Evaluation of Survey Effects in Pre-election Polls

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Abstract

Pre-election polls can suffer from survey effects. For instance, individuals taking part in the poll may become more aware of the upcoming election so that they become more inclined to vote. Such effects cause biases in forecasted outcomes of elections. We propose a simple methodology that takes such survey effects explicitly into account when translating poll results into election outcomes. By collecting data both before and after the election, the survey effects can be estimated and used as correction factors in later polls. We illustrate our method by means of a field study with data collected before and after the 2007 regional elections (for 'Provincial States') in the Netherlands. Our study provides empirical evidence of significant positive survey effects with respect to voter participation, and this effect is the largest for left-wing voters. That is, surveys seem to motivate left-wing people who otherwise would not have participated in the elections. This means that both the voter turnout and the number of seats going to left-wing parties may be overestimated by pre-election polls that do not correct for survey effects.

Keywords

pre-election polls, survey effects, intention modification, data collection, turnout forecast, bias correction

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1 Introduction

Forecasting voting behavior in democratic elections is of substantial practical interest. Pre-election polls are popular sources of information in many countries, and in some cases several agencies are in competition by publishing the outcomes of political polls on a regular basis. The degree of accuracy of election forecasts varies substantially, both among agencies and between different elections. In The Netherlands, for example, the forecasts of 'Interview-NSS', 'TNS-Nipo', and 'Maurice de Hond' play an important role in the political discussions before elections. At the regional elections of March 2007, the left-wing parties gained 38.8% of the votes, which is well below the forecasts of all three agencies: 42.0% by Interview-NSS, 41.7% by TNS-Nipo, and 42.6% by Maurice de Hond. In our paper, we investigate some of the possible causes of such differences between forecasts and actual outcomes.

The fact that election forecasts often do not match well with actual observed outcomes may be caused by several factors. For example, political sentiments can change in the days that lie between the date of the survey and the date of the elections. This effect can be reduced by taking polls on a regular basis, for instance weekly, and by continuing the polls until shortly before the day of the elections. It may also be that the survey sample is not sufficiently representative or that the survey questions cause certain biases. Some people may wish not to respond, resulting in non-response bias, and others may answer incorrectly. Such response bias may be conscious or unconscious,

for instance, because the respondent commits to the interviewer. These effects can all be mitigated by a careful design of the survey questionnaire and of the way the survey is performed.

In this paper, we investigate another possible cause of forecast biases, that is, that interviewed people may change their voting behavior in response to the interview. This is called a self-generated validity effect in the psychological and marketing literature on survey effects, see, for instance, Feldman and Lynch (1988) and Chandon et al (2005). This means that the survey may affect the latent intentions and, in turn, the manifest behavior of the respondents. For instance, the interview can increase the awareness of the respondent for the upcoming election. Several studies indicate that voter participation may be overestimated due to survey effects, see, for example, Traugott and Katosh (1979), Greenwald et al (1987) and Granberg and Holmberg (1992). It is important to take such psychological effects into account, as they influence the outcomes of opinion polls. The very act of surveying causes automatically that the survey group is not representative, as the people in the survey are subjected to psychological effects that are not present in the rest of the population. This implies that the survey outcomes can not be extrapolated to the population in a straightforward way.

Basically, there are two possible solutions. The first is to try to construct questionnaires that have a minimal psychological impact on subsequent behav-

ior. We refer to Belli et al (1999) and Brian et al (2007) for contributions on survey question wording that reduce the bias in self-reported voting behavior. A second way, which we will adopt in this paper, is to estimate the survey effects and to use these as correction factors to adjust the outcomes in the survey.

The primary goal of this paper is to investigate the magnitude of self-generated validity effects in political opinion polls. This is analyzed by a field study concerning the March 2007 regional elections in The Netherlands, the elections of the so-called 'Provincial States'. The survey effects are measured by collecting data from two groups, a survey group and a control group. People in the survey group are interviewed twice, both before and after the elections. The first interview is face-to-face, and the second is done by telephone or e-mail. People in the control group are interviewed only after the elections, by means of a face-to-face interview, so that they are not influenced in their voting decision. The interview questionnaires ask for information on several control variables, including previous political choice, voting intentions, and socioeconomic and demographic background. This information is used to estimate survey effects, in particular, whether voter turnout increases and voter choice changes due to participating in the survey. The obtained correction factors can be used in future polls to get more reliable forecasts of actual election outcomes. This may be of interest, for example, for agencies involved in political polls as well as for political journalists and campaign managers.

The paper is organized as follows. Section 2 describes the data and provides details on the method of data collection. Section 3 discusses the employed models, consisting of a binary probit model to predict voter turnout and a multinomial logit model for party choice (left-wing, right-wing, or other, including the decision not to vote). Section 4 presents the results, including estimates of the survey effects on participation rates and on party choice. Section 5 concludes with a summary of our findings and with some further research topics.

2 Data

2.1 Design of field study

To investigate the potential effects of surveys on people's voting decisions, we performed a field study concerning regional elections in the Netherlands at March 7, 2007, to elect members of the so-called 'Provincial States'. Some days before the election, we performed our first survey. Respondents were asked to answer a list of questions on their political interests, their voting decisions at previous elections, their inclination to participate in the upcoming elections, and some personal questions on age, education, income, and work. In our analysis, we focus on modelling two voting decisions: whether or not to participate in the election, and whether to vote for a left-wing or a right-wing party. Full details of the questionnaire are given in Appendix A, where Questions 18 and 19 measure the two voting decisions. The respondents in the first survey were also asked to provide their telephone number or email

address, so that we could contact them after the election to ask them whether they had gone voting and, if so, which party they had voted for. We call this group, which is interviewed twice, the survey group. The second survey was performed on a fresh set of respondents briefly after the elections, using a similar questionnaire, see Appendix A for details. We call this group the control group.

