3

AN ANALYSIS OF ELECTRONIC VOTING IN BELGIUM

Do voters behave differently when facing a machine?

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3.1 Introduction

In 1991, Belgium was one of the first countries to test on-site electronic voting (e-voting) for political elections.[1] Since then, the country has continuously used e-voting in all of its binding elections (from the local to the European ones). In addition, this implementation has been scattered around the country as some municipalities used e-voting while other (sometimes neighboring) municipalities used paper voting. These three elements – continuity over almost 30 years, use for all binding elections and implementation in only some municipalities – make the Belgian case of e-voting unique worldwide.

The Belgian e-voting experience is not only unique but also constitutes an original field study. The use of paper voting in some municipalities and of e-voting in others – as well as their variation over time – allows a comparison between voting modalities while keeping constant most of the features of the electoral system. This kind of analysis is not possible in countries such as Brazil where e-voting has been implemented in all municipalities. Since municipalities were not systematically selected (e.g. based on certain criteria), we could consider this a natural experiment, in which some municipalities (rather by chance) use electronic voting and others not. One exception to this pattern is that e-voting was abolished in 2017 for the elections in the Walloon region, while it is still used in (some) municipalities in the rest of the country.

Building on the uniqueness of the Belgian case, this chapter aims at investigating the impact of e-voting on voting behavior. Political scientists are generally aware that the design of the ballot or the electoral system has potentially an impact on voting behavior (see for instance Kimball & Kropf, 2005), but we know less about the consequences for the voters of the decision of using voting machines rather than paper ballots (Conrad et al., 2009; Roth, 1998;

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Wang et al., 2017). E-voting is still a recent phenomenon and remains limited to a small number of countries (mostly Brazil, India and the United States), where it often remains peripheral (for instance in Canada, France, Japan or Peru). Most prior works tend to focus on specific countries and elections and there are few comparative studies (see van den Besselaar et al., 2003 for an exception). This chapter aims to contribute to the emerging literature on the impact of voting machines on voters' behavior by digging into the Belgian case.

In Section 3.2, this chapter investigates scholarly literature regarding the impact of e-voting on several dimensions of the voting decision. Empirical studies from several countries and from previous works on Belgium will lead to draw three hypotheses regarding turnout, invalid votes and split-ticket voting. Section 3.3 presents an overview of the use of e-voting in Belgian elections and its evolution over the last three decades. In Section 3.4, I empirically investigate the impact of e-voting on voting behavior by comparing electoral districts using e-voting with the ones using paper voting regarding electoral participation (i.e. turnout), the share of invalid votes as well as split-ticket voting. This section relies on legislative election results for the period 1991–2019 in two Belgian provinces and confirms that turnout is lower in electoral districts using e-voting, while paper voting tends to lead to more invalid votes and to more split-ticket votes.

3.2 E-voting and structure of the vote

Political scientists generally agree that any change regarding the organization of an election – be it the polling place, the design of the ballot or the electoral system – has potentially an impact on voting behavior (see for instance Kimball & Kropf, 2005; Miller & Krosnick, 1998; Reynolds & Steenbergen, 2006 on the impact of ballot design on election results). The introduction of e-voting is similarly considered a disruptive element. For instance, it is literally impossible to replicate exactly the paper ballot on the screen: for a series of technical reasons (screen size, color, font size, etc.), the ballot needs to be adapted to fit the screen. The literature teaches us that e-voting supposedly has an impact on the propensity to cast a vote and on voting behavior.

