Do Voting Advice Applications Change Political Behavior?

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We analyze how the introduction of the voting advice application *smartvote* in Switzerland affects voter turnout, voting behavior, and electoral outcomes. The Swiss context offers an ideal setting to identify the causal effects of voting advice applications using real-world aggregate data because *smartvote* was introduced in different cantons at different points in time. We find that *smartvote* does not affect turnout but that voters more actively select candidates instead of parties by splitting their ballot. Our findings suggest that no specific party seems to benefit from the change in voting behavior.

The advancement of the internet has sparked a debate over its impact on politics (Boxell, Gentzkow, and Shapiro 2017; Gavazza, Nardotto, and Valletti 2019). While the internet has displaced other media with more news content, such as newspapers, television, and radio, it also helps voters gather political information. In the context of elections and referendums, voting advice applications (VAAs) have become popular in almost all democratic countries over the last decade. VAAs are internet-based applications that help voters find candidates and parties that are closest to their own policy positions. Early studies have documented that citizens who use VAAs are more likely to participate in elections (Dinas, Trechsel, and Vassil 2014; Ladner, Fivaz, and Pianzola 2012) and also adapt their political behavior more often than voters who do not use VAAs (Israel, Marschall, and Schultze 2017). However, the literature has pointed out that it is unclear whether VAAs make voters more likely to be active or whether active voters are more likely to use VAAs. More recent studies have thus explored the impact of VAAs using experiments (Garzia, Trechsel, and De Angelis 2017; Pianzola et al. 2019). These experimental studies can help us understand mechanisms at the voter level. But they remain silent on the overall impact of VAAs in real-world elections because they focus on a relatively small group of the electorate, mostly students, and rely on self-stated survey answers.

In this article, we estimate the causal effect of VAAs on voter turnout, voting behavior, and electoral outcomes in real-world elections. We use data on Swiss cantons that introduced the exact same VAA technology, *smartvote*, at different points in time between 1995 and 2018. Our main analysis exploits this staggered introduction in a difference-in-differences framework to estimate causal effects. To better understand the differences between users and nonusers of *smartvote*, we complement our analysis with a descriptive study based on individual-level survey data from federal elections in 2007, 2011, and 2015. In this descriptive analysis, we characterize *smartvote* users and their voting behavior. The typical *smartvote* user tends to be male and young, has a university degree, lives in an urban region, supports the left parties, has a high political knowledge, and possesses a strong interest in politics. Our descriptive analysis also documents that self-reported turnout is 16.9 percentage points higher among *smartvote* users compared to nonusers. Despite this descriptive difference in turnout, our causal estimates at the

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cantonal level provide evidence that the introduction of *smartvote* does not lead to systematically higher turnout in cantonal legislative elections but that it rather affects voting behavior of those citizens who already turn out. The cantons in our data use open-list proportional elections in which voters can distribute their votes among all candidates of an electoral race. Candidates are listed on separate party ballots per party list, and voters can modify such ballots or, alternatively, write down their preferred names on an empty ballot. Voters can modify party ballots by substituting candidates with candidates from other parties (panache vote) or by voting for the same candidate twice (cumulative vote).

We find that voters become more likely to modify their ballot and that they modify it more extensively. This increase in modified ballots is mostly driven by an increase in panache votes. Our main findings are robust to accounting for selective treatment timing and dynamic treatment effects. Moreover, VAAs might also affect electoral outcomes. However, our empirical analyses do not uncover important effects on electoral outcomes. We find no statistically significant effect on the vote share of the four main political parties and no effect on the aggregate vote share of all the other political parties. To further explore these latter results and to better understand potential dependencies among our outcome variables, we analyze individual-level survey data in a complementary, but more exploratory, analysis. This helps us understand why we do not observe effects on electoral outcomes. The exchange of votes between the main four political parties seems to be a zero-sum game in which no party has a substantial net benefit from modified ballots.

Our article contributes to the literature on the effects of VAAs on turnout and electoral outcomes. Early studies in this literature predominantly rely on postelection surveys and document that VAAs are mostly used by young and educated voters who are more interested in politics compared to the average citizen. These patterns have been found for various electoral contexts with different types of VAAs, including elections in Belgium (Walgrave, van Aelst, and Nuytemans 2008), Germany (Marschall and Schultze 2012), and Switzerland (Fivaz and Nadig 2010), as well as elections to the European Parliament (Dinas et al. 2014). In addition, most of these studies find that VAAs are positively correlated with voter turnout and vote choice even when controlling for sociodemographic characteristics (Andreadis and Wall 2014; Dinas et al. 2014; Ladner et al. 2012). Survey studies also show that some VAA users are convinced that the VAA motivated them to turn out or influenced their voting decision, although the respective shares of voters vary considerably between studies (Arts and van der Kolk 2007; Ladner, Felder, and Fivaz 2010; Ladner and Pianzola 2010; Marschall and Schmidt 2010; Marschall and Schultze 2012; Walgrave et al. 2008). However, most of these early papers suffer from methodological problems, such as sampling bias and selection bias (for a detailed discussion, see Gemenis and Rosema [2014]; Pianzola [2014a]). To account for differences in observable characteristics between voters who use VAAs and those who do not, scholars have used matching estimators and selection models (Gemenis and Rosema 2014; Germann and Gemenis 2019; Pianzola 2014a, 2014b). These studies find smaller effects of VAAs on voter turnout or voting behavior. The recent literature on VAAs has conducted experiments to address possible differences in unobservable characteristics between users and nonusers of VAAs. Garzia et al. (2017) use data on Italy and find that self-stated turnout rates are 10.7 percentage points higher for VAA users. Pianzola et al. (2019) explore the impact of VAAs using data on Switzerland and document that VAAs increase the intention to vote for the most preferred party and also increase the number of parties considered as potential vote options. Our study advances this literature by focusing on observed, rather than self-reported voting behavior in large real-world elections.

The remainder of this article is organized as follows. The next section presents the theoretical background. The section “Institutional Background and Data” explains the features of *smartvote* in the context of cantonal elections in Switzerland and presents the data. The section “Identification and Empirical Strategy” introduces the empirical strategy. The section after that presents our main results and robustness checks. The section following explores mechanisms between VAAs and our outcomes of interest. The final section concludes.

THEORY

When voters choose parties and candidates, information is an important driver of both turnout and electoral choice (Feddersen and Pesendorfer 1996; Lassen 2005). If voters are uncertain about politicians’ policy positions and want to avoid electing a bad candidate in terms of ideology and competence (Degan and Merlo 2011; Feddersen and Pesendorfer 1996; Krishna and Morgan 2011), additional information on candidates can reduce uncertainty, increase turnout, and facilitate the electoral choice. Yet, collecting information on candidate attitudes is costly and time consuming. In order to reduce information costs, party labels provide cues and information shortcuts (Lupia 1992, 1994). However, in many electoral systems, particularly in multiparty systems, political attitudes of candidates are not perfectly separated along party lines (Calvo and Hellwig 2011). Therefore, additional information on candidate attitudes is valuable for voters. VAAs provide such information in a condensed form.

VAAs are online tools that provide voters with voting advice based on an algorithm that compares a voter’s responses to issue questions with candidates' responses to the same issue questions. Our VAA of interest, *smartvote*, provides a detailed list of candidates that are closest to a voter's political attitudes, independent of party affiliation (see fig. A.1). Of course, aggregate party attitudes are correlated with the party's individual candidate attitudes, but the party affiliation itself does not play a role in the voting advice algorithm. However, such voting advice is costly. First, voters have to fill out a lengthy questionnaire—in the context of *smartvote* it includes at least 35 questions—on contemporary politics, which requires time.[1] Second, voters also have to be able to state their personal attitudes on these issues, which requires substantial knowledge of the issues at hand. In what follows, we make conjectures about the impact of the introduction of a VAA on turnout, voting behavior, and electoral outcomes.

