Assessing Ballot Structure and Split Ticket Voting: Evidence from a Quasi-Experiment

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Although a growing number of countries have implemented electronic voting, few scholars have considered the unintended consequences of such reforms. We argue that changes in ballot structure imposed by electronic voting, implemented under the exact same electoral rules, can facilitate ballot splitting. Exploiting data from three elections and a novel ballot reform in Salta, Argentina—electronic voting was incrementally introduced over multiple elections—we provide an empirical analysis of how ballot structure influences ballot splitting. We use the Geographic Information System to reconstruct precinct demographics and matching to address threats to random assignment. This empirical strategy allows us to treat our data as a quasi-experiment. We find that precincts casting electronic ballots under an Australian ballot, rather than the ballot-and-envelope system, have significantly higher rates of ballot splitting. Our findings imply that less complicated voting procedures can affect the composition of legislative representation and manufacture a more inclusive legislature.

In recent years, many governments have changed their voting procedures in an attempt to make elections more efficient and reliable (Alvarez and Hall 2008; Alvarez, Katz, and Pomares 2011). In particular, dozens of countries around the world have piloted or adopted electronic voting devices designed to increase efficiency, confidence, and turnout by offering more user-friendly procedures for voters and automatizing vote tallying (Alvarez et al. 2009; Tula 2005). Scholars have devoted considerable attention to understanding whether the implementation of electronic voting successfully improves electoral processes and bolsters confidence in elections. Yet the implementation of electronic voting frequently introduces small adjustments to the ballot structure that may have unintended effects on representation (Calvo, Escolar, and Pomares 2008; Katz et al. 2011). We contend that seemingly minor changes have major consequences for how citizens cast their vote. Specifically, we examine how modifications to ballot structure imposed by electronic voting influence ballot splitting.

Split ticket voting (i.e., voting for a different party for different contests in the same election) is a common feature in many electoral systems and is extremely important for representation because it influences the distribution of legislative seats—and subsequently which voters, policies, and preferences are represented in office (Massicotte, Blais, and Yoshinaka 2004; McAllister 2015). Voters may split their ballot to produce ideological or partisan balance (Burden and Helmke 2009), to support candidates who exhibit desirable personal traits (Beck et al. 1992), or to vote strategically to avoid wasting their vote (Cox 1997; Moser and Scheiner 2009). Despite voters' incentives to split their ballots, not all voters are willing to pay the costs associated with splitting their ticket. We argue that altering something as simple as the ballot structure, while maintaining the exact same electoral rules, can lower the cost of split ticket voting, thereby significantly increasing the probability of ballot splitting.

Indeed, complicated ballot structures, such as the ballot-and-envelope system (i.e., the French system, in which each party prints and distributes a unique partisan paper ballot, and voters can either vote straight ticket or create their own mixture of partisan ballots by physically splitting their

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ballots and then placing their vote in an envelope), create unnecessary complications that may discourage ballot splitting. By contrast, more user-friendly ballot structures, such as the Australian ballot (in which the candidates from all political parties are grouped on a single ballot by office), make it easier and more convenient for voters to split their ballot and may even encourage such behavior (Burden and Kimball 2002; Rusk 1970).

To test our argument, we take advantage of a novel ballot reform in Salta, Argentina, where electronic voting was incrementally implemented over multiple elections. In 2007, the entire electorate used the traditional ballot-and-envelope system. In 2011, for the first time, half of the voters in the district of Salta used electronic devices, while the other half used the ballot-and-envelope system. Finally, in 2015, all voters used electronic voting.[1] The reform only introduced one change—with electronic voting voters were given the option to view the ballot either arranged by *political party* (similar to the ballot-and-envelope system) or by *elected positions* (similar to the Australian ballot). If voters chose to vote by political party, it was similar to viewing the partisan paper ballots. But if they chose to vote by elected position, the voter could easily vote for different parties for each position. The availability of this second option makes vote splitting easier.

The quasi-experimental design facilitated by the partial implementation of the reform in 2011 offers a unique opportunity to assess the impact of ballot structures on ballot splitting using a difference-in-difference strategy that compares the likelihood of ballot splitting in those precincts with and without electronic voting. As quasi-experiments do not involve an explicit random assignment, we construct an original data set using Geographic Information System (GIS) technology to identify precinct demographics and employ matching methods to reproduce the properties of a randomized experiment using observational data. This empirical approach allows us to explicitly address endogeneity issues associated with institutional reforms—that is, the concern that electronic voting was assigned in precisely those precincts where voters have a higher proclivity to split their ballots.

Results from difference-in-difference analyses demonstrate that precincts using electronic voting with the option to view the Australian ballot structure (treatment group), as compared to the ballot-and-envelope system (control group), have significantly higher rates of ballot splitting. Whereas there are statistically significant differences between the treatment and control groups in 2011 under partial implementation, there are no differences between the treatment and control groups in the 2007 (no implementation) or 2015 (full implementation) elections, indicating that the increase in ballot splitting is a product of the ballot reform. Results from a precinct-party–level analysis provide some insight into how modifications to the ballot structure may influence ballot splitting differently across political parties. In particular, we see that electronic voting led to an uptick in ballot splitting among smaller political parties where the electoral payoff for split ticket voting was less clear. Taken together, our results demonstrate how changes in voting procedures and ballot structures, within the exact same electoral institutions, can transform a system from being one where voters are effectively discouraged from splitting their votes to one where voters are able to deliberately maximize their interests by more accurately translating their preferences at the polls.

This result has important implications for public policy. Although many leaders are resistant to major electoral reforms known to influence election outcomes, they are more open to minor, seemingly innocuous, adjustments to voting procedures and ballot structures. Yet our findings indicate that electoral engineers might be introducing new incentives for split ticket voting even when reforming small, apparently neutral voting measures. These minor alterations in ballot structures, moreover, have important implications for representation linkages in democracies. As executive races are the locus of electoral competition in presidential systems, concurrence between executive and legislative elections reduces the number of legislative parties (Cox 1997; Jones 1997; Shugart and Carey 1992). When ballot structures erode the influence the executive race exerts over the legislative race by facilitating ballot splitting, they are likely to increase the effective number of legislative parties and thereby manufacture more inclusive and representative legislative outcomes.

THE (UN)INTENDED CONSEQUENCES OF BALLOT STRUCTURES AND VOTING PROCEDURE

In recent decades, the adoption and piloting of different voting procedures and ballot structures have spurred considerable research on the effect of these reforms on electoral competition and political outcomes (Alvarez and Hall 2008; Herrnson et al. 2009). Governments reform their voting procedures in an effort to increase political participation (Barnes and Rangel 2014; Kersting and Baldersheim 2004), reduce electoral fraud (Fujiwara 2015; Rezende 2003), and bolster confidence in the electoral process (Alvarez et al. 2009, 2011; Thompson Jiménez 2009; Tula 2005).

1. In 2013, all voters used electronic ballots, and in 2009, all voters used paper ballots. These, however, were midterm elections, and thus, they are not useful for studying executive-legislative ballot splitting.

For example, electronic voting (herein e-voting) in Brazil was introduced in part as an effort to lower barriers to political participation among less educated voters by eliminating the difficulties associated with writing-intensive paper ballots (Fujiwara 2015; Rezende 2003). Still, in other countries, concerns about election transparency and fraud have triggered the adoption of different versions of the Australian ballot (Alvarez et al. 2011; Prasad et al. 2010) as a way of centralizing ballot provision and guaranteeing the availability of every ballot in every voting center. In the ballot-and-envelope system—a paper ballot that, until recently, was common in Latin America, (e.g., Argentina, Panama, Colombia, and Uruguay) and Africa (e.g., Chad, Guinea, Burkina Faso, Mali, Mauritania, Niger, Senegal, and Tunisia)—parties are responsible for printing, distributing, and stocking their own ballots. Under such rules, smaller parties often lack the resources to ensure ballot availability during elections and even run the risk of their ballots being stolen from some polling stations (ACE 2011; Pomares et al. 2014b). Conversely, the Australian ballot system and e-voting can both reduce fraud by assuring voters have the option to vote for each of the parties competing in the electoral contest. Similarly, confidence in the electoral process is a major concern when it comes to ballot reforms. With respect to e-voting in particular, whereas earlier studies in the United States have found that voters are skeptical about reforms (Alvarez and Hall 2008; Alvarez, Hall, and Llewellyn 2008), more recent research from the United States, Belgium, Argentina, and Colombia suggests that, conditional on demographic characteristics, citizens' concerns surrounding e-voting are abating (Alvarez et al. 2011, 2013; Beaulieu 2015; Delwit, Kulachi, and Pilet 2005).

