banks, 1988; Bargsted and Kedar, 2009; Hobolt and Karp, 2010). This concept of *policy maximizing* largely informs the various types of strategic voting in PR systems with coalitions. The first type is labelled *insurance threshold* and it relates to voters preferring a smaller party to

(less than 10% in 1987), however, are in line with self-reported responses documented by Heath et al. (1991).

their sincere preference to ensure the formation of a preferred coalition. This type regularly occurs when a small party that could be part of a preferred coalition is likely to fall short of the parliamentary entrance threshold (see Gschwend, 2007).[3] A more general type includes strategic voters preferring a party likely to enter a coalition rather than their own party or *preferred coalition* that only has slim chances of winning. For the psychological mechanism behind this decision, this type has been called coalition-targeted Duvergerian strategic voting (see Bargsted and Kedar, 2009; Hobolt and Karp, 2010). The final type of strategic voting is *policy-balancing*. Voters following this pattern tend to desert their party to shift a potential coalition's policy ideal point closer to their own (Duch et al., 2010).

There is empirical literature confirming the importance of those three types. Kedar (2005) finds evidence for policy balancing, whereby voters will desert their preference to move to the extreme in order to bring the policy position of the potential coalition government closer to their ideal points. Bargsted and Kedar (2009) argue that left-wing and right-wing voters who expect an unfavourable right or left coalition to win will be more likely to abandon their sincere preference and choose the moderate party from the initially unfavourable coalition to prevent the worst. In line with the "threshold insurance" hypothesis, Gschwend (2007) demonstrates how voters vote strategically thorough ticket splitting (see also Shikano et al., 2009). Using experiments on a sample of Austrian voters, Meffert and Gschwend (2010) find that hypothetical (plausible) scenarios of coalitions increase the individual propensities to switch vote intentions. Finally Bowler et al. (2010) show how strategic considerations are important for voters in New Zealand and how preferences over and expectations about coalition governments are distributed.

The above literature offers a handful of evidence that confirm the existence of strategic considerations in PR systems with coalition governments. The central incentive to cast a strategic vote relates to the expectations about the set of policies that would come about across different coalition governments. Even though these considerations are complex, voters appear capable to manage them and eventually prone to cast instrumentally rational votes to maximise their policy utilities.

[3] This relates directly to Cox's (1997) finding on low district magnitude in PR systems and strategic voting.

3 Mixed Incentives in the 2010 British Election Campaign

The key difference in the literatures outlined in the previous section is that in PR systems the pay-offs of voting strategically are concentrated at the national level (influence over policy) whereas in majoritarian systems they are concentrated at the district level (influence over the rankings of the parties). The question immediately arising is what happens in the rare case where a coalition government is likely to be formed in FPTP systems. The 2010 British general election is one of those rare cases. Whereas in most British elections voters usually face a clear-cut choice between a Conservative or a Labour government, this time the possibility of a hung parliament with a coalition government added new dimensions to the election campaign and strategic considerations at the national level were being constantly communicated.

Even before the campaign started, a hung parliament was a possibility. Although the Conservatives were leading in the polls since ..., pundits and academics considered their lead as too small to translate into an absolute majority in parliament. However, translating pre-election national poll shares into possible seat shares is a difficult task. Usually, media outlets assume a uniform national swing. This shorthand probably started with the swing-o-meter in the BBC or at least rose to national prominence with it. They assume that the difference between the current poll and the previous election result is mirrored in each constituency. This yields a measure of how many seats the party will have. Although this approach may have its flaws, what is important here is that media outlets could use it as a shorthand to communicate what the current polls mean in terms of who forms the government.

The televised leadership debate intensified the discussion over the hung parliament. Published polls immediately after the leadership debate showed that most people said that Nick Clegg won (Shirbon, 2010). The Liberal Democrats were on the rise and these polls shaped the news cycle. The Liberal Democrats surpassed Labour and three polls even showed them above the Conservatives. Taken at face value, this could mean that the Liberal Democrats had a change of "winning" the election.

However, these shifts in vote intentions led to an odd result: assuming a uniform national swing, Labour would come third in votes, but first in seats. This worried people and some

pundits even spoke of a "constitutional crisis". Labour would have the "right" to form the government. This led the Conservative campaign to respond with the slogan "vote Clegg, get Brown". This slogan aspired to stimulate voters' tactical considerations: by voting in a particular way, people may end up with their least preferred party. Be that as it may, the first leadership debate changed the informational environment and it further increased the possibility of a hung parliament.

The translation from votes to seats, discussed previously, became a pivotal issue in the campaign. The Conservatives created a campaign slogan and the Liberal Democrats used the awareness about the odd characteristics of first-past-the-post system to push for an electoral reform that would benefit them and also tackle the normative issue of the present case. Most importantly, the media increasingly reported on the horse race character of the campaign and begun highlighting the policy consequences from having a hung parliament.

Did voters have preferences over the possibility of a hung parliament? What we generally know from the literature is that voters do have preferences over coalition and single-party governments (Bowler et al., 2010). Similarly, about half of the respondents in the campaign wave of the BES Campaign Internet Panel Survey were in favour of a coalition government.[4] Among Conservative supporters the share was about one-fourth, among Labour supporters more than one-third, and among Liberal Democrats supporters about three-fourth. In a poll for the *Sunday Mirror/The Independent*, ComRes found that almost 40% of the voters wanted the Liberal Democrats as partners in a potential coalition (either with Labour or the Tories) while in the same poll, nearly 1 out of 2 respondents wanted Nick Clegg to play a role in the next government. This discussion intensified in the final days of the campaign newspapers, websites and pundits were keen to highlight how voters could increase (or shrink) the likelihood of a hung parliament. Consider the examples of *The Daily Mail* and *The Independent on Sunday*. On the one hand, on 5 May *The Daily Mail* published a guide on how to vote tactically to reduce the chances of a hung parliament waghorne:dailymail. On the other hand, on 2 May *The Independent on Sunday* hailed the hung parliament as "a once-in-a-lifetime op-

[4]The question wording is "Thinking about the outcomes of general elections, which of these statements is more important to you?" The answer categories are "That one party get more than half the seats in parliament so it can govern of its own" and "That every party's percentage of seats in parliament is the same as their percentage in the vote".

portunity . . . to enhance the democratic rights of all" and urged its readers to "[v]ote for a hung parliament, and a better, fairer, greener Britain" (Independent, 2010). Following this perspective, as in PR systems, voters in FPTP systems can choose the policy mixture closer to their ideal points.

To wrap up, the informational environment in 2010 was very dynamic in terms of intensity *and* complexity. With respect to the former, the media coverage gave the campaign the characteristic of a horse race on which every opinion poll published was an indicator of how close was the Conservative party to a majority in the House of Commons. Political parties would respond to these opinion polls by spinning new strategies. The polls themselves were extremely volatile with the Conservatives leading in the polls with Labour coming second. Later in the campaign the Liberal Democrats surpassed Labour and even in a couple of polls they surpassed the Conservatives (they later fell back to the third place). With respect of the Hung parliament, a discussion about a 'constitutional crisis' was initiated referring to the possibility of a party being (for a short point in time) first in terms of seats but third in terms of votes. As a consequence, voters had a number of different incentives to deviate from their first preference. The possibility of a hung parliament was the most important one at the national level.

4 Information Flows and the Formation of Expectations about Electoral Results

The discussion in the previous section pivoted on the distinctions between two motivations for tactical voting in the 2010 British Election: avoiding to waste one's vote for a party or candidate that has no chance of winning the seat of the constituency in which one is eligible to vote and avoiding (or bringing about) a "hung parliament", a situation in which none of the parties attains a majority in the House of Commons. For these two types of tactical voting, two different types of expectations are pertinent. The "classical" type of tactical voting is oriented at expectations about which parties or candidates appear to have reasonable chances of winning the constituency seat and which parties or candidates appear

to be uncompetitive. Tactical voting that aims to avoid a "hung parliament" is oriented at (national-level) expectations about the chances of the parties to gain an overall majority in the House of Commons.

"Rational" expectations about the outcome of elections at the constituency or the national-level in the sense of the formal-modelling literature would require information about the distribution of preferences and/or vote intentions among the voters at the level of the constituency or at national level. While equilibrium levels of tactical voting may be of some theoretical interest, calculating optimal decisions based on such complete information is likely to be beyond the ken of real actors with bounded rationality (Simon, 1955). Nevertheless one can formulate criteria for the *reasonableness* of expectation formation under conditions of limited information.

A first criterion for this reasonableness is that voters take into account information that is readily at hand. A second criterion is that voters take into account only information that is relevant. While the requirement of exhaustive information retrieval may be infeasible of actors of bounded rationality, *selective* processing of available and relevant information is within the capability of reasonable actors. That is in the present case, if voters form expectations about the outcome at a particular parliamentary constituency (the one that they are eligible to vote in) and if they are reasonable, then they will only take into account information pertinent to the outcome at the constituency level. This information certainly includes the vote shares of the (major) parties in the constituency in the previous election or at least which party has won the seat. The overall vote share of the parties at the national level however is much less pertinent for the formation of reasonable expectations at the level of the constituency. The popularity of the parties in opinion polls, at least if compared to their national-level results in the previous election may however give some limited information about how the chances of the parties in the constituency have changed relative to the previous election. Conversely, if voters form expectations about the outcome at the national level and are reasonable, they take into account only information pertinent to the overall electoral outcome. Parties' popularity in opinion polls is certainly relevant, but their past success in the parliamentary constituency in which a voter is eligible is clearly is much less so.

A third criterion for a reasonable formation of expectations is that they are updated as new information comes in, and again this applies only to relevant information. This does not mean that reasonable expectation formation requires the application of 'Bayesian updating'. Such a requirement does not seem plausible in the light of the existing evidence gathered by cognitive psychologists about the difficulties that people have in understanding and calculating probability, not to speak of an understanding of Bayes' Theorem (Kahneman and Tversky, 1979; Gigerenzer, 2008). Yet it does seem plausible that reasonable voters will expect the likelihood of a party to gain a majority in the House of Commons to increase if its popularity in opinion polls increases.

A fourth criterion of reasonableness in the formation of expectations is that they are not overshadowed by wishful thinking. That is, expectations are not clouded by voters' preferences over the parties or their positive or negative affect towards them. While it is thus not consistent with our proposed interpretation of reasonableness if voters preferences and affects influence their expectations about the parties' chances of success at the level of the constituency or at national level, it is less clear whether an influence of expectations on preferences or affect should count as unreasonable, especially if one admits the possibility of a "taste for winning".

The BES Campaign Internet Panel Survey (CIPS) provides an excellent opportunity to examine the expectation formation in British voters. The panel survey consists of three waves, a first wave conducted immediately before the official start of the electoral campaign on 12 April 2010, the second conducted at more or less evenly spaced times throughout the campaign phase, and the third wave immediately after the election on 6 May 2010. The survey data set contains, among others, variables on respondents' expectations about Labour, the Liberal Democrats, and the Conservatives (and in addition for Welsh respondents, about Plaid Cymru, and about the Scottish National Party for respondents in Scotland) to win the election and about whether they would win the seat in which the they are eligible to vote. In addition the data set contains information about the respondents' vote intentions at each point in time, their (positive or negative) affect about the relevant parties and their leaders. Further, the data sets contains the respondents' vote intentions for the first and

second wave and their recalled vote decision in the third wave. The data set comes with additional information about the constituencies the respondents are eligible to vote, most importantly in the form of (notional) constituency results of the parties in the previous election of 2005. With this data we merged the average poll results of the three major parties obtained from Wells (2010), such that data in any of the three waves is matched with the parties' popularity in the polls immediately before the respective interviews were conducted.

The data set of the BES Campaign Internet Panel Survey has a "wide" format such that each row in the data set corresponds to an individual respondent, where the expectations about the chances of the parties at the national level and the constituency level formed in each of the panel waves are recorded as different variables, and the same applies for the affects towards each of the parties and each of the parties' leaders. Since we are interested in the formation of expectation in general and not with regards to individual parties we recast the data set before analysis into a 'semi-long' format: In this format, the rows of the data set are pairs of parties and respondents and the expectations of the respondents to the various parties in a single wave correspond to a single variable or data set column, and the same applies to the respondents affects to the parties and their respective leaders. The information about the parties' constituency results and about their popularity in the opinion poll is also brought into this long format. In order to facilitate the modelling of dynamics, the expectations, affects and other information pertinent to different waves are nevertheless kept in different data set columns or variables in this semi-long format.[5] The resulting arrangement of the data in the such reshaped data set is illustrated by figure 1.

When analysing these data one should take into account that they are essentially clustered: For each individual respondent there are several observations on expectations, preferences etc. Observations related to the same individual may thus be correlated, in particular because different individuals may have different response biases that lead them to give generally positive or negative answers to a set of questions. If individuals show the same amount of bias in their reported expectations about parties at different levels and at different points in times and also in their reported affects to parties and their leaders, this may lead to spuriously

[5] In a fully long format, different points in time would also be arranged in different rows of the data set rather than in different columns.

