The Representational Consequences of Electronic Voting Reform: Evidence from Argentina

Online Appendix

Santiago **Alles**
Universidad de San Andrés
salles@udesa.edu.ar

Tiffany D. **Barnes**
University of Kentucky
tiffanydbarnes@uky.edu

Carolina **Tchintian**
CIPPEC
ctchintian@cippec.org

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Abstract. Ballots and voting devices are fundamental tools in the electoral process. Despite their importance, scholars have paid little attention to the broader implications of voting procedures. We contend that ballots have significant implications for democratic representation, as they affect the cost associated with voting for citizens and electioneering for elites. In this book, we explain how ballot designs affect the behavior of voters, the performance of candidates, and the strategies of parties. As for voters, we show how voting procedures structure the likelihood of vote splitting and ballot roll-off. This in turn has implications for candidates. Focusing on gender and experience, we show how ballot form alters the salience of personal vote earning attributes. With respect to political parties, ballot structure can shift both the cost, strategies, and ultimately electoral fortunes of political parties. Finally, we discuss the profound implications ballot forms have for party campaigns and election outcomes.

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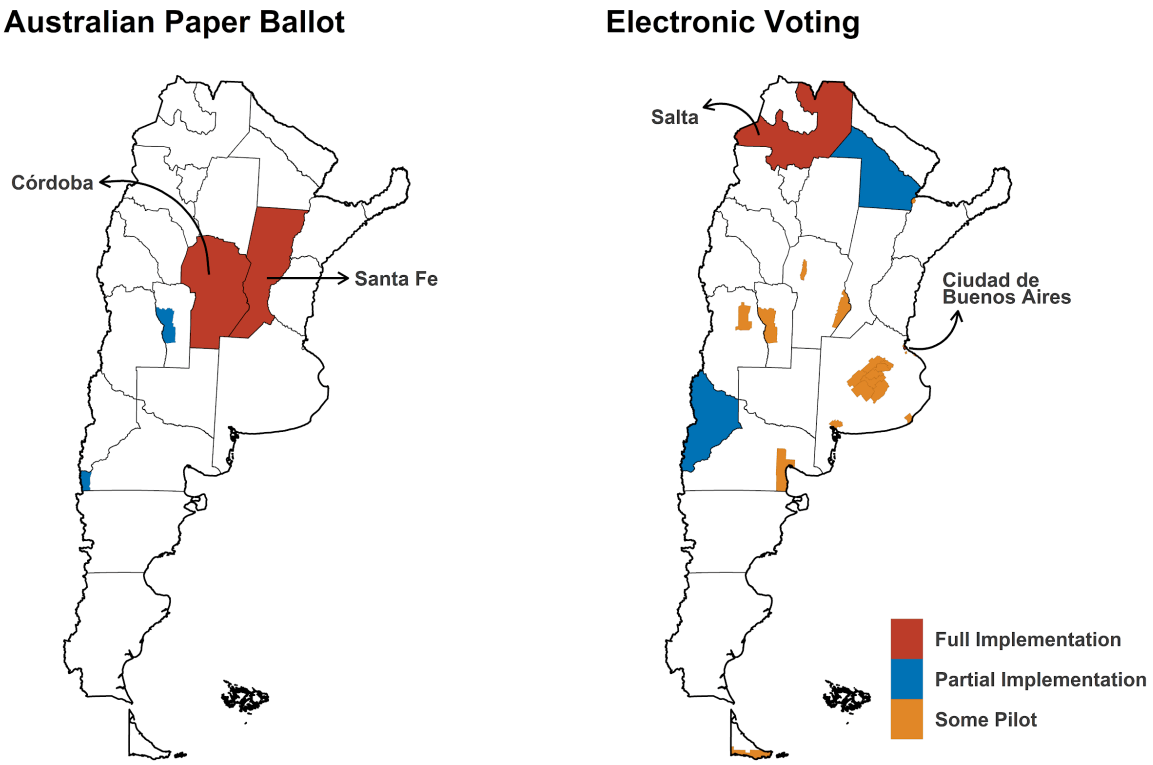
Appendix I. Brief Description of Voting Procedures in the Argentine Provinces

In Argentina, while voting procedures at the national level have remained the same for decades, numerous innovations have occurred in the provinces in the last decade. The election of subnational offices is regulated by provincial constitutions and laws (see Calvo and Micozzi 2005; Calvo and Escolar 2005), and each province has its own electoral authorities in charge of conducting province-level elections. Electoral rules such as formulas, term limits, district magnitudes, and gender quotas, among many other aspects, vary considerably across provinces. Nevertheless, despite this wide institutional diversity, until very recently, all of the provinces used the same partisan paper ballot.