To assess the impact of e-voting on voting behavior, researchers investigate its usability (Conrad et al., 2009; Roth, 1998; Wang et al., 2017). Usability is often understood as the degree to which individuals find it easy and satisfying to use systems and to perform the expected tasks accurately and within a reasonable amount of time (Herrnson et al., 2008). Ensuring usability is important for consolidating representative democracy in the digital age. First, universal suffrage guarantees that every citizen should not only be allowed to vote but s(he) should also be able to vote electronically. It is therefore important to ensure that the usability of e-voting leads to a greater equality among voters. Voters should be equal when facing the voting machine, independent of their

gender, age, voting experience or digital skills. Second, usability is particularly important concerning the will of the voters. E-voting equipment or interface should not have an influence on the decision of the voter or cause her to make mistakes (for instance by unintentionally invalidating her vote and by selecting the next candidate on the list). E-voting systems need to make sure that citizens accurately vote for their preferred party or candidate.

The literature on electoral studies has indicated to us that seemingly minor changes in the electoral system may have major consequences for how citizens cast their vote. These findings are confirmed in the case of e-voting systems: voters alter their behavior and their vote choice in response to different e-voting technologies, which, in turn, may lead to different electoral outcomes across voting systems (Calvo et al., 2008; Katz et al., 2008). According to Conrad et al. (2009), "in a close election, even rare usability problems can distort the outcome, particularly if they lead to systematic, as opposed to randomly distributed, errors". The impact of the (poor) usability of e-voting systems is therefore to be found for three different types of voting behavior: turnout, invalid voting and split-ticket voting.

First, even if voters ultimately vote the way they intend to, they may find the experience unsatisfying and it might lead them to avoid future elections (Conrad et al., 2009). Based on field experiments in four European countries, van den Besselaar and colleagues (2003) demonstrated that a poor e-voting system design, and in particular an insufficient voter usability, may decrease turnout in future elections. Yet, an analysis of aggregate local election results in Japan demonstrated that turnout is higher in districts using e-voting compared to districts using paper voting (Tsukiyama, 2018). Other studies indicate a lower turnout in e-voting districts, such as in India (Debnath et al., 2017) and the United States (Card & Moretti, 2007; Roseman & Stephenson, 2005). Finally, scholars find no statistically significant effect of on-site e-voting on turnout in Brazil (Fujiwara, 2015), India (Desai & Lee, 2019) and the Netherlands (Allers & Kooreman, 2009).

Concerning the Belgian case, it is interesting to notice that – even if voting is compulsory – there are significant variations of turnout across the territory and over time. Several studies demonstrated the negative impact of electronic voting on turnout in local elections: in Flanders in 2006 (Ackaert et al., 2011), in Wallonia in 1994–2012 (Dandoy, 2014) and in all municipalities in 2006–2012 (Dejaeghere & Vanhoutte, 2016). The conclusions of the BeVoting (2007) study are more mixed as the researchers observed a drop of turnout in the Flemish cantons but not in Brussels and one of the two analyzed elections in Wallonia. As a result, the first hypothesis (H1) tested in this chapter implies that a lower turnout should be observed in cantons using e-voting.

Second, a poor usability of e-voting systems can also directly contribute to an increase of voter errors (Conrad et al., 2009; Herrnson et al., 2008) and lead to an increase of the share of invalid votes (Stein et al., 2008). However, e-voting presents the advantage of preventing the unintentional expression invalid votes:

in most of the cases, the software and/or the equipment does not allow voters to cast null votes. Voting behaviors such as writing comments on the ballot, over-voting or voting for candidates from different lists (except systems allowing *panachage*) are technically not possible with e-voting and one can expect to observe a decrease of the share of invalid votes. For instance, Nicolau (2015), Fujiwara (2015) and Katz and Levin (2018) showed that the introduction of electronic voting machines greatly reduced the quantity of null votes in Brazilian elections. In the United States, the introduction of on-site e-voting elections significantly reduced the number of residual votes (Kimball et al., 2004; Stewart, 2006) and the number of over- and under-votes (Frisina et al., 2008).[2] The same findings are reflected in the Dutch (Allers & Kooreman, 2009), Indian (Debnath et al., 2017; Desai & Lee, 2019) and Japanese cases (Tsukiyama, 2018).