Turnout

The impact of a VAA on turnout is a priori unclear. On the one hand, additional information on candidates reduces voters' uncertainty. Filling out the VAA questionnaire is less costly than finding the same detailed information in traditional media, particularly for citizens who do not regularly follow politics in the media. Thus, a VAA increases turnout if these citizens decide to participate in elections. On the other hand, using the voting advice still comes at a cost in terms of time and knowledge of the questionnaire's issues. These costs are relatively low for well-informed voters who tend to have high education (Bechtel and Schmid 2021; Hodler, Luechinger, and Stutzer 2015; Wolfinger and Rosenstone 1980). Yet well-informed voters are likely to turn out independent of the availability of a VAA. The costs, however, are relatively high for citizens who are less politically knowledgeable because they are less familiar with the political issues in the questionnaire. If these costs are too high, less knowledgeable citizens will not use the VAA. Therefore, it may be that only core voters use the VAA, in which case we expect no impact of VAAs on turnout. Overall, the effect of VAAs on turnout remains ambiguous.

Voting behavior

How may the introduction of a VAA affect voting behavior? Because the voting advice is based on measures of voter attitudes matched with the same measures of candidate attitudes, it is more specific and precise in comparison to party cues and information about candidates in traditional media outlets, such as newspapers, television, and radio. It is thus likely that the voting advice provided by a VAA changes a voter's set of politically close and feasible candidates including candidates from different parties, a result that has been documented in experimental studies (Pianzola et al. 2019). For this reason, we expect voters who use VAAs in open-list proportional elections to become more likely to modify their ballot.[2] In the Swiss electoral system, there are two forms of modifying a ballot, panache votes and cumulative votes, which we present in the section "Cantonal Elections in Switzerland." In this regard, we can distinguish the extensive and intensive margin of modifications. The extensive margin measures the share of modified ballots, which corresponds to the number of voters who modify their ballot relative to the total number of ballots. The intensive margin measures the number of votes from modified ballots relative to the total number of votes cast.[3] If voters who have previously not modified their ballot use the VAA to find ideologically close candidates, we expect an increase of the extensive margin, which should also lead to an effect on the intensive margin. However, if predominantly voters who already have modified their ballot before the introduction of the VAA use the voting advice, we expect no effect on the extensive margin but a positive effect on the intensive margin. A change in voting behavior might also affect election results. In more traditional media outlets, incumbents have an advantage over challengers because publication space is limited and because incumbents generate more attention than challengers (Prior 2006).

Electoral outcomes

A similar mechanism as described for the vote share of incumbents is at work for news coverage of big and established parties versus small and more recent parties, particularly if competition is weak (Petrova 2011). In contrast to traditional media, a VAA treats all candidates equally, independent of incumbency status or the size of a party. Thus, we expect that the introduction of a VAA reduces the incumbency advantage and the vote share of big parties.

INSTITUTIONAL BACKGROUND AND DATA

Cantonal elections in Switzerland

Switzerland is a highly decentralized country. The 26 Swiss cantons are not only responsible for the provision of many public goods, such as education and health care but also set and levy their own taxes. In the year 2017, the cantons accounted for 24.5% of the total tax revenue, which is 7% of GDP.[4] Cantonal politics and elections are therefore highly relevant.

1. Figure A.2 shows a sample of the questionnaire.

2. In closed list elections, the influence of VAAs might be much more limited, as the voting advice would have to disclose new information on the aggregate match between voter and party preferences that goes beyond what could already be inferred from traditional information sources.

3. Note that voters can cast as many votes as there are seats in a district. For example, if a district has 10 seats, a voter can cast up to 10 candidate votes in this district.

4. Data from the OECD. https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed November 2, 2021).

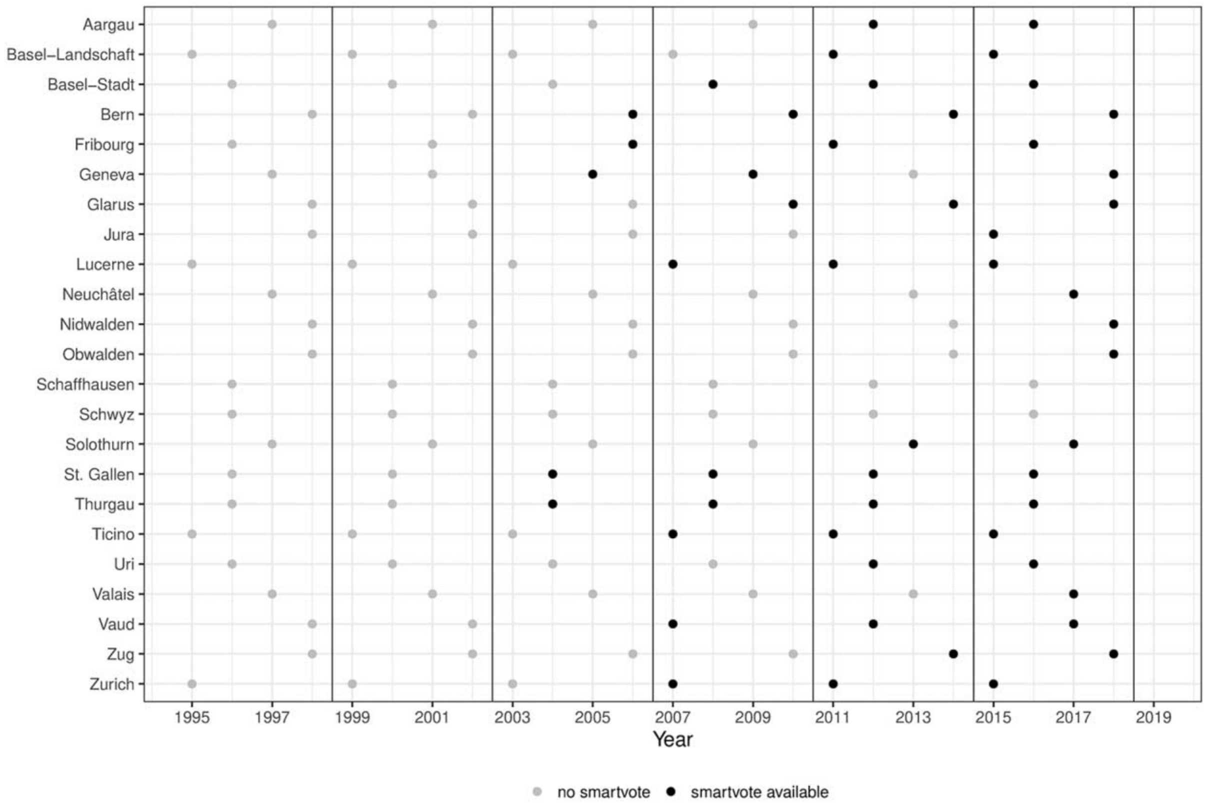

Figure 1. The availability of *smartvote* for cantonal elections. The cantons of Appenzell Innerrhoden, Appenzell Ausserrhoden, and Graubünden are excluded from the sample because their elections take place in open community assemblies. The cantons of Nidwalden and Obwalden do not use *smartvote*, but they introduced their own VAA in the last voting period 2015–18. Their VAA is in fact the same as *smartvote* but from a different provider.

Cantonal parliaments are usually elected every four years in proportional election systems[5] and count between 46 and 200 members. Depending on the size of the parliament and the number of voting districts in a canton, local voters can elect between one and 100 members of parliament. A particularity of the Swiss voting system is that voters cannot only choose among parties but also among individual candidates, as legislative elections are organized as open-list proportional elections. Voters can modify their ballot in two ways. The first option is that voters delete candidates on a party list and fill in the names of candidates from other parties (panache votes).[6] The second option is that voters can put up to two votes on particularly preferred candidates (cumulative votes).