Figure 1: Arrangement of the data in semi-long format (extract)

ID	Constituency	Interview Date	Party	Perc.Votes in 2005	Likelh.win Constcy	Vote (Intention)
27	Colchester	27/04/10	Labour	20.3	3	1
27	Colchester	27/04/10	Conservative	32.1	1	0
27	Colchester	27/04/10	Liberal Dem	47.1	10	0
27	Colchester	27/04/10	Other	0.0	–	0
2749	Glasgow Central	15/04/10	Labour	48.2	8	1
2749	Glasgow Central	15/04/10	Conservative	6.3	0	0
2749	Glasgow Central	15/04/10	Liberal Dem	17.8	0	0
2749	Glasgow Central	15/04/10	SNP	14.8	5	0
2749	Glasgow Central	15/04/10	Other	12.9	–	0

increased correlations between these variables that actually reflected correlated measurement errors. A feasible way to adjust for the possibility of such correlated measurement errors is to centre response scale values for each individual: For example, if $c_{1i1}, \ldots, c_{1im_i}$ are the expectations about parties $1, \ldots m_i$ to win a constituency seat reported by individual i in the first panel wave interview[6] then the adjusted or centred expectations are constructed as

$$c_{1ij}^{(\text{adj})} = c_{1ij} - \frac{1}{m_1} \sum_{k=1}^{m_i} c_{1ij} \tag{1}$$

For the analysis of the role of information flows for expectation formation the following variables are relevant: (1) respondents' perceived chances of the parties to win the constituency seat formed at or before the first wave of the panel (abbreviated as C_1) (2) the corresponding expectations about the parties formed at or before the second wave of the panel (abbreviated as C_2), (3) respondents' perceived chances of the parties to win the election at the national level formed at or before the first wave of the panel (abbreviated as N_1), (4) the corresponding expectations about the parties formed at or before the second wave of the panel (abbreviated as N_2), (5) parties' vote shares in the respondents' constituency (voting district) in the previous election of 2005 (abbreviated as D_{05}), (6) parties' popularity in opinion polls just before the first wave (abbreviated as P_1), and (6) parties' popularity in opinion polls just before the respondents' second-wave interview (abbreviated as P_2).

[6] $m_i = 4$ for respondents from England and $m_1 = 5$ for voters from Scotland (because of the presence of the SNP as an option) or Wales (because of the presence of Plaid Cymru as an option).

In the following, the role of information flows for expectation formation is examined using a structural equation model, where parties' district-level vote shares and popularities in opinion polls (variables D_{05}, P_1, and P_2) are considered as exogenous and the respondents' expectations about parties' chances to win a seat or the election in both waves (variables C_1, C_2, N_1, N_2) are endogenous variables. The model contains influence paths of information available during the first wave on respondents' expectations reported in the first wave and influence paths of information available during the second wave on respondents' expectations in the second wave. Further the model includes influence paths from expectations reported in the first wave to expectations reported in the second wave. The model thus constructed is illustrated in figure 2 and its parameter estimates (along with goodness-of-fit statistics) are reported in table 1.[7]

The estimates reported in table 1 suggest that the respondents in the BES Campaign Internet Panel Survey mostly conform to the first three criteria of reasonable expectation formation. This is not so much so because of the significance levels of the coefficients as because of the relative sizes of the standardised coefficients, which can be interpreted as path coefficients indicating the relative strengths of influence among the different variables. That respondents conform to the first criterion of reasonable expectation formation is borne out by the fact that the district-level results of 2005 have a large and positive path coefficient in the equation of the district-level expectations of the first panel wave and that parties' popularity in opinion polls has a high path coefficient in the equation of the national-level expectations of the first panel wave and moderately high path coefficient in the equation of the national-level expectations of the second panel wave. The second criterion, of selective consideration of relevant information, is borne out by very small path coefficients of parties' opinion poll popularity in the equations of constituency-level expectations for both panel waves and the very small path coefficients of the constituency-level results in 2005 in the equations of national-level expectations. Further, there is little "cross-contamination" in the expectations about the constituency level results and about the national-level results: The path coefficients

[7]The estimated were computed using the `lavaan` extension package for *R* (Rosseel, 2012; R Core Team, 2013). This package is mainly intended to estimate structural equation models that also involve latent variables, yet it also allows to specify structural equation models that involve only manifest variable in a relatively painless way.

Table 1: A structural equation model of information flows and expectation formation. ADF-WLS estimates of the standardized solution (i.e. all coefficients are rescaled to the range from −1 to +1 and all variances to 1)

(a) Standardised coefficients

	C_1	N_1	C_2	N_2
C_{05}	0.630	0.096	0.300	−0.022
	(0.004)	(0.004)	(0.005)	(0.005)
P_1	0.084	0.725		
	(0.004)	(0.004)		
C_1			0.584	0.092
			(0.006)	(0.005)
N_1			−0.073	0.574
			(0.005)	(0.005)
P_2			0.075	0.252
			(0.004)	(0.004)
GFI	1.000			
TLI	0.921			
RMSEA	0.102			
N	37074			

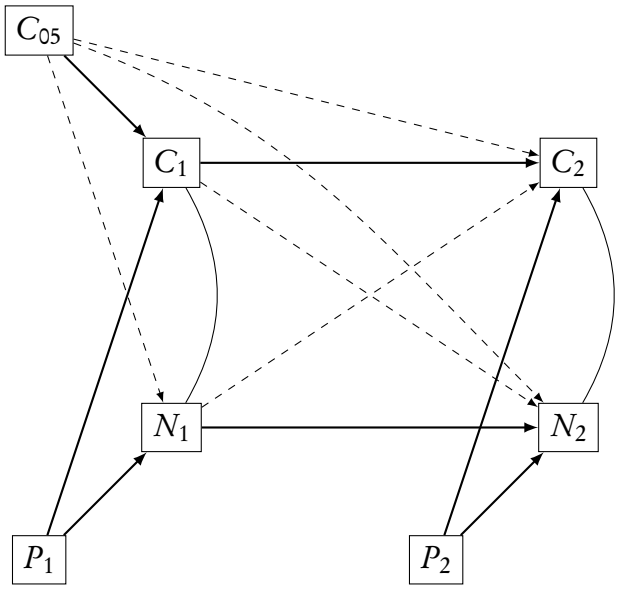
(b) Error (co-)variances

	C_1	N_1
C_1	0.564	
	(0.004)	
N_1	0.282	0.422
	(0.006)	(0.004)

	C_2	N_2
C_2	0.363	
	(0.004)	
N_2	0.234	0.408
	(0.006)	(0.004)

Notes: D_{05} denotes the parties' district-level results in 2005, P_1 denotes the parties' popularities during the first wave, P_2 denotes the parties' popularities during the second wave, C_1 denotes respondents' expectations about parties' chances at constituency-level during the first wave, C_2 denotes respondents' expectations about parties' chances at constituency-level during the second wave, N_1 denotes respondents' expectations about parties' chances at national level during the first wave, N_2 denotes respondents' expectations about parties' chances at national level during the second wave.
Robust standard errors are shown in parentheses. All estimates are statistically significant at a level of $p \leq .001$
Abbreviations of goodness of fit statistics: GFI: Jörekeskog's goodness-of-fit index, TLI: Tucker-Lewis index, RMSEA: root mean square error of approximation.

Figure 2: A diagram of the model of information flows and expectation formation. Dashed and solid arrows are contained in the model, solid arrows in diagram correspond the notion of a "reasonable" formation of respondents' expectation about parties chances at the constituency level and the national level.



Notes: "C_{05}" denotes the parties' constituency results in 2005, "P_1" denotes the parties' popularity during the first wave, "P_2" denotes the parties' popularity during the second wave, "C_1" denotes respondents' expectations about parties' chances at constituency-level during the first wave, "C_2" denotes respondents' expectations about parties' chances at constituency-level during the second wave, "N_1" denotes respondents' expectations about parties' chances at national level during the first wave, "N_2" denotes respondents' expectations about parties' chances at national level during the second wave.

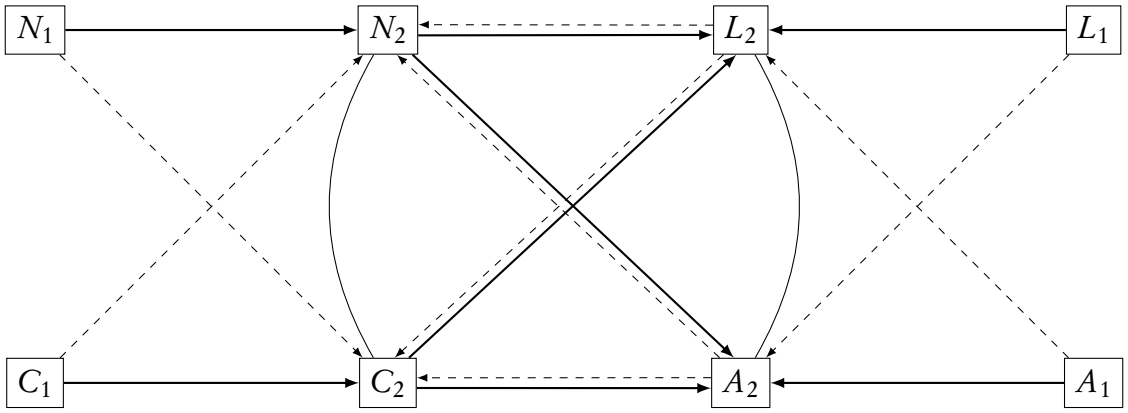
of constituency-level expectations in the first panel wave in the equation of national-level expectation in the second panel wave and of national-level expectations in the first panel wave in the equation of constituency-level results are quite small. The third criterion of updating previous expectations in concordance to new information is borne out by the positive path coefficients of parties' opinion poll popularity in the equation of national-level expectations in the second wave even though this criterion also shows a moderately large path coefficient of national-level expectations in the second wave. That is, there is a systematic positive relation between *changes* in expectations about the national level and the popularity of the parties. The constituency results of the previous election also have a moderately large path coefficient in the equation of constituency-level expectations of the second panel wave. While results of the previous election at constituency level are not really new information this does not contradict the idea that it is reasonable to update one's expectation about parties chances

at the level of the constituency if this information is made aware to the respondents. Thus the path coefficient of the 2005 constituency-level results in this equation may indicate that not all respondents have the results of the previous election ready in their memory, but may be reminded by campaign actors of this important piece of information.

The results just discussed suggest that British voters mostly conform to three of the four criteria of reasonable expectation formation discussed earlier: Using available information, discarding irrelevant information, and updating expectations as new information comes in. However it was not yet examined whether the fourth criterion applies. For such an analysis the following variables are relevant: (1) respondents' perceived chances of the parties to win the constituency seat formed at or before the first wave of the panel (abbreviated as C_1 – as in the previous analysis) (2) the corresponding expectations about the parties formed at or before the second wave of the panel (abbreviated as C_2 – as in the previous analysis), (3) respondents' perceived chances of the parties to win the election at the national level formed at or before the first wave of the panel (abbreviated as N_1 – as in the previous analysis), (4) the corresponding expectations about the parties formed at or before the second wave of the panel (abbreviated as N_2 – as in the previous analysis), (5) respondent's affect towards the parties at the first wave of the panel (abbreviated as A_1) and (6) at the second wave of the panel (abbreviated as A_2), (7) respondent's affect towards party leaders at the first wave of the panel (abbreviated as L_1) and (8) at the second wave of the panel (abbreviated as L_2).

The discussion at the beginning of this section concerns two directions of causality between expectations and feelings towards parties and their leaders. If voters have a taste for winning, then their expectations may influence their feeling towards the parties or their leaders, which is still compatible with reasonable expectation formation, however if feelings towards the parties and their leaders influences expectations this would indicate wishful thinking, incompatible with reasonable expectation formation. Such reciprocal causation can lead to unidentified model parameters, unless the model contains enough exogenous variables that can be used as instruments. The model that is discussed in the following uses respondents' expectations about parties chances and their feelings towards the parties and their leaders at the first wave as instruments and allows for reciprocal causation between ex-

Figure 3: A diagram of the model reciprocal influence between expectations and affect or feelings towards parties and their leaders. Dashed and solid arrows are contained in the model, solid arrows in diagram correspond the notion of a "reasonable" formation of respondents' expectation about parties chances at the constituency level and the national level.



Notes: "A_1" denotes respondents' feeling towards the parties at the first wave, "A_2" denotes respondents' feeling towards the parties at the second wave, "L_1" denotes respondents' feeling towards party leaders at the first wave, "L_2" denotes respondents' feeling towards party leaders at the second wave, "C_1" denotes respondents' expectations about parties' chances at constituency-level during the first wave, "C_2" denotes respondents' expectations about parties' chances at constituency-level during the second wave, "N_1" denotes respondents' expectations about parties' chances at national level during the first wave, "N_2" denotes respondents' expectations about parties' chances at national level during the second wave.

pectations and feelings in the second wave of the panel. This model is illustrated in figure 3.