The interviews in the survey and control groups were taken during various train trips. An attractive aspect of this set-up is that most people have little to do during their travel, so that many of them are willing to cooperate. We tried our best to draw reasonably comparable samples in the survey and control groups. As far as personal characteristics like gender, age, education, and income is concerned, both groups have roughly similar characteristics, see the lower panel in the table at the end of Appendix A for details. In total, 129 respondents answered all required questions, 62 in the survey group and 67 in the control group.

Because of the relatively small sample sizes, we decided to simplify the (open) answers to several questions on party choice by aggregating them into three categories: 'left-wing' (three parties), 'right-wing' (also three parties), and 'no vote'. Actually, the last category also contains a few very small parties that are not easily placed on the left-right political scale, but the non-voters form the vast majority in this category. As an example, we consider the ques-

tion regarding the actual vote at the March 2007 election. For this question, the third choice category consists of 72 people, 66 of whom did not vote and only 6 of whom voted for small parties. Further, 30 respondents voted for left-wing parties and 27 for right-wing parties.

2.2 Descriptive statistics

The questionnaire consists of 19 questions in the survey group and of 17 questions in the control group, see Appendix A. As we will discuss in Section 4, only a subset of nine variables will be used in our analysis. These variables are listed in the upper panel of the table at the end of Appendix A, to which we refer for details on the variable names, their meaning, and their relation to the survey questions.

Table 1 shows the sample mean of the variables, for the full data set as well as for the sub-samples within the survey and control groups. We mention some aspects of interest. The expressed intention to vote for the March 2007 election is 60% in the survey group, and in reality 58% made their vote in this group, as compared to only 40% in the control group. The two groups also differ in their participation in past elections in 2003, with values of 47% in the survey group and 27% in the control group. One reason for the lower participation in 2003 is that some of the younger respondents were not yet allowed to vote in 2003. The survey and control groups are roughly comparable in their average left-right position in the political spectrum and in the percentage of people

having a mortgage, although the survey group is a bit more left oriented than the control group. As compared to the target population, part-time workers are somewhat over-represented in the sample, especially in the survey sample.

The past and current voting behavior are displayed in more detail in Table 2. This shows that about 30% of the past non-voters do vote now, whereas about 15% of the past voters do not vote now. A more detailed analysis shows that the step from past-non-voter to current voter is made more easily in the survey group (36%) than in the control group (25%). This result is possibly due to survey effects. Of the 24 past non-voters who do vote now, 12 are in the survey group, with a left-right division of 9-3, and also 12 are in the control group (4-4, while 4 other votes are on small parties). Of the 39 past voters who vote also now, the left-right division in the survey group is 13-10 and in the control group 4-10.

Table 3 shows bivariate sample correlations between the variables, neglecting their discrete nature. For our later analysis, it is of particular importance to find factors that have an effect on the voting intention and on the right-left position in the political spectrum, especially in the survey group. The voting intention is most strongly related to the opinion on the importance of the election and to past activity at elections, as expected. The large correlation with active participation at the March 2007 election does also not come as a surprise. The position in the political spectrum is most strongly related to

past voting preferences, as expected. Another important factor is whether one has a part-time job or not. Part-timers position themselves, on average, more to the left as compared to fulltime workers or people who do not work.

3 Models

3.1 Voting participation model

The individual decision whether or not to participate in the elections (survey Question 18, see Appendix A) is modelled by means of a binary choice model. We assume that each individual has a latent intention to vote, denoted by LI, which differs across individuals but which is assumed to be constant for each individual over the considered time period. The actual decision whether to participate or not depends on LI as well as on other factors that are unobserved and that are represented by a random term ε. This random term varies across individuals and it may also vary over time for each individual. The resulting intention to participate is modelled as

$$B^* = \alpha + \beta LI + \varepsilon,$$

where α and β are unknown parameters with $\beta > 0$. In order to incorporate possible survey effects, we extend the approach developed by Chandon et al (2005) for regression models to the case of binary choice models, see also Heij and Franses (2006). Let the values of (α, β) be (α_1, β_1) in the control group and $(\alpha_1 + \alpha_2, \beta_1 + \beta_2)$ in the survey group, so that α_2 and β_2 measure the survey effect. Further, let S be a dummy variable, with value $S = 1$ in the

survey group and $S = 0$ in the control group. Then the voting intention model for the combined survey and control group can be expressed as

$$B^* = \alpha_1 + \beta_1 LI + \alpha_2 S + \beta_2 (LI \cdot S) + \varepsilon. \tag{1}$$

The actual participation decision is denoted by the binary variable B, with value $B = 1$ if the individual does vote and $B = 0$ if not. We use a binary choice model for this decision. That is, an individual does vote if and only if the intention is non-negative, so that $B = 1$ if and only if $B^* \geq 0$. More precisely, we employ the probit model that is based on the assumption that the random term ε has the standard normal distribution. Let Φ denote the corresponding cumulative distribution function, then the probability to vote is given by

$$P(B = 1) = \Phi(\alpha_1 + \beta_1 LI + \alpha_2 S + \beta_2 (LI \cdot S)). \tag{2}$$