The voting advice application *smartvote*

The introduction of *smartvote*. The online platform *smartvote* is a voting advice application developed and maintained by Politools, a nonprofit and nonpartisan network of researchers who are associated with the University of Berne. At the federal level, *smartvote* has been available for all elections since 2003. At the cantonal level, *smartvote* has become available at different points in time, but is still not available in some cantons. Figure 1 provides an overview of the availability of *smartvote* in cantonal parliamentary elections. The vertical lines separate the election periods that are defined according to the federal election years.[7] For the election period 2003–6, *smartvote* was available for five cantonal parliamentary elections and in 2007–10 for 10 cantonal elections. In the period 2011–14, five more cantons introduced *smartvote*. In the last period, 2015–18 in our sample, a total of 21 cantons provided the VAA *smartvote*.

The voting advice from *smartvote*. The VAA *smartvote* is based on an online survey of candidates and voters.[8] In a first step, all candidates of a specific election receive an invitation to answer a survey on their political attitudes. In a

5. Exceptions are three-year election cycles in Aargau (since 2009) and Graubünden (until 2006), and five-year election cycles in Fribourg and Vaud (since 2002). In the canton of Graubünden, the parliament is elected by a majoritarian system.

6. Alternatively, voters can also fill in a blank list with candidates from several parties.

7. Federal elections took place in November 1995, 1999, 2003, 2007, 2011, and 2015.

8. For a detailed description, see www.smartvote.ch and Fivaz and Schwarz (2007).

Table 1. The Usage of *smartvote* in Cantonal Elections

Voting Period	Elections with *smartvote*	Elections without *smartvote*	Candidate Participation (%)			Voting Advice as Share of Voters (%)		
			Mean	Min	Max	Mean	Min	Max
2003–6	5	17	68.5	63	75	18.4	16	25
2007–10	10	12	68.0	49	85	16.0	11	22
2011–14	15	7	70.9	52	89	16.4	5	29
2015–18	19	4	73.3	47	92	17.5	5	34

Note. The cantons of Appenzell Innerrhoden, Appenzell Ausserrhoden, and Graubünden are excluded from the sample because their elections take place in open community assemblies. The cantons of Nidwalden and Obwalden do not use *smartvote*, but they introduced their own VAA in the last voting period 2015–18. Their VAA is in fact the same as *smartvote* but from a different provider. For that reason, we only observe 19 elections in the last voting period with *smartvote* instead of 21.

second step, voters can answer the exact same online survey. Voters can choose between the complete survey of about 70 issue statements in 12 political domains and a shorter version of a subset of about 35 statements from all political domains. Candidates and voters can indicate whether they agree, rather agree, rather disagree, or disagree with the statements. Voters can also indicate if they have no opinion toward a statement and give different weights to different statements. Figure A.2 shows an excerpt of the voter survey for the 2012 election in the canton of Aargau. In a third step, *smartvote* calculates the match between a voter's attitudes and each candidate's attitudes. The voter receives voting advice in the form of a list of candidates ordered by the highest congruence of political attitudes, independently of the candidates' party. Figure A.1 provides an example of voting advice for the 2012 election in Aargau.

Table 1 presents summary statistics on the usage of *smartvote* during cantonal legislative elections for the 23 cantons in our sample. The data come from the provider Politools. The average candidate participation increased from 68% to 73% over the last four voting periods. The average number of voting advices as share of voters varies between 16% and 18%.[9]

Data

We collected data from the cantonal chancelleries and archives, and the cantonal statistical offices. The administrative data are available at the district level, but the treatment (the introduction of *smartvote*) is administrated at the cantonal level. Therefore, we aggregate the district data to the cantonal and, thus, the treatment level.[10] We distinguish three categories of outcome variables: voter turnout, voting behavior, and electoral outcomes. In the first category, our dependent variable "Turnout" is the number of ballots cast relative to the number of eligible voters. In the category of voting behavior, the variable "Modified Ballots" represents the extensive margin and captures the number of modified ballots relative to the number of valid ballots. The variable "Votes from Modified Ballots" represents the intensive margin, and it contains the two categories "Panache Votes" and "Cumulative Votes." The variables are expressed relative to the total number of candidate votes. The variable "Votes Incumbents" is the total number of votes for incumbent candidates expressed relative to the number of candidate votes.[11] Finally, the variables in the category of electoral outcomes are the individual party vote shares, which are measured as the votes for a specific party relative to the total number of party votes. For the years from 1995 to 2018, we split the data into six election periods according to the federal election cycles because cantonal elections do not take place on a yearly basis. For the cantons of Appenzell Innerrhoden, Appenzell Ausserrhoden, and Graubünden, no data are available because the elections were held in open community assemblies. This leaves us with data on 135 elections in 23 cantons.[12]

The Swiss Election Study (Selects) provides individual-level survey data for the federal elections 2007, 2011, and 2015. The postelectoral survey mainly focuses on who participates in elections and who votes for a certain party. The survey asks respondents about their turnout, voting behavior, and electoral choice. It also includes a question on the usage of *smartvote* and detailed sociodemographic variables. These data help us to

9. These numbers may slightly overestimate the actual share of voters who make use of *smartvote* because voters might consult *smartvote* several times.

10. For the cantons of Geneva and Ticino the entire canton corresponds to a single electoral district.

11. In the open-list electoral system of Switzerland, voters can issue a preference for candidates, and thus we think that the variable "Votes Incumbents" is a good proxy for the individual advantage of the incumbents.

12. The cantons of Vaud and Fribourg have only four elections in the period 1995–2018 because these two cantons have five-year election cycles.

Table 2. Descriptive Statistics of Cantonal Elections in Switzerland

	Mean (1)	SD (2)	Min (3)	Max (4)	Observations (5)
Turnout (%)	43.43	9.54	27.34	71.86	133
Modified ballots (%)	64.62	14.01	35.64	94.21	98
Votes from modified ballots (%)	58.04	15.31	17.27	92.21	93
Panache votes (%)	20.96	10.29	2.01	44.79	102
Cumulative votes (%)	34.76	11.19	5.11	61.20	88
Votes incumbents (%)	26.54	8.29	8.69	50.71	134
Votes SP (%)	19.22	6.27	3.45	34.54	133
Votes CVP (%)	19.69	12.43	.41	50.95	132
Votes FDP (%)	21.90	6.45	8.95	37.96	128
Votes SVP (%)	19.01	8.73	.10	37.37	127
Votes others (%)	20.95	11.53	0	46.18	135
Parliament size	109.27	39.51	55	200	135
Eligible voters	198,367.63	199,175.13	18,286	879,262	133
Concurrent federal vote	.23	.42	0	1	135
Concurrent cantonal vote	.04	.21	0	1	135
Postal voting	.93	.25	0	1	135
Voting age 16	.02	.15	0	1	135
Pukelsheim	.10	.30	0	1	135

Note. This table reports descriptive statistics for outcome and control variables. Columns 1–4 report mean, standard deviation, minimum, and maximum value. Column 5 reports the available number of observations. One observation represents a cantonal election. The variable "Modified ballots" measures the share of modified ballots relative to the number of eligible ballots. "Votes from modified ballots" is the share of votes from modified ballots relative to all votes. "Panache votes" and "Cumulative votes" capture the panache and cumulative votes relative to the total votes, respectively. The remaining "Votes" variables measure the share of votes of incumbents, of the big four parties, and of the other parties aggregated relative to the total number of votes. The control variables "Postal voting," "Voting age 16," and "Pukelsheim" are dummy variables for the cantonal availability of postal voting, the legal voting age of 16 (instead of the standard legal voting age 18), and the use of the biproportional seat allocation mechanism by Pukelsheim. SP = Social Democratic Party; CVP = Christian Democratic People's Party; FDP = Free Democratic Party; and SVP = Swiss People's Party.

understand who uses *smartvote* and to better understand the mechanisms behind our aggregate-level main results.