Over the last decade, however, several provinces have reformed their voting procedures, trying to modernize the election administration. Figure I-1 illustrates the scope of these ballot innovations. The group of "full implementers" comprises four provinces—making up about 28% of the country electorate—where the entire province used a new ballot form in one or more gubernatorial elections. The group of "partial implementers" includes three provinces where a significant portion of the voters used a new ballot form, and have laid out plans to extend it to the entire territory in future elections. Finally, a few provinces conducted some pilots, mostly limited to local races, covering a small number of voters.

Two provinces, Santa Fe and Córdoba, have adopted paper-based Australian ballots in 2011 for the election of all provincial and local authorities, and they have continued using them in every election cycle since then. Despite the concurrent timing of the reforms, they implemented slightly different versions of the Australian ballot. While ballots in Cordoba display all the races on a single piece of paper and explicitly provide the option of voting straight ticket, ballots in Santa Fe present each race in a separate sheet, undermining the coattails between offices (Calvo and Leiras 2011). Finally, the provinces of San Luis and Río Negro parcially adopted an Australian paper ballot for local elections: Juan Martín de Pueyrredón (San Luis), the department that hosts the province capital, and Bariloche (Río Negro) adopted them in the 2019 and 2013, respectively. Despite the dominance of the Australian ballot across Latin America, just one province, San Luis, has emulated Santa Fe and Córdoba since then, and it only did it partially.

Figure I-1. Innovations in Voting Procedures across Provinces in Argentina



Note: The figure presents the ballot innovations piloted or adopted in sub-national elections in Argentina between 2003 and 2021. Australian ballots are used in Córdoba and Santa Fe, and partially in San Luis and Río Negro. Electronic voting is used in Salta, has been used in the City of Buenos Aires, and partially implemented in Chaco and Neuquén. Tile map by INDEC <https://www.indec.gob.ar/indec/web/Institucional-Indec-Codgeo>.

Electronic voting has attracted more attention from reformers. Thirteen provinces currently allow the utilization of some type of electronic device in province- and local-level elections (see: Observatorio Político Electoral 2021), and most of them have employed it at some point. However, the scope of these implementations varied widely. Two provinces, Salta and the City of Buenos Aires, have used electronic voting across the entire jurisdiction to elect the executive and all the legislators in at least one election. Salta was the first and most resolute implementer in the pool: electronic voting was used in every election cycle between 2011 and 2019. The City of Buenos Aires, instead, implemented electronic devices in 2015 for the election of the city mayor and local legislators, but paper ballots were used again in the following three renovation cycles (i.e., 2017, 2019 and 2021).

Neuquén and Chaco undertook a gradual approach. Neuquén, after piloting electronic devices in a limited number of voting centers in 2015 and 2017, extended its use to almost the entire province in 2019 for the election of the governor and provincial legislators. Chaco has gradually introduced e-voting though at a much slower pace and, by the end of the decade, the adoption was still incomplete: it piloted electronic voting in about 10% of the voting booths in 2011 and it reached about 30% of them in the following elections (i.e., 2015 and 2019).

Finally, eight other provinces have piloted the use of electronic voting in local elections, though these experiences have been limited to a few polling places in one or a handful of municipalities. Tierra del Fuego provided a very early experience: it piloted electronic voting in 105 booths, spread in 12 voting centers, in the 2003 local level elections. The province of Buenos Aires conducted several pilots between 2003 and 2009, but they comprised a small part of the electoral roll in a limited number of municipalities. Short lived pilots have been observed in Las Grutas, Rio Negro in 2007; in Santa Rosa, Mendoza in 2016; and in three different municipalities in Cordoba—La Falda in 2011, Marcos Juárez in 2015, and Cosquín in 2019. Finally, San Luis and Corrientes offer the two most recent experiences: e-voting was used for local elections in Pueyrredón Department (San Luis) in 2015 and 2017, and in Capital Department (Corrientes) in 2017.

In a nutshell, by the beginning of the decade, there have been three major reformers: Santa Fe and Córdoba, fully adopting an Australian ballot; and Salta, fully adopting electronic voting. No other reformer went that far. The City of Buenos Aires elected all authorities using e-voting in one election, 2015, but its use was discontinued later on. Two provinces gradually implemented electronic voting for provincial and local elections; of them, Neuquén is the only one actually close to a full adoption. The rest of the cases did not go beyond, being small pilots.

Appendix II. Model Results

This Appendix presents the model results of chapter 2 to 6, including tables and a brief summary of the findings. The results presented here are complementary to the report included in the book's text.