To make this operational, we need to model the unobserved latent intention LI in terms of observed variables. For this purpose, we follow Chandon et al (2005) again, where the latent intention is measured in the survey group but not in the control group. This is precisely the situation relevant for our analysis. Respondents in the survey group were asked to specify their intention to vote at the upcoming elections (survey Question 9, see Appendix A, with answers on a seven-point scale ranging from 'certainly not' to 'yes, for sure'). However, this question was not posed in the control group, because these respondents were only interviewed after the elections had taken place. This is because, after the elections, respondents will tend to have a highly biased

recollection of their prior intentions. The measured intention in the survey group is denoted by MI. It may differ from the latent intention LI because of errors that are due to the measurement process, so that

$$MI = LI + \delta, \tag{3}$$

where δ denotes the measurement error. To obtain an estimate of LI for the control group, we follow Chandon et al (2005) again. The measured intention MI in the survey group is assumed to be related to a set of other variables that are also available in the control group. Let Z denote the vector of variables included to explain MI, then the linear model for MI is given by

$$MI = Z\gamma + \eta, \tag{4}$$

where γ is a set of parameters and η is an error term. Estimates of γ, denoted by $\widehat{\gamma}$, can be obtained by a regression using data in the survey group. In the control group, with known scores for the variables Z, the intention to participate is then estimated by $Z\widehat{\gamma}$.

Summarizing the above, the probability to vote is given by equation (2). The unobserved latent intention LI is replaced by MI in the survey group and by $Z\widehat{\gamma}$ in the control group, where $\widehat{\gamma}$ is obtained by regression in (4) for the data of the survey group. The parameters $(\alpha_1, \beta_1, \alpha_2, \beta_2)$ of the resulting probit model (2) are estimated by maximum likelihood. The survey effect on voter participation can then be computed as $P(B = 1|S = 1) - P(B = 1|S = 0)$, that is, the increase in the probability to vote that is due to the survey. For a

given level of intention LI, this effect is equal to

$$\Phi(\alpha_1 + \alpha_2 + (\beta_1 + \beta_2)LI) \; - \; \Phi(\alpha_1 + \beta_1 LI). \tag{5}$$

It is shown in Heij and Franses (2006) that this method provides consistent estimates only if the measurement errors δ in (3) are zero. Otherwise the method is inconsistent, that is, the estimates of the parameters $(\alpha_1, \beta_1, \alpha_2, \beta_2)$ remain biased even in very large samples. The reason for this is the following. By substituting (3) into (1) for the survey group, we obtain

$$B^* = \alpha_1 + \alpha_2 + (\beta_1 + \beta_2)MI + (\varepsilon - \beta_1\delta - \beta_2\delta S).$$

In this equation, the explanatory variable $MI = LI + \delta$ is correlated with the composite error $\varepsilon - \beta_1\delta - \beta_2\delta S$, because of the common error component δ in both terms. Stated technically, the explanatory variable is endogenous if δ is non-zero, and standard estimation procedures are no longer consistent. This can be solved in a rather straightforward way by using the method of Rivers and Vuong (1988), see also Wooldridge (2002). As is explained in Heij and Franses (2006), the solution consists of adding the residuals e of the regression in (4) to the probit model (2) for the survey group. More precisely, in the presence of measurement errors, consistent estimates of the parameters $(\alpha_1, \beta_1, \alpha_2, \beta_2)$ are obtained as follows. In the control group, estimate the probit model

$$P(B = 1) = \Phi(\alpha_1 + \beta_1 Z\widehat{\gamma}). \tag{6}$$

In the survey group, estimate the probit model

$$P(B = 1) = \Phi(\alpha_3 + \beta_3 MI + \theta e). \tag{7}$$

Then α_2 and β_2 are estimated by using $\alpha_2 = \alpha_3 - \alpha_1$ and $\beta_2 = \beta_3 - \beta_1$, after applying an appropriate scale transformation of the estimates of α_3 and β_3. We refer to Heij and Franses (2006) for further details. A test for the significance of the measurement errors is given by the t-test on the parameter θ in (7).

In our application in Section 4.1, we will see that the measurement errors are not significant at the 5% level (with a P-value of 0.08). For this reason, we will not pay any further attention to measurement errors in this paper, but the results after correction for measurement errors are available on request for readers interested in this matter. We mention that correction for measurement errors results in even somewhat larger survey effects than the ones reported in Section 4, but the overall picture remains very much unaffected.

We conclude by stating the required estimation steps.

(a) Estimate $\widehat{\gamma}$ by regression in (4)for the survey group, with residuals e.

(b) Estimate (7) by probit for the survey group.

(c) If θ is not significant, then estimate (2) by probit for the combined survey and control group, replacing LI by $Z\widehat{\gamma}$. If θ is significant, then estimate (6) by probit for the control group and re-scale the estimates of (7) in (b) to estimate (α_2, β_2).

3.2 Party choice model

As was discussed in Section 2.1, the party choice options are aggregated because of the relatively small number of observations and the large number of parties involved in the elections. We distinguish two types of vote: left-wing (Labor, Socialist, and Green Left parties) and right-wing (Christian Democrats, Liberals, and Christian Union). A third option is not to vote, or to vote for one of the smaller parties, see Section 2.1 for further details. Then each individual has to choose among these three options, and we wish to investigate the possible existence of survey effects on this decision. For this purpose, we extend the binary model of the previous section to this multinomial setting.

The decision variable is denoted by M, with $M = 0$ for 'no vote or vote for small party', $M = 1$ for 'vote on right-wing party', and $M = 2$ for 'vote on left-wing party'. The values 0, 1 and 2 are just labels and do not correspond to any ordering. In multinomial choice models, one option is chosen as benchmark and the intentions to choose for one of the other options is expressed in terms of a latent variable. Here we choose option 0 as benchmark, and the latent intention to choose for the other options is denoted by LI. This intention is measured to some extent in the survey group, as respondents are asked to position themselves on a seven-point scale from left to right in the political spectrum. The measured intention is denoted by MI. The question on the position in the political spectrum is also asked in the control group,

but the answers in this group may give a biased picture of their position before the elections. This is because the respondents in the control group were interviewed only after the elections, and it may well be that their choice at the elections has affected their subjective evaluation of the political position they had before the elections. Therefore, we choose to follow a similar procedure as in the previous section. The measured intention in the survey group is related to a set of variables Z by (4), where Z consists of variables that are also measured in the control group and that are not influenced by the decision made at the elections. Of course, the specific set of variables may differ here from the one chosen in the binary participation model of the previous section. The estimated intention in the survey and control groups is then given by $Z\widehat{\gamma}$, where $\widehat{\gamma}$ is obtained by regression in (4) for the survey group.