Descriptive statistics

Table 2 presents summary statistics of all outcome and control variables. The average voter turnout in our sample is 43.4%. In the category voting behavior, the share of modified ballots is 64.6%. At the level of votes, 58.0% of all votes are modified, 21.0% are panache votes, and 34.8% are cumulative votes.[13] In our sample, the average relative vote share of incumbents is 26.5%. In the category electoral outcomes, the average party strength of the four main political parties, Social Democratic Party (SP), Christian Democratic People's Party (CVP), Free Democratic Party (FDP), and Swiss People's Party (SVP), varies between 19.0% and 21.9%.[14] The share of votes from all the other political parties is 21.0%.[15] In our analysis, we control for the number of parliamentary seats and the number of eligible voters. Furthermore, we use dummy variables for concurrent federal votes, concurrent cantonal votes, and for changes in cantonal voting systems, namely, the introductions of postal voting, the legal voting age 16, and the

13. The number of observations for panache and cumulative votes is slightly different compared to the number of observations with respect to modified ballots. This is because for some cantonal elections, information is missing on cumulative votes.

14. The four parties SP, CVP, FDP, and SVP are considered the major political parties in Switzerland. At the national level, these parties combine between 69% and 82% of the votes in our sample period. In addition, they have exclusively formed the federal council (Bundesrat) except for the years 2008–15, when only six of the seven council seats were allocated to the four main political parties. At the cantonal level, SP and FDP are present in all parliaments. CVP did not receive a seat in the following elections: Berne 2014 and 2018 as well as Neuchâtel 1997, 2001, 2005, and 2009. SVP did not run in the following elections: Geneva 1997, Neuchâtel 1997 and 2001, Nidwalden 1998, Obwalden 1998, Uri 1996, and Valais 1997.

15. The set of the other parties includes the Green Party, the Green Liberal Party, the Evangelical People's Party, and the Federal Democratic Union, among many others.

biproportional seat allocation mechanism proposed by the mathematician Friedrich Pukelsheim. In our sample, the average parliament has 109.3 members and the average of eligible voters is 198,367.6. In 23% of the elections in the sample, a concurrent federal referendum takes place, and in 4% a concurrent cantonal referendum takes place. Ninety-three percent of all cantonal elections allow for postal voting. There are only six cantons where postal voting was not available at the beginning of our sample period.[16] The dummy variable "Voting Age 16" and the one for the biproportional seat allocation mechanism called "Pukelsheim" have mean values of 0.02 and 0.1, respectively. The voting threshold of 16 years exists only in the canton of Glarus, and the voting system Pukelsheim was only introduced recently in five cantons.[17]

Characterization of *smartvote* users

Before discussing the empirical analysis at the aggregate level, we briefly describe the sociodemographic background of *smartvote* users and how individual usage has changed over time using individual-level survey data from federal elections in the years 2007, 2011, and 2015. The first important descriptive difference between users of *smartvote* and nonusers is that turnout is 16.9 percentage points higher among *smartvote* users. In addition, figure 2 documents that male and young voters are more likely to use *smartvote* compared to female and old voters. Moreover, voters who live in big and urban municipalities use *smartvote* with a higher probability than those in small and rural municipalities, but these differences are less pronounced. Yet, there are substantial differences in *smartvote* usage between educational groups. While 26% of voters with a university degree used *smartvote* in 2015, only 14% of voters with no such degree did so. In absolute terms, this gap is relatively constant over time. We also find that voters with high political knowledge and those who are politically interested are more likely to use *smartvote* compared to voters with low political knowledge and those who are less politically interested. Finally, left-wing voters are most likely to use *smartvote*, followed by middle and then right-wing voters. This gap has increased in absolute terms over time.

IDENTIFICATION AND EMPIRICAL STRATEGY

The identification of the causal effect of VAAs on voting behavior and electoral outcomes is challenging. At the individual level, the use of *smartvote* is correlated with observable and unobservable characteristics as documented in the previous section. If these characteristics are correlated with the outcome variable, a simple regression of the outcome on *smartvote* usage will yield biased estimates. Therefore, to convincingly estimate the causal effect of *smartvote*, we exploit the fact that it was introduced in different cantons at different points in time and compare cantons with and without *smartvote* before and after the introduction of *smartvote*.[18] Our approach has two additional advantages over the existing literature. First, we base our analysis on revealed rather than stated behavior and use actual election data and not self-reported survey data. Second, our data cover the entire population of voters and not a sample of self-selected voters. Our basic estimation equation is

$$Y_{it} = \mu_i + \delta_t + \omega_i t + \tau \text{smartvote}_{it} + X'_{it}\beta + \varepsilon_{it}. \qquad (1)$$

In equation (1), Y_{it} is the outcome of interest in canton i in election period t, smartvote_{it} is a dummy variable indicating the availability of *smartvote* in a canton in a given election, μ_i are canton fixed effects, δ_t election period fixed effects, ω_i are canton-specific linear time trends, X'_{it} is a matrix of control variables, β is a vector of coefficients, and ε_{it} is the error term. Our coefficient of interest is τ, which measures how *smartvote* affects the outcome variable. Since voting patterns may be serially correlated within cantons, throughout the article we cluster standard errors at the cantonal level.

We control for variables that may affect political behavior. The literature has shown that the introduction of postal voting contributes to a substantial increase in voter turnout (Bechtel and Schmid 2021; Funk 2010; Luechinger, Rosinger, and Stutzer 2007) and may also change voting behavior and electoral outcomes (Hodler et al. 2015). The Swiss cantons introduced postal voting in a staggered way with the majority adopting it in the 1990s. A second driver of political behavior is the fact that some elections and popular votes take place on the same day (Schmid 2016). In Switzerland, cantonal elections are sometimes held concurrently with federal or cantonal votes. Therefore, we also control for both concurrent cantonal and federal votes. We further control for important institutional changes, namely, the introduction of the biproportional seat allocation mechanism by Pukelsheim and voting age 16 as well as for the size of the cantonal parliament and the number of eligible voters. All these factors may confound the impact of *smartvote* on political behavior.

16. Postal voting was introduced later in the following cantons: Schwyz (2001), Ticino (2006), Vaud (2002), Valais (2005), Neuchâtel (2001), and Jura (2002).

17. The biproportional seat allocation mechanism by Pukelsheim was introduced in the following cantons: Zurich (2007), Schaffhausen (2008), Aargau (2009), Nidwalden (2014), and Zug (2014).

18. For federal elections, *smartvote* is available since 2003, and thus some cantons in the control group for cantonal elections are in the treatment group for federal elections. However, we expect no or small spillover effects from the usage of the federal *smartvote* on cantonal outcomes because the candidates differ and federal and cantonal elections take place on different dates (except for the canton Jura).