The estimates of the model of respondents' feelings about the parties and their leaders and respondents' formation of expectations about the parties' chances at the level of the constituency and at national level are shown in table 2. They show that there is little evidence of a taste for winning: The path coefficients of respondents' expectations on their feelings towards are very close to zero. On the other hand, two of the path coefficients that leads from the feelings to the expectations have a non-negligible yet moderate size: the coefficients of the paths from respondents' feelings towards the parties and their leaders to respondents' expectations about parties chances to win the elections overall. However, these coefficients do not easily lead to an interpretation in terms of a symptom of wishful thinking. The path coefficients from feelings towards the parties themselves to the expectations about their chances of success at constituency level are however very small. If these coefficients were more than just modest in size, this could be counted as relatively unambiguous evidence for wishful thinking. Path coefficients of more than modest size are however found in the equation of expectations about parties' chances to succeed at national level, yet they have different signs:

Table 2: A structural equation model of information flows and expectation formation. ADF-WLS estimates of the standardized solution (i.e. all coefficients are rescaled to the range from −1 to +1 and all variances to 1)

(a) Standardised coefficients

	L_2	R_2	C_2	N_2
L_1	0.605	0.191		
	(0.006)	(0.006)		
R_1	0.332	0.730		
	(0.006)	(0.006)		
C_2	0.009	0.016		
	(0.003)	(0.003)		
N_2	−0.052	0.007		
	(0.003)	(0.003)		
C_1			0.744	0.053
			(0.004)	(0.004)
N_1			0.004	0.708
			(0.004)	(0.004)
L_2			0.062	0.272
			(0.009)	(0.010)
R_2			0.032	−0.100
			(0.009)	(0.010)
GFI	0.996			
TLI	0.994			
RMSEA	0.057			
N	35478			

(b) Error (co-)variances

	L_2	R_2
L_2	0.204	
	(0.002)	
R_2	0.502	0.175
	(0.006)	(0.002)

	C_2	N_2
C_2	0.405	
	(0.004)	
N_2	0.178	0.399
	(0.006)	(0.004)

Notes: "A_1" denotes respondents' feeling towards the parties at the first wave, "A_2" denotes respondents' feeling towards the parties at the second wave, "L_1" denotes respondents' feeling towards party leaders at the first wave, "L_2" denotes respondents' feeling towards party leaders at the second wave, C_1 denotes respondents' expectations about parties' chances at constituency-level during the first wave, C_2 denotes respondents' expectations about parties' chances at constituency-level during the second wave, N_1 denotes respondents' expectations about parties' chances at national level during the first wave, N_2 denotes respondents' expectations about parties' chances at national level during the second wave.
Robust standard errors are shown in parentheses.
Abbreviations of goodness of fit statistics: GFI: Jörekeskog's goodness-of-fit index, TLI: Tucker-Lewis index, RMSEA: root mean square error of approximation.

While the path coefficient from feelings towards party leaders to expectations about parties chances at the national level is positive, the path coefficient towards the parties themselves has a negative sign. The positive path coefficient of feelings towards party leaders may be a symptom of a "Clegg effect" – respondents may evaluate his performance in televised debates as positive and therefore think that the Liberal Democrats have increased their chances to be successful at the national level even if they are not supportive of the Liberal Democrats – but there may also be more complex processes at work. However, to explore such processes is beyond the scope of this paper.

5 Modelling Sincere and Tactical Voting

The previous section has shown that respondents to the British Election Campaign Panel Internet Survey form their expectations about parties chances to win a constituency seat or to win the election overall in a mostly reasonable or at least not grossly unreasonable way. Furthermore, we have evidence that respondents have been able to distinguish in their expectations clearly between the constituency level and the national level, since we found that there is little "cross-contamination" between expectations about both levels. This all suggests that respondents are able to vote tactically, one the one hand to avoid wasting their vote at the constituency level or on the other hand to prevent a "hung parliament". The discussion at the beginning of the paper shows however that the reconstruction of tactical voting has proven to be a difficult task.

The main problem in the reconstruction of tactical voting is that one can only observe how voters have decided, yet that it can only inferred indirectly whether they have done so for tactical reasons. Yet while it is impossible to read off the voting decision whether it was a sincere vote or a tactical vote, it is possible to describe with some clarity how voters will decide *if* they follow a pattern of sincere or tactical voting: (1) If citizens vote sincerely, then they will consider all available alternatives and choose from them based on their policy positions or on how much they like the parties or their leaders. (2) If citizens vote tactically in the "classical" sense, that is with respect to the outcome on the level of the constituency,

they will restrict their choice set to those parties that have a realistic chance to win the constituency seat. Tactical voters will not consider the party they like the most or that has the most attractive policy positions if this party does not stand a chance to win the seat and thus fail to prevent a party to gain the seat that they like much less. (3) If voters vote tactically to avoid a hung parliament, they will restrict their choice set to only those (two) parties that have a realistic chance to gain a majority in the House of Commons, even if a third party has a realistic chance to win the constituency seat.

Suppose a voter's preferences for parties and their candidates are determined, or at least influenced, by attributes of the parties, such the policy distance between the him/her and the party and an overall affective evaluation of the party and its leader(s). Suppose that there are four parties or candidates in the voter's choice set, numbered 1,2,3, and 4 and that in terms of the predictors of party preferences, alternative no 1 would be choice to be expected from this voter. If the voter intends to vote for no 1, while expecting this party to win the seat in the constituency where he/she will vote and expecting this party to be the one to gain a majority in the House of Commons, there is no way to distinguish whether this voter is a sincere one who will support this first preference no matter what, a tactical voter who would have tried to avoid wasting his/her vote for a party or candidates without any chances to gain a seat in the constituency or who would have tried to avoid to contribute with his/her vote to a hung parliament. If the voter intends to vote for no 1, while not expecting this party to win the seat in the constituency where he/she will vote and expecting this party to be the no better than the third largest party in the House of Commons after the election, one could arguably infer that he or she is a sincere voter, because his/her vote choice is not compatible with any of the two types of tactical voting. If the voter intends to vote for another party than no 1, say no 2, and this party is expected by the voter to be, in contrast to party no 1, a viable contender in the constituency, but still likely to be only the third-largest party in Parliament, then one could arguably infer that this voter is a tactical voter in the classical sense. One could discuss more situations that can be distinguished, but nevertheless from the discussion so far it is hopefully clear that, given certain hypothetical pattern types of sincere and tactical voting, one can state that the intended vote choice is compatible or incompatible

with them, but this vote choice may be compatible with more than one. One could describe the voting decision strategy given that a voter is of a particular type, say, a sincere voter, a wasted vote-avoider or a hung parliament-avoider, but the actual voting decision is often not sufficient to decide which type applies to a voter. We therefore propose to treat the voting strategy – sincere, tactical to avoid a wasted vote or tactical to avoid a hung parliament – as an unobserved categorical random variable, or *latent class*. Latent class analysis is well suited to model causal heterogeneity, but as will be shown below, it has the additional advantage to allow the construction of probabilities of voters' membership in the latent classes, that is, to obtain the probability by which a particular voter is a sincere voter, or some type of tactical voter.

The type of the voting decision exercised by a voter – with running number i in the data set can thus be envisaged as a discrete random variable U_i with potential values $h \in \{0, 1, 2\}$. Then each type of voting decision can characterised by a particular *conditional* distribution of the choices given the decision type. This distribution pertains to the set of random variables Y_{ij} that indicate whether voter i chooses from the set of available alternatives $\mathcal{S}_i = \{1, \ldots, m_i\}$ the party (or rather party candidate) j (in which case $Y_{ij} = 1$) or not ($Y_{ij} = 0$), so that the sum of the random variables over the choice set is

$$\sum_{j \in \mathcal{S}_i} Y_{ij} = \sum_{j=1}^{m_i} Y_{ij} = 1 \tag{2}$$

Now if citizen i votes sincerely (i.e. $U_i = 0$) then he or she chooses any of the alternatives in the choice set with positive probability:

$$\Pr(Y_{ij} = 1 | U_i = 0; \boldsymbol{X}_i\boldsymbol{\beta}) > 0 \quad \text{for all} \quad j \in \mathcal{S}_i \tag{3}$$

where $\boldsymbol{X}_i$ is a matrix of attribute variables of the alternatives and $\boldsymbol{\beta}$ is a parameter vector that expresses how much different alternative variables (the parties' positions, how much the voter likes the respective parties and their leaders etc.) pertain to the choice. If citizen i votes tactically (i.e. $U_i = h$ with $h > 0$) he or she will vote with positive probability only for an alternative from a proper subset $\mathcal{S}_{i|h} \subset \mathcal{S}_i$ (e.g. the set of the two parties with viable chances

to gain the seat in the relevant electoral district):

$$\Pr(Y_{ij} = 1|U_i = h; \boldsymbol{X}_i\boldsymbol{\beta}) \begin{cases} > 0 & \text{if } j \in \mathcal{S}_{i|h} \\ = 0 & \text{if } j \notin \mathcal{S}_{i|h} \end{cases} \tag{4}$$

However it is not the conditional distribution that is of interest here, but what can be learned about a citizen's type of voting decision from her or his choice. For this, Bayes' Theorem can be applied: Suppose the relevant alternative variables in $\boldsymbol{X}_i$ are observed and the parameter vector $\boldsymbol{\beta}$ is known and also a prior probability $\Pr(U_i = h)$ for each $h \in \{0, 1, 2\}$, then the posterior probability of citizen i to engage in voting type h is

$$\Pr(U_i = h|Y_i = \boldsymbol{y}_i; \boldsymbol{X}_i\boldsymbol{\beta}) = \frac{\Pr(Y_{ij} = \boldsymbol{y}_i|U_i = h; \boldsymbol{X}_i\boldsymbol{\beta}) \Pr(U_i = h)}{\sum_{g=0}^{2} \Pr(Y_{ij} = \boldsymbol{y}_i|U_i = g; \boldsymbol{X}_i\boldsymbol{\beta}) \Pr(U_i = g)} \tag{5}$$

where Y_i is a random vector with elements $Y_{i1}, \ldots, Y_{im_i}$ and $\boldsymbol{y}_i$ is a with elements $y_{i1}, \ldots, y_{im_i}$ with $y_{ij} \in \{0, 1\}$ and $\sum_j y_{ij} = 1$.

This application of Bayesian inference regarding the type of voting a citizen engages in seems to beg the question about what the prior distribution is, that is, how to determine the prior probabilities $\Pr(U_i = h)$ for $h = 0, 1, 2$. Fortunately, it is possible to estimate these from observed data. This is so because the conditional distribution of the choices described by the probability mass function

$$\mathcal{L}_{i|h} := \Pr(Y_{ij} = \boldsymbol{y}_i|U_i = h; \boldsymbol{X}_i\boldsymbol{\beta}) \tag{6}$$

does not depend on the value of U_i. Further, if the prior probabilities $\phi_{hi} := \Pr(U_i = h)$ are treated as a parameters or rather as a function of covariates collected in a vector $\boldsymbol{z}_i$ and parameter vectors $\boldsymbol{\gamma}_1$, and $\boldsymbol{\gamma}_2$ then the marginal distribution of the choices

$$\mathcal{L}_i := \sum_{h=0}^{2} \mathcal{L}_{i|h}\phi_{hi} = \sum_{h=0}^{2} \Pr(Y_{ij} = \boldsymbol{y}_i|U_i = h; \boldsymbol{X}_i\boldsymbol{\beta}) \Pr(U_i = h), \tag{7}$$

which is in the denominator of the right hand side in equation (5), is independent from

the values of any unobserved data (the type of voting). In fact, maximizing the *marginal likelihood* $\mathcal{L} = \prod_{i=1}^{N} \mathcal{L}_i$ or rather the log-marginal likelihood $\ell = \sum_{i=1}^{N} \ln \mathcal{L}_i$ for $\boldsymbol{\beta}$, and $\boldsymbol{\gamma}_1$, and $\boldsymbol{\gamma}_2$ will give the maximum likelihood estimates of these parameters, which can be substituted into equation (5) to obtain *emprical Bayes* posterior for the type of voting voter i engages in. The technical details for the maximum likelihood procedure to estimate the parameters and for the computation of posterior probabilities are presented in the appendix of the paper.

6 "Objective" Tactical Voting

The latent class model of voting types introduced before rests on a predetermined description of from *what set of alternatives* voters choose if they engage in a particular type of voting – from the full set in case of sincere voting, from restricted choice sets in case classical tactical voting to avoid wasting their vote for a party or candidate hopeless to get a constituency seat, or tactical voting to avoid a hung parliament – and contains parameters that describe *how* they choose from these alternatives and how the different types of voting are *distributed*. The part of the latent class model that describes the pattern of choice conditional on the type of voting could be called its *choice component* whereas the part of the model that describes the distribution of the voting types could be called its *latent distribution component*. The reconstruction of the distribution of sincere voting, classical tactical voting, and hung parliament avoidance based on this model can be described intuitively – at the price of some simplification – such that vote propensities based on each voting type are compared with actual votes or vote intentions to assess on this base which type of voting a voter or survey respondent has used with what probability.

The reconstruction of the different voting types rests of course on their a-priori specification, and there may be different ways to define tactical voting in this sense. In this and the following section we explore the implications of two different conceptions of tactical voting. In the present section we consider a model in which the choice sets and thus the voting types are determined based on objective information: Here we understand tactical voting in the

classical sense such that voters engaged in this type of voting consider only those parties (or their candidates) as viable that in the previous election ranked first or second in terms of vote share in the constituency in which they are eligible vote. That is, tactical voters in this sense restrict their effective choice set to the two parties that gained the relatively most votes in the respective voting district in the previous election – the election to the House of Commons in 2005. In addition we envisage a type of tactical voting that aims to avoid a hung parliament as restricting the effective choice set to the two largest parties in Britain in the previous or actual election: the Conservative Party and the Labour Party of the UK. While one can expect that these two choice sets may coincide for many voters, it is not necessary always so. In the election of 2005 and especially in the election of 2010 in several constituencies other parties – above all the Liberal Democrats, but also the Scottish National Party, Plaid Cymru, and even the Green Party – were able to win pluralities in several constituencies and thus seats in the House of Commons or at least to become the runners-off.