In Belgium, it is important to notice that, while invalid voting is virtually impossible,[3] the e-voting machine displays a 'blank vote' button on the bottom right-hand of the party menu. As the official election statistics do not allow to distinguish between blank from null votes, the share of invalid votes in paper districts represents both types of votes, while it accounts only for blank votes in the case of e-voting municipalities. Several studies indicated that e-voting helped reduce the share of invalid votes for the 2009 European elections (Pion, 2010) and for the local elections in 1994–2012 (Dandoy, 2014) and in 2006–2012 (Dejaeghere & Vanhoutte, 2016). In their study of local elections in Flanders in 2006, Ackaert and colleagues (2011) observed the opposite phenomenon: more blank votes in e-voting municipalities compared to paper-based municipalities. A second hypothesis (H2) will test whether a smaller share of invalid votes is observed in cantons using e-voting.

Finally, e-voting may have a direct impact on the vote for candidates or political parties.[4] The first set of works investigating this question look at vote differences across elections held on the same day. Analyzing the 2011 elections in Argentina, Barnes and colleagues (2017) found out that voters using e-voting systems display a significantly higher rate of ballot splitting than voters using the paper vote. Comparing different types of e-voting systems in the same country, Calvo and colleagues (2008) observed a significant variation of split-ticket rates depending on whether the system reinforces candidate-centric or party-centric cues (the rate of ballot splitting being lower in the latter case).

Another set of scholarly studies observes whether e-voting had an impact on the vote share of specific political parties. Katz and colleagues (2008) found significant differences in party vote shares depending on the e-voting technology used by the voter and several authors investigated the parties and candidates that benefited from the implementation of e-voting. For instance, Card and Moretti (2007) analyzed the effects of touch-screen e-voting during the 2000 and 2004 US presidential elections and observed a small but statistically significant positive effect on electoral support for George Bush. Similarly, Debnath and colleagues (2017) found out that candidates associated with corruption and criminal activities receive relatively less votes than other candidates in e-voting

polling stations in India, while Desai and Lee (2019) conclude that e-voting is associated with an increase of vote shares for minor parties. In the Brazilian case, Fujiwara (2015) indicated that e-voting caused a large enfranchisement of less educated voters, which led to the election of more left-wing state legislators. Yet, another piece of literature on the impact of e-voting on party vote shares leads to less articulate conclusions. Little effect on partisan votes is, for instance, observed in the case of a regional referendum in Brazil (Mellon et al., 2017), of local elections in Japan (Tsukiyama, 2018) and of local and national elections in the Netherlands (Allers & Kooreman, 2009).

Admittedly, the effect of electronic voting equipment on voting behavior may be of an indirect nature. For instance, the impact of e-voting could be mediated by turnout: the categories of voters that decide not to go to the polling station because e-voting is used are also the ones that are more likely to vote for specific parties (Geser, 2004). As result, e-voting punishes parties whose voters do not trust this new form of voting or are less familiar with new technologies. In India, the positive effect of e-voting on the vote share of minor parties was moderated by the share of invalid rates: the votes that were previously discarded as invalid are being funneled instead to minor parties (Desai & Lee, 2019). In addition, e-voting equipment may lead to a larger number of split-ticket votes and Barnes and colleagues (2017) observed that this voting behavior leads to a small increase in the vote shares obtained by minor parties in Argentina. They calculated that e-voting and ballot splitting would enable some of these parties to win a seat in the assembly. In the framework of this chapter, I will test a third hypothesis (H3) according to which the share of split-ticket votes is higher in cantons using e-voting.