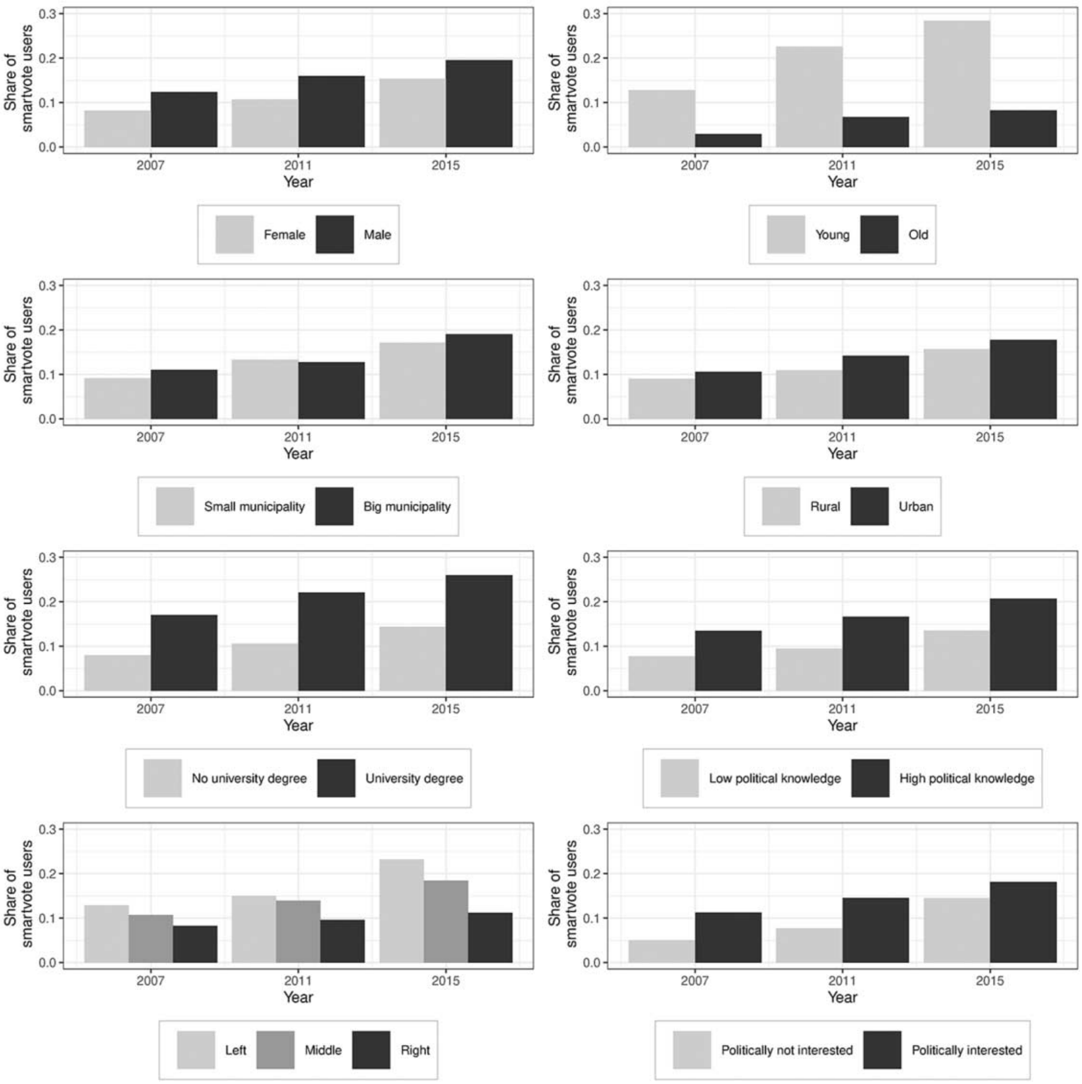

Figure 2. Share of *smartvote* users. The graph depicts the share of *smartvote* users relative to all voters for different subgroups in the federal elections 2007, 2011, and 2015. Citizens who are 50 years of age or older are defined as old and young otherwise. A municipality is defined as big if it has more than 5,000 inhabitants and small otherwise. High political knowledge means that someone could answer more than half of a battery of political knowledge questions, such as the name of the president of the Confederation and the number of parties in the Federal Council. Someone is defined as politically interested if she considers herself to be rather interested or very interested in politics.

By including canton fixed effects, we control for unobserved and time-invariant heterogeneity at the cantonal level, which might be related to the adoption of *smartvote*. The election period fixed effects control for unobserved and canton-invariant heterogeneity such as overall declines in turnout. Furthermore, we use canton-specific linear time trends to control for heterogeneous time trends across cantons. The crucial assumption to estimate the causal effect of *smartvote* in a difference-in-differences setting is that the outcome of treatment and control group would follow the same path in the absence of the treatment. We cannot test this assumption directly but we can evaluate its plausibility by studying potential pretreatment effects or by directly controlling for linear group-specific pretrends. Hence, we estimate pretreatment effects for the two years prior to the introduction of *smartvote* and show that there are no visible pretrends, except for "Cumulative Votes." However, for such a specific analysis of pretreatment effects, the staggered introduction of *smartvote* in combination with the limited number of pre- and posttreatment elections leaves only few periods with a somewhat balanced combination of treated and untreated cantons. These data limitations make robust claims about the parallel trends assumption difficult. Therefore, we complement our analysis and control for potentially differing pretrends by including pretreatment-group-specific linear time trends (see Goodman-Bacon 2021). Our estimates controlling for such trends corroborate our main results.

In a similar vein, recent literature has shown that the two-way fixed effects estimator is generally biased if (i) the data include more than two time periods and (ii) the introduction of the treatment is staggered (see Abraham and Sun 2021; Athey and Imbens 2022; Borusyak and Jaravel 2017; de Chaisemartin and D'Haultfœuille 2020; Goodman-Bacon 2021). De Chaisemartin and D'Haultfœuille (2020) show that such an estimator identifies a weighted sum of the average treatment effects (ATEs) in each group and period with weights that may be negative, where a group is defined by the time period when units are first treated. These negative group- and period-specific weights might cause some misleading treatment effects, because the linear regression estimand may be negative while all the ATEs are positive. To explore whether this is a problem for our analysis, we compute the weights of the group and time ATEs as suggested by de Chaisemartin and D'Haultfœuille (2020). In our analysis of the main outcomes, we find that one unit has a negative weight in 10 of our 11 estimations. This unit is the election in Geneva in election period 6 with standardized weights ranging from −0.026 to 0.003. Because of the few and relatively small negative weights, the linear regression estimand should not be misleading. Nevertheless, in the robustness section, we apply a different estimator, introduced by Callaway and Sant'Anna (2021), to address the problem of negative weights.

RESULTS

Main results

We begin our empirical analysis by estimating the effect of the VAA *smartvote* on voter turnout, voting behavior, and electoral outcomes. Tables 3 and 4 present the results of estimating equation (1) with cluster-robust standard errors and p-values based on a T-distribution with $C - 1$ degrees of freedom (with C being the number of clusters). We also report p-values based on the wild cluster bootstrap procedure by Cameron, Gelbach, and Miller (2008) because we have only 19–23 clusters depending on data availability of the respective dependent variable.

Effect of *smartvote* on voter turnout and voting behavior. Table 3 presents the results on voter turnout and voting behavior. The result in column 1 indicates that *smartvote* has no effect on voter turnout; the point estimate of 0.06 percentage points is close to zero and statistically not significant. Column 2 presents the effect of *smartvote* on the share of modified ballots (extensive margin). We estimate an effect of 2.0 percentage points with a wild clustered bootstrap p-value of .064. Column 3 indicates that the introduction of *smartvote* increases the relative vote share from modified ballots by 2.9 percentage points (intensive margin). This effect is statistically significant with a wild clustered bootstrap p-value of .100. Columns 4 and 5 help us understand whether the effect in column 3 primarily comes from voters who modify their ballots by adding candidates from other lists (panache votes) or by primarily substituting candidates from the same party list (cumulative votes). The estimated effect of *smartvote* on panache votes is 2.5 percentage points and statistically significant with a wild clustered bootstrap p-value of .086. The estimated coefficient on cumulative votes is not statistically significant.

Table 3. Effect of *smartvote* on Voter Turnout and Voting Behavior

	Turnout (1)	Modified Ballots (2)	Votes from Modified Ballots (3)	Panache Votes (4)	Cumulative Votes (5)	Votes Incumbents (6)
smartvote	.055	2.037	2.873*	2.451*	1.944	.470
	(.646)	(1.207)	(1.477)	(1.217)	(1.362)	(2.186)
Bootstrap p-value	.920	.064	.100	.086	.155	.823
Observations	133	98	93	102	88	132
R^2	.669	.825	.813	.542	.808	.447
Number of cantons	23	19	21	20	20	23

Note. In all six columns, we include canton and election period fixed effects, canton-specific linear time trends, and control variables. All six outcome variables are relative to either the number of eligible voters, the number of valid ballots, or the total number of candidate votes. Cluster-robust standard errors are reported in parentheses.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Our results indicate that *smartvote* causes voters to replace candidates on their ballots more often with candidates from other ballot lists than with candidates from the same list. To analyze whether this change in electoral behavior affects the success of incumbents relative to challengers, we estimate the effect of *smartvote* on the vote share of incumbents in column 6. We find no statistically significant effect of *smartvote* on the vote share of incumbents. We conclude that the introduction of *smartvote* does not affect voter turnout, but it causes voters to modify their ballots more often and they do so by including more candidates from different political parties.