Although research has most often focused on these intended consequences of ballot reforms, new ballot structures and voting procedures may also have meaningful unintended consequences for election outcomes. For example, in the United States, e-voting attenuates ballot roll-off (Nichols and Strizek 1995). Complicated ballot structures, by comparison, may cause confusion and frustration for voters and ultimately increase the number of invalid votes (Kimball and Kropf 2005). Moreover, changes in the voting procedure can bias outcomes by inconsistently influencing turnout across different groups of voters and shifting vote choice in favor of different parties or candidates. For instance, Card and Moretti (2007) show that the adoption of touch screen machines in the United States was associated with lower turnout in counties with large Hispanic populations. Similarly, both Calvo et al. (2008) and Katz et al. (2011) report that the informational cues offered by different ballot structures favor some parties to the detriment of others. Ballots that reinforce party-centric informational cues, such as party name or logo, decrease the likelihood of split ticket voting.

We contribute to this nascent body of literature by examining another unintended—but electorally important—consequence of ballot structure. Specifically, we examine how changes in the ballot structure introduced by e-voting in Argentina affect the way voters translate their preferences into votes—either by casting a straight ticket ballot in concurrent executive-legislative elections or by splitting their ballot.

BALLOT SPLITTING AND THE CRUCIAL IMPACT OF BALLOT STRUCTURES

Voters are often called upon to make multiple decisions for different contests in the same election. Although straight ticket voting, in which voters support the same political party for each contest at stake, is the dominant form of voting, a number of voters prefer to split their ballot. Split ticket voting occurs when voters choose between parties competing to fill political posts at different levels of government (e.g., vertical ticket splitting) or between parties competing for equivalent offices (e.g., horizontal ticket splitting; Burden and Helmke 2009; Campbell and Miller 1957).

The level of split ticket voting varies substantially across different political and institutional contexts. In the United States, for instance, ticket splitting between presidential and House member candidates rose from about 12% of voters in the 1950s to more than 25% during the 1980s, and then it declined again in the 1990s (Burden and Kimball 2002). These values vary across congressional districts, depending in part on how contested the election is (Brunell and Grofman 2009; Burden and Kimball 1998, 2002). Further, split ticket voting tends to be higher in countries with multi-party systems and where political parties are weakly institutionalized (Burden and Kimball 2002; Moser and Scheiner 2009). In Brazil, for example, where the number of effective parties is high, approximately 70% of voters split their ticket between presidential and legislative candidates (Ames, Baker, and Reno 2009). In Mexico, by comparison, where there are far fewer competitive political parties, less than 10% of voters split their ballot during concurrent presidential elections (Helmke 2009). Horizontal ticket splitting in mixed member systems also varies substantially, ranging from a low of 8.73% in Hungary to more than 30% in New Zealand and South Korea (Rich 2014).

Incentives to cast a split ticket are diverse. Voters may have incentives to split their ballot in an effort to achieve policy/ideological balancing (Alesina and Rosenthal 1995; Brunell and Grofman 2009; Shugart 1995), to engage in strategic voting (Cox 1997; Moser and Scheiner 2009), because

they are attracted to an individual candidate's personal qualities (Beck et al. 1992), or even because they are indifferent between political parties (Campbell and Miller 1957). Despite these incentives, the electoral benefits of split ticket voting are not always clear. Thus, not all voters who prefer to split their vote are willing to pay the costs of doing so. In particular, we argue that some ballot structures can impose unnecessary costs on voters, making it taxing for them to split their ballot.

Ballot structures vary substantially in terms of the levels of difficulty, that is, the cognitive and physical demands they place on voters. Some ballots require voters to select or punch multiple boxes, to cut or tear the ballot, or to use complex machines that demand considerable attention. Such variation in ballot structure affects voters' behavior at the polls, making them more or less likely to cast a split ticket vote. Thus, even when voters prefer to split their ticket, if it is uncertain how it will affect the electoral outcome, the costs imposed by complicated ballot structures may be sufficient to discourage voters from doing so. By contrast, other ballot structures can streamline the ticket splitting process, making it easy for motivated voters to split their vote. When voters can split their ballot without incurring any additional costs, they are more likely to do so, even if they do not anticipate that it will result in clear electoral payoffs.

Previous research from the United States provides some evidence to support the idea that the ballot structure shapes voters' predisposition to split their vote (Rusk 1970). When ballots do not offer a straight party option, and thus require voters to make separate decisions for each contest, splitting one's vote is no more costly than voting straight ticket. Consequently, voters are more likely to split their ballot when they are not presented with a straight ticket option (Campbell et al. 1960; Campbell and Miller 1957; Darcy and Schneider 1989; Reynolds and McCormick 1986; Walker 1966).

The ballot-and-envelope system is a good example of how the ballot structure can discourage split ticket voting. The default is straight ticket voting. To vote straight ticket all voters need to do is select a ballot, put it in an envelope, and place it in the ballot box. Split ticket voting requires voters to manually tear a paper ballot in order to split their vote. This is inconvenient, complicated, and requires extra effort and time in the ballot box. For this reason, we argue that the ballot-and-envelope system discourages split ticket voting, particularly when the electoral payoffs are unclear.

By contrast, streamlined voting procedures such as the Australian ballot simplify the vote splitting process. For example, a single paper ballot (such as the ones recently adopted by Benin, Guinea, Niger, and Tunisia) or an electronic ballot (like the ones adopted in Brazil, Estonia, the Philippines, India, the United States, and Venezuela) displaying all candidates/parties on the same ballot limit the number of steps voters must take to split their ballot. Voters only need to click a button or check a box to choose an executive candidate and a legislative candidate from different parties. We anticipate that more user-friendly ballot structures that allow voters to view the ballot organized by office substantially reduce the cost of ballot splitting by making it convenient, fast, and easy as compared to the ballot-and-envelope system. To evaluate this proposition, we test the following hypothesis:

> **H1.** The average level of ballot splitting will be lower with the ballot-and-envelope system than with the Australian ballot.

THE VARYING IMPACT OF BALLOT STRUCTURE ON SPLIT-TICKET VOTING ACROSS PARTIES

Although we anticipate that the Australian ballot structure should, on average, increase ballot splitting as compared to the ballot-and-envelope system, we should not expect a uniform effect across all political parties. To understand how changes in the ballot structure will influence ballot splitting differently across political parties, it is important to take into consideration voters' incentives for splitting their ballot. Regardless of voters' motivations to split their ballot (e.g., policy/ideological balancing, attraction to individual candidates, indifference toward parties, or strategic voting), the physical characteristics of the electoral ballot could explain some of the overall increase or decrease in the proportion of split ticket voting (Campbell et al. 1960). Only strategic voting theory, however, offers insight about which candidates or parties will see the largest uptick in vote splitting resulting from different ballot structures.

The strategic voting explanation relies on voters' calculations, arguing that voters refrain from voting for their most preferred candidate and instead vote for their most preferred viable candidate to avoid wasting their vote (Cox 1997). In concurrent elections, candidates compete under the same party label, but often each race is governed by a different set of electoral rules or structured by a different field of political competition. Consequently, voters face different incentives for each candidate selection.