3.3 Overview of e-voting in Belgium

In 1991, Belgium decided to introduce on-site electronic voting in its elections. The arguments behind this decision were that it would help reducing the cost of elections (for instance, the costs related to the ballot papers and to the payment of polling station staff), accelerate the publication of the results, increase the reliability of the results and reduce the number of staff in each polling station. Two different e-voting systems were tested in two cantons (Verlaine and Waarschoot) at the occasion of the 1991 legislative elections and it was decided to implement e-voting at a larger scale.[5]

The Law of 11 April 1994 regulates the implementation and use of e-voting in Belgium. About 20% of the Belgian voters were allowed to use e-voting in 76 municipalities at the occasion of the European elections of June 1994 and of the local and provincial elections in October 1994. All types of political elections were concerned, and e-voting has been used in all local, provincial, regional, national and European elections organized in Belgium since 1994. E-voting occurs on-site (on election day in the polling stations) while anticipated voting and internet voting are not allowed. Each polling station is equipped with at

least one voting machine. The voting process is quite simple: the voter receives a smart card that s(he) introduces in the machine; the voter indicates his/her preferences for parties and the candidates on the screen (using a light pen or a touchscreen); the voter confirms his/her votes (blank votes are allowed) and the voter gets the smart card back and introduces it into the ballot box.

While the 1994 law regulates the use of e-voting, the lists of cantons using the system are managed by royal arrests. It means that the enlargement of e-voting to other cantons is rather simple and does not require a heavy legislative effort. E-voting has consequently been enlarged to about half of the cantons in the provinces of Antwerp and Liège and in Brussels, and from 1999 to 2014, about 44% of the Belgian voters have been using e-voting. The situation varied territorially as all municipalities in the Brussels region and German-speaking community use e-voting, while it nearly concerns half of the voters in Flanders and only 22% of the voting population in French-speaking Wallonia. With the 5th state reform, the regions received in 2001 the oversight on provinces and municipalities, implying that the regions can now choose themselves the voting modalities for local and provincial elections on their territory.

The e-voting also evolved over time, partly following the evolution of the technology. For instance, a system of e-voting with paper trail (or paper record) has been tested in 2003 in two cantons (Verlaine and Waarschoot) and, partly based on the recommendations of the interuniversity report BeVoting, gradually enlarged to all Brussels, Flemish and German-speaking municipalities. Since 2014, the light pen system has been gradually replaced by a touch-screen system. In 2019, a system allowing the visually impaired or blind voter to cast their vote independently (by following the voice instructions emitted by the voting software, via a headset) has been tested in two municipalities (Aalst and Mechelen).

The use of e-voting in Belgium has not been without debate and without problems. The equipment used since 1994 became relatively obsolete by the mid-2000s but their life span was extended (resulting in additional costs for the maintenance of the equipment). In some Brussels and Walloon municipalities, the old e-voting system has been used until the 2014 elections, creating an increasing number of small-scale incidents. Among those incidents, I can cite the 2003 problem in the municipality of Schaerbeek where a candidate received more than 4000 additional preference votes, or the 2004 problem in the municipality of Antwerp where a defective floppy disk created counting errors. In 2018, in one Brussels (Saint-Josse-ten-Noode) and six Flemish municipalities, a recount of the paper trails had to be carried out after aberrant results were observed because of software issues.

The 2014 elections witnessed a problem of another magnitude: a programming error in the software used in 39 Walloon and 17 Brussels municipalities implied that the ballots of some of the voters who changed their mind during the voting process were not recorded. This problem delayed the publication of the results for three days in Brussels and it was estimated that the votes of

2250 voters have been lost. In the days that followed, several political leaders in Brussels and Wallonia declared that they were in favor of returning to paper voting. In June 2015, the Walloon Parliament confirmed the abandonment of electronic voting in this region and this decision will be extended to regional, federal and European elections. The software problem had the opposite impact in Brussels and in the German-speaking community: these two entities decided to completely renew their old e-voting equipment and replace it with an e-voting system with paper trail. Since the 2018 elections, e-voting with paper evidence is used in all Brussels and German-speaking municipalities, as well as in a majority of Flemish municipalities. The other Flemish municipalities and all the French-speaking Walloon municipalities exclusively use paper voting.