To investigate the parallel trend assumption, figure A.3 presents estimates of pretreatment effects for all of our main outcome variables presented in table 3. With the exception of cumulative votes, we find no significant pretreatment effects and no pretreatment trends. In the case of cumulative votes, a pretrend is visible. Hence, our effect on cumulative votes in table 3 should be interpreted with caution. Given the low number of pretreatment periods in our data and the limited options to directly investigate pretrends, we extend our analysis with two complementary empirical approaches in the robustness section. First, we control for potentially differing pretrends by including pretreatment-group-specific linear time trends. Second, we control for selective treatment timing and for dynamic treatment effects. These results in the robustness section lend support to our main insights that voter turnout remains practically unaffected, while voters tend to react to the introduction of *smartvote* by becoming more likely to modify their ballot.

In a next step, we explore whether some parties are more affected by changes in voting behavior induced by *smartvote* and how they gain and lose votes. Table 4 presents the effect of *smartvote* on panache votes and on votes from unmodified ballots, separately for the four big parties. Panel A presents the effect of *smartvote* on the party-specific panache votes. The results indicate that *smartvote* tends to increase panache votes for all parties, but especially for the center-right party, FDP, and, to some extent, the right-wing SVP. We estimate a statistically significant increase of 2.3 percentage points of panache votes for center-right FDP. Panel B shows how many votes the parties lose on their specific party ballots, when voters add modifications (panache votes) instead of casting an

Table 4. Effect of *smartvote* on Party Level Outcomes

	SP (1)	CVP (2)	FDP (3)	SVP (4)
	A. Panache Votes			
smartvote	.695	1.413	2.346*	1.690
	(2.032)	(1.662)	(1.289)	(1.412)
Bootstrap *p*-value	.749	.401	.097	.236
Observations	97	97	97	94
R^2	.459	.556	.542	.589
Number of cantons	19	19	19	19
	B. Votes from Unmodified Ballots			
smartvote	−.092	−.405	−4.281***	−.380
	(3.153)	(3.423)	(1.432)	(2.879)
Bootstrap *p*-value	.976	.904	.012	.888
Observations	96	96	91	93
R_2	.823	.819	.913	.826
Number of cantons	20	20	19	20

Note. Panel A presents the effect on relative party-specific panache votes, and panel B presents the effect on party-specific votes from unmodified ballots relative to all votes. In all four columns, we include canton and election period fixed effects, canton-specific linear time trends, and control variables. Cluster-robust standard errors are reported in parentheses. SP = Social Democratic Party; CVP = Christian Democratic People's Party; FDP = Free Democratic Party; and SVP = Swiss People's Party.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Table 5. Effect of *smartvote* on Electoral Outcomes

	SP (1)	CVP (2)	FDP (3)	SVP (4)	Others (5)
smartvote	−.081	.291	.075	−1.290	1.075
	(.867)	(.444)	(.846)	(1.118)	(1.436)
Bootstrap *p*-value	.914	.468	.923	.244	.502
Observations	131	130	126	125	133
R^2	.657	.882	.788	.866	.653
Number of cantons	23	23	22	23	23

Note. This table presents the effect of *smartvote* on the relative share of party votes. In all five columns, we include canton and election period fixed effects, canton-specific linear time trends, and control variables. Cluster-robust standard errors are reported in parentheses. SP = Social Democratic Party; CVP = Christian Democratic People's Party; FDP = Free Democratic Party; and SVP = Swiss People's Party.
* $p < .1$.
** $p < .05$.
*** $p < .01$.

unmodified ballot. Consequently, we report the effect of *smartvote* on the vote share from unmodified ballots. None of the effects is statistically significant except the effect on the center-right party FDP. This effect is statistically significant with a wild clustered bootstrap *p*-value of .012. These results indicate that there are some small differences between the four main political parties in Switzerland: particularly the FDP gains votes from external ballots, but, on the other hand, the FDP also loses votes from unmodified ballots. The total effect of *smartvote* on overall electoral outcomes is explored in the next section.

Effect of *smartvote* on electoral outcomes. From a theoretical perspective, we expect that *smartvote* decreases information asymmetries between small and big parties as it provides information on political attitudes for a large set of candidates, independent of party affiliation. In general, traditional media outlets, such as newspapers, television, and radio, tend to focus more on candidates from more established and bigger parties. Table 5 presents the estimated impact of *smartvote* on the party vote shares of the four major parties, defined as those represented in the federal executive. Columns 1–4 present the individual results for each of the four main political parties, and column 5 reports the results for the aggregate vote share of all the other parties. None of the effects at the party level are statistically significant, and most of them are close to zero. An exception is the right-wing party, SVP, for which the estimated negative coefficient is much larger in comparison. Our results indicate that the change in voting behavior, due to the introduction of *smartvote*, does not cause any statistically significant effects on electoral outcomes.

Robustness

Dynamic treatment effects. As discussed in the section "Identification and Empirical Strategy," our regression includes election period fixed effects and canton fixed effects. The introduction of the treatment is staggered, and once a canton receives the treatment, it stays in the treatment group for the rest of the sample period.[19] The recent literature on difference-in-differences designs has pointed out that the estimated treatment effect might be misleading when applying a two-way fixed effects model for data with more than two time periods and a staggered introduction of the treatment (Abraham and Sun 2021; Athey and Imbens 2022; Borusyak and Jaravel 2017; de Chaisemartin and D'Haultfœuille 2020; Goodman-Bacon 2021). In that case, the two-way fixed effects estimator is generally biased. Therefore, we follow Callaway and Sant'Anna (2021) and apply a weighted average of the group-time average treatment effects on the treated. They define the group-time average treatment effect on the treated for group g in period t as follows:

$$\mathrm{ATT}(g,t) = E[Y_t - Y_{g-1}|G_g = 1] - E[Y_t - Y_{g-1}|C = 1]. \quad (2)$$

The aggregation of group-time average treatment effects on the treated helps us understand how the average treatment effects vary across groups. In particular, we explore whether the effect of *smartvote* is larger for cantons that introduced the VAA earlier relative to cantons with a later adoption.

Table 6 presents the results of the aggregated group-time average treatment effects on the treated (ATT) for cantons

19. An exception is the canton of Geneva, where *smartvote* was available in 2005, 2009, and 2018, but not in 2013.

Table 6. Selective Treatment Timing and Dynamic Treatment Effects

	Treatment Periods	
	Three (1)	Two (2)
A. Voter turnout:		
smartvote	1.15	.23
	(2.97)	(3.76)
B. Modified ballots:		
smartvote	5.06	5.71
	(5.77)	(8.87)
C. Votes from modified ballots:		
smartvote	7.67	2.93
	(4.76)	(4.79)
D. Panache votes:		
smartvote	5.60	6.62
	(3.81)	(7.44)
E. Cumulative votes:		
smartvote	−.35	−.98
	(3.24)	(3.51)
F. Votes incumbents:		
smartvote	−.38	.25
	(1.17)	(2.27)

Note. The treatment group in col. 1 consists of all treatment observations with at least three posttreatment periods. The treatment group in col. 2 consists of all observations with at least two posttreatment periods. Cluster-robust standard errors are reported in parentheses.
* $p < .1$.
** $p < .05$.
*** $p < .01$.

with two and three posttreatment periods. We drop the last period $t = 6$ to enlarge the control group with those cantons who introduced *smartvote* in the last period.[20] We set the focus on the same outcome variables as in table 3 to test the robustness of our main findings. Column 1 presents the aggregated ATT of treatment groups with three posttreatment periods. Since we drop the last period, these observations are the cantons with the first treatment in period 2003–6 (see fig. 1). A treatment group is defined by the time period when it is treated for the first time. In column 2, we present the results from the sample where we exclude the treatment groups with less than two posttreatment periods. This means that we use only one treatment group in column 1 but over three time periods and two different treatment groups over two time periods in column 2. Panel A presents the effect of *smartvote* on voter turnout. We do not find a statistically significant effect on turnout, independent of how many treatment periods and treatment groups we include. We estimate in panel B an effect of 5.1 and 5.7 percentage points on the share of modified ballots, but this effect is statistically not significant. The effect of *smartvote* on votes from modified ballots is shown in panel C. We estimate a positive effect, which varies with the number of treatment periods and treatment groups between 7.7 and 2.9 percentage points. The estimated effect in column 1 is statistically insignificant but at the margin of statistical significance. Panel D presents the effect of *smartvote* on panache votes. This effect varies between 5.6 and 6.6 percentage points, and it is statistically not significant but at the margin of statistical significance when we use three treatment periods. We do not find any statistically significant effects of *smartvote* on cumulative votes nor on the share of votes from incumbents in panel E and panel F, respectively.