For the model component that pertains to the selection of alternatives from choice sets we use those variables in the British Election Internet Panel Survey that best represent the feelings of the respondents to the parties and their leaders and the (impact of) parties' perceived policy positions. For the first kind of party attributes we use the responses to the questions asked in the survey (1) about how much respondents like the Conservative Party, the Labour Party, the Liberal Democrats, Plaid Cymru (for Welsh respondents), and the Scottish National Party (for Scottish respondents) and (2) about how much respondents like the respective leaders of the parties, that is, David Cameron (of the Conservatives), Gordon Brown (of Labour), Nick Clegg (of the Liberal Democrats), Alex Salmond (of the Scottish National Party), or Ieuan Wyn Jones (of Plaid Cymru). In the survey respondents could answer the questions about their feelings towards each of the party and each of the party leaders on a scale from "Strongly dislike" (coded as 0) to "Strongly like" (coded as 10). For the analysis the corresponding variables were rescaled to the range from 0 to 1. For modelling the impact of parties' positions as perceived by the respondents we use the responses to questions asked in the survey about where the respondents themselves and the parties stand on the issues of (1) cutting taxes versus increasing government spending – here the response

categories range from "cut taxes a lot and spend much less" (coded as 0) to "increase taxes a lot and spend spend much more" (coded as 10) – and (2) fighting crime versus defending civil rights – with response categories ranging from "reducing crime more important" (coded as 0) to "rights of accuses more important" (coded as 10). For the analysis the corresponding variables were first rescaled to the range from 0 to 1, then the parties perceived positions were subtracted from the respondents own positions and finally these differences were squared. The selection of alternatives from each of the choice set was modelled based on conditional logits. Conditional logits are particularly useful here because they can be set up such that they allow for choice sets that vary from choice occasion to choice occasion, which means in the present case that conditional logit accommodates choice sets that vary from individual to individual (that is from individuals from England, Scotland, or Wales) *and* from voting type to voting type. For this type of model, data were arranged in the same "long format" as described in the third section, such that each row in the data set reshaped into long format corresponds to a respondent-party pair. Details of the conditional logit component of the model are given in the appendix of this paper.

Table 3 shows the estimates of the choice component of several specifications of predictor variables of the voting types discussed in the next paragraphs. Since the choice component of these models is not of substantive interest, but merely serves an auxiliary function, they are provided here only as a reference. That being said, one notable aspect of the estimates of the choice component of these models is that they hardly differ in terms of the relative influence of parties' positions and of the feelings towards the parties and their leaders. One could thus argue that the choice component of these models forms a quite stable basis for the reconstruction of the different types of voting decisions.

The more interesting component or the latent class models is of course the one that specifies the distribution of the voting types, that is, of sincere voting, "classical" tactical voting, and tactical voting to avoid a hung parliament. In the previous section is was described how the posterior probabilities of each respondent to have engaged in each of this voting types can be obtained from some prior probabilities and the conditional choice likelihoods (which are built build the choice component of the model described in the previous paragraph). As

Table 3: Choice parameters of various latent class models of sincere and tactical voting

	(0)	(1)	(2)	(3)
Position tax vs. spend	−1.578**	−1.627**	−1.765**	−1.755**
	(0.536)	(0.544)	(0.552)	(0.553)
Position fight crime vs. rights	−1.259***	−1.246***	−1.216***	−1.205***
	(0.278)	(0.281)	(0.284)	(0.284)
Party feeling	11.698***	11.766***	11.869***	11.871***
	(0.377)	(0.373)	(0.382)	(0.381)
Leader feeling	2.736***	2.768***	2.819***	2.840***
	(0.236)	(0.237)	(0.241)	(0.242)
Log-likelihood	−2584.7	−2565.4	−2521.6	−2519.5
N	8890	8890	8822	8822

Notes: Maximum marginal likelihood estimates with standard errors in parentheses. p-value symbols: $***$: $p < .001$, $**$: $p < .01$, $*$: $p < .05$.

already discussed, the prior probabilities needed to obtain the posterior probabilities can be either treated as parameters or as functions of predictor variables that are parametrised by slope coefficients. We use a multinomial logit specification for the link between the prior probabilities and the predictor variables and slope parameters, as detailed in the appendix for this paper.

Table 4 shows the estimates of the parameters of the distribution of the voting types for various latent class models of sincere and tactical voting. The first model shown in the table (the estimates are in the first two columns) is a "null" model containing only the constant term of the two equations of the multinomial logit model of the prior distribution of the voting types. Both constants are log-odds with the sincere voting type as baseline. There negative signs thus indicate that both types, classical tactical voting and the avoidance of a hung parliament are less common than sincere voting. Further, the larger negative log-odds of hung parliament avoidance indicates that this type of voting is even less common than classical tactical voting.

The inclusion of predictor variables in the specification (empirical) prior distribution of the voting types allows describe how the incidence of tactical voting varies across constituencies and points in time. The second model (designated as "(1)" in the table) allows to examine the effect of the closeness of the race on the propensity to vote tactically. It is

Table 4: Parameters of the distribution of voting types in latent class models of sincere and tactical voting

	(0)		(1)		(1r)		(2)		(3)	
	Cnstcy	Big Two	Cnstcy	Big Two	Cnstcy	Big Two	Cnstcy	Big Two	Cnstcy	Big Two
Constant	−2.071***	−4.524***	−1.587***	−7.232***	−1.305***	−6.148***	−2.622***	−6.330***	−2.489***	−6.488***
	(0.094)	(0.656)	(0.253)	(1.588)	(0.142)	(1.230)	(0.361)	(1.591)	(0.376)	(1.553)
Diff 1st/2nd cnstcy 2005			−4.954***	6.488	−4.868***		−1.633		−1.645	
			(0.901)	(3.337)	(0.909)		(1.145)		(1.146)	
Diff 1st/2nd opinion polls			5.706	21.631		30.456*		29.417		30.577
			(3.861)	(16.841)		(15.420)		(20.754)		(19.576)
Diff 2nd/3rd cnstcy 2005							5.738***		5.244***	
							(1.346)		(1.395)	
Diff 2nd/3rd national								6.531		7.741
								(5.836)		(5.826)
Scotland									−0.460	−0.695
									(0.359)	(1.104)
Wales									−0.006	1.035
									(0.379)	(0.877)
Log-likelihood	−2584.7		−2562.1		−2565.4		−2521.6		−2519.5	
N	8890		8890		8890		8822		8822	

Notes: Maximum marginal likelihood estimates with standard errors in parentheses. p-value symbols: ***: $p < .001$, **: $p < .01$, *: $p < .05$.

often assumed that the close the race in a constituency, the stronger the incentive to vote tactically at the constituency level. Similarly, the closer the race on the national level the more a hung parliament will seem likely, thus strengthening the incentive to avoid it if this is seen as an undesirable course of events. In the model that pertains to the distribution among the types of voting we use the absolute differences between the 2005 vote shares of the first- and second-placed parties in the constituency the respondents are eligible to vote to represent the closeness of the race at the constituency level. To model the closeness of the race a the national level we use the absolute differences in the projected vote shares of the first- and second-placed parties in the aggregated opinion polls just before the time respondents were interviewed. The difference between the first and second placed in the constituency in 2005 has a statistically significant coefficient with negative sign in the logit equation for classical tactical voting, indicating that closeness of the race is indeed an incentive to engage in tactical with respect to the constituency seat. However the corresponding coefficient in the logit equation for hung parliament avoidance does not attain statistical significance despite is large value, because of its high standard error. Further, the coefficients of the difference in popularity between first- and second-placed parties in the polls are statistically significant in neither of the two equations, despite the large estimate in the logit equation of hung parliament avoidance. In an attempt to gain some precision in the estimation of the parameters of interest in the third model the coefficient of distance on constituency level in the equation of hung parliament avoidance and the coefficient of distance in the polls in the equation of classical tactical voting are fixed to zero. Indeed as the estimates of this model (under the heading "(1r)") indicate, the coefficient of distance between the first- and second-placed party in the polls now gains statistical significance. However, its sign is not compatible with the notion that closeness of competition at national level is an incentive for hung parliament avoidance. For this to be the case, the sign of the coefficient would have to be negative, yet its estimate is positive, leading to the conclusion that hung parliament avoidance increased or decreased with the distance between the Conservatives and Labour in the polls.

Another common expectation about tactical voting is that the incentive to vote tactically gets stronger the farther away a preferred party is from competitiveness. That is, the less a

preferred party has a viable chance to compete at the constituency level (or at the national level) the higher the incentive to vote tactically. We represent this distance from contention at the constituency level with the absolute differences between the 2005 vote shares of the second- and third-placed parties in the respective constituencies and we represent the distance from contention at the national level with the absolute differences in projected vote shares of the second- and third-placed parties in the aggregated opinion polls just before the time respondents were interviewed. The inclusion of these predictors into the fourth model, the estimates of which are shown in the two columns in the table with the heading "(2)", lends some support about these expectations with regards to classical tactical voting at the constituency level, however not with regards to tactical voting aimed at avoiding a hung parliament. The difference between the second- and the third-placed party at the constituency level attains a statistically significant positive coefficient, indicating that as the chances of third-party candidates decline the incentive to vote tactically increases. However, the inclusion of this predictor into the logit equation of classical tactical voting suppresses the coefficient of the difference between the second- and third-placed parties. This may be the consequences of the tendency of the differences in vote shares between first- and second-placed and between second- and third-placed parties to be (negatively) correlated, but it could also be argued that at the constituency level, tactical voting is more incited by the hopelessness of third parties than by the closeness of the race between the two largest parties in the constituency. A tendency of correlation between the difference between first- and second-placed and the difference between the second-placed and the third-placed party may also be the reason why both coefficients of differences in poll results do not attain statistical significance in the logit equation of hung parliament avoidance.

The last model with estimates in table 4 expands the previous model by dummy variables for Scotland and Wales. The intention of this model extension is to check for any systematic departures from the overall pattern in the Celtic countries of the UK, where the Conservatives tend to be much weaker than in England while the Liberal Democrats and also the regionalist parties Plaid Cymru and Scottish National Party are stronger. Yet the estimates of the coefficients of the dummy variables are not statistical significance. Hence we do not

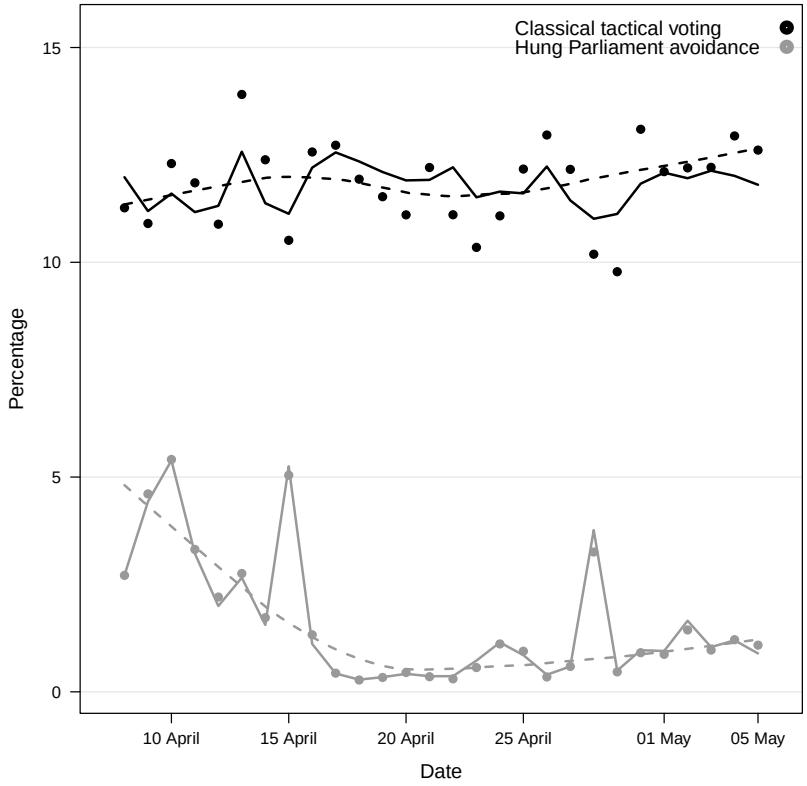
find evidence for differences from England in the pattern of tactical voting in Scotland and Wales.

Figure 4 shows how the distribution of voting types changes over time, as reconstructed with the help of model "(2)" in table 4. It suggests that while the incidence of classical tactical voting is more or less stable, even showing a slight upward trend, the avoidance of a hung parliament shows a clear decline, where most of the decline occurs in mid-April, around the time of the first televised leadership debate that was, according to published opinion, clearly won by Nick Clegg, the leader of the Liberal Democrats (Shirbon, 2010). The almost abrupt decline in hung parliament avoidance thus appears to be a reflection of a "Clegg effect" that may have lead many voters to no longer believe that a hung parliament to be undesirable.

With the latent class model introduced in this paper it is not only possible to reconstruct the distribution of sincere voting, classical tactical voting and tactical voting that aims to avoid a hung parliament, but also to reconstruct how respondents voted or would have voted *conditionally on* having voted sincerely or tactically (of any of the two types considered in this paper). Further, by comparing actual vote intentions reported by respondents in the survey with their vote probabilities conditional on having voted sincerely, it is possible to estimate the wins and losses of particular parties incurred by individual parties. Estimated losses incurred by the Liberal Democrats due to tactical voting are depicted in figure 5.