Overall, the Belgian e-voting case presents a profile based on three main characteristics that is unique worldwide. First, it has been used for all binding elections organized in the country. Many other countries implemented e-voting only for local (and/or regional) elections, such as Australia, Canada or Japan. Second, it presents a continuity over almost 30 years, unlike countries such as Bulgaria, Ecuador, the Netherlands or the United Kingdom. Third, it has been implemented in a varying number of municipalities, contrary to countries such as Brazil or Venezuela. This last characteristic of a 'moving target' implies that researchers can compare between municipalities using e-voting and neighboring municipalities using paper voting, as well as comparing one municipality over time as it may oscillate between paper and e-voting.

3.4 E-voting and voting behavior in Belgium

As indicated in Section 3.3, e-voting is a widespread phenomenon in Belgium. In this chapter, I focused on a limited geographical subset of elections using e-voting and I provide a detailed analysis of the e-voting phenomenon in all the municipalities and cantons from the provinces of Liège in Wallonia and of Limburg in Flanders. The choice of these provinces is rather logical. Unlike other provinces, there have been no changes over time in the list of municipalities that used e-voting in these two provinces until 2014. Probably more importantly, there is a relatively equal number of municipalities and cantons using e-voting and paper voting in the provinces of Liège and Limburg.[6] Out of the 84 municipalities in the Liège province, 34 of them used e-voting for every single election between 1995 and 2014, which correspond to 12 electoral cantons out of 26 and about 62.75% of the voting population of the province. In the Limburg province, exactly half of the municipalities used e-voting between 1999 and 2014, i.e. 7 cantons out of 15 and 60.61% of the voting population.[7] This occurrence of municipalities using e-voting next to municipalities using paper voting in the same province for all elections and over a larger period of time constitutes a rather unique quasi-experiment.

For the analyses of the impact of e-voting on voting behavior, I focused on the national (federal) elections (House of Representatives). The advantage of these elections is that the electoral district is provincial-wide, meaning that the same set of parties and candidates are presented to all the voters in the province, independent of the voting modality in their canton. Given their specific voting behavior (particularly in terms of turnout and invalid votes shares – see Dandoy, 2014; Dejaeghere & Vanhoutte, 2016; Istasse, 2020), I excluded the German-speaking municipalities from the analyses. In addition, and unlike the other Walloon municipalities, these municipalities kept the e-voting modality for their elections after 2014. The data consist of national election results at the canton level for the provinces of Liège (1995–2014) and of Limburg (1999–2019).

The analyses indicate that the first hypothesis is confirmed: turnout is lower in cantons using e-voting compared to cantons with paper voting in both provinces. On average, during the period 1995–2014, turnout reached 90.35% in the Liège cantons using paper voting while we observe a turnout of 87.56% in the e-voting cantons. In the Limburg province, cantons using paper voting display an average turnout of 94.07% while this figure drops to 92.61% on the cantons with e-voting. Overall, the turnout difference between the two voting modalities is of 2.79% in the Liège province and of 1.46% in the Limburg one. These differences are quite important when one remembers that there is less variance in turnout figures in countries where voting is compulsory. Figure 3.1 shows that these differences in turnout are present in all election years, independent of the overall decline of turnout over the period under investigation.

In the Liège province, the difference in turnout between the two types of voting modalities seems to decrease over time. The difference in turnout between cantons using paper voting and e-voting was 3.60% in 1995 while it declined and reached a difference of only 2.17% in 2014. This evolution is not due to the fact that voters using e-voting tend to participate proportionally more over time but rather the consequence of the overall decline of turnout