With this set-up, we can in principle follow a similar estimation procedure as before, now with the multinomial probit model instead of the binary probit model. However, a numerically much simpler method is to use the multinomial logit model, see, for instance, Franses and Paap (2001). In terms of the latent intention LI, the choice probabilities for each of the three options are modelled by the following equations, where 'exp(x)' denotes the exponential function e^x.

$$\begin{aligned} P(M=0) &= \frac{1}{1+\exp(\alpha_1+\beta_1 LI)+\exp(\alpha_2+\beta_2 LI)} \\ P(M=1) &= \frac{\exp(\alpha_1+\beta_1 LI)}{1+\exp(\alpha_1+\beta_1 LI)+\exp(\alpha_2+\beta_2 LI)} \\ P(M=2) &= \frac{\exp(\alpha_2+\beta_2 LI)}{1+\exp(\alpha_1+\beta_1 LI)+\exp(\alpha_2+\beta_2 LI)} \end{aligned} \tag{8}$$

To incorporate possible survey effects, the parameters α_1, β_1, α_2 and β_2 can be chosen to be different for both groups. The multinomial logit model for the combined survey and control groups then has eight parameters, which can be estimated by maximum likelihood after replacing the unobserved variable LI by the fitted intentions $Z\widehat{\gamma}$. The survey effects can be evaluated by comparing the choice probabilities $P(M = j)$ (with $j = 0, 1, 2$) for the survey and control groups, for given intention level LI.

We conclude by listing the required estimation steps.

(a) Estimate $\widehat{\gamma}$ by regression in (4) for the survey group.

(b) Estimate the parameters of the multinomial logit model (8), replacing LI by $Z\widehat{\gamma}$ and using different sets of parameters for the survey and control groups.

4 Results

4.1 Voting participation

We estimate the binary decision whether or not to vote by means of the three-step methodology described at the end of Section 3.1. First we specify the regression equation (4) for the survey group, which relates the expressed voting intentions to a set of explanatory variables. The available data information consists of the answers of 62 respondents on a set of 17 questions, see Appendix A. The voting intention MI is measured by Question 9, asking whether the respondent intends to vote at the upcoming elections. The corresponding vari-

able is denoted by 'VOTE_INTENTION', with seven possible scores ranging from 1/7 (for the answer 'certainly not') to 7/7 = 1 (for 'yes, for sure'). As was discussed in Section 2.2, this intention is most strongly related to the opinion on the importance of the elections (Question 3, 'VOTE_IMPORTANT') and to the past activity at elections (Questions 6 and 7, 'PAST_VOTE'), see Table 3. These two variables are therefore chosen as explanatory variables. We tested for the additional explanatory power of further variables by following the stepwise forward selection method. That is, first we search for the most significant variable (as measured by the t-value), and we continue until no additional variables are significant anymore. It turned out that the mortgage variable (Question 15, 'MORTGAGE') is the most significant extra variable and that no other variables add significantly anymore (at the 5% significance level). The resulting regression relation (4) is given by

$$\text{V\_INT} = -0.072 + 0.140 \times \text{V\_IMP} + 0.306 \times \text{PAST\_V} - 0.142 \times \text{MOR} + e, \quad (9)$$

where e denotes the residual term of this equation. We used abbreviations for the variable names, and we refer to Table 4 for further details. As expected, the opinion on the importance of the elections and the past voting activity both have a positive effect on the voting intention. People with a mortgage for their own house are relatively less inclined to vote. This can be due to the fact that the elections are regional, whereas the decisions on tax policies for own houses are decided at the national level and on the city level.

The second step is to estimate the probit model (7) for the survey group.

The explained variable is the actual decision whether to vote or not, as measured by Question 18. This variable is denoted by 'VOTE_ACTUAL', with value 1 if the respondent did vote and 0 if not. The explanatory variable is the vote intention. As is explained in Section 3.1, the residuals e of (4) are added as an additional regressor to account for possible measurement errors in the intention variable. The estimated probit equation (7) is given by

$$P(\text{V\_ACT} = 1) = \Phi\Big(-1.612 + 3.517 \times \text{V\_INT} - 1.817 \times e\Big). \tag{10}$$

The coefficient of e has standard error 1.045, giving a P-value of 0.082. This means that the measurement errors are not significant (at the 5% level), so that the model can be estimated without taking this issue into account. This leads us to the third and final step of the estimation methodology described at the end of Section 3.1. That is, the probit model (2) is estimated for the combined survey and control group, replacing LI by the fitted values of (9). These fitted measured intentions are denoted by 'FMI'. The value of FMI for each respondent is computed by the formula on the right-hand-side of (9), by substituting the scores of the respondent on the variables V_IMP, PAST_V, and MOR. The resulting estimated probit model is as follows, where S is the survey dummy variable with value 1 for respondents in the survey group and value 0 for respondents in the control group.

$$P(\text{V\_ACT} = 1) = \Phi\Big(-1.842 + 3.175 \times \text{FMI} + 0.193 \times S + 0.026 \times (\text{FMI} \cdot S)\Big). \tag{11}$$

As expected, the probability to vote is larger for respondents with a larger

intention to vote. The survey effects are positive, as the constant term (-1.842 + 0.193 = -1.649) and the slope coefficient (3.175 + 0.026 = 3.201) in the survey group are both larger than in the control group. Such effects are in line with findings in a previous study of Dutch elections by Voogt (2004). Note, however, that the survey effects are not significant, see Table 5 for further details. This finding is probably due to the relatively small sample sizes, with 62 respondents in the survey group (36 of whom vote) and 67 respondents in the control group (27 of whom vote).