In concurrent executive and legislative elections, for example, the executive candidates compete for a single seat. Voters may, therefore, be compelled to vote strategically because there are fewer viable candidates. By contrast, in multimember legislative elections, as the number of seats at stake

grows, there are a larger number of viable candidates, and voters have stronger incentives to cast a sincere vote for their most preferred candidate (Moser and Scheiner 2009). Moreover, even when the different races are governed by the same electoral rules, candidates from the same political party may be more or less viable for elections at different levels of government. When there is more certainty about the electoral payoff of split ticket voting, voters are more willing to pay the cost of splitting their ballot even when doing so is inconvenient, as with the ballot-and-envelope system. The strategic voting literature thus implies that overall levels of ballot splitting will be higher among the most popular/viable executive candidates than for the less competitive executive candidates regardless of the ballot structure.

It is our contention that ballot structures that facilitate ticket splitting, such as the Australian ballot (as compared to the ballot-and-envelope system), increase split ticket voting by lowering the cost of ballot splitting such that the benefit outweighs the cost. Thus, in thinking about how ballot structure may cause a larger increase in ballot splitting for some parties than others, the strategic voting literature implies that an uptick in ballot splitting may be larger for smaller parties where the payoff for split ticket voting is unclear. As voters are already inclined to split their ticket when there are clear electoral payoffs, lowering the cost of ballot splitting may not substantially increase the level of split ticket voting in such circumstances. By contrast, a simplified ballot structure may produce an uptick in split tickets when the payoff for ticket splitting is ambiguous. That is, if a voter is uncertain how much ticket splitting will pay off, she may be less likely to pay the costs of undertaking the laborious procedure of splitting their paper ballot. But, when ticket splitting is costless, voters will be more likely to do so, even if the payoff is uncertain. Given this, in the executive-legislative context, we expect that the Australian ballot is most likely to result in an uptick in split ballots among smaller parties with nonviable executive candidates and/or those with a lower probability of winning a legislative seat.

> **H2.** The adoption of the Australian ballot will lead to a greater increase in ballot splitting among smaller political parties.

PARTIAL IMPLEMENTATION OF ELECTRONIC VOTING IN SALTA: A QUASI-EXPERIMENT

In 2011, e-voting was implemented in Salta, Argentina, replacing the ballot-and-envelope system that was ubiquitous across the entire country (Alvarez et al. 2013; Pomares et al. 2011). The governor and the Electoral Tribunal jointly decided to incrementally introduce the new voting procedure to half of the electorate in the legislative district of Salta.[2] The partial implementation provides a rare opportunity to evaluate the relationship between voting procedures and ballot splitting using a quasi-experimental design. We exploit this opportunity by analyzing data from the 2007 (no implementation), 2011 (partial implementation), and 2015 (full implementation) concurrent gubernatorial and provincial legislative elections.

We leverage precinct-level observational data from the district of Salta—the only legislative district in which half of the voters used electronic ballots and half used paper ballots—to evaluate how different ballot structures facilitate ballot splitting.[3] The unit of analysis is the precinct because this is the unit of assignment for the treatment condition. The precinct-level analysis combined with partial implementation allows us to examine different ballot structures applied in the exact same district, in the exact same election, and under the same electoral rules.[4] As the effects of ballot reforms are conditional on other cultural, institutional, and political factors (e.g., the electoral rules or the number of parties competing in the election), the primary advantage of a subnational analysis is that it facilitates a controlled comparison across precincts where other potentially confounding factors are held constant. In a cross-national setting, by contrast, institutional and political factors vary substantially, making it more difficult to isolate the effect of ballot reform. Although this variation presents a host of research design challenges, the subnational setting with partial implementation in the same election makes it possible to identify the causal effects of ballot structures—a comparison that is virtually impossible in a cross-national analysis.

In the quasi-experimental research design, the "control group" comprises precincts using the ballot-and-envelope system in the 2011 election. Precincts using the e-voting device in the 2011 election comprise the "treatment group."

2. In 2011, a total of 33% of the voters across the entire province used the electronic voting system for the first time. In the following two elections (2013 midterm and the 2015 gubernatorial elections), e-voting was used across the entire province.

3. There are 54 precincts in the district of Salta. Each includes many polling stations (i.e., schools) and multiple voting booths within each station. Voters within precincts are assigned to voting booths according to the first letter of their last name (see table B2 in appendix B).

4. The governor is elected by plurality rule, and deputies in the district of Salta are elected from a closed list proportional representation system with a district magnitude of 9.

We briefly explain the voting procedures and ballot structures for the two types of ballots to illustrate how they influence ballot splitting.

Control condition: Ballot-and-envelope system

Before 2011, the same ballot-and-envelope system was used in virtually every Argentine election across the entire country. Under this system, each party is represented on a separate ballot, and every party is responsible for printing and distributing their ballots to every voting center. Figure 1 shows an example of the paper ballot from 2011 from the district of Salta. The paper ballot is a single piece of paper, with the party label, the party/coalition registration number, and sometimes a picture of the candidate. It contains the party's candidates for all the positions at stake in a given district, divided by a printed line. In the voting booth, the voter finds the ballots from all the contending parties, sorted by their registration number. The voter selects the ballot of her choice, folds it, places it into an envelope provided by the Electoral Tribunal, and slips it into the ballot box.

If the voter wants to split her ballot, she is tasked with a more laborious and risky process. First, the voter must gather the different ballots of her preferred parties for each office at stake. Then she must physically "split" the ballot by cutting out the elected position she supports from each party, placing all the preferred ballot pieces in the envelope, and discarding the unwanted pieces of the ballots. If the voter makes an error when casting her ballot, such as tearing the ballot, including more than one ballot for the same office, or not including a ballot for some category at stake, she wastes her vote by either spoiling her vote or by voting blank for the omitted category.

Treatment condition: Electronic ballot

The voting procedure under the electronic ballot is very different and considerably more user-friendly. The voter first approaches a touch screen machine. Then she chooses how the candidates for each position at stake will be displayed on the screen. Candidates can be displayed in one of two ways: (1) by political party or (2) by elected positions. If voters choose candidates to be displayed by political party, the e-voting device will first show all gubernatorial candidates competing in that election. After the voter chooses the gubernatorial candidate of her choice, the device will display the other lists and candidates associated with the gubernatorial candidate. In Argentina, the top gubernatorial candidates frequently run with the support of other smaller parties that choose not to field their own gubernatorial candidates. For those candidates competing with several legislative lists, the electronic device will show a second screen in which the executive ticket is represented on the screen multiple times, once for each of the lists affiliated with the can-

Figure 1. Demo paper ballots from the 2011 election in the district of Salta, Argentina. Each one-third of the ballot corresponds to a different elected position. Voters choosing to split their ballot can divide their ballot accordingly.

didate. Finally, voters may cast a straight ticket ballot by confirming and selecting this option on the screen. By contrast, if the voter chooses candidates to be displayed by elected position, she views all the candidates for each position at once, and selects the party/candidate she supports for each election at stake. Compared to the ballot-and-envelope system, this option makes it simple to cast a split ticket, while it assures that ballots for each of the political parties at stake are always available at every polling station.

Threats to random assignment

Despite the partial implementation of e-voting, the treatment assignment criteria are not random. Indeed, treatments in quasi-experiments do not involve an explicit random assignment, which is the primary feature of our research design that distinguishes it from a natural experiment. We identified the threats to random assignment, and we use this information to match precincts from the treatment group and the control group to improve our ability to make inferences.

To begin with, bureaucrats and politicians may have had incentives to pilot e-voting in some precincts rather than others. Elite interviews with the bureaucrats who organized the reform report that partial implementation was chosen as a means to assure a successful execution and to avoid any resistance to the reform (Alvarez et al. 2013; ONPE 2014; Pomares, Levin, and Alvarez 2014a). Thus they initiated e-voting in places with more sophisticated voters, that is, in precincts where socioeconomic status (SES), education, and technological sophistication are higher (Alvarez et al. 2013; Pomares and Zárate 2014). Moreover, given that the incumbent governor spearheaded the decision to implement e-voting and to do so incrementally, it is possible that some political calculations guided the treatment assignment. The incumbent's performance in the district of Salta in the previous election was 5% below the province average, and his support was distributed relatively evenly across the precincts in the district of Salta.