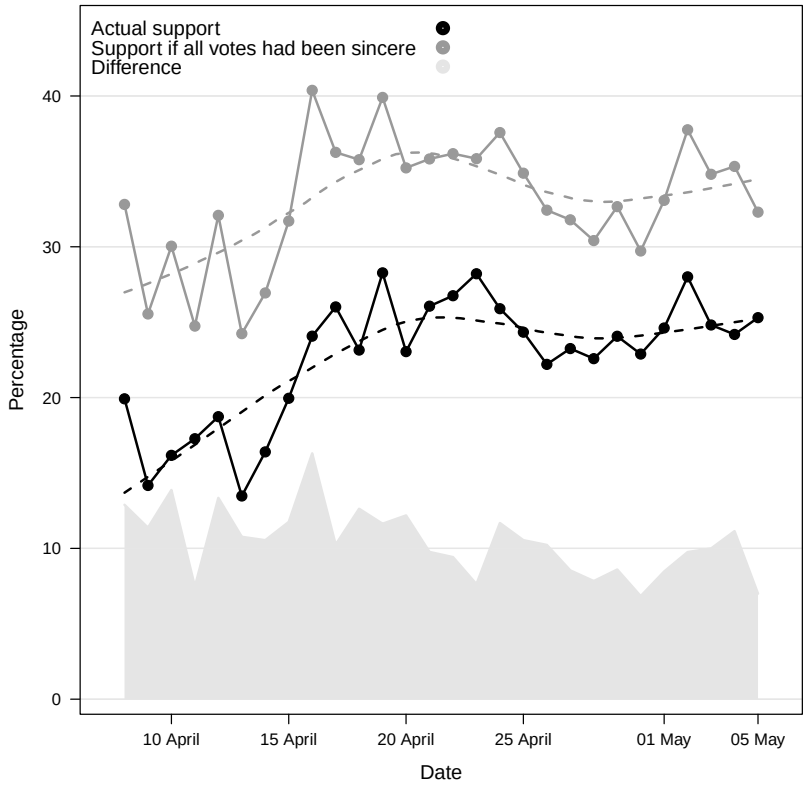
As becomes clear from figure 5, the share of vote intentions for the Liberal Democrats may have been considerably larger if all vote intentions had followed the type of sincere voting. While their actual vote share in the British Election Campaign Internet Panel Survey fluctuated around 15 percent before the leadership debate on 15 April and around 25 percent after the debate, the Liberal Democrats share may have been between 25 percent and 30 percent before the debate and between 30 percent and 40 percent after the debate. Consequently, the estimated shortfall for the Liberal Democrats due to tactical voting is substantial even though it declined a bit throughout the campaign, from just above 10 percent before 15 April and just below 10 percent thereafter. However the decline in the shortfall for the Liberal Democrats seems rather modest. That is, although the "Clegg effect" exerted by the first televised leadership debate may have prompted some voters to return from tactical vot-

Figure 4: The distribution of voting types throughout the campaign



Notes: The diagram shows daily averages of posterior probabilities (dots), daily averages of prior probabilities (connected by solid lines), and a lowess curve that smooths the average posterior probabilities (dashed line, the span of the lowess smoother is 0.5).

Figure 5: Projected vote share of the Liberal Democrats under exclusively sincere voting in comparison with actual vote intentions



ing to sincere voting – and this seems to have mainly affected those who wanted to avoid a hung parliament (see figure 4) – its effect seems to have been stronger on the "fundamentals" of voting – the evaluation of the party and its leader – than on the consequences of tactical voting.

7 Expectation-based Tactical Voting

In the previous section we examined the implications of a conception of tactical voting that rests on "objective" properties and information, parties' constituency results from the previous election and their current support in opinion polls. In this section we take a different approach and look at a conception of tactical voting that rests on respondents' expectations about the results at the level of the constituency in which they are eligible to vote and about the overall result of the House of Commons election. These are the expectations the formation of which was examined in a previous section. The data on these expectations come from the responses given to questions asked in the BES Campaign Internet Panel Survey about each of the relevant parties – the Labour Party, the Conservative Party, the Liberal Democrats, Plaid Cymru, and Scottish National Party – how likely they think that the party will win (1) the seat in the respective constituency the respondent is eligible to vote in and (2) to win the election overall.

Again we distinguish between classical tactical voting aimed at avoiding votes wasted for parties or candidates hopeless to get a constituency seat and tactical voting aimed at avoiding a hung parliament. Classical tactical voting now is defined as choosing from the set of the two parties that the respondent thinks are most likely to win the constituency seat, while hung parliament avoiding is now defined as choosing from the set of the two parties that the respondent thinks are the most likely to win the election overall. While we use a different construction of the choice sets that define the types of voting, we use the same variables in the choice component of the latent class model, that is, policy distances between the respondents and the parties on the issues of lower taxation versus higher spending and of fighting crime versus protecting defendants' rights, respondents feelings towards the respective parties and

towards their leaders.

Table 5 shows estimates of this choice component of latent class models with various specifications of the distribution of the voting types. Like the estimates shown in table 3 in the previous section, these estimates are not of great substantial importance and are shown only for reference purposes. Overall the estimates hardly differ between specifications of the distribution of the voting types, indicating the stability of the choice component of the model. In that way the results in table 5 mirror the results table 3. Furthermore, the estimates in table 5 are similar to the results in table 3, the only systematic difference being that the coefficient of respondents' feelings towards the parties tend to be a bit larger.

Table 6 and 7 show the parameters of different specifications the empirical prior distribution of the three different voting types constructed on respondents' expectations about parties chances at the level of the constituency and the national level. The first model marked with "(0)" is a null model that contains only the constant terms of the logit equations of the two types of tactical voting. Both constant terms are estimated to be negative (like the constant terms of the analogous models in table 4), however the constant term in the equation of hung parliament avoidance is smaller in absolute size than the analogous term in table 6. This means that hung parliament avoidance if defined based on expectations is more common than if defined based on objective information. The log-likelihood is higher than the null model in table 4, which may indicate that the expectation-based model fits the data better than the objective information-based latent class model of voting types.

The second model shown in table 6 includes the measures of the perceived closeness of the race at the constituency and the national level, the differences between the first- and second-placed parties in terms of the perceived likelihood of the parties to win the constituency seat and in terms of the perceived likelihood of the parties to win the election at national level. The statistically significant negative estimate of the coefficient of the difference between the first- and second-placed party at the constituency level in the logit equation of classical tactical voting conforms with the expectation that the closeness of the race is an incentive to engage in this type of voting. The statistically significant coefficient of the difference between the first- and second-placed party at the national level in the logit equation of hung parlia-

Table 5: Choice parameters of various latent class models of sincere and tactical voting

	(0)	(1)	(2)	(3)	(4)	(5)
Position tax vs. spend	−1.533**	−1.864**	−1.837**	−1.920**	−1.933**	−1.897**
	(0.557)	(0.596)	(0.615)	(0.635)	(0.634)	(0.637)
Position fight crime vs. rights	−1.189***	−1.132***	−1.248***	−1.140***	−1.137***	−1.105***
	(0.288)	(0.294)	(0.317)	(0.319)	(0.319)	(0.321)
Party feeling	12.320***	12.386***	12.255***	12.211***	12.201***	12.168***
	(0.397)	(0.407)	(0.450)	(0.452)	(0.452)	(0.451)
Leader feeling	2.766***	2.774***	2.470***	2.475***	2.478***	2.520***
	(0.246)	(0.256)	(0.283)	(0.284)	(0.284)	(0.287)
Log-likelihood	−2560.3	−2400.5	−1949.7	−1931.1	−1930.8	−1921.7
N	8890	8487	6961	6961	6961	6961

Notes: Maximum marginal likelihood estimates with standard errors in parentheses. p-value symbols: $***$: $p < .001$, $**$: $p < .01$, $*$: $p < .05$.

Table 6: Parameters of the distribution of voting types in latent class models of sincere and tactical voting

	(0)		(1)		(2)	
	Cnstcy	Hung Parl	Cnstcy	Hung Parl	Cnstcy	Hung Parl
Constant	−2.008***	−2.746***	−0.875***	−3.348***	−1.656***	−3.853***
	(0.101)	(0.190)	(0.140)	(0.416)	(0.198)	(0.526)
Diff 1st/2nd cnstcy			−2.214***	0.898	−3.698***	
			(0.345)	(0.585)	(0.415)	
Diff 1st/2nd national			−0.263	1.408*		−1.854
			(0.454)	(0.588)		(1.038)
Diff 2nd/3rd cnstcy					2.721***	
					(0.452)	
Diff 2nd/3rd national						4.374***
						(1.269)
Log-likelihood	−2560.3		−2400.5		−1949.7	
N	8890		8487		6961	

Notes: Maximum marginal likelihood estimates with standard errors in parentheses. p-value symbols: $***$: $p < .001$, $**$: $p < .01$, $*$: $p < .05$.

ment avoidance however has the "wrong" sign – it suggests that the closeness of the race at the national level is a disincentive for tactical voting at this level. The next model, denoted by the heading "(2)" adds the difference between the second- and third-placed party at the constituency-level to the logit equation of classical tactical voting and the difference between the second- and third-placed party at the national level to the logit equation of hung parliament avoidance. In addition, this model drops those terms that turned out to be statistically insignificant in the previous model. The coefficients of the added terms are both statistically significant and have a sign that conforms with the expectation that the distance from contention or the hopelessness of third parties is an incentive for tactical voting. Additionally the coefficient of the difference between the first- and second-placed party at the national level in the logit equation of hung parliament avoidance now attains a sign that conforms to the notion that the closeness of the race is an incentive to vote tactically, yet at the same time it looses its statistical significance.

Table 7 shows estimates of further specifications of the distribution of the voting types. The model designated by "(3)" adds respondents' preferences about the format of the government to the equations of the distribution of the voting types. These are obtained from the responses to a question asked in the third wave of the British Election Campaign Internet Panel Survey about the preferred format of government (the response categories where "A government made up of a single party", "A coalition government made up of two or more parties", and "Don't know"). The preferences about the format of the government are dummy-coded in the model with "coalition government" as baseline category. As can be seen in the first two columns of table 7, the coefficient of the dummy variable that contrasts the preference for a single-party government to a coalition government is statistically significant in the logit equations of both types of tactical voting. The statistically significant large positive coefficient of the dummy variable of a preference for a single-party government in the logit equation of hung parliament avoidance conforms to notion that such a preference is an incentive to vote tactically against a hung parliament. Yet the coefficient of the same dummy variable in the logit equation of classical tactical voting, which is also statistically significant but negative, does not lend itself to an easy interpretation. It may indicate that some voters

Table 7: Parameters of the distribution of voting types in latent class models of sincere and tactical voting

	(3)		(4)		(5)	
	Cnstcy	Hung Parl	Cnstcy	Hung Parl	Cnstcy	Hung Parl
Constant	−1.404***	−4.414***	−1.457***	−4.544***	−1.298***	−3.999***
	(0.221)	(0.635)	(0.237)	(0.695)	(0.231)	(0.535)
Diff 1st/2nd cnstcy	−3.733***		−3.739***		−3.866***	
	(0.426)		(0.427)		(0.438)	
Diff 2nd/3rd cnstcy	2.757***		2.754***		2.874***	
	(0.465)		(0.465)		(0.480)	
Diff 1st/2nd national		−0.853		−0.861		−1.142
		(0.840)		(0.837)		(0.817)
Diff 2nd/3rd national		2.460**		2.415*		2.714**
		(0.954)		(0.952)		(0.945)
Single-party gov.	−0.481*	2.296***	−0.488*	2.349***	−0.478*	2.077***
	(0.219)	(0.641)	(0.219)	(0.667)	(0.224)	(0.539)
No preference	0.065	0.350	0.047	0.404	0.088	0.134
	(0.294)	(1.181)	(0.294)	(1.191)	(0.293)	(1.067)
Risk aversion			0.133	0.208		
			(0.200)	(0.347)		
Scotland					−0.766*	−1.897*
					(0.319)	(0.929)
Wales					−0.407	0.399
					(0.467)	(0.481)
Log-likelihood	−1931.1		−1930.8		−1921.7	
N	6961		6961		6961	

Notes: Maximum marginal likelihood estimates with standard errors in parentheses. p-value symbols: $***$: $p < .001$, $**$: $p < .01$, $*$: $p < .05$.

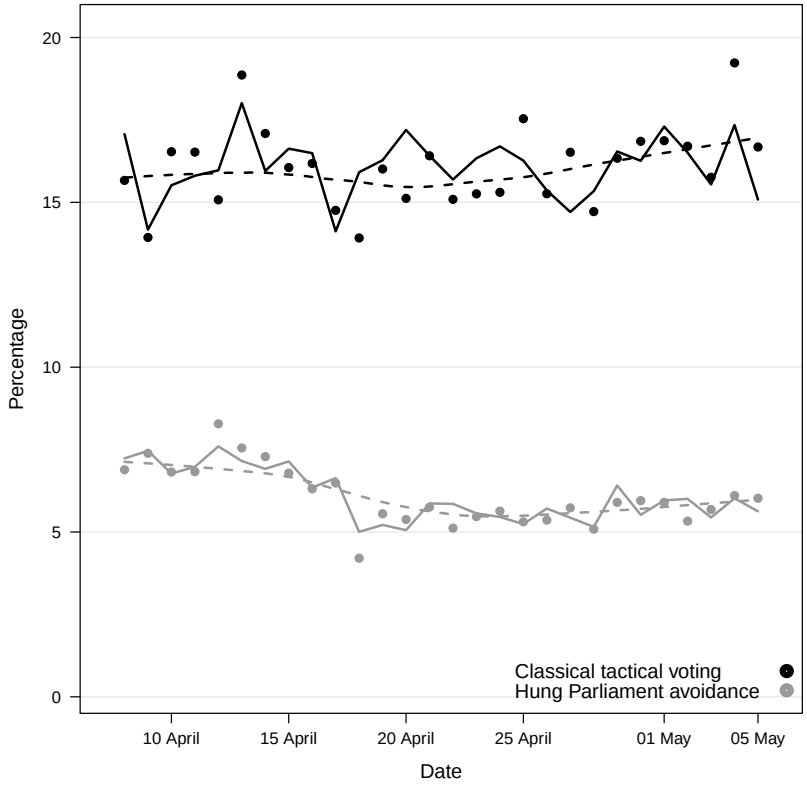
who prefer a coalition government tend to vote tactically in favour of the Liberal Democrats when the opportunity to do so exists, but it may also be just a statistical fluke: The standard error of this coefficient is high relative to the estimate, which achieves only a 5 percent level of significance. In a model with many coefficients it is almost inevitable that one of them attains such a significance level out of chance.