For a given intention level FMI, the probability to vote can be computed from (11), both for the survey group and for the control group. The voting intention is measured on a seven-point scale running from 1/7 to 7/7=1, and Table 6 shows the estimated voting probabilities for the two groups as well as the corresponding survey effects. The survey effects are positive for all intention levels. The effects are the largest (about 6-8%) for people with median intention levels (3/7 - 6/7) and the smallest (about 2-4%) at extreme intention levels (1/7, 2/7, and 7/7). This is as expected, as people with strong (positive or negative) intentions to vote will be affected less by the survey than people who are very much in doubt whether they will vote or not.

4.2 Party choice

In Section 3.2, we described a two-step methodology to model the multinomial decision whether not to vote (option 0), to vote for a right-wing party (option

1), or to vote for a left-wing party (option 2). The first step consists of a regression in (4) for the survey group. Here the explained variable MI is the intention to vote for a left-wing or right-wing party, and Z consists of a set of variables driving this intention. The intention MI is measured by Question 8, asking the respondent to indicate his or her position in the political spectrum. The corresponding variable is denoted by 'RL_POSITION', with seven possible scores ranging from 1 (far left) to 7 (far right). As was discussed in Section 2.2, this self-positioning variable is most strongly related to the past voting behavior (Questions 6 and 7, 'PAST_LEFT' and 'PAST_RIGHT'). As in the previous section, additional explanatory variables are chosen by stepwise forward selection. This results in a single added variable, indicating whether the respondent has a part-time job (between 12 and 34 hours per week) or not (fulltime job, no job, or a job for less than 12 hours a week). The score on this variable is obtained from Question 12 and is denoted by JOBPART, with value 1 if the respondent has a part-time job and 0 otherwise. The resulting regression relation (4) is given by

$$\text{RL\_POS} = 3.705 + 1.650 \times \text{PAST\_R} - 1.166 \times \text{PAST\_L} - 0.655 \times \text{JOBPART}. \tag{12}$$

We used abbreviations for some of the variable names, and we refer to Table 7 for further details. The coefficients of the two variables related to past voting behavior have the expected signs, as lower scores on RL_POS correspond to political positions further to the left. Further, respondents having a part-time job take, on average, political positions that are relatively more to the left.

The second step is to estimate the multinomial logit model (8), replacing LI by the fitted values FMI of (4) and using different sets of parameters for the survey and control groups. For each respondent, the fitted political position FMI is computed by the formula on the right-hand-side of (12), by substituting the scores on the variables PAST_R, PAST_L, and JOBPART. This gives the following multinomial models for the survey and control groups:

$$\begin{aligned} P(M=0) &= \frac{1}{1+e^R+e^L}, \\ P(M=1) &= \frac{e^R}{1+e^R+e^L}, \quad P(M=2) = \frac{e^L}{1+e^R+e^L}, \end{aligned} \tag{13}$$

where R and L are given by the equations

$$\begin{aligned} \text{survey} &: \quad R = -7.547 + 1.647 \times \text{FMI}, \quad L = 6.301 - 2.043 \times \text{FMI}, \\ \text{control} &: \quad R = -12.865 + 3.043 \times \text{FMI}, \quad L = 6.669 - 2.658 \times \text{FMI}. \end{aligned}$$

Seven out of the eight coefficients are significant at the 5% level, and we refer to Table 8 for further details. The probability of a right-wing vote ($M = 1$) increases for larger values of R, and the probability of a left-wing vote ($M = 2$) increases for larger values of L. As larger values of FMI correspond to a position more to the right, the positive sign of FMI in the equations for R and the negative sign of FMI in the equations for L are as expected.

To evaluate the magnitude of survey effects on party choice, we compare the probabilities of each voting option for the survey and control groups. First of all, we test for the significance of the differences between the four coeffi-

cients in the survey group and the four corresponding coefficients of the control group. These differences are not significant at the 5% significance level (the Likelihood Ratio test for the four coefficient restrictions has a P-value of 0.l2). This lack of significance is again due to the relatively small sample sizes in our study.

Table 9 compares the choice probabilities for the seven possible values of the right-left position in the political spectrum, ranging from 1 (far left) to 7 (far right). As expected, the vote preference (left or right) is strongly related to the position in the political spectrum. The survey effects are the strongest (32 percent points) for the probability that a moderately left-wing oriented person (political score 3) will vote on a left-wing party instead of deciding not to vote. The survey also affects people who take a moderately right-wing position (political score 5), as their probability to choose not to vote increases considerably (by 25 percent points). That is, the survey seems to motivate left-wing people who otherwise would not have participated in the elections. The effect is opposite for right-wing people, as they tend to be discouraged by the survey to participate. Further, the effects are strongest for people with a moderate political position, and the effects are small at both ends of the political spectrum.

It is of evident interest to use these results to get an indication of the overall bias that may be expected from surveys based on a random sample.