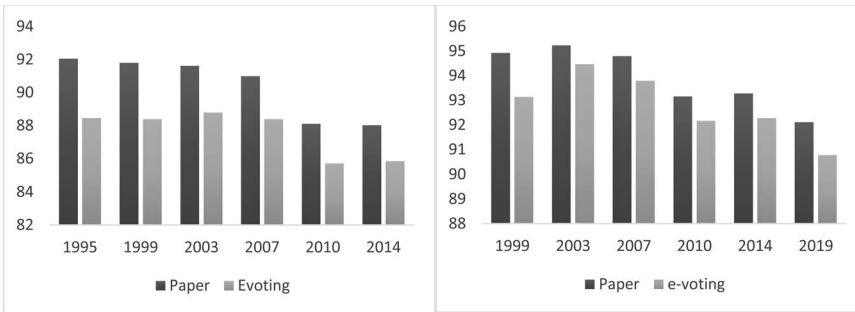

FIGURE 3.1 Turnout in national elections (Liège province, 1995–2014; Limburg province, 1999–2019)

in the province that affects more particularly the cantons using paper voting. In the Limburg province, the difference in turnout between cantons using paper voting and using e-voting remains fairly stable over time. In any case, it is interesting to notice that we do not observe that the negative impact of e-voting on turnout diminished over time in parallel with voters' increasing familiarity with e-voting and increasing digital skills.

Yet, the differences in turnout cannot be fully attributed to different types of voting modalities and several other factors may come into play. For instance, Dejaeghere and Vanhoutte (2016) indicated that sociodemographic variables measured at the municipal level such as age, marital status or migration had an impact on turnout in Belgian local elections besides e-voting, while Dandoy (2014) stressed out the importance of party competition, the presence of protest parties and urbanization for the same type of elections. Yet, these works have in common that they also put forward the importance of the size of the electoral districts, confirming the numerous studies that investigated the impact of the size of communities on turnout since Dahl and Tufte (1973). There is indeed an important bias in the sample of cantons that used e-voting in our two provinces and the average number of voters is significantly higher in cantons using e-voting compared to cantons using paper voting.

Concerning the second hypothesis, our data suggests that it is also confirmed. Cantons using paper voting display a larger share of invalid votes compared to cantons using e-voting. On average, during the period 1995–2014, the share of invalid votes is larger by 2.42% in cantons using paper voting (7.71%) compared to cantons using e-voting (5.29%) in the Liège province. Those figures reach, respectively, 6.06% and 5.13% in the Limburg province, indicating a difference of 0.93% between the cantons using different voting modalities. Our data based on national election results indicate important differences in the share of invalid votes between cantons using different voting modalities, confirming previous findings for local elections in Flanders (Dejaeghere & Vanhoutte, 2016).[8] Overall, the observed difference in invalid vote share is rather important and somehow compensates the difference in turnout observed above: turnout is lower in cantons using e-voting but voters from these cantons express a larger share of valid votes.

Figure 3.2 displays the share of invalid votes across election years for both types of cantons in both provinces. Over the whole period, the share of invalid votes is always higher in cantons using paper voting compared to cantons using e-voting. Yet, there seems to be no clear time-related patterns in the Liège province: the largest difference between cantons using paper voting and using e-voting was in 2003 (3.01%) while the smallest was observed in 1995 (1.53%). On the contrary, the share of invalid votes in the Limburg province clearly declines over time: from a difference of 1.34% in 1999 to a mere difference of 0.22% in the 2019 elections. In any case, we do not observe a clear relation between turnout and the share of invalid votes as the decrease of turnout over time is not followed by a similar pattern concerning the share of invalid votes in the cantons using e-voting.