To address bureaucratic concerns, we match precincts on the share of families that live below the poverty line and on the share of the population with elementary education or less (i.e., the first seven years of formal education) as a proxy of voters' sophistication. To address the potential political motivations, we match precincts on the percentage of votes the runner up (i.e., the opposition candidate) won in the 2007 gubernatorial election—the election prior to the assignment of e-voting.[5]

Geo-referenced data

Although electoral data are available at the precinct level, sociodemographic variables are only available at the census-tract level, and census tracts do not map onto precincts. The lack of information on precinct boundaries presents a major challenge for identifying the SES characteristics of precincts. To address this, we built an original data set using ArcGIS to recreate precinct boundaries based on the location of voting centers. We map this information onto existing census tract boundaries to identify precinct-level demographics. As the shape of the precincts is unknown, we use two different GIS techniques to approximate the precinct boundaries, allowing us to examine the sensitivity of our results to the different procedures (see appendix A for details; appendices A–F are available online). The results are remarkably robust to the two GIS techniques; thus, we report results from the Thiessen polygon technique in the text and results from the nearest neighbor technique in appendices D and E.

Matching methods

Matching methods attempt to construct a data set where background conditions in the sample are equal across the treatment and control groups, operating as a pre-processing step before the parametric analysis. This approach allows us to account for the potential confounding effects between the treatment and the outcome, and it reduces the probability that the results are model dependent (King and Zeng 2006). We employ two alternative matching methods to reconstruct the balance in the sample: Propensity Scores (PS) matching without replacement (Gelman and Hill 2007; Ho et al. 2007) and Coarsened Exact (CE) matching (Iacus, King, and Porro 2011, 2012).

Quantile-quantile plots (Q-Q plots) used to assess the post-matching balance improvement indicate that the balance improved substantially for two of the three background confounders (i.e., poverty and education; see appendix C for Q-Q plots and summary statistics). Balance does not improve for the opposition vote share, as it was already well balanced prior to matching. The CE matching produces the larger balance improvement. Of the 54 precincts in the district of Salta, the treatment and control subsamples comprise 14 and 19 observations, respectively, for the Thiessen polygon technique, and 14 and 20, respectively, for the nearest neighbor technique. In both samples, the balance for poverty and education improves by at least 75%. The PS matching produces the

5. The power of these variables was modeled to predict the treatment assignment, and the results suggest that there is some association: electronic devices were somewhat more likely in precincts with more educated voters and with less support for the runner up governor in the previous gubernatorial election. These findings also suggest how suitable the pool of variables used to match the data was. See table B1 in appendix B

poorest post-matching balance in the data. The treatment and control subsamples comprise 25 and 9 observations, respectively, for the Thiessen polygon technique, and 25 and 10, respectively, for the nearest neighbor technique, and none of the variables improved by more than 55%. Typically there is a trade-off between sample size and post-matching balance (King, Lucas, and Nielsen 2014), but in the case of our data, CE matching produces better balance and a sample size that compares favorably to the one produced from PS matching. For this reason, and because the results are robust to both matching procedures, we report results using CE matching in the text and those from the PS matching in Appendices D and E.

MEASURING SPLIT TICKET VOTING

Our theory posits that reforms to the ballot structure introduced by e-voting should increase the overall level of ballot splitting (hypothesis 1). Yet, we should not expect to see uniform increases in ballot splitting across all political parties (hypothesis 2). In this section, we explain how we measure each of our two dependent variables to test our precinct- and party-level hypotheses.

Vote splitting at the precinct level

Our first dependent variable measures the overall share of split tickets within the precinct. Thus, the unit of analysis is the precinct. To calculate the share of split ballots within the precinct, y_i, we take the absolute value of the difference in the gubernatorial candidate's votes, G_{ij}, compared to the legislative ticket's votes, D_{ij}, for each party j competing in each precinct i.[6] We sum across all parties in precinct i, divide by two, and weigh the value as a share of the total valid votes, V_i, in the precinct.[7] This gives us the share of split ticket votes in a given precinct: $\text{Split}_i = \left(\sum |G_{ij} - D_{ij}|/2\right)/V_i$.

Figure 2 illustrates the trends in ballot splitting across precincts and over time. It represents each precinct in our matched sample on the x-axis and the share of split ballots (i.e., the dependent variable) on the y-axis for each year in our analysis. The dark bars indicate precincts using e-voting, and the light bars denote those using paper ballots. We can see immediately from figure 2 that in 2011 the overall share of split ballots was higher in those precincts using e-voting than in those precincts using the ballot-and-envelope system. In fact, in the vast majority of e-voting precincts, the share of split ballots is greater than in paper ballot precincts. Out of 14 matched precincts using e-voting, 13 have the highest share of split ballots in the 2011 sample. Whereas there is a clear jump from 6 to 10 points in the share of split ballots between the control and treatment precincts in 2011, there is no clear pattern between levels of ballot splitting and voting systems in 2007 (no implementation) or 2015 (full implementation) elections.

Vote splitting at the precinct-party level

Our second dependent variable calculates the share of split tickets at the precinct-party level for each party fielding a gubernatorial candidate. Here the unit of observation is the precinct-party. We calculate y_{ij} to reflect ballot splitting for every political party j that fielded a gubernatorial candidate in precinct i. We measure the difference between the number of votes obtained by the gubernatorial candidate, G_{ij}, and the number of votes his legislative lists won, D_{ij}, divided by the total number of votes obtained by each party, V_{ij}. This gives us our precinct-party level dependent variable: $\text{Split}_{ij} = (G_{ij} - D_{ij}/V_{ij})$. Positive (negative) values indicate that the gubernatorial candidate won more (less) votes than the legislative list.

When gubernatorial candidates are featured on multiple ballots with different legislative lists, voters can technically vote for the gubernatorial candidate and a legislative list from a different party without physically splitting their ballot. In our analysis, we define split ticket voting as the cases in which voters using the ballot-and-envelope system physically split their ballot (and not those cases where voters can technically vote for two different parties without splitting their ballot). When more than one list is attached to the gubernatorial ticket, we calculate the number of votes the legislative lists won by summing the votes for all of the lists affiliated with a single gubernatorial candidate. The total number of votes is defined by the maximum number of votes obtained by the party in any of the two categories.

Potential data limitations

Scholars studying ballot splitting routinely face a host of methodological challenges (Burden and Helmke 2009). Although we are able to overcome some very difficult research design problems using a quasi-experimental approach, data availability still poses potential limitations for our analyses. One limitation of our precinct-party level variable is that the

6. When the gubernatorial candidate runs with multiple legislative lists, we take the difference between the votes obtained by the gubernatorial candidate and the sum of votes obtained by the different lists attached to his ticket.

7. Transforming the dependent variable into a ratio makes it comparable across electoral precincts regardless of the number of registered voters.