Table 10 summarizes the survey effects for the six types of people that can be distinguished with regard to the three explanatory variables in our political orientation model (12). The three variables in this model are all binary, giving a total of eight combinations. However, two of these combinations are impossible, as a past left-wing vote excludes a past right-wing vote and vice versa. For each of the six types of people, the political orientation FMI can be computed from equation (12). The survey effects can then be computed from equation (13). Finally, the overall bias can be estimated by taking the weighted average of the survey effects, with weights equal to the proportion of voters in each of the six categories. The resulting average survey effects are shown in the bottom row of Table 10. Here we used the six proportions that apply for our combined survey and control samples. The results are as follows. The probability not to vote decreases by 14%, from 61% to 47%. The probability to vote for a left-wing party increases by 17%, from 16% to 33%. Finally, the probability to vote for a right-wing party decreases by 3%, from 23% to 20%.

Summarizing, we find evidence for the potential danger that pre-election opinion polls over-estimate the percentage of votes for left-wing parties if the polls are not corrected for survey effects. Our analysis indicates that this kind of survey bias may be substantial. This provides a possible explanation for recent experiences of polling agencies that consistently over-estimated the share of left-wing parties.

4.3 Limitations and discussion

The results presented above should be interpreted with some caution. Our results are based on the relatively small sample of 129 people who participated in this study. In order to extrapolate this to the Dutch population, a crucial question is whether our sample is sufficiently representative for this population, or even better, for the samples that are used by agencies involved in producing political polls.

The survey effects could not be estimated with great precision because of the small sample size. Further, the proportions of the six types of people in our survey do not correspond very well with the actual proportions in the Dutch society. This is because the data were collected during train trips. Train travellers are not fully representative of society, and furthermore it was not possible to interview people during peak hours as trains tend to be overly crowded at that time. This has caused some over-representation of part-time workers, as their share in the sample is 37% as compared to about 20% in the target population of people who are allowed to vote. Another obstacle in the survey group was that some people were not willing to provide us with their phone number or email address, which may cause a selective non-response bias in this group.

We conjecture that the (positive) survey effect on the probability to vote for a left-wing party is over-estimated, whereas the (negative) effect to vote

on a right-wing party is estimated imprecisely, with the possibility that this effect can actually be positive. Our finding that especially left-wing people can be motivated to participate in voting by being subjected to a survey is in line with previous findings. For instance, weather conditions on the election day seem to have a stronger impact on left-wing people than on right-wing people. In general, right-wing people tend to be more determined than left-wing people to participate in elections, so that positive and negative stimuli have a stronger effect on left-wing people. One of the possible explanations is a different age distribution for both wings, as right-wing people are on average somewhat older and many of them have known times when voting was still obligatory.

5 Conclusion

The outcomes of pre-election polls may be biased for several reasons, an important one being that the survey itself may change the behavior of surveyed people. We applied discrete choice models to evaluate the magnitude of survey effects on voting behavior. The data are obtained for two groups: a survey group that is interviewed both before and after the elections, and a control group that is surveyed only after the elections. Respondents in the latter group can not be influenced in their voting behavior anymore, whereas respondents in the survey group can be affected by the pre-election survey. By comparing the voting behavior in both groups, we obtain estimates of the involved survey effects.

As concerns the voter turnout, the empirical results indicate positive survey effects. This means that surveyed people are, on average, more likely to go voting than non-surveyed people. To prevent this upward bias, voter turnout predictions based on pre-election polls must be corrected downwards. The required correction in our application ranges from about eight percent points for people with moderate prior inclination to vote to about two percent points for people with a very low inclination to vote. Further, as concerns party choice, left-wing voters are more strongly influenced by the survey than right-wing voters are. That is, the probability that left-wing oriented people go voting is increased considerably by being exposed to the pre-election survey, whereas this effect is much smaller for right-wing oriented people. As a consequence, correction for survey effects is also needed to prevent overestimation of the share of votes for left-wing parties. This may provide a possible explanation for recently observed biases in opinion polls in The Netherlands, where the election forecasts of all three major agencies overestimated the share of left-wing parties by three to four percent points.

An evident limitation of our study is that the results are based on relatively small samples. The survey sample contains 62 respondents, 36 of whom went voting, and the control sample consists of 67 people, 27 of whom went voting. The above mentioned effects on voter turnout and party choice are found to be quite consistent all over the sample, but the effects are not highly

significant. A field study of a larger scale could shed more light on the precise magnitude of the involved survey effects, and it would also give the opportunity to disaggregate the party choice beyond the currently employed rough left-right division.

In order to apply the required corrections for survey effects in future forecasts, more experience should first be gained by comparing the behavior of surveyed and non-surveyed people by means of the methodology proposed in this paper. This will provide more reliable estimates of the required correction factors, which can then be applied to correct opinion poll responses for survey effects to get more accurate forecasts of the actual election outcomes.

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A Questionnaire and List of Variables

In the survey group, the following 17 questions were posed before the regional elections took place (the answer options are in parentheses).

Q_1 Are you interested in politics and political decision making? (7-point scale, from 1 = not at all to 7 = very much)

Q_2 Please express your opinion on the following statement: 'It is everyone's duty to vote'. (7-point scale, from 1 = strongly disagree to 7 = fully agree)

Q_3 What is your opinion, is voting for the Provincial States important? (7-point scale, 1 = not at all to 7 = very much)

Q_4 Did you vote at the last national elections in 2006? (yes, no and was not allowed to vote, no but was allowed to vote)

Q_5 For which party did you vote at the last national elections in 2006? (open answer)

Q_6 Did you vote at the previous regional elections in 2003? (yes, no and was not allowed to vote, no but was allowed to vote)

Q_7 For which party did you vote at the previous regional elections in 2003? (open answer)

Q_8 If you had to position yourself in the political spectrum, where would that be? (7-point scale, from 1 = left to 7 = right)

Q_9 Do you intend to vote at the upcoming regional elections? (7-point scale, from 1 = certainly not to 7 = yes, for sure)

Q_{10} Which party are you likely going to vote for at the upcoming regional

elections? (multiple choice, including the eight major parties as well as the options 'I do prefer not to tell', ' I do not know yet' and 'I will certainly not go voting')

Q_{11} Please express the importance that you assign to each of the following themes: Education, Economics and Finance, Environment, Traffic and Transport, Security, Housing, Health and Sport (7-point scale for each theme, from 1 = not at all to 7 = very much)

Q_{12} Please indicate whether you have a job. (yes fulltime, yes part-time, no)

Q_{13} Please indicate the net income per month of your household. (6 options, from below 400 euro to above 4000 euro)

Q_{14} Please state the highest education level that you completed. (4 options, from below middle education to university degree)

Q_{15} Do you have a mortgage? (yes, no)

Q_{16} Please fill in your age. (open answer)

Q_{17} Please fill in your gender. (male, female)

In the survey group, the following two questions were posed after the regional elections had taken place.