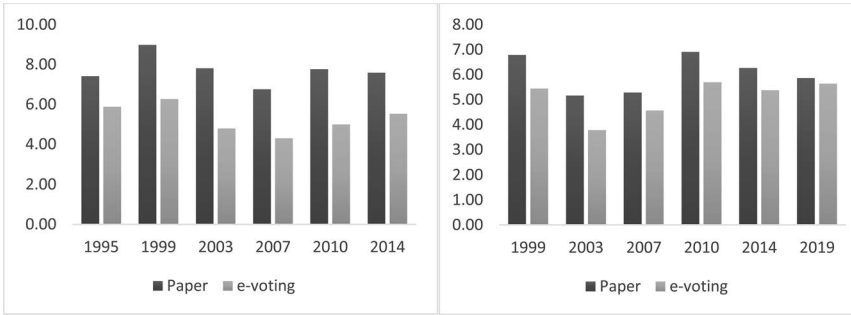

FIGURE 3.2 Share of invalid votes in national elections (Liège province, 1995–2014; Limburg province, 1999–2019)

Once again, several sociodemographic factors may in parallel have an impact on the share of invalid votes in these two provinces. Similar to their findings concerning turnout, Dejaeghere and Vanhoutte (2016) observed that invalid votes in local elections in Belgium are – besides e-voting – statistically related to age and migration, as well as to unemployment. In his study, Dandoy (2014) found out that turnout, municipality size and the patterns of competition (number of lists and presence of national parties) are similarly associated with the share of invalid votes in local elections in Wallonia.

Finally, this chapter aimed at observing the impact of e-voting on party vote shares. Given the specificity of the cantons in the Liège and Limburg provinces and the geographical grouping of the cantons using paper voting and using e-voting, observed differences regarding party vote shares are mostly explained by sociodemographic variables rather than by the voting modality.[9] For instance, e-voting cantons in the Liège province include left-leaning cantons such as Herstal, Saint-Nicolas or Seraing that bias the comparison between e-voting and paper cantons. However, the split-ticket voting hypothesis can be tested at the occasion of the 2014 elections. On the same day, voters had to choose their representatives in the federal parliament, the Walloon and Flemish regional parliaments and the European parliament. We therefore can compare whether e-voters tend to split their votes more often than voters using paper ballots (H3). German-speaking municipalities – where voters could emit an additional vote concerning the election of the German-speaking community parliament – are excluded from the calculations for the Liège province.

Table 3.1 presents the share of voters voting for different parties between the three combinations of elections. For instance, the figure of 3.91% for the province of Liège means that 3.91% of the voters in the cantons voting with paper did vote for two different parties in the federal elections compared to the regional elections. Overall, we observe that the share of split-ticket voting remains quite modest when using aggregate data,[10] in contrast with the 34.5% of the survey respondents that report having divided their votes among

TABLE 3.1 Share of split-ticket votes in the 2014 elections (Liège and Limburg provinces)

	Liège province		*Limburg province*	
	Paper voting (%)	*E-voting (%)*	*Paper voting (%)*	*E-voting (%)*
Federal – Regional	3.91	1.50	2.37	1.63
Federal – European	6.42	5.17	7.90	7.40
Regional – European	4.15	4.87	9.07	7.08

different parties at the 2014 simultaneous elections (Willocq & Kelbel, 2018). Figures are slightly higher for the Limburg province due to the 'Verhofstadt effect' in the European elections, meaning that an important share of Flemish voters decided to vote for the party of former prime minister Guy Verhofstadt in the European elections while voting for their preferred party in the other two elections.

Nonetheless, the data allow us to investigate trends across cantons with different voting modalities. Contrary to the third hypothesis, the share of split-ticket voters is larger in cantons using paper voting in both provinces. This is in particular true when looking at the differences between the federal elections and the regional and European elections in the Liège provinces and when looking at differences between the regional and European elections in the Limburg province. In our data, the only couple of elections that display a higher share of split-ticket voting in e-voting cantons concern the difference between the regional and European elections in the Liège province. We can conclude from these analyses that there seems to be more impact of voting for different elections on different paper ballots than voting on different successive computer screens.