Risk preferences are often posited to be relevant for tactical voting. Risk averse citizens may be less likely to accept the risk that they indirectly support a party or candidate they do not like by casting a vote for a hopeless candidate. For this reason we add risk preferences to the model denoted by "(4)". Respondents' risk preferences are obtained from a question asked in the first wave of the British Election Campaign Internet Panel Survey about how willing they are to take risks. Four response categories where allowed from "very willing" to "very unwilling". For the purposes of the analysis we dichotomised this variable into to categories "willing" and "unwilling". The resulting dummy variable is denoted as "Risk aversion" in table 7. The estimates of the coefficients of this dummy variable in both equations is positive, suggesting that risk aversion may be an actual incentive for tactical voting. But the size of the coefficients is very small and they fail to attain statistical significance.

The last model with estimates of which are shown in table 7 – denoted by "(5)" – contains dummy variables for respondents form Scotland and Wales (but not the dummy variable for risk aversion). The coefficient of the Scotland-dummy attains statistical significance in both logit equations and has a negative sign. Obviously, Scottish voters are less likely to engage in tactical voting of any kind. However, such a tendency cannot be ascertained for voters from Wales.

Like with the latent class models discussed in the previous section, it is also possible to estimate the incidence of tactical voting if voting types are defined based on choice sets constructed from voters expectations. The estimate of the distribution of the voting types throughout the campaign is depicted in figure 6 which shows, in analogy to figure 4, the aggregated prior and posterior probabilities for each day in the campaign period. One difference to figure 4 becomes immediately obvious: When defined based on choice sets constructed from expectations, tactical voting appears much more common than when defined

Figure 6: The distribution of voting types throughout the campaign

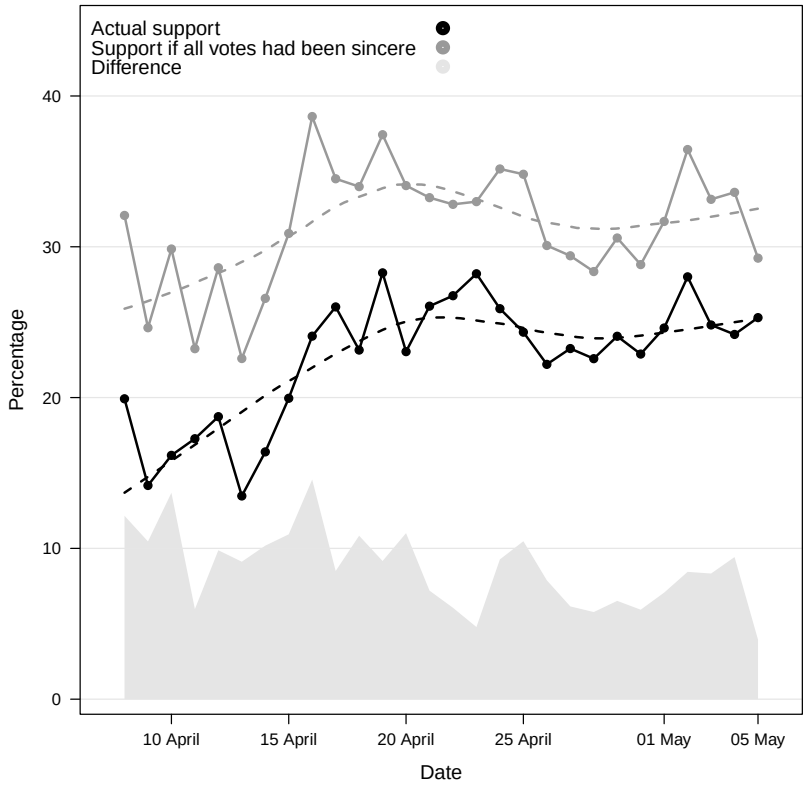


Notes: The diagram shows daily averages of posterior probabilities (dots), daily averages of prior probabilities (connected by solid lines), and a lowess curve that smooths the average posterior probabilities (dashed line, the span of the lowess smoother is 0.5).

based on choice sets constructed from "objective" information. Now more than 15 percent of the respondents intend to vote tactically throughout the campaign – with the same slight increase as found in figure 4. Further while in figure 4 hung parliament avoidance was not very common before the leadership debate of 15 April and a marginal phenomenon thereafter, this type of tactical voting now is estimated to have reach a proportion of more than 5 percent throughout the campaign, with only a very modest decline after 15 April.

The relative high level of tactical voting as defined on repsondents' expectations could lead one to presume that the losses to third parties, other than the Conservatives and Labour is also high. Yet as a comparison between figure 7 and figure 5 suggests, the shortfall in vote intentions incurred by expectation-based tactical voting appears smaller than if tactical is defined by objective information. While the difference between counter-factual sincere vote intentions and actual vote intentions amounts to roughly 10 percent throughout the campaign if tactical voting is supposed to rest on objective information, this difference shows a decline below the 10 percent mark if tactical voting is supposed to be based on expectations. Since actual vote intentions cannot differ between figure 5 and 7, this difference can be related only to differences in the counter-factual sincere vote percentages. Indeed, the counter-factual sincere vote-intentions in support for the Liberal Democrats reaches 40 percent just after 15 April in figure 5 and fluctuates thereafter around 35 percent, whereas corresponding percentages in 7 tend to be lower. Here, the sincere-vote support for the Liberal Democrats fails to reach the 40 percent mark and reaches just above 35 percent immediately after 15 April and shows a decline to a level between 30 and 35 percent thereafter. Obviously it matters for the diagnosis of tactical voting and its consequences for the support for parties, how tactical voting is conceptualised and operationally defined. For this reason the two versions of tactical voting are compared with respect to their specificity and their correspondence to respondents' own statements about whether they have voted tactically.

Figure 7: Projected vote share of the Liberal Democrats under exclusively sincere voting in comparison with actual vote intentions



8 Discussion: Comparing the two Approaches to Tactical Voting

As the previous two sections showed, it matters much for estimates about the distribution of tactical voting on what basis voting types – sincere voting, classical tactical voting, and tactical voting to avoid a hung parliament – are defined. This naturally leads to the question which of two different definitions used in the previous two sections is the "correct" one. This question does not have a straightforward answer, because there is no independent "gold standard" that allows to gauge the performance of the two reconstructions of tactical voting. Yet it does not mean that it is impossible to compare the quality these two reconstruction, if is willing to accept less-then-perfect but plausible criteria of convergent validity.

In each wave of the British Election Campaign Internet Panel Survey respondents were asked about their motives of the formation of their vote intention or of their recalled vote decision. The response categories used in the survey included "I really prefer another party but it stands no chance of winning in my constituency" and "I vote tactically". Respondents who chose one of these two categories were further asked in the survey which party they "really preferred". From these three variables and the stated vote intention we constructed, for the campaign wave, a categorical variable of stated voting reasons using the following steps. In the first step we recoded the stated reasons of voting into a variable with the three categories "Tactical vote (explicit)" (respondents that gave "I voted tactically" as a reason for the vote/vote intention), "Preferred party hopeless" (respondents that gave "I really prefer another party but it stands no chance of winning in my constituency") and "Other, non-tactical" (all other valid responses). Not all respondents that used one of the responses that indicate tactical voting gave a different "really preferred" party than the one they intended to vote for. We therefore corrected our stated voting reasons variable by recoding it to "Other, non-tactical" where the respondent's stated "really preferred" party coincided with his/her reported vote intention .

It would certainly be too strict a criterion of convergent validity of the reconstructed voting types based on our latent class model, if one required that the association between

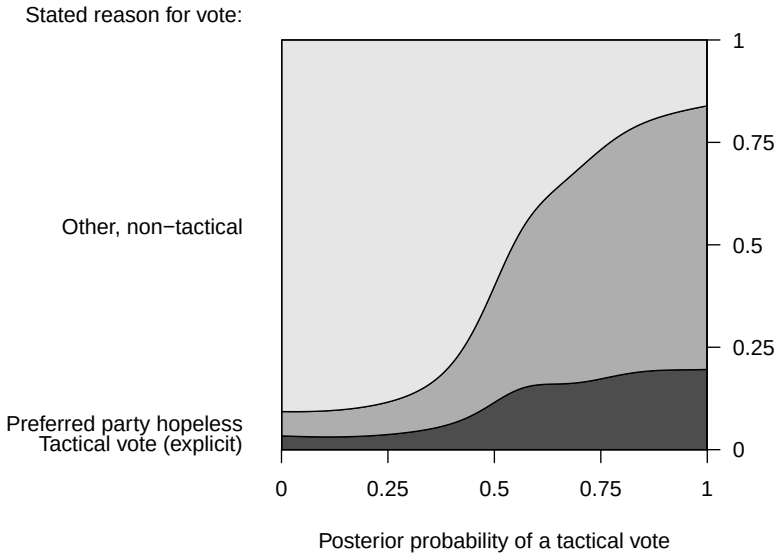
posterior probabilities of tactical voting and stated tactical voting be perfect, because the latter may well be subject to measurement error. But a minimal requirement would be that the probability of stated tactical voting increases with the posterior probability of tactical voting (of either type, because in the reasons given by the respondents no distinction is made between "classical" tactical voting and hung parliament avoidance). Whether and to what degree this requirement is fulfilled can be seen in figure 8.

Figure 8 shows two conditional density plots that summarise how the proportion of the three stated reasons of voting changes with the posterior probability of tactical voting. These summaries are non-parametric, comparable to a scatterplot smoother like LOESS, yet here the smoothing rests on a kernel density method (in both diagrams the kernel bandwidth was set to 0.1). If the association between the posterior probability of a tactical vote and a stated tactical vote were maximal, the sum of the smoothed proportions of the categories "Preferred party hopeless" and "Tactical voting (explicit)" would be equal to the posterior probability of a tactical vote, so that the line separating the area of "Other, non-tactical" from the two other areas would be the diagonal connecting the bottom-left corner (with coordinates $[0, 0]$) with the top-right corner (with coordinates $[1, 1]$). In neither of the two conditional density plots do we find such a diagonal, instead the line separating the area of "Other, non-tactical" forms an S-curve in each of the two diagrams, with the curve in the diagram with expectation-based tactical voting shifted to the right. Further, in both cases the S-curve is mostly located below the bottom-left–top-right diagonal. Obviously with both definitions of tactical voting, the posterior probability of tactical voting "under-predicts" stated tactical voting. Yet the amount of under-prediction by posterior probabilities of expectation-based tactical voting is worse than the under-prediction by posterior probabilities of objective information-based tactical voting.

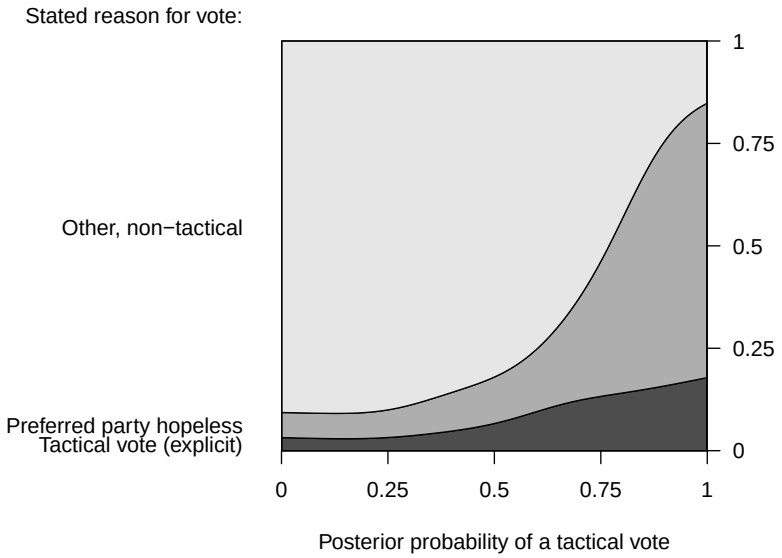
It would however be a mistake to conclude from this that expectation-based posterior probabilities lead to a too low prediction of the incidence of tactical voting if the distribution of stated tactical voting is used as a yardstick. Indeed, in the previous section we found that the expectation-based definition of tactical voting leads to a higher estimate of the proportion of tactical voting than the definition based on objective information. The apparent

Figure 8: Conditional density plots of stated voting reasons by posterior probability of tactical voting

(a) Objective tactical voting



(b) Expectation-based tactical voting



contradiction between lower predictions in figure 8 and higher predictions in figure 5 comes from the fact that figure 8 shows the distribution of stated tactical voting *conditional* on the posterior probabilities and thus does not take into account the distribution of the posterior probabilities in the data. A better glimpse of the bivariate distribution of reconstructed tactical voting and stated tactical voting is given by figure 9 where the marginal distribution of reconstructed tactical voting is accounted for.