Chapter 2. Electronic Voting in Salta: From Adoption to Implementation

Reconstructing Precincts' Demographics

Although electoral data are available at the precinct level, sociodemographic indicators are only available at the census-tract level, and census tracts do not map onto precincts. Some precincts span multiple census tracts; thus, it is needed to aggregate the demographic attributes of the area comprising the precinct. However, the lack of information on precinct boundaries presents a substantive challenge for identifying their socioeconomic characteristics. To address this, we built an original data set using ArcGIS to approximate precinct boundaries based on the location of voting centers and we linked all of the census tracts to the projected boundaries.

First, the exact location of each voting center is known with precision. The provincial Electoral Tribunal provides the address of voting centers and based upon their address, we identify the latitude and longitude coordinates of each of them. Second, it is also known, based on the Tribunal records, to which precinct each voting center belongs. Third, precincts are continuous and relatively compact geographical areas that cannot cross department limits. Based on these three pieces of information, we partitioned the territory of every department into polygons surrounding each voting center. Each polygon contains only one polling place. The entire area of each polygon is closer to its corresponding polling place, than to any other polling place in the department, and it is called a Thiessen polygon or Voronoi cells. Finally, all the polygons drawn from voting centers that belong to the same precinct were combined into a single encompassing polygon.

Voters in Argentina can only vote in-person, on election day, in the assigned polling place: the electoral authority assigns every person to a voting center located in the precinct where she lives. Though official records of voters' addresses are sometimes outdated, most of the people vote in a place near their home. Hence, we mapped the projected polygons onto existing census tract boundaries to identify precinct-level demographics. The characteristics of census tracts entirely falling within a polygon are simply attributed to that electoral precinct, while census tracts split over two or more projected polygons are attributed to the one in which the centroid of that census tract is located. Finally, the demographics of a precinct are reconstructed by aggregating the demographics of all the linked tracts.

Empirical Results

Table II-2-1 shows the results of a series of logistic models: each observation is an election precinct in the 2011 election; the dependent variable captures the assignment of electronic devices; and the independent variables are precinct-level demographics.

Table II-2-1. Assignment of Electronic Machines, by demographic composition and previous party vote
Province of Salta, 2011

	Province	Capital	Interior
Incumbent governor vote (%)	0.0469*	-0.0938	0.0590**
	(0.0198)	(0.0647)	(0.0210)
Complete high-sch. or higher (%)	0.1321***	0.1278**	0.1388***
	(0.0192)	(0.0485)	(0.0363)
Poverty rate (%)	0.1545***	0.0910	0.1553**
	(0.0429)	(0.1440)	(0.0477)
Constant	-7.6856***	-1.5016	-8.2921***
	(1.3847)	(4.0867)	(1.5546)
AIC	176.04	56.94	120.72
BIC	190.57	64.89	134.41
Observations	280	54	226

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

The first model comprises all the precincts in the province, while the other two models split the sample in two—precincts in the Capital Department and precincts in the rest of the province.

Predictions based on Model 1 in Table II-2-1 are presented in Figure 5, p. 25, in Chapter 2.

Chapter 3. Disconnecting Races: The Behavioral Implications of Independent Choices

Matching methods attempt to construct a dataset where any background condition in the sample is equal across treatment conditions (see King and Zeng 2006; Morgan and Winship 2014; Ho et al. 2007). We employ Coarsened Exact matching to reconstruct the balance in the sample (Iacus et al. 2012, 2011; King and Nielsen 2019), and we use two alternative matching thresholds: the stricter threshold creates a more balanced post-matching sample at the cost of reducing the sample size; model results do not differ significantly due to the selected threshold.

Data has been matched over three covariates: (1) the percentage of precinct's population with complete high-school education or higher, (2) the percentage of precinct's population with unsatisfied basic needs, and (3) the electoral support of the incumbent governor in the election before the reform adoption.

Table II-3-1. Summary of Balance for All and Matched Data, by Matching Threshold
Party-Precinct Level Analysis, 2011

	All Data			*Matched Data*			*Balance Improve-ment*
	Means treated	Means control	Std. Mean Diff.	Means treated	Means control	Std. Mean Diff.	
Strict threshold							
Incumbent's vote (%)	39.80	45.42	-0.86	42.00	42.56	-0.08	**90.1**
Complete HS (%)	47.56	31.44	1.52	44.41	42.25	0.20	**86.6**
Poverty rate (%)	2.07	4.02	-1.64	2.39	1.99	0.34	**79.6**
Loose threshold							
Incumbent's vote (%)	39.80	45.42	-0.86	43.40	44.32	-0.14	**83.5**
Complete HS (%)	47.56	31.44	1.52	45.28	39.56	0.54	**64.5**
Poverty rate (%)	2.07	4.02	-1.64	2.45	2.29	0.13	**91.8**

Note: The matching covariates correspond to the covariates included in the equations in Table II-2-1: "Incumbent's vote" is the vote percentage of the incumbent governor in the previous election (2007); "Complete HS" is the percentage of the precinct's population with complete high-school education or higher; and "Poverty rate" is the percentage of the precinct's population with unsatisfied basic needs.