These robustness results support the findings in table 3. We do not find a statistically significant effect on voter turnout and the positive effect of *smartvote* on the share of modified ballots, on votes from modified ballots and on panache votes seems to be robust, although the lack of statistical power seems to make the estimation of statistically significant effects difficult. Furthermore, we do not find any effect of *smartvote* on cumulative votes and on the share of votes from incumbents. Therefore, the negative weights in our main estimation using ordinary least squares (OLS) do not cause problems because they are only a small fraction of all weights in absolute and relative terms.

Pretreatment-group-specific linear time trends. In our main analysis in "Main Results," we include canton-specific linear time trends to allow that treatment and control group follow different trends. Goodman-Bacon (2021) argues that these trends might overcontrol by absorbing time-varying treatment effects that are larger at the end of the panel. We address these counterfactual trends by estimating pretreatment trends in the outcome variable and extrapolate them (see Bhuller et al. 2013). Therefore, we first estimate the pretreatment-group-specific linear time trends and partial them out in the following way:

$$Y_{it} = \mu_i + \delta_t + \omega \hat{\nu}_g t + \tau \text{smartvote}_{it} + X'_{it}\beta + \varepsilon_{it}. \quad (3)$$

In equation (3), Y_{it} is the outcome of interest in canton i in election period t, $smartvote_{it}$ is a dummy variable indicating the availability of *smartvote* in a canton in a given election, μ_i are canton specific fixed effects, δ_t election period dummies, ω includes average treatment-group-specific linear time trends, $\hat{\nu}_g$ are the estimated pretreatment trends per treatment group g, X'_{it} is a matrix of control variables, β is a vector of coefficients, and ε_{it} is the error term.

20. These are the cantons Jura, Neuchâtel, Nidwalden, Obwalden, and Valais. Furthermore, we exclude the canton Geneva from our sample because it switches from the treatment group to the control group and back.

Table 7. Effect of *smartvote* on Voter Turnout and Voting Behavior with Pretreatment-Group-Specific Time Trends

	Turnout (1)	Modified Ballots (2)	Votes from Modified Ballots (3)	Panache Votes (4)	Cumulative Votes (5)	Votes Incumbents (6)
smartvote	.424	2.587**	5.459***	3.370**	1.577	.647
	(.639)	(1.215)	(1.634)	(1.541)	(1.605)	(1.614)
Bootstrap *p*-value	.492	.028	.003	.077	.362	.690
Observations	133	70	75	75	70	132
R^2	.510	.756	.685	.295	.775	.271
Number of cantons	23	14	16	15	15	23

Note. In all six columns, we include canton and election period fixed effects, pretreatment-group-specific linear time trends, and control variables. Cluster-robust standard errors are reported in parentheses.
* $p < .1$.
** $p < .05$.
*** $p < .01$.

Table 7 presents the coefficients of the regressions in equation (3). We do not find a statistically significant effect of *smartvote* on turnout in column 1. Column 2 presents an effect of 2.6 percentage points on modified ballots with a bootstrap *p*-value of .028. Column 3 presents the effect of *smartvote* on the share of votes from modified ballots. We estimate a statistically significant effect of 5.5 percentage points with a bootstrap *p*-value of .003. The effect of *smartvote* on panache votes is 3.4 percentage points with a bootstrap *p*-value of .077, and the effect on cumulative votes is 1.6 percentage points but statistically not significant. We do not find any statistically significant effect on the share of votes of incumbents. These results support our main findings in "Main Results," although the effects are slightly stronger. The reason for this might be time-varying treatment effects, which may be absorbed when we include canton-specific linear time trends.

MECHANISMS

In this section, we explore various mechanisms to further understand our reduced-form results. In principle, there can be dependencies among the three categories of political behavior that we have analyzed in our previous section. In figure 3, we present these potential dependencies and discuss the resulting effect paths. As our aggregate data do not permit us to precisely differentiate between direct and indirect effect paths, we complement our evidence by a descriptive study of individual survey data to understand how *smartvote* could affect our outcome variables beyond the previously presented reduced-form estimates.

Figure 3 depicts our conceptual understanding of potential dependencies and the implied pathways. The dark arrows indicate the various potential direct effect paths from *smartvote* to turnout, voting behavior, and electoral outcomes as well as the indirect effect paths of *smartvote* through interdependencies between these outcome variables. The light arrows reflect effect paths that we deem theoretically implausible as we will explain in more detail below.

Turnout

Our previous results show no significant reduced-form effect of *smartvote* on turnout. This reduced-form effect consists of the direct effect of *smartvote* on turnout (fig. 3, [1]) as well as the indirect effects going through voting behavior (4) and

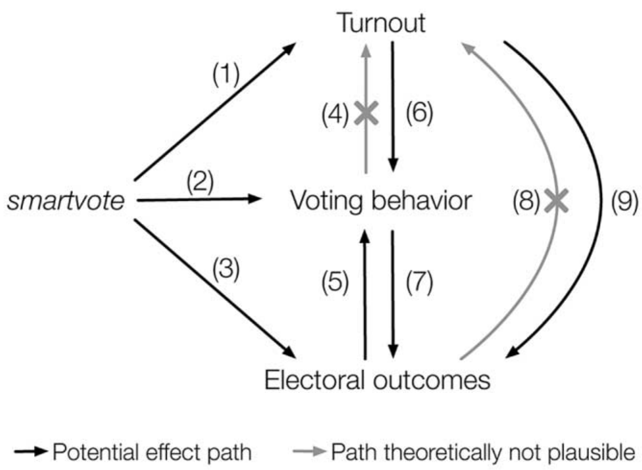

Figure 3. Potential effect paths of the VAA

electoral outcomes (8). It could therefore be the case that the direct and indirect effects cancel out and produce the null reduced-form result. We believe that the indirect paths to turnout, either through voting behavior (4) or electoral outcomes (8), are theoretically not plausible in a standard two-stage model of turnout and voting behavior (Degan and Merlo 2011). In this model, voters decide about turning out or not in the first stage and then about their voting behavior and their electoral choices in the second stage. Figure 3 depicts this reasoning by presenting the indirect paths to turnout with light instead of dark arrows. If one were to accept this reasoning, the indirect paths to turnout are not empirically relevant and the reduced-form estimate is likely to coincide with the direct effect of *smartvote* on turnout.

Voting behavior

In contrast to turnout, we have shown previously that there are significant reduced-form effects of *smartvote* on voting behavior, primarily at the intensive margin through an increase in votes from modified ballots, in particular via panache votes. Theoretically, the indirect paths running from *smartvote* through turnout and electoral outcomes to voting behavior are not implausible. As we have argued before, the direct effect of *smartvote* on turnout (1) is likely to correspond to the reduced-form effect which is not significantly different from zero. Consequently, the indirect effect running through turnout (6) does not seem to be empirically relevant. With respect to the indirect path through electoral outcomes, we have seen that the reduced-form effects of *smartvote* on electoral outcomes did not produce significant results. Therefore, it also seems unlikely that the indirect path through electoral outcomes (5) is empirically pertinent. Based on these arguments, the reduced-form effect of *smartvote* on voting behavior is likely to coincide with its direct effect (2).