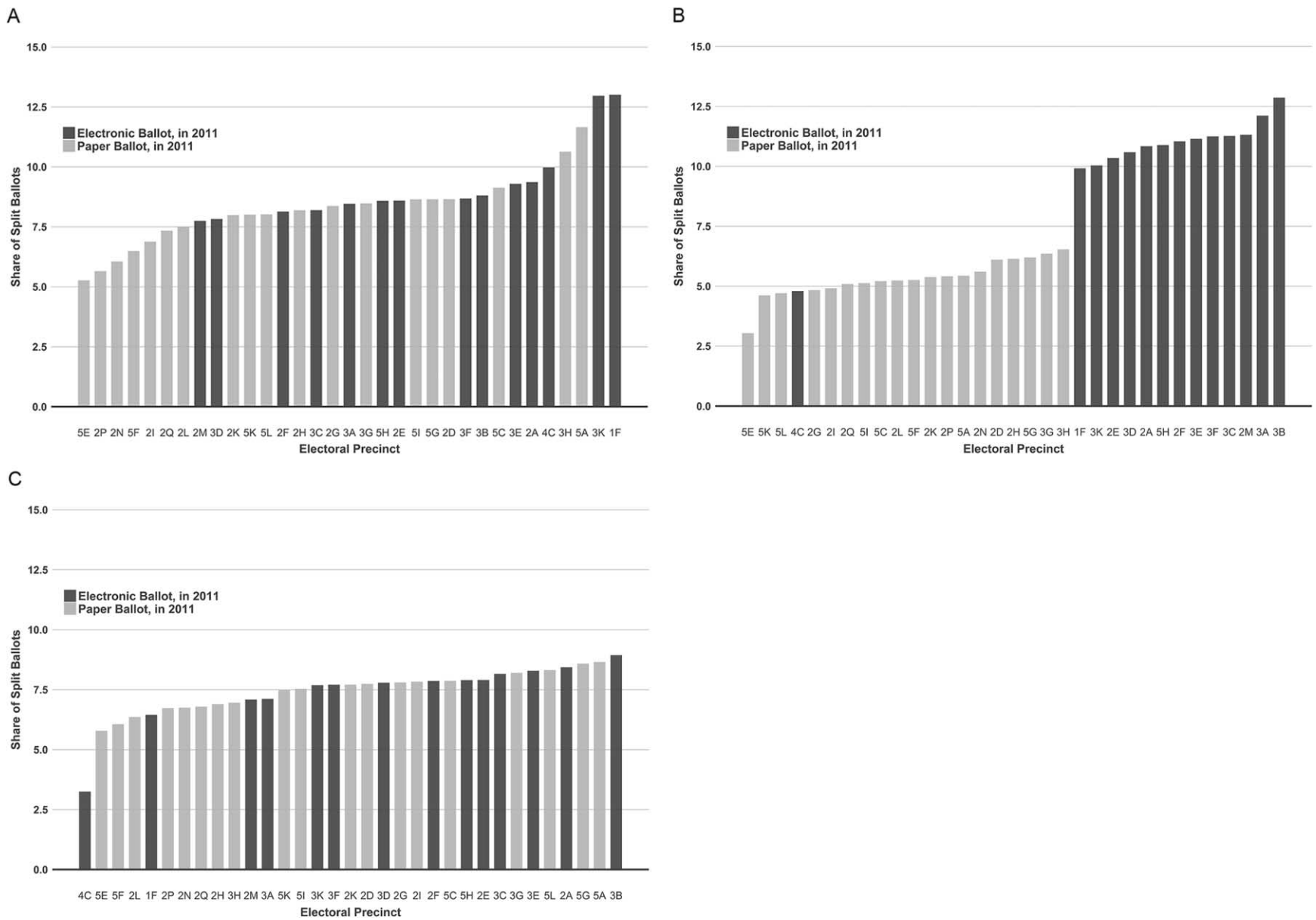

Figure 2. Share of split ballots, by precinct and type of ballot: *A*, 2007 election, no implementation; *B*, 2011 election, partial implementation; *C*, 2015 election, total implementation

Electoral Tribunal only reports the overall number of votes each gubernatorial candidate won and the overall number of votes each of the legislative lists won. The tribunal does not distinguish between the votes gubernatorial candidates won from each of the different legislative lists. We cannot, therefore, empirically distinguish among the votes gubernatorial candidates earned when competing with different legislative tickets. An empirical implication of this data limitation is that it provides a conservative estimate of how frequently voters support a leading gubernatorial candidate without supporting the candidate's party. As such, it may decrease the overall level of ballot splitting we observe at the precinct level and in particular among parties that field gubernatorial candidates with multiple supporting legislative party lists at the precinct-party level. Nonetheless, because the same parties compete with multiple lists attached to their gubernatorial ticket across all of the precincts in our analysis, and this does not vary across the treatment and control groups, it does not limit our ability to observe the causal impact of the ballot reform on split ticket voting. Importantly, our results are robust to the exclusion of parties that run with multiple list attached to the gubernatorial ticket (see appendix F).

A second limitation of our data is that in precincts using the ballot-and-envelope system, it is clear to voters which legislative lists are associated with which gubernatorial candidate. By contrast, in the e-voting system, this same information is not presented on the ballot if the voter chooses to view the ballot by elected position. If voters in precincts with e-voting do not have information regarding which legislative lists support which gubernatorial candidates, this could increase ballot splitting in precincts with e-voting due to a lack of information. For instance, voters may want to vote for one of the parties that supports their favored gubernatorial candidate, but they may erroneously choose a legislative list that does not support their favored candidate. That said, this scenario would only increase ballot splitting for the political parties that run with multiple legislative lists (in 2011 the FREJUREVI and Frente Olmedo), thus increasing ballot splitting for parties with viable gubernatorial candidates and reducing the probability that we find support for hypothesis 2. By contrast, parties that run with only one legislative list attached to their gubernatorial candidate include the party name, the logo, and the registration number on both the gubernatorial and legislative portions of the ballot, providing a cue for those voters who want to vote straight ticket.

Finally, as noted, under the ballot-and-envelope system parties are responsible for supplying their own ballots (Pomares et al. 2014b). This sometimes presents a challenge for smaller parties; in fact, news reports suggest that this has been a problem in Salta.[8] In theory, ballot splitting may be lower under the ballot-and-envelope system if smaller parties cannot consistently supply ballots. As the number of parties competing in each contest decreases, the probability that a voter randomly choosing between parties for each contest at stake splits his/her ticket also decreases (Ames et al. 2009). Consequently, if ballot supply is a problem, the Australian ballot will be associated with a higher level of *overall voting* and *ballot splitting* for smaller parties than the ballot-and-envelope system, simply by assuring that all options are available at the voting booth. Although ballot availability may have been a problem in some precincts, additional analyses of precincts using paper ballots in our matched sample indicate that this was not problematic for our results (see appendix F).

PRECINCT-LEVEL ANALYSES AND RESULTS: DIFFERENCE-IN-DIFFERENCE TESTS

We use a standard difference-in-difference approach to examine the causal relationship between e-voting and ballot splitting using the matched sample (hypothesis 1). The top panel of table 1 shows the results from the difference-in-difference analysis comparing the 2007 election (no e-voting) to the 2011 election (partial implementation). Before the implementation of e-voting, the average share of split ballots between the executive and legislative election was 8.52 in the control group in 2007, and 9.26 in the treatment group. The difference is not statistically significant. In 2011, the difference is substantially larger. Whereas the share of vote splitting was only 5.23 in precincts with paper ballots, the share of split ballots increased almost twofold in districts with e-voting to 10.6. The difference-in-difference approach identifies the causal effect of e-voting, which corresponds to a statistically significant increase of 4.64. The difference-in-difference comparison between 2007 and 2011 provides systematic support for our hypothesis, as it demonstrates that precincts using e-voting with the option to view the Australian ballot structure had higher levels of ballot splitting than precincts using the ballot-and-envelope system.

The bottom panel in table 1 provides further evidence in support of hypothesis 1. Here we compare the partial implementation of e-voting in 2011 to the full implementation in 2015. Whereas the partial implementation resulted in a two-fold increase in ballot splitting between the treatment group (precincts with e-voting) as compared to the control group (precincts with paper ballots) in 2011, once e-voting

8. See, e.g., reports from *La Nación*, "En Salta se estrena el voto electrónico," April 5, 2011, http://www.lanacion.com.ar/1363033 (accessed May 7, 2016).