3.5 Conclusion

This chapter aimed at investigating whether voters alter their behavior and their vote choice in response to different voting technologies. Given the varying usability of paper voting and electronic voting (e-voting), I assessed the impact of e-voting on voting behavior by focusing on three distinct phenomena: turnout, invalid voting and split-ticket voting. Building on the uniqueness of the Belgian e-voting system, this chapter relied on a quasi-experimental research design. Patterns of voting behavior have been empirically studied by comparing national legislative election results in cantons using e-voting with cantons voting with paper ballots in two Belgian provinces for the period 1995–2019.

This chapter confirmed previous findings reported in other countries. A lower turnout is observed in cantons using e-voting compared to cantons using paper voting. In a country where voting is compulsory, and where voting

participation remains very stable across election years, a difference of turnout of about 2% is an important phenomenon. It is also interesting to notice that we do not observe that the negative impact of e-voting on turnout diminished over time in parallel with voters' increasing familiarity with e-voting and increasing digital skills. Turnout remains lower in cantons using e-voting in recent election years.

In parallel, this chapter also acknowledges that – in line with a second hypothesis – a smaller share of invalid votes is observed in cantons using e-voting. Even if this is explained by the fact that the voting machine does not allow voters to express a null vote (only blank votes are allowed), the impact of e-voting is stronger than the indirect effect of compulsory voting, i.e. a large share of invalid votes in observed in countries using this voting feature. In a next step, a comparison with countries presenting similar characteristics (i.e. e-voting and compulsory voting) such as Ecuador or Peru would help us validate these findings for the Belgian case.

Contrary to the first two hypotheses, we do not witness a higher share of split-ticket votes in cantons using e-voting. On the contrary, there are proportionally more split-ticket voters in cantons using paper voting, probably due to the fact that these voters had separate paper ballots in hand while e-voters faced different screens on the same voting machine. More work is needed to investigate this issue and a comparative study of the impact of unified vs. separate ballots and e-voting is welcome. Finally, as the number of split-ticket votes has a direct consequence on election results and on party vote shares, the indirect impact on e-voting needs to be further investigated. Differences in party vote shares may not only be the consequence of the cantons' sociodemographic features but also on the (higher) incentive for voters to express split-ticket votes in cantons using paper voting.

Notes

1 The first trials took place in the United States in 1974 and in India in 1982.
2 In their study of US elections, Ansolabehere and Steward III (2005) found out that the variation of the share of residual votes depends not only on the type of voting technology but also on the type of elections (presidential, gubernatorial or senatorial).
3 Even if it is possible to manipulate the system in a specific way to cancel the vote (see the complex procedure in Pilet et al., 2019).
4 To my knowledge, there are no works investigating the impact of e-voting on voting behavior in Belgium.
5 A system of optic scanning of paper ballots was also tested in two cantons (Chimay and Zonneke) between 1999 and 2003, while a system of computer-assisted counting system of the paper ballots has been used in 35 Flemish and Walloon cantons between 2012 and 2018.
6 In Brussels, all municipalities use e-voting and a large majority of municipalities use it in the Antwerp and Flemish Brabant provinces. In the other provinces, the e-voting is not used (provinces of Namur and Walloon Brabant) or used in only a handful of municipalities (provinces of Hainaut, Luxembourg and East- and West-Flanders).

7 For the 2019 legislative elections, six additional municipalities decided to move to e-voting, while four other municipalities merged, slightly skewing the balance in favor of e-voting for these elections.
8 On the contrary, past analysis of invalid voting in local elections in Wallonia indicated no significant differences between paper voting and e-voting (Dandoy, 2014). This is probably related to the political offer (i.e. there are many more parties and candidates in national elections compared to the local ones) and *de facto* to the size of the ballot paper.
9 For instance, for the 2014 federal elections in the Liège province, the parties PTB and PS scored better in e-voting cantons (+5.6% and 4.76%, respectively) while the parties MR and cdH obtained a lower vote share in these e-voting cantons (−6.06% and −3.75%, respectively).
10 The share of split-ticket voting has been calculated in a conservative way by summing the vote share differences between two elections for all parties, divided by two.

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