Table II-3-1 reports the balance improvement when the precincts are matched on these three covariates, for the two matching thresholds.

The "strict" matching significantly reconstructed the sample balance: improvement goes from 79.6 percent for poverty rate, to 86.6 percent for educational attainment, to 90.1 percent for incumbent's vote share. The "loose" matching also improves the sample balance, but it produces comparatively poorer balance in the matched data: improvement goes from 64.5 percent for educational attainment, to 83.5 percent for incumbent's vote share, to 91.8 percent for poverty rate.

Table II-3-2. Sample Size, by Matching Threshold
Party-Precinct Level Analysis, 2011

	Strict threshold		Loose threshold	
	Control	Treated	Control	Treated
All	29	25	29	25
Matched	8	8	16	16
Unmatched	21	17	13	9
Discarded	0	0	0	0

Table II-3-2 reports the differences in sample size across matching thresholds. There is frequently a trade-off between post-matching sample size and balance improvement (King et al. 2014), since a better balance might imply a larger number of discarded observations. As expected, the stricter threshold produces a better balance at the cost of a larger reduction of the sample size.

Model results do not differ significantly due to the selected threshold, which suggests that the results are robust. Along the book, as well in this appendix, we report results based on the stricter matching threshold.

Table II-3-3. Difference-in-Differences Analyses: Split-Ticket Voting Precincts' Average, by Treatment and Election Cycle
Capital Department, 2007-2015

	Control group	Treated group	**Difference**
No Implementation (2007) versus Partial Implementation (2011)			
No implementation	9.1040	9.5273	**0.4233**
Partial implementation	5.6652	10.2229	**4.5577*** **
Difference	**-3.4388*** **	**0.6956**	**4.1344** **
Partial Implementation (2011) versus Full Implementation (2015)			
Partial implementation	5.6652	10.2229	**4.5577*** **
Full implementation	7.9395	7.6570	**-0.2825**
Difference	**2.2743** **	**-2.5659***	**-4.8401*** **

† p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

Table II-3-3 presents the results of the difference-in-differences (DiD) analysis. Each observation in the data is an election precinct, and the dependent variable is the split-ticket voting in a given precinct. Reading each panel horizontally, the results present the differences between treatment and control groups within the same election; reading them vertically, figures show the differences across time, within the same treatment condition. The lower-right corner presents the DiD estimator (δ).

The top panel shows the results from the difference-in-differences analysis comparing the 2007 election (no e-voting) to the 2011 election (partial implementation). The bottom panel compares the 2011 election (partial implementation) to the 2015 election (full implementation).

Comparing the 2007 election to the 2011 election, the average share of split ballots between the executive and legislative election was 9.10 percent in the control group, and 9.53 percent in the treatment group. In 2011 the difference was substantially larger. Whereas the share of vote splitting was only 5.67 percent in precincts with paper ballots, the share of split ballots was about double in precincts with electronic devices to 10.22 percent. The DiD comparison brings strong evidence of the ballot effect: overall, the adoption of e-voting corresponds to a statistically significant increase of 4.13 percentage points. Finally, the share of split ballots is statistically indistinguishable between the same precincts in 2015, when all share procedures: 7.66 and 7.94 percent, in treatment and control groups respectively.

Predictions based on models in the table are presented in Figure 7, p. 35, in Chapter 3.

Table II-3-4. Difference-in-Differences Analyses: Gubernatorial Residual Vote Precincts' Average, by Treatment and Election Cycle
Capital Department, 2007-2015

	Control group	Treated group	**Difference**
No Implementation (2007) versus Partial Implementation (2011)			
No implementation	4.8621	4.0884	**-0.7736**
Partial implementation	1.6112	3.1990	**1.5878***
Difference	**-3.2509*****	**-0.8894***	**2.3615***
Partial Implementation (2011) versus Full Implementation (2015)			
Partial implementation	1.6112	3.1990	**1.5878***
Full implementation	3.7406	2.9221	**-0.8185**
Difference	**2.1294****	**-0.2770**	**-2.4064***

† p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

Table II-3-4 uses a difference-in-differences (DiD) approach to examine the relationship between ballot form and residual votes using the matched sample. Each observation is an election precinct; and the dependent variable is the residual votes in the gubernatorial race.