Table 1. Difference-in-Difference Analyses

	Control Group (Paper Ballots in 2011)	Treated Group (Electronic Ballots in 2011)	**Difference**
	No Implementation (2007) versus Partial Implementation (2011)		
2007 elections (no implementation)	8.5198	9.2592	**−.7394**
2011 elections (partial Implementation)	5.2254	10.6010	**−5.3756*** **
Difference	**3.2944*** **	**−1.3418**	***4.6362*** **
	Partial Implementation (2011) versus Fulll Implementation (2015)		
2011 elections (partial implementation)	5.2254	10.6010	**−5.3756*** **
2015 elections (full implementation)	7.8052	7.4684	**.3368**
Difference	**−2.5798*** **	**3.1326*** **	***−5.7124*** **

Note. Cells with plain text indicate the average level of vote splitting (the dependent variable) for each group, the bolded cells indicate the difference between two groups, and the bolded and italicized cells indicate the difference-in-difference. Results presented in this table were calculated based on the Thiessen Polygon Geographic Information Systems (GIS) technique and the Coarsened Exact (CE) matching procedure. Results based on the alternative GIS technique and matching procedure appear in appendix D.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

is implemented in all precincts (2015), the share of split ballots is statistically indistinguishable between the treatment and control groups. Moreover, the difference-in-difference results show a statistically significant increase of 5.71, offering further evidence that the new ballot structure introduced by e-voting increased ballot splitting.

Still, it is important to note that even though e-voting is associated with an increase in split ticket voting within the exact same election, the overall levels of split ticket voting decreased between the 2007 (no implementation) and 2015 (full implementation) elections. To understand the difference in the overall level of split ticket voting between different elections, it is necessary to consider the larger political context. In the case of Salta, split ticket voting is likely higher in 2007 because the gubernatorial election was more competitive and a larger number of political parties fielded gubernatorial candidates that year. Indeed, electoral competition and multipartism are both associated with increases in split ticket voting (Ames et al. 2009; Burden and Kimball 1998). Whereas the governor only won the 2007 election by 1.07% of the vote, the winner of the gubernatorial elections in both 2011 and 2015 secured at least 20% more votes than the runner-up. Further, 10 political parties fielded gubernatorial candidates in 2007, compared to only eight in 2011 and five in 2015. The larger number of parties fielding gubernatorial candidates also explains why split ticket voting is slightly lower among treated groups in 2015 than in 2011.

PRECINCT-PARTY LEVEL ANALYSES AND RESULTS

It is clear from the difference-in-difference analyses that the new ballot structure is associated with significant increases in the average level of ballot splitting. Nonetheless, we anticipate that the new ballot structure is more likely to result in an increased level of ballot splitting for some political parties than for others (hypothesis 2). In this section, we use our precinct-party level measure of vote splitting to investigate which parties experienced an uptick in split tickets after the reform.

Using the matched data, we estimated a linear model with clustered standard errors (on precincts) to account for the correlation between observations in the same precincts. We include a dummy variable to distinguish between the treatment and control groups. It is coded 1 for the treatment group (i.e., e-voting in 2011) and 0 for the control group (i.e., paper ballots in 2011). We include a dummy variable for each of the party lists fielding a gubernatorial candidate in the election and an interaction between the party dummy variables and the e-voting variable to analyze which party ballots were most affected by the implementation of e-voting. We analyze three models, one for each election year. The results for these analyses are reported in table 2.

To determine which parties saw an uptick in ballot splitting after the ballot reform, we calculate the marginal effect of e-voting on ballot splitting for each party in our analyses. Recall that all coefficients must be interpreted relative to the baseline category and cannot be interpreted based only on the size and direction of the coefficient. The marginal effects are calculated from the least-squares regression models, and the confidence area of the estimations are based on 50,000 simulated independent draws (Gelman et al. 2015; Gelman and Hill 2007).

Figure 3 reports the marginal effect of e-voting on ballot splitting by political party. A value of zero (denoted by the horizontal reference line) indicates that ballot splitting was no more likely in precincts with e-voting than in precincts with a paper ballot for a given political party. Positive values show that e-voting is associated with an increase in the share of split ballots in favor of the gubernatorial candidate—that is, the executive ticket won more votes than the party's legislative ticket. Hence, a marginal effect of .25 represents a 25% increase in ballot splitting in favor of the gubernatorial ticket in e-voting precincts, with respect to the average paper ballot precinct. By contrast, negative values indicate an increase in split ballots in favor of the legislative list.

The left panel in figure 3 plots the marginal effect of the treatment group by party in 2007 when all precincts used the ballot-and-envelope system, and the panel on the right plots the results from 2015 when all precincts used e-voting. As with the previous analysis, these panels show that there are no significant differences between the treatment and control groups when all voters use the same ballot structure. The marginal effect of e-voting is close to zero for each political party, and in all cases, the confidence intervals cross zero. These results provide further evidence that the differences observed in the 2011 analysis are not simply a product of underling differences in the treatment and control groups.

Next, turning to the 2011 election when e-voting was partially implemented, the center panel in figure 3 shows that precincts using e-voting have a significantly higher share of split ballots than do those using paper ballots. As anticipated this pattern varies across political parties, lending some support for hypothesis 2, that an increase in ballot splitting will be most likely among smaller political parties with more uncertainty surrounding their electoral fates.

To begin with, in 2011, there was only one clear front-runner. Juan Manuel Urtubey from the FREJUREVI won 60% of the popular vote and was polling above 50% prior to the election. The closest competitor was only poling at 18%. According to the strategic voting literature, for voters who prefer Urtubey to other potentially electable candidates but do not truly prefer his party, the electoral payoff for splitting one's ticket to vote for Urtubey but not his legislative list is clear. Thus, we argue that voters should be more willing to incur the cost of split ticket voting regardless of the ballot structure, and lowering cost of split ticket voting via ballot reform should not, therefore, substantially increase the level of split ticket voting for the FREJUREVI.

Technically, Alfredo Olmedo was the runner-up, so we may anticipate the same logic would apply to his election. That said it is not clear how "viable" Olmedo was in the election. He earned almost 35% less votes than the top gubernatorial candidate and immediately prior to the election was polling third. Pollsters predicted he would capture only 17.8% of the vote compared to Walter Wayar, who was predicted to win 17.9% of the vote.[9] Given that Olmedo and Wayar were both trailing far behind the front-runner, the electoral payoffs for voting for either of these candidates is unclear. Our argument implies that when the electoral payoffs of split ticket voting are unclear, lowering the cost of ballot splitting (by introducing a ballot structure that facilitates split ticket voting) will lead to an increase in ballot splitting among those voters who prefer to split their ticket.

As a matter of fact, there was a statistically significant increase in the share of split tickets for both Olmedo and Wayar, and the size of the effect was substantial. Wayar won 24.5% more votes than his party's legislative list among voters using the paper ballot. That is, for every 100 legislative votes his party won, he obtained about 125 votes (a party coefficient of 0.393 and −0.147 for the equation intercept). Yet our model estimated that the share of split votes was 23.7% larger in precincts using e-voting than in precincts with paper ballots (a coefficient of 0.340 for the party interaction term and −0.103 for the intercept on e-voting). Thus, for every 100 legislative votes his party won, he obtained about 148 votes in precincts with e-voting (i.e., 24.5% + 23.7%). Put differently, in districts with e-voting, Wayar won almost 50% more votes than his party list.

Olmedo, by contrast, won fewer votes than did his tandem legislative lists. This does not come as a surprise given that Olmedo was embroiled in a scandal that broke just before the election and received substantial news coverage.[10] In paper ballot precincts, he won only 91% of the votes

9. The polls were reported in *Infobe*, "Salta: las últimas encuestas otorgaban una cómoda victoria para Urtubey," April 10, 2011, http://www.infobae.com/c574779 (accessed May 7, 2016).

10. The story was widely covered by national publications (i.e., *Ámbito Financiero* or *La Razón*) as well as leading provincial newspapers (i.e., *Los Andes*). See, e.g., *Ámbito Financiero*: "Olmedo justifica trabajo en negro en su campo por los planes sociales," March 17, 2011, http://www.ambito.com/573245 (accessed May 7, 2016).