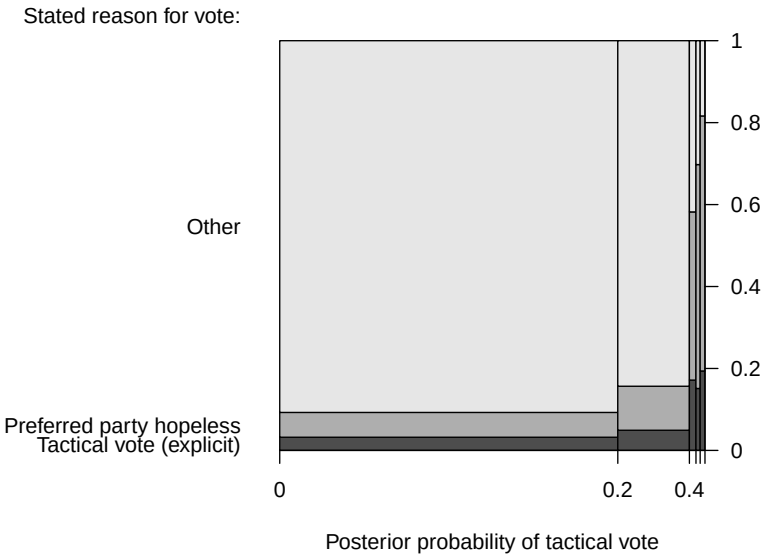
Figure 9 shows two spinograms of the bivariate distribution of reconstructed tactical voting and reasons given by voters for their voting decision. In contrast two figure 8, the units of the horizontal axis are not equally spaced, but instead the horizontal axis is separated into 5 blocks such that the width of each block corresponds to the relative proportion of respondents that fall into each block. For example, in the upper spinogram in 9 more than two third of the respondents have posterior probabilities of tactical voting smaller than or equal 0.2, while in the lower spinogram the proportion of with such a low posterior probability is a little more than half of all respondents. In both plots, the total area corresponding to the three stated reasons of voting has to be the same because it is the same variable. Now if expectation-based posterior probabilities of tactical voting tend to "under-predict" stated tactical voting more than objective information-based posterior probabilities this is possible only because expectation-based posterior probabilities tend to be higher than objective information-based posterior probabilities.

The above paragraphs show that tactical voting as reconstructed using the latent class model introduced earlier in this paper has a positive relation to stated tactical voting. But they also show that the shape of this relation depends on how voting types are defined. It appears that the match between reconstructed tactical voting and stated tactical voting is better if the voting types to be reconstructed are defined on the base of objective information rather than on the base of expectations. Since the different definitions also lead to different estimates of the overall level of tactical voting the question arises how these two variants of reconstructing tactical voting compare to stated tactical voting in terms of its overall level and its dynamics throughout the campaign. Such a comparison is enabled by figure 10.

Figure 10 shows the level of tactical voting for each day throughout the campaign, based

Figure 9: Spinograms of stated voting reasons by posterior probability of tactical voting

(a) Objective tactical voting



(b) Expectation-based tactical voting

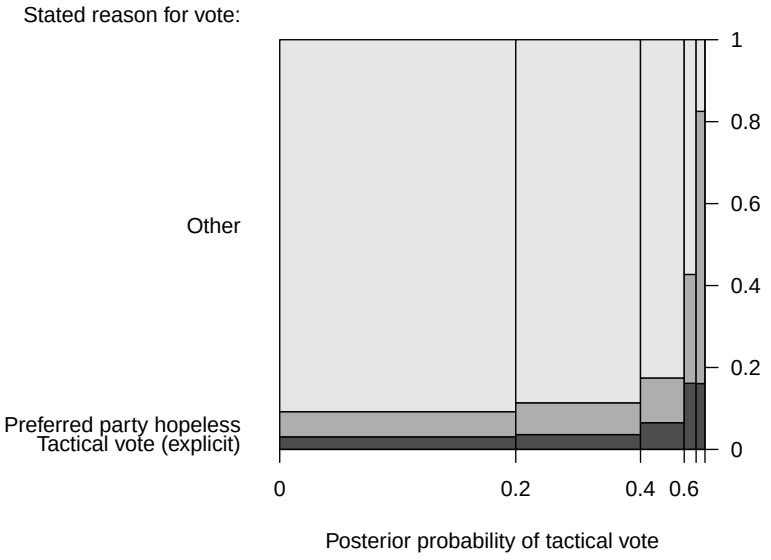
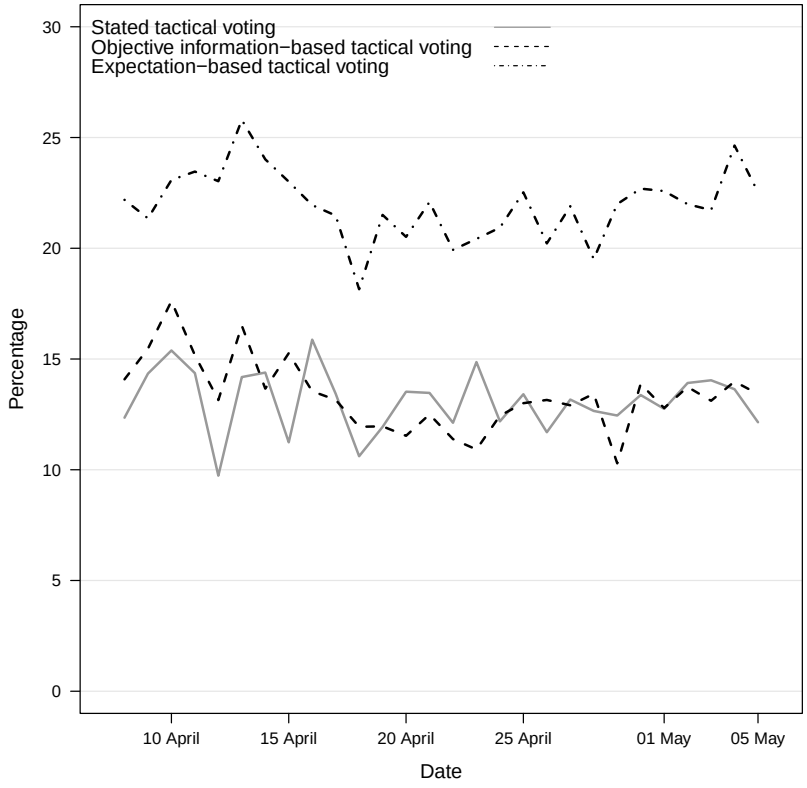


Figure 10: A comparison of the distribution of tactical voting throughout the campaign based on stated reasons of the vote and the two latent class approaches



Notes: The diagram shows daily averages of stated reasons of voting that are counted as tactical and daily averages posterior probabilities of tactical voting, based on the two variants of latent class analysis.

on stated stated voting reasons and based on two latent class approaches. The level of tactical voting as per stated reasons of the voting decision is simply computed as the proportion in each day of respondents that report to have voted tactically or because their preferred party did not have a chance to win, the level of tactical voting according to latent class analysis is computed as daily average of sum of the posterior probabilities of "classical" tactical voting and hung parliament avoidance. What becomes immediately clear from the figure is that if stated tactical voting is used as a yardstick for the "correct" level of tactical voting, the reconstruction of tactical voting using the expectation-based approach to latent class analysis crossly overestimates tactical voting. Another conclusion that can be drawn from the figure is that after 15 April stated tactical voting and tactical voting reconstructed to the objective information approach to latent class analysis, almost coincide in terms of level, if not in terms of dynamics. The difference in level observed before 15 April may be attributable to the more widespread hung parliament avoidance in this period of the campaign – which apparently was not understood by many voters as tactical voting in the common meaning of the expression.

If one uses stated reasons for vote decisions as a standard then the decision about which of the two approaches at reconstructing tactical voting using class analysis is preferable is quite clear: the approach based on objective information prevails. Such a choice seems convincing not only to the degree one accepts stated reasons as valid. Rather one could argue that the almost coincidence between stated tactical voting and the reconstruction based latent class analysis and objective information could also serve to cross-validate stated tactical voting as a measure of "real" tactical voting: Since both ways of measuring tactical voting lead to so similar results it seems that they are both more or less unbiased measures.

Looking back at the results of the third section of this paper, there is another reason why the objective information-based approach is the preferable one from the two latent class approaches: In table 2 we found that there is a feed-back between feelings towards a party and a party's leader to expectations about their chances to win the election overall. Expectations on this level were in turn used to construct hung parliament avoidance in the expectation-based latent class approach. As we saw in figure 6, this approach leads to much higher

predictions about the level of hung parliament avoidance than the approach based on objective information. With the feedback effect just mentioned one has a plausible explanation for a bias in the predictions based on the expectation-based approach.

9 Conclusion

The literature on strategic considerations in the formation of voting decisions knows about to different targets of these considerations: the outcome in the single-member districts in which voters are eligible to cast their vote and the outcome at the national level. While the first type is specific to first-past-the post systems – such as the British one – and perhaps to the district-level vote in dual ballot mixed electoral systems – such as the German one – the second type seems to be a typical phenomenon of electoral systems with proportional representation. The UK general election of 2010 may however be one of the rare instances were both types of considerations where present in the minds of British voters leading many of them to use both while deciding whether to engage in strategic voting – or "tactical voting" in British parlance. Perhaps for the first time in recent post-war history the possibility of a "hung parliament" – an outcome of the election to the House of Commons without a clear majority for any party – was a topic of the public debate during the electoral campaign.

In the absence of full information and perfect rationality in voters that exist as real human beings, the presence of strategic considerations is plausible only to the degree that the relevant information is available to the voters and that voters are able to form expectations about the outcomes of elections in reasonable ways based on this information. In our paper we show that respondents to the 2010 BES Campaign Internet Panel Survey show this kind of reasonable information processing. They reacted in distinctive ways to available outcome on the constituency level to form expectations about which party would win the seat and to available and incoming information to form expectations about which party would win the the election overall. We however also find that state expectations are contaminated at least to some degree by their feelings towards party leaders.

Available and incoming information is shown in this paper not only to be relevant for the

formation of expectations about electoral outcomes, but also for whether and what type of tactical voting citizens engage in. A novel approach based on latent class analysis enabled us to uncover tactical voting of two different types – (1) classical tactical voting to avoid wasting one's vote for a party or candidate hopeless at the constituency level and (2) tactical voting aimed at avoiding a hung parliament – without the need to recur to explicit statements of voters about the reasons for their vote. Such an approach was necessary because in British Election Study surveys voters are usually given the opportunity to state that their vote was tactical, but not whether their tactical considerations were targeted at the constituency or the national level.

We examine two approaches at reconstructing tactical voting using latent class analysis that differ with in how voters are assumed to sort out alternatives as "hopeless" or uncompetitive. The first approach rests on the assumption that if voters engage in classical tactical voting they adjudicate the viability of parties at the constituency level based on their vote share in the constituency in the previous general election of 2005 and restrict their choice set to the two parties with the highest vote share in the constituency while if voters engage in tactical voting to avoid a hung parliament they simply restrict their choice set to the two parties with the largest overall vote share in 2005 and 2010, namely to the Conservative Party and the Labour Party. The second approach rests on the assumption that voters use their expectations – as recorded in survey interviews – to restrict their choice set if they vote tactically. More specifically, the assumption is that if voters engage in classical tactical voting, they restrict their choice set to the two parties that rank first and second in terms of their perceived chances these parties to have to win the constituency seat, whereas if they vote tactically to avoid a hung parliament they restrict their choice set to the two parties they rank first and second in terms of their perceived chances to win the election overall. We find that it matters considerably for the estimated amount of tactical voting whether it is assumed to be based on available objective information or to be based on stated expectations. In the latter case tactical voting appears to be much more widespread than in the former case and this especially applies to the avoidance of a hung parliament.

The striking differences between the estimated levels of tactical voting based on the two

approaches lead to the question which of these two approaches is more plausible. We use the information in the survey on voters stated reasons for their vote intentions. This information allows us to obtain levels of tactical voting as stated by the respondents. As already mentioned, thus stated tactical voting does not differentiate between classical tactical voting and hung parliament avoidance. Therefore we collapse the two types of tactical voting as reconstructed by latent class analysis for comparison with stated tactical voting and find that tactical voting as estimated based on objective information matches stated tactical voting better than tactical voting estimated on expectations.

That reconstructing tactical voting with the help of respondents' stated expectations apparently leads to bias may be one the one hand less surprising if one takes into account the finding earlier in the paper that expectations are not fully exogenous with respect to respondents' feelings towards the parties and their leaders. On the other hand, the close match between stated tactical voting and tactical voting reconstructed with objective information may seem surprising if one presumes that stated expectations about parties' chances to win a constituency seat or the election overall give as immediate a picture about what voters were actually thinking as their stated reasons for their voting decisions. A resolution of this paradox may be that expectations as stated by the respondents are not a mediator between objective information and voting strategies but are co-determined by them. An implication of this is that voters may use available information in reasonable ways to vote tactically and also may be able to reflect that they do so, but are not fully able to reflect on the actual decision process that leads to their choices. Human beings find it notoriously difficult to calculate with probabilities (Tversky and Kahneman, 1974; Kahneman, 2011; Gigerenzer, 2008) thus may rather rely on heuristics or cues from others to come to their decisions (Sniderman et al., 1991; Lupia and McCubbins, 1998). That way they may still be able to make reasonable choices when they engage in tactical voting even if the expectations they formulate about the parties are somewhat distorted by their feelings about parties or their leaders.