Q_{18} Did you go voting at the regional elections of 2007? (yes, no)

Q_{19} For which party did you vote for at the regional elections of 2007? (multiple choice, including the eight major parties as well as the option 'I prefer not to tell')

In the control group, questions Q_1 - Q_8 and Q_{11} - Q_{19} were posed after the regional elections had taken place.

For each variable that is used in the paper, the list below shows the variable name, the meaning of the variable, the question from which the scores on the variable are derived, and some further information. The lower part shows some variables that are not used in the analysis but that provide background information on the sample.

Name	Meaning	Q	Information
JOBPART	part-time job	Q_{12}	12 to 34 hours per week
MORTGAGE	mortgage own house	Q_{15}	
PAST_LEFT	past left-wing	$Q_{6,7}$	Green Left, Labor, Socialist
PAST_RIGHT	past right-wing	$Q_{6,7}$	Chr.Democrats, Chr.Union, Liberal
PAST_VOTE	active previous	$Q_{6,7}$	left-wing or right-wing vote
RL_POSITION	right-left	Q_8	
VOTE_ACTUAL	active current	$Q_{18,19}$	left-wing or right-wing vote
VOTE_IMPORTANT	elections important	Q_3	
VOTE_INTENTION	voting intention	Q_9	
	Income	Q_{13}	av. 1800 euro (survey and control)
	Education	Q_{14}	higher: 55% (survey), 40% (control)
	Age	Q_{16}	av. 36 (survey), 33 (control)
	Gender	Q_{17}	male: 57% (survey), 48% (control)

Table 1: Sample mean of variables used in the analysis

Note: All variables are binary (0 or 1), except VOTE_IMPORTANT and RL_POSITION that take values from 1 to 7

GROUP	SIZE	VOTE_INTENTION	VOTE_IMPORTANT	PAST_VOTE	VOTE_ACTUAL	RL_POSITION	PAST_RIGHT	PAST_LEFT	MORTGAGE	JOBPART
All	129	0.60	3.95	0.36	0.49	3.84	0.16	0.14	0.37	0.37
Survey	62	0.60	4.19	0.47	0.58	3.55	0.21	0.18	0.42	0.45
Control	67	NA	3.72	0.27	0.40	4.12	0.12	0.10	0.33	0.30
Difference			0.48	0.20	0.18	-0.57	0.09	0.07	0.09	0.15

Table 2: Cross tables for past and current voting behavior

Note: 1 = yes, 0 = no

All	PAST_VOTE	PAST_VOTE	
VOTE_ACTUAL	0	1	Total
0	58	8	66
1	24	39	63
Total	82	47	129

Current voters	PAST_VOTE	PAST_VOTE	
NOW_VOTE	0	1	Total
Right	7	20	27
Left	13	17	30
Other	4	2	6
Total	24	39	63

Table 3: Sample correlations of variables used in the analysis

Combined sample (n = 129, except for VOTE_INTENTION with n = 62)

	VOTE_INTENTION	VOTE_IMPORTANT	PAST_VOTE	VOTE_ACTUAL	RL_POSITION	PAST_RIGHT	PAST_LEFT	MORTGAGE
VOTE_IMPORT	0.71							
PAST_VOTE	0.59	0.46						
VOTE_ACTUAI	0.62	0.55	0.52					
RL_POSITION	-0.15	-0.12	-0.03	-0.07				
PAST_RIGHT	0.14	0.24	0.58	0.33	0.39			
PAST_LEFT	0.43	0.34	0.53	0.23	-0.38	-0.18		
MORTGAGE	0.01	0.09	0.22	0.08	0.06	0.14	0.11	
JOBPART	0.11	-0.05	-0.08	0.05	-0.37	-0.17	0.15	-0.19

Survey group (n = 62)

	VOTE_INTENTION	VOTE_IMPORTANT	PAST_VOTE	VOTE_ACTUAL	RL_POSITION	PAST_RIGHT	PAST_LEFT	MORTGAGE
VOTE_IMPORT	0.71							
PAST_VOTE	0.59	0.42						
VOTE_ACTUAI	0.62	0.54	0.47					
RL_POSITION	-0.15	-0.14	0.09	-0.11				
PAST_RIGHT	0.14	0.04	0.55	0.20	0.57			
PAST_LEFT	0.43	0.45	0.50	0.31	-0.44	-0.24		
MORTGAGE	0.01	0.16	0.25	0.06	-0.05	0.04	0.20	
JOBPART	0.11	0.01	-0.14	0.11	-0.32	-0.15	0.09	-0.05

Table 4: Regression relating voting intention to personal characteristics

Note: Explanatory variables are selected step-wise by forward selection, until no additional variables are significant (at the 5% level). Data are restricted to the survey group, as the voting intention is not measured in the control group.