Table 2. The Effect of Ballot Structure on the Share of Split Ballots, by Party

2007 Elections: No Implementation		2011 Elections: Partial Implementation		2015 Elections: Full Implementation	
Electronic device (ED)	.0096	Electronic device (ED)	−.1025**	Electronic device (ED)	−.0481
	(.0169)		(.038		(.0338)
PH	−.2766***	PO	.0741***	Frente Popular	−.036
	(.0323)		(.0158)		(.0413)
MST	−.3333***	Wayar	.3927***	PO	−.2218***
	(.0339)		(.0232)		(.0245)
Mov. Pop. Salteño	−.2365***	CC-ARI	.0693*	UCR-UNEN-PS	.3289***
	(.0569)		(.0288)		(.0236)
PO	−.4124***	MIJD	.0899	FREJUREVI	−.1449***
	(.0212)		(.0536)		(.0268)
Nueva Generación	−.2462***	SUR-PS	.3091***	Romero + Olmedo	.0834**
	(.0481)		(.0186)		(.0261)
Propuesta Salteña	−.2786***	FREJUREVI	.2266***		
	(.0238)		(.0197)		
FPV-PRS	.0723***	Olmedo	.0615***		
	(.0061)		(.0175)		
Enc. Pop. Amplio	−.2791***				
	(.0301)				
UCR	−.3217***				
	(.0357)				
ED × PH	−.0265	ED × PO	.0295	ED × Frente Popular	.0698
	(.0580)		(.0448)		(.0528)
ED × MST	−.0757	ED × Wayar	.3397***	ED × PO	.0398
	(.0745)		(.0506)		(.0325)
ED × Mov. P. Salteño	.0223	ED × CC-ARI	.072	ED × UCR-UNEN-PS	.0686
	(.1247)		(.0637)		(.0353)
ED × PO	−.0009	ED × MIJD	.0998	ED × FREJUREVI	.0668
	(.0450)		(.1093)		(.0343)
ED × Nva. Generación	.0373	ED × SUR-PS	.3413***	ED × Rom. + Olmedo	.0162
	(.0551)		(.0525)		(.0390)
ED × P. Salteña	−.0184	ED × FREJUREVI	.1186**		
	(.0324)		(.0377)		
ED × FPV-PRS	.0132	ED × Olmedo	−.0546		
	(.0231)		(.0381)		
ED × E. P. Amplio	−.0689				
	(.0551)				
ED × UCR	−.0095				
	(.0467)				
Intercept	.1203***	Intercept	−.1474***	Intercept	.0292
	(.0122)		(.0161)		(.0277)
Observations	329	Observations	264	Observations	198
Adjusted R^2	.5267	R^2	.7518	R^2	.8720

Note. Coefficients from ordinary least squares regression with clustered standard errors by precinct (in parentheses). Results in table 2 are based on the Thiessen Polygon Geographic Information Systems (GIS) technique and the Coarsened Exact (CE) matching procedure. Results based on the alternative GIS technique and matching procedure appear in appendix E.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

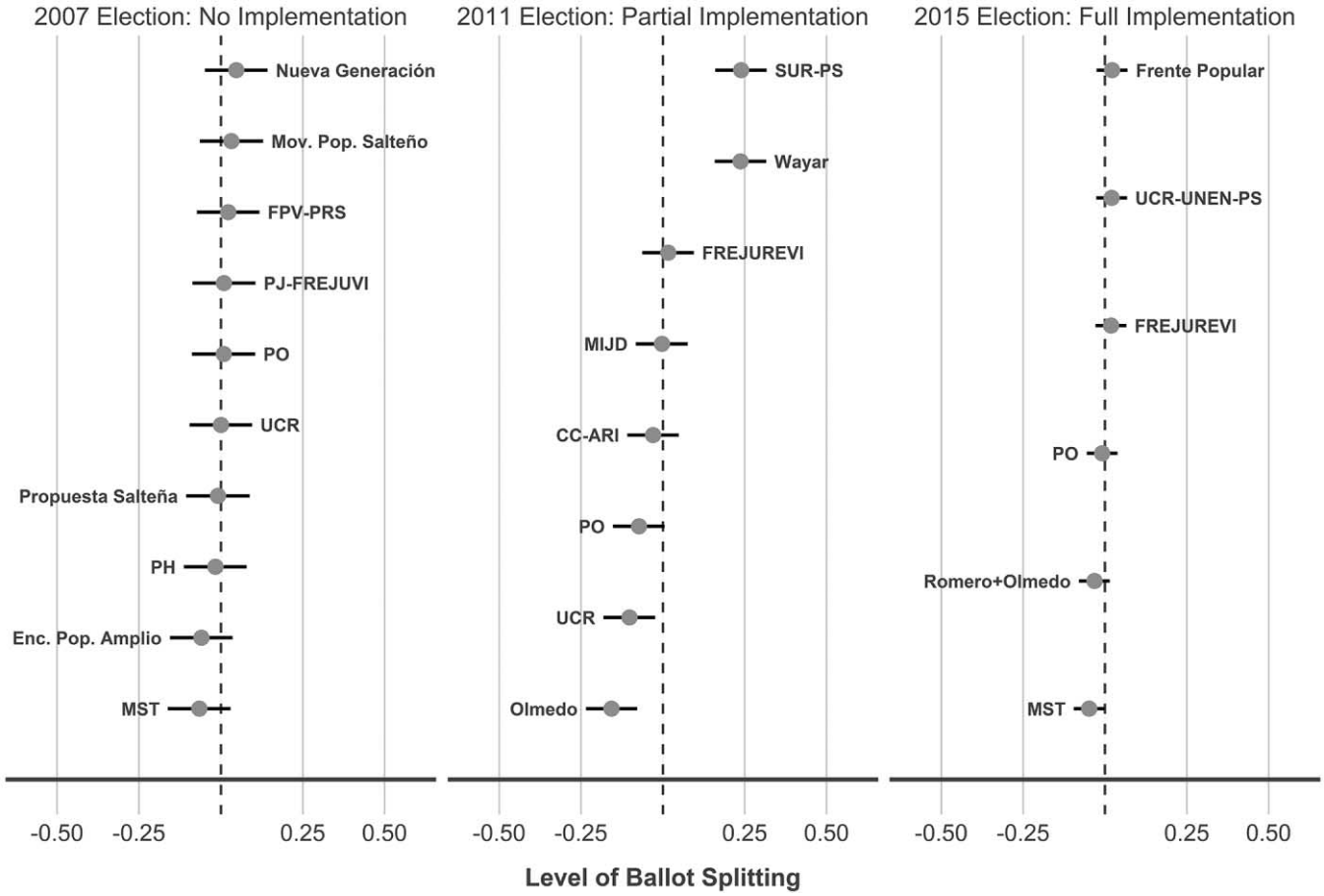

Figure 3. Marginal effect of e-voting on the share of split ballots, by party. This figure plots the marginal effect of belonging to the treatment group (i.e., assignment to electronic voting in 2011) on ballot splitting for each party competing in the 2007 (no implementation), 2011 (partial implementation), and 2015 (full implementation) elections relative to the control group (i.e., assignment to paper ballots in the 2011 election). Values different from zero indicate that there was more ballot splitting in precincts with electronic voting than in precincts with paper ballots. Positive values indicate that the governor's party received more votes than the legislative party, and negative values indicate the legislative party received more votes than the governor's ticket. Marginal effects are based on results presented in table 2.

his legislative lists won: for every 100 legislative votes, he only won 91 votes (a party coefficient of 0.062 and 0.147 for the equation intercept). In precincts with e-voting, the split punished Olmedo by an extra 15.7% (a baseline for the party interaction term of −0.055 and −0.103 for the intercept on e-voting). Thus, for every 76 votes the gubernatorial candidate won, his legislative lists won 100 in districts with e-voting.

Additionally, we observe an uptick in split tickets for other small parties with uncertain electoral fates: the SUR-PS, the PO, and the UCR. Only the two smallest parties (MIJD and CC-ARI), both winning less than 1% of the overall vote share, did not see an uptick in split tickets. Perhaps lowering the cost of split ticket voting did not translate into an increase in split tickets for the MIJD and the CC-ARI because there was very little uncertainty surrounding the electoral payoffs. Both parties were extremely unlikely to secure enough votes to win a seat in the legislature.