An objection that could be raised against stated reasons for a voting decision is that they may be inaccurate because they may be ex-post rationalisations, as human beings often make decisions out of motives that are not transparent to them because humans are "strangers to

ourselves" (Wilson, 2002). Such considerations have led researches to look for alternative roots for the recovery of actual levels of tactical voting that rest on objective information. However, while scholars have devised ways to include e.g. constituency vote shares into models of vote choices – in the form of additional main and interaction effects – these improved voting models do not allow to derive explicit estimates of the amount of tactical voting in a survey sample. The latent class approach introduced in this paper however makes this possible. Yet a comparison of levels of tactical voting estimated this way from objective information with levels of stated tactical voting suggests that the stated reasons for voting are not such a bad indicator after all.[8]

[8]The argumentation of the last two paragraphs may appear circular. But such apparently circular argumentation is inevitable as long as their is no "gold standard" of uncovering or measuring tactical voting. If one prefers using objective information and latent class analysis as the more "fundamental" way of measuring tactical voting then one could use it to assess the validity of stated reasons as a measure of tactical voting. Conversely, if one puts more trust in voters statements about whether they avoided to vote for a hopeless candidate then tactical voting thus measured can be used to assess the validity of the results of latent class analysis. The circularity of the argumentation disappears once one commits to one of these two alternatives.

Appendix

A Technical Details of the Latent Class Model

The point of departure of our latent class analysis this model is that the type of voting used by voter i, whether sincere or some type of tactical voting (to avoid wasting the vote or to avoid supporting a Hung Parliament), is an unobserved categorical random variable U_i with values $h = 0, 1, \ldots, H$, the latent classes. Each type of voting, corresponding to one of the latent classes, defines a particular pattern of decision making, which can be expressed as a model of probabilities of choices *conditional* on U_i. If voter i votes sincerely, for which we set $U_i = 0$, he or she will consider the full set of alternatives available. If Y_{ij} is a dichotomous variable that represents whether voter i votes for party j (or rather, for the candidate of this party), we assume that conditional on $U_i = 0$ the probability of $Y_{ij} = 1$ (voter i votes for party or candidate j, denoted as $\pi_{ij|0}$) is

$$\pi_{ij|0} := \Pr(Y_{ij} = 1|U_i = 0) = \frac{\exp(\boldsymbol{x}'_{ij}\boldsymbol{\beta})}{\sum_{k\in\mathcal{S}_i} \exp(\boldsymbol{x}'_{ik}\boldsymbol{\beta})} \tag{8}$$

where $\mathcal{S}_i$ is the (full) choice set, the set of all alternatives available to the voter i, i.e. the set of all party candidates in the constituency where i votes, $\boldsymbol{x}_{ij}$ is a vector of observed attributes of the alternatives, such as the (perceived) issue distance between voter i and party j, the affective evaluation of party j and its leaders by voter i, etc., and $\boldsymbol{\beta}$ is a coefficient vector to be estimated from the data, that is, the observed choices y_{ij}.

If voter i engages in some type of tactical voting, that is $U_i = h > 0$, then we assume that he or she restricts his or her effective choice set to a proper subset $\mathcal{S}_{i|h} \subset \mathcal{S}_i$, so that the probability $\pi_{ij|h}$ that $Y_{ij} = 1$ conditional on $U_i = h$ is zero if $j \notin \mathcal{S}_{i|h}$ and nonzero if $j \in \mathcal{S}_{i|h}$, more specifically

$$\pi_{ij|h} := \Pr(Y_{ij} = 1|U_i = h) = \begin{cases} 0 & \text{if } j \notin \mathcal{S}_{i|h} \\ \dfrac{\exp(\boldsymbol{x}'_{ij}\boldsymbol{\beta})}{\sum_{k\in\mathcal{S}_{i|h}} \exp(\boldsymbol{x}'_{ik}\boldsymbol{\beta})} & \text{if } j \in \mathcal{S}_{i|h} \end{cases} \tag{9}$$

If one defines the "set indicator weights"

$$w_{ij|0} = 1 \quad \text{and} \quad w_{ij|h} = \begin{cases} 1 & \text{if } j \in \mathcal{S}_{i|h} \\ 0 & \text{if } j \notin \mathcal{S}_{i|h} \end{cases} \quad \text{for } h > 0 \tag{10}$$

then equations (8) and (9) can be combined into

$$\pi_{ij|h} := \Pr(Y_{ij} = 1 | U_i = h) = \frac{w_{ij|h} \exp(\boldsymbol{x}'_{ij}\boldsymbol{\beta})}{\sum_{k \in \mathcal{S}_i} w_{ij|h} \exp(\boldsymbol{x}'_{ik}\boldsymbol{\beta})} \tag{11}$$

for $h \geq 0$. More generally, each type of voting can be expressed by a particular pattern of weights $w_{ij|h}$ and one could generalize this even to non-binary weights.

So far we have discussed only the conditional distribution of the choices, but as was already indicated earlier, the random variable U_i is unobserved. Yet it is possible, given enough data, to estimate the probability distribution of U_i. This can be based on the following probability model: If ϕ_{hi} is the probability that $U_i = h$ (for $h \geq 0$) then $\sum_h \phi_{hi} = 1$ and we assume the following baseline-logit model

$$\phi_{hi} = \Pr(U_i = h) = \begin{cases} \dfrac{1}{1 + \sum_{g>0} \exp(\boldsymbol{z}'_i \boldsymbol{\gamma}_g)} & \text{if } h = 0 \\ \dfrac{\exp(\boldsymbol{z}'_i \boldsymbol{\gamma}_h)}{1 + \sum_{g>0} \exp(\boldsymbol{z}'_i \boldsymbol{\gamma}_g)} & \text{if } h > 0 \end{cases} \tag{12}$$

or

$$\ln \frac{\phi_{hi}}{\phi_{0i}} = \boldsymbol{z}'_i \boldsymbol{\gamma}_h \tag{13}$$

where $\boldsymbol{\gamma}_h$ is a coefficient vector specific for the probability that $U_i = h$ and $\boldsymbol{z}_i$ is a vector of voter-specific predictor variables, such which may include a voter's preference for a single-party government and aspects of the constituency in which the voter resides, such as the difference in vote share between the strongest party in the constituency and the second strongest.

To understand how the parameters of the model, the coefficient vectors $\boldsymbol{\beta}$, and $\boldsymbol{\gamma}_1, \ldots, \boldsymbol{\gamma}_H$ can be estimated, suppose that for voter i the choices y_{ij} for $j \in \mathcal{S}_i$ are observed (where all

y_{ij} are binary and only one of them is equal to one). The *conditional likelihood* of these data given $U_i = h$ is

$$\mathcal{L}_{i|h} = \prod_{w_{ij|h}>0} \pi_{ij|h}^{y_{ij}} \tag{14}$$

and the conditional log-likelihood is

$$\ell_{i|h} = \sum_{j\in\mathcal{S}_i} y_{ij} \ln \pi_{ij|h} = \sum_{j\in\mathcal{S}_i} y_{ij} \ln w_{ij|h} + \sum_{j\in\mathcal{S}_i} y_{ij} \boldsymbol{x}_{ij}'\boldsymbol{\beta} - \ln\left(\sum_{j\in\mathcal{S}_i} w_{ik} \exp(\boldsymbol{x}_{ij}'\boldsymbol{\beta})\right) \tag{15}$$

Note that if $y_{ij} = 1$ is observed while $w_{ij|h} = 0$, that is, if voter i makes a choice that is incompatible with the tactical voting type h, then $\mathcal{L}_{i|h} = 0$ and $\ell_{i|h} = -\infty$. The *marginal likelihood*, which depends only on observed data and the model parameters, is

$$\mathcal{L}_i = \sum_h \mathcal{L}_{i|h}\phi_{hi} = \sum_h \prod_{j\in\mathcal{S}_i} \pi_{ij|h}^{y_{ij}} \phi_{hi} \tag{16}$$

Note that if $y_{ij} = 1$ is observed while $w_{ij|h} = 0$ for all $h > 0$, that is the voter's choice is only compatible with sincere voting, then $\mathcal{L}_i = \mathcal{L}_{i|0}\phi_{i0}$.

Now the log marginal likelihood of the observed data on *all* respondent voters i in a sample survey takes the form

$$\ell = \sum_i \ln \mathcal{L}_i = \sum_i \ln\left(\sum_h \mathcal{L}_{i|h}\phi_{hi}\right) = \sum_i \ln\left(\sum_h \prod_{j\in\mathcal{S}_i} \pi_{ij|h}^{y_{ij}} \phi_{hi}\right) \tag{17}$$

which is quite unwieldy in comparison to a log likelihood we would obtain in the absence of latent classes, namely $\ell = \sum_i \sum_j y_{ij} \ln \pi_{ij}$. A convenient and numerically stable way to maximize the log marginal likelihood (17) is the expectation-maximization (EM) algorithm that involves repeating the following steps until convergence:

1. Starting values for the estimates $\boldsymbol{\beta}^{(1)}, \boldsymbol{\gamma}_1^{(1)}, \ldots, \boldsymbol{\gamma}_H^{(1)}$ are obtained and the current values of the conditional likelihoods $\mathcal{L}_{i|h}^{(1)}$, the latent class probabilities $\phi_{hi}^{(1)}$, and marginal likelihoods $\mathcal{L}_i^{(1)}$ for each of the voters i are computed. From this we obtain a current value of the log-likelihood function $\ell^{(1)}$ of the data on all voters $i = 1, \ldots, n$.

2. At the s-th iteration we compute for all individuals i current values of the posterior probabilities $\mathcal{P}_{h|i} = \Pr(U_i = h|Y_{i1} = y_{i1}, \ldots, Y_{im_i} = y_{im_i})$ of the values of U_i, given the observed choices and based on current values of the estimates $\boldsymbol{\beta}^{(s)}, \boldsymbol{\gamma}_1^{(s)}, \ldots, \boldsymbol{\gamma}_H^{(s)}$, which is given by

$$\mathcal{P}_{h|i}^{(s)} = \frac{\mathcal{L}_{i|h}^{(s)} \phi_{hi}^{(s)}}{\mathcal{L}_i^{(s)}} = \frac{\mathcal{L}_{i|h}^{(s)} \phi_{hi}^{(s)}}{\sum_g \mathcal{L}_{i|g}^{(s)} \phi_{ig}^{(s)}} \tag{18}$$

where the $\mathcal{L}_{i|h}^{(s)}$ is the contribution of the observed choices of individual i to the conditional likelihood (14) evaluated at $\boldsymbol{\beta} = \boldsymbol{\beta}^{(s)}$ and $\phi_{hi}^{(s)}$ is the probability ϕ_{hi} of $U_i = h$ evaluated at $\boldsymbol{\gamma}_h = \boldsymbol{\gamma}_h^{(s)}$.

3. To obtain updated values $\boldsymbol{\beta}^{(s+1)}$ we maximize the expected (conditional) log-likelihood

$$Q(\boldsymbol{\beta}|\boldsymbol{\beta}^{(s)}) := \sum_i \mathrm{E}(\ell_{i|h}|Y_{i1} = y_{i1}, \ldots, Y_{im_i} = y_{im_i}) = \sum_i \sum_h \mathcal{P}_{h|i}^{(s)} \ell_{i|h} \tag{19}$$

for $\boldsymbol{\beta}$ (whereby the posterior probabilities $\mathcal{P}_{h|i}^{(s)}$ are held fixed). Note that if $y_{ij} = 1$ while $w_{ij|h} = 0$, the product $\mathcal{P}_{h|i}^{(s)} \ell_{i|h}$ is by convention set to zero even though $\ell_{i|h} = -\infty$. That is, within this step we estimate the parameters of a conventional conditional logit model with augmented data: For each voter i we have $H + 1$ observations, each a choice from the set of alternatives with $w_{ij|h} > 0$, weighted by $\mathcal{P}_{h|i}^{(s)}$.

4. For the updated values $\boldsymbol{\gamma}_h^{(s+1)}$, note that the derivative of ℓ is, for posterior probabilities $\mathcal{P}_{h|i}$ held fixed,

$$\frac{\partial \ell}{\partial \boldsymbol{\gamma}_h} = \sum_i (\mathcal{P}_{h|i} - \phi_{hi}) \mathbf{z}_i. \tag{20}$$

That is, updated values $\boldsymbol{\gamma}_h^{(s+1)}$ are obtained by estimating the coefficients of a baseline multinomial logit model with the posterior probabilities $\mathcal{P}_{h|i}^{(s)}$ as responses.

5. With updated estimates $\boldsymbol{\beta}^{(s+1)}, \boldsymbol{\gamma}_1^{(s+1)}, \ldots, \boldsymbol{\gamma}_H^{(s+1)}$, we compute for each i the updated values of the conditional likelihoods $\mathcal{L}_{i|h}^{(s+1)}$, the latent class probabilities $\phi_{hi}^{(s+1)}$, and marginal likelihoods $\mathcal{L}_i^{(s+1)}$ for each of the voters i. From this obtain a current value of the log-likelihood function $\ell^{(s+1)}$ of the data on all voters $i = 1, \ldots, n$. If $|\ell^{(s+1)} - \ell^{(s)}| < \epsilon$ for a small number $\epsilon > 0$ the algorithm stops and sets $\hat{\boldsymbol{\beta}} = \boldsymbol{\beta}^{(s+1)}, \hat{\boldsymbol{\gamma}}_1 =$

$\boldsymbol{\gamma}_1^{(s+1)}, \ldots, \hat{\boldsymbol{\gamma}}_H = \boldsymbol{\gamma}_H^{(s+1)}$ as maximum likelihood estimates.

The algorithm is just a standard application of the EM principle well established in the literature. One motivation for using this algorithm is that the derivatives of ℓ and $Q(\boldsymbol{\beta}|\hat{\boldsymbol{\beta}})$ for $\boldsymbol{\beta}$ are identical at $\boldsymbol{\beta} = \hat{\boldsymbol{\beta}}$. A useful by-product of an converged EM algorithm is that we obtain for each voter i, a posterior probability $\mathcal{P}_{h|i}$ that he or she was engaged in voting of type h.

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