Dependent Variable: VOTE_INTENTION Method: Least Squares Included observations: 62				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.072	0.089	-0.814	0.419
VOTE_IMPORTANT	0.140	0.021	6.494	0.000
PAST_VOTE	0.306	0.070	4.401	0.000
MORTGAGE	-0.142	0.065	-2.182	0.033
R-squared	0.631	F-statistic		33.086
Adjusted R-squared	0.612	Prob(F-statistic)		0.000
S.E. of regression	0.243			

Table 5: Effect of voting intention on actual voting decision

Note: FMI is the fitted voting intention, obtained from the relation in Table 4 when applied to the survey and control groups. DUM_SUR is a dummy variable with value 1 in the survey group and value 0 in the control group.

Dependent Variable: VOTE_ACTUAL Method: ML - Binary Probit Included observations: 129				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.842	0.407	-4.525	0.000
FMI	3.175	0.720	4.408	0.000
DUM_SUR	0.193	0.611	0.316	0.752
DUM_SUR*FMI	0.026	1.020	0.026	0.980
Mean dependent var	0.488	LR statistic (3 df)		57.775
S.E. of regression	0.399	Probability(LR stat)		0.000
Obs with Dep=0	66	Total obs		129
Obs with Dep=1	63			

Table 6: Voting probabilities for giving prior voting intentions

Note: Probabilities are obtained from Table 5

	Probability to vote		
Intention	survey	control	survey eff.
0.00	0.050	0.033	0.017
0.17	0.132	0.095	0.038
0.33	0.280	0.217	0.064
0.50	0.481	0.400	0.081
0.67	0.686	0.608	0.078
0.83	0.846	0.789	0.057
1.00	0.940	0.909	0.031

Table 7: Regression relating political orientation to personal characteristics

Note: Explanatory variables are selected step-wise by forward selection, until no additional variables are significant (at the 5% level).
Data are restricted to the survey group.

Dependent Variable: RL_POSITION Method: Least Squares Included observations: 62				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.705	0.220	16.840	0.000
PAST_RIGHT	1.650	0.351	4.703	0.000
PAST_LEFT	-1.166	0.371	-3.141	0.003
JOBPART	-0.655	0.280	-2.342	0.023
R-squared	0.474	F-statistic		17.456
Adjusted R-squared	0.447	Prob(F-statistic)		0.000
S.E. of regression	1.083			

Table 8: Multinomial logit model for voting choice

Note: Voting options are right wing (option 1), left wing (option 2), or not to vote or to choose another party (option 0, benchmark).
The political orientation is measured by the fitted value obtained from Table 7, when applied to the survey and control groups.
The coefficients "A" refer to constant terms, and "B" to the political orientation.
The further interpretation of the coefficients is discussed in the text.

LogL: MNL_RL_CH Method: Maximum Likelihood (Marquardt) Included observations: 129				
	Coefficient	Std. Error	z-Statistic	Prob.
AS(1)	-7.547	2.094	-3.604	0.000
BS(1)	1.647	0.470	3.505	0.001
AC(1)	-12.865	5.984	-2.150	0.032
BC(1)	3.043	1.663	1.830	0.067
AS(2)	6.301	2.737	2.302	0.021
BS(2)	-2.043	0.831	-2.460	0.014
AC(2)	6.669	2.354	2.833	0.005
BC(2)	-2.658	0.793	-3.352	0.001

Table 9: Estimated effect of survey on voting decision

	Probability to vote on a right-wing party			Probability to vote on a left-wing party			Probability not to vote or to vote other		
RL_position	survey	control	survey eff.	survey	control	survey eff.	survey	control	survey eff.
1	0.00	0.00	0.00	0.99	0.98	0.00	0.01	0.02	0.00
2	0.00	0.00	0.00	0.90	0.79	0.11	0.10	0.21	-0.11
3	0.03	0.02	0.01	0.52	0.21	0.32	0.44	0.77	-0.33
4	0.25	0.33	-0.08	0.10	0.01	0.09	0.65	0.66	-0.01
5	0.66	0.91	-0.25	0.01	0.00	0.01	0.33	0.09	0.25
6	0.91	1.00	-0.08	0.00	0.00	0.00	0.09	0.00	0.08
7	0.98	1.00	-0.02	0.00	0.00	0.00	0.02	0.00	0.02

Table 10: Estimated effect of survey on voting decision within sub-groups

Note: FMI_RL are the fitted political orientation values obtained from Table 7, for six possible values of X = (PAST_RIGHT, PAST_LEFT, JOBPART).
The size and proportion of each group is derived from the combined survey and control samples (n = 129).

					Probability to vote on a right-wing party			Probability to vote on a left-wing party			Probability not to vote or vote other		
Individual	X	FMI_RL	n	proportion	survey	control	survey eff.	survey	control	survey eff.	survey	control	survey eff.
Left part-timer	(0, 1, 1)	1.88	10	0.08	0.00	0.00	0.00	0.92	0.84	0.08	0.08	0.16	-0.08
Left	(0, 1, 0)	2.54	8	0.06	0.01	0.00	0.01	0.75	0.48	0.27	0.24	0.52	-0.28
Part-timer	(0, 0, 1)	3.05	34	0.26	0.04	0.02	0.02	0.50	0.19	0.31	0.46	0.79	-0.33
Non-voter or otl	(0, 0, 0)	3.71	56	0.43	0.16	0.16	-0.01	0.19	0.03	0.15	0.66	0.80	-0.14
Right part-timer	(1, 0, 1)	4.70	4	0.03	0.54	0.81	-0.27	0.02	0.00	0.02	0.44	0.19	0.25
Right	(1, 0, 0)	5.37	17	0.13	0.78	0.97	-0.19	0.00	0.00	0.00	0.22	0.03	0.19
Average					0.20	0.23	-0.03	0.33	0.16	0.17	0.47	0.61	-0.14