Together the results from the 2011 analysis indicate not only that ballot splitting is more likely under e-voting than under the traditional paper ballot but also that the substantive results are larger for parties with unclear electoral fates. Although this analysis can provide some insights into how parties are differentially affected by changes in the ballot structure, as we can only examine partial implementation of ballot reform for one legislative election, we are limited in our ability to offer more generalizable conclusions. Future research should further consider the differential effects of ballot reforms across different political parties.

In all, the findings from the 2011 analysis of partial implementation of e-voting demonstrate that ballot structure has a significant effect on ballot splitting. Voters in precincts with the option to view the Australian ballot structure are significantly more likely to split their ballot—particularly among political parties fielding nonviable gubernatorial candidates or those with a lower probability of winning a legis-

lative seat, where the electoral payoff for split ticket voting is unclear. Analyses of the 2007 and 2015 elections indicate that the significant differences observed between the treatment and control group in 2011 are not a product of underlying differences between the two groups. Instead, there is strong evidence to support our argument that e-voting facilitates ballot splitting.

ELECTORAL IMPLICATIONS OF BALLOT SPLITTING

The effect of e-voting is sizable and statistically significant, but the question remains, are the effects of e-voting on ballot splitting large enough to have electoral implications? To evaluate the electoral implications of e-voting, we simulated election results over the distribution of party votes from the 2011 election. The simulation is based on 10,000 independent random draws, and the probability of winning is calculated according to the set of electoral rules governing the state legislative election in the district of Salta: a district magnitude of 9, with a 5% vote threshold for winning a seat, and vote to seat allocation calculated based on the D'Hondt formula.

Figure 4 plots the simulation results. The results show that for minor parties, small increases in the vote share obtained by the legislative ticket can dramatically increase their probability of winning a seat in the legislature. Specifically, the predicted probability of winning one seat in office is only 7.8% when a party obtains 8.50% of the legislative votes. The probability of winning a seat increases substantially to 30.9% when the party obtains 8.75% of the votes. Further, parties winning 9.00% of votes have a 70.4% chance of winning a seat in office. Thus, for parties winning

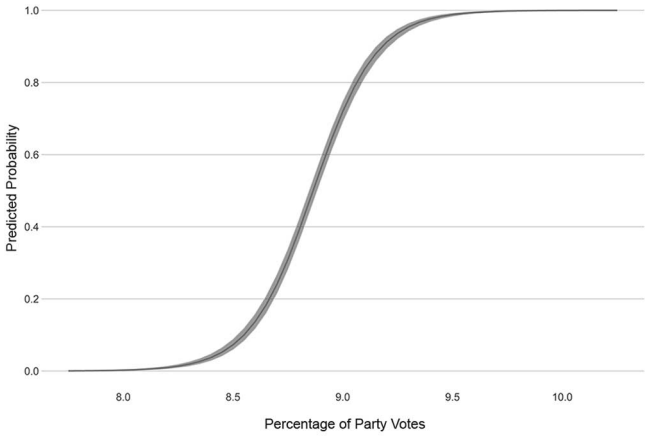

Figure 4. Predicted probability of winning a first seat. We use 10,000 independent random draws to estimate the predicted probability of a party winning a first seat in the legislative office (*y*-axis) as the percentage the party wins increases (*x*-axis). The predicted probabilities are calculated based on the electoral rule in the district of Salta, i.e., a 9 seat electoral district, 5% threshold, and D'Hondt seat allocation formula.

only a small share of votes in legislative elections, the implementation of e-voting stands to alter electoral outcomes by facilitating ballot splitting in favor of the legislative list when the party list curries more favor with voters than does the gubernatorial candidate. The overall substantive effects of e-voting were curtailed in 2011, as it was only partially implemented in the province, but under full implementation of e-voting, the level of ballot splitting may be much larger as parties and voters learn to take advantage of the ease of ballot splitting on the electronic devises.

Indeed, ballot splitting in the 2015 election resulted in a victory for the Partido Obrero (PO). In the district of Salta, the gubernatorial candidate for the PO won 8.80% of the valid votes. Our simulations predict that if his party list won the exact same share of votes in the legislative election, the party would have less than a 50% chance of winning a legislative seat. The PO's legislative list, however, won almost 2 percentage points more votes than did the gubernatorial candidate (10.78% of the valid votes). According to our simulations, parties winning more than 10% of the valid votes in the legislative election are virtually guaranteed a seat. And, consistent with our expectations, the PO won one seat in the district of Salta in 2015. One seat is not trivial, as there are only nine seats up for grabs in the district. It is far less likely that the PO would have won enough votes to secure a seat if voters had cast their ballots using the ballot-and-envelope system.

More generally, the PO's case illustrates that the shift away from the ballot-and-envelope systems may have important electoral implications in settings where the effective vote threshold to win a seat is low. In Argentina, for example, multiple provinces with high district magnitudes—which decreases the effective threshold—have piloted e-voting devices (Calvo et al. 2008) or introduced paper Australian ballots (Pomares and Zárate 2014). Our findings indicate that these ballot reforms may manufacture opportunities for small parties to win seats by facilitating ballot splitting.

The implications of this research go beyond Argentina. The effect of a ballot reform on split ticket voting ultimately depends on the difference between the layout of the old ballot and the new ballot and the broader electoral rules and dynamics. Where e-voting is introduced, the electronic device defines the structure of the new ballot (Calvo et al. 2008; Herrnson et al. 2009). The screen may display the full ballot at once (similar to an Australian paper ballot) or show the ballot by elected position, both making it easier for voters to split their ballot. By contrast, if voters view the ballot organized by different political parties, ballot splitting may be more burdensome—albeit still easier than physically cutting different ballot strips. Finally, if the ballot

prompts voters to vote a straight ticket on the first screen, it may discourage ballot splitting similar to the ballot-and-envelope system. Nonetheless, the overall impact of ballot reform depends on the broader electoral context.

CONCLUSIONS

Our study provides a systematic analysis of how a change of the ballot structure introduced by the implementation of e-voting can facilitate ballot splitting. We find support for the hypothesis that implementing an electronic ballot that makes ballot splitting more convenient, compared to the traditional ballot-and-envelope system, significantly increases the share of split ballots. The party-level analysis shows that although the average level of ballot splitting increases in precincts with electronic voting, the magnitude of this effect is larger for parties with no viable executive candidates or where the electoral payoff for split ticket voting was less clear for the voter.

These findings have important implications for political representation and the policy-making process alike. To begin with, in presidential systems, voters often feel compelled to vote for viable executive candidates; thus, executive coattails reduce the number of legislative parties. Yet research has demonstrated that voters sometimes choose to split their vote, resulting in more diverse legislative representation. Still, some voters who want to split their ballot often refrain from doing so because the process is unnecessarily complicated and laborious. This is particularly relevant when the benefit from splitting the vote is uncertain. Simplified voting procedures, however, can provide voters an additional incentive to cast a split ticket vote by lowering the cost and the risk associated with this process. Consequently, the findings from our research imply that ballot structures can inadvertently affect the composition of legislative representation.

At the same time, voting procedures that increase the probability of ballot splitting, and that therefore augment the number of legislative parties in office, have consequences for substantive representation. When the effective number of parties is large, the probability that any single party holds a majority of seats is smaller, making it more difficult for legislators to advance policy. Although this situation may increase the probability of legislative gridlock (Mainwaring 1993), it is an opportunity to improve substantive representation, as parties are required to cultivate a broad legislative coalition to reach a policy outcome (Áleman and Calvo 2010; Calvo 2014), increasing the number of views that are articulated in the policy-making process (Barnes 2016).

Given the potential consequences of seemingly minor changes in voting procedures on descriptive and substantive representation, future research should examine whether similar results hold for other contexts and other types of reforms. In particular, in contexts with large district magnitudes, the electoral effects of ballot splitting may be larger given that the vote share necessary to win a seat decreases as the district magnitude increases. Moreover, our framework is applicable to other types of reforms, such as replacing the ballot-and-envelope system with a single paper ballot (e.g., Australian ballot), that simplify voting procedures and enable citizens to more easily express their preferences at the polls.

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