Electoral outcomes

The reduced-form estimates of the effect of *smartvote* on electoral outcomes were statistically not significantly different from zero. However, there might be competing indirect effects of *smartvote* running through turnout (9) or voting behavior (7). Given our previous arguments pertaining to the insignificant turnout effect, the indirect path running through turnout (9) is unlikely to be empirically relevant. However, potential effects through the indirect path from *smartvote* to voting behavior (2) and subsequently to electoral outcomes (7) are likely and cannot be excluded.

We further investigate these potential interdependencies between voting behavior and electoral outcomes induced by the introduction of *smartvote* with a more descriptive approach using individual-level survey data. In this analysis, we describe how party voters of the four main political parties modify their ballot to infer potential effects on electoral outcomes. As presented before in table 5, we do not observe any statistically significant effects on electoral outcomes, while in table 3 we document a positive and significant effect at the intensive margin on panache votes. We analyze panache votes with survey data at the individual level for the federal parliamentary elections in 2007, 2011, and 2015. This allows us to study how voters split their ballots and which candidates tend to benefit or suffer most when voters modify their ballot.

Figure 4 presents the relative panache votes for the four major parties and shows which of those benefit when a party voter modifies the list of his preferred party. The upper left panel presents the left party's (SP) relative loss of panache votes. The histogram indicates that most SP voters who modify their ballots replace the SP candidates with candidates from other than the four major party lists. Hence, the other main parties benefit only modestly from SP voters modifying their ballots, and this benefit is even smaller when voters use *smartvote*. The upper right panel presents the relative panache votes for the center-right party (FDP). The histogram indicates that the FDP loses votes equally to all three main parties CVP, SP, and SVP. It also shows that most overall votes are lost to other parties and especially so among *smartvote* users. The lower left panel indicates that the center-left party (CVP) loses votes to the SP, FDP, and other parties, and only to a minor extent to the SVP. The lower right panel indicates that the right-wing party (SVP) loses panache votes primarily to the FDP and other parties, not so much to the left and center-left parties SP and CVP. However, the losses to other parties are particularly pronounced among *smartvote* users.

However, the key findings of figure 4 are the differences in the voting behavior between users and nonusers of *smartvote*. It appears that *smartvote* users who modify their ballot are more likely to support parties other than the big four. This empirical pattern is present for all parties but is most pronounced in the case of SVP panache votes losses. These findings are in line with our hypothesis that especially smaller political parties ought to benefit from the introduction of *smartvote*. However, the pattern documented in this descriptive section does not materialize in a statistically significant manner in our causal estimates presented in the previous section. The still relatively low penetration rate of *smartvote* among voters might be a reason.

CONCLUSION

The internet has transformed how voters get informed about politics. One important technological advance in recent years is VAAs that allow voters to obtain detailed information on the political attitudes of candidates at relatively low costs.

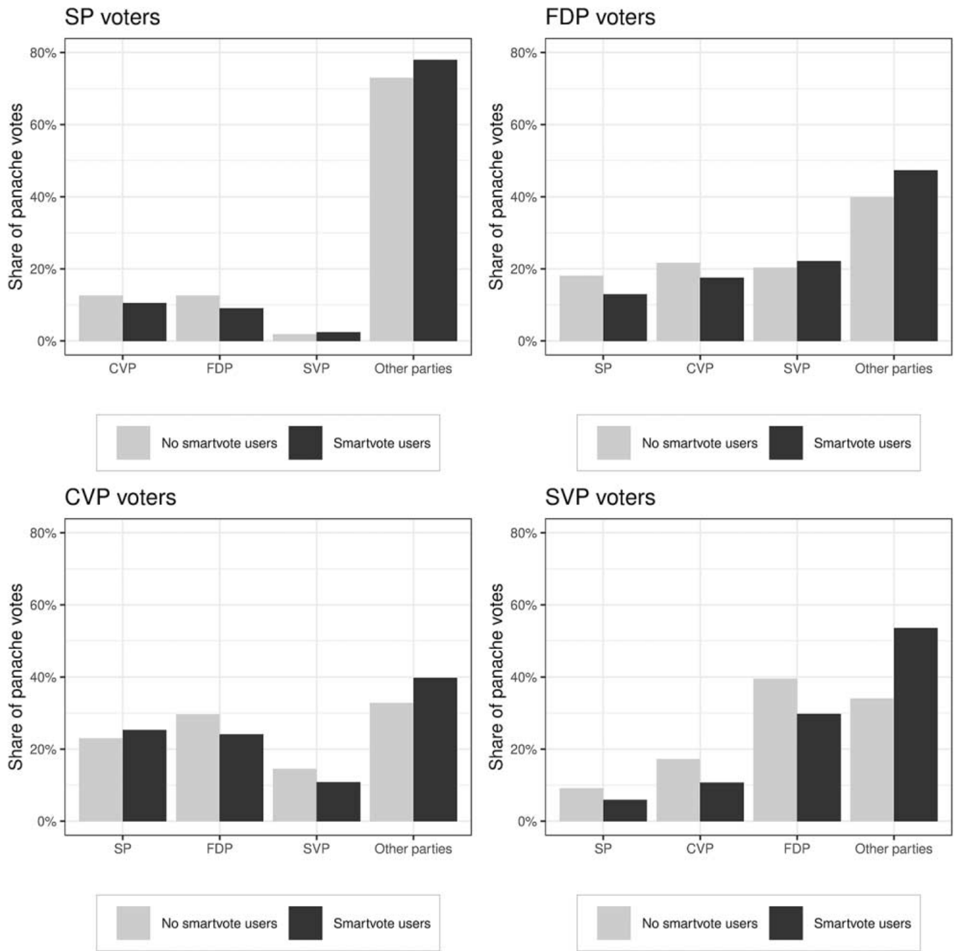

Figure 4. Panache votes of the four big parties. The upper left panel shows the relative loss in panache votes of the SP party voters who modified their ballots, distinguished by *smartvote* users and nonusers. The other panels present the same but for FDP, CVP, and SVP party voters. In the upper left panel, we have 853 observations, in the upper right panel 662 observations, in the lower left panel 461, and in the lower right panel 599 observations. The data are from postelection surveys conducted for the federal parliamentary elections in 2007, 2011, and 2015. SP = Social Democratic Party; CVP = Christian Democratic People's Party; FDP = Free Democratic Party; and SVP = Swiss People's Party.

Although there is an experimental literature on the impact of VAAs, so far, no other study has explored the causal impact of VAAs in real-world elections. Our article shows that the introduction of the online voting advice application *smartvote* in Switzerland does not affect voter turnout. However, we find that voters change their voting behavior. They are more likely to modify their ballot, mainly by including candidates from other parties. These results might indicate that VAAs matter primarily for voters who already decided to turn out and, hence, affect only the electoral choices of this group. We find no effect on electoral outcomes in terms of party shares of the four main political parties. Our analysis of individual survey data indicates that vote modifications among the main political parties tend to be zero-sum games. However, in line with our theoretical intuition, we find that *smartvote* users are more likely to include candidates from other parties.

Our results are specific to Switzerland, so it is important to consider the external validity of the results for other countries. Switzerland traditionally has a relatively low turnout for elections, as major decisions are made in popular votes. For countries with higher turnout, the potential impact of VAAs on turnout is likely even lower because a high share of the eligible voting population already votes. Switzerland also has a fragmented party system with a large number of parties. This could be one reason why the effects of *smartvote* on voting behavior do not translate into effects on electoral outcomes. It may be that in countries with fewer parties VAAs also affect electoral outcomes. Finally, the open-list electoral system of Switzerland is candidate-centered, and thus it would be interesting to explore whether our findings on voting behavior are similar in a more party-centered environment.

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