The top panel shows the results from the DiD analysis comparing gubernatorial elections in 2007 and 2011; the bottom panel compares the 2011 and 2015 elections.

Before the implementation of electronic voting, the average of residual votes was roughly the same for the two groups: 4.86 percent in the control group, and 4.09 percent in the treatment group. In 2011, the difference between groups was much larger. Whereas residual votes were only 1.61 percent in precincts with paper ballots, the average increased almost twofold in precincts with electronic devices to 3.20 percent. The DiD comparison between 2007 and 2011 indicates that the adoption of electronic voting corresponds to a statistically significant increase of 2.36 percentage points. Instead, when all the precincts used electronic voting in the following election, differences between groups were not significant.

Table II-3-5. Difference-in-Differences Analyses: Ballot Roll-Off Average in House and Mayoral Elections, by Treatment and Election Cycle
Capital Department, 2007-2015

Ballot Roll-Off in House Elections			
	Control group	Treated group	**Difference**
No Implementation (2007) versus Partial Implementation (2011)			
No implementation	8.3283	8.2021	**-0.1261**
Partial implementation	3.6155	1.1397	**-2.4758*** **
Difference	**-4.7128*** **	**-7.0624*** **	**-2.3497** **
Partial Implementation (2011) versus Full Implementation (2015)			
Partial implementation	3.6155	1.1397	**-2.4758*** **
Full implementation	1.0624	1.1952	**0.1328**
Difference	**-2.5530*** **	**0.0556**	**2.6086*** **
Ballot Roll-Off in Mayoral Elections			
	Control group	Treated group	**Difference**
No Implementation (2007) versus Partial Implementation (2011)			
No implementation	5.1916	5.8606	**0.6690**
Partial implementation	1.9219	0.7864	**-1.1356**
Difference	**-3.2696** **	**-5.0743*** **	**-1.8046**
Partial Implementation (2011) versus Full Implementation (2015)			
Partial implementation	1.9219	0.7864	**-1.1356**
Full implementation	0.1060	0.6980	**0.5920**
Difference	**-1.8160†**	**-0.0884**	**1.7276**

† p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

Table II-3-5 presents a systematic examination of the ballot effect, employing again a difference-in-differences approach, over the matched election data.

Each observation is an election precinct. The dependent variable is the roll-off rate, measured as the difference between the votes for gubernatorial candidates and a down-ballot race; the value of the race goes negative when a given down-ballot race attracts more party votes than the gubernatorial competition.

The top panel examines the ballot roll-off in House elections, while the lower panel examines the ballot roll-off in Mayoral elections; for each of them, we present results from the DiD analysis comparing elections in 2007 vs. 2011, and in 2011 vs. 2015.

Ballot roll-off has been overall larger in House elections. However, ballot roll-off was roughly the same in 2007 across precincts: 8.33 percent in the control group, and 8.20 percent in the treatment group. In 2011, the difference between groups was instead significantly larger. Whereas roll-off was 3.62 percent in precincts with paper ballots, the average roll-off was about a third in precincts voting with electronic devices: 1.14 percent. The DiD comparison between

2007 and 2011 indicates that the adoption of electronic voting corresponds to a statistically significant change of -2.35 percentage points. Instead, when all the precincts used electronic voting in the following election, differences were entirely gone: ballot roll-off was 1.20 and 1.06 percent in treatment and control groups, respectively.

The overall level of ballot roll-off has been lower in mayoral elections. The DiD analysis suggests that the same ballot effect is observable in mayoral elections too: in 2011, roll-off was 1.92 percent in precincts with paper ballots, while the average roll-off was 0.79 percent in precincts voting with electronic devices, however, the relationship is, in comparison to the effect on House roll-off, statistically weaker.

Predictions based on models in the table are presented in Figure 10, p. 38, in Chapter 3.

Chapter 4. The Rise of the Personal Vote: The Implications for Candidates

Models in Table II-4-1 examine the influence of candidate experience on the vote share, between 2007 and 2019, using municipality-level candidate data.

Table II-4-1. The Influence of Experience:
Incumbents and Legislators running in Mayoral Elections
Candidate Votes (%). Province of Salta, 2007-2019

	All candidates	**Single candidates**
Incumbent mayor (dummy)	28.9909***	31.8510***
	(1.2208)	(2.4347)
Provincial legislator (dummy)	9.8443***	15.2364***
	(1.5785)	(2.5831)
Incumbent governor's ticket (dummy)	3.4847***	8.4862*
	(1.0101)	(3.9896)
Number of mayoral candidates	-2.8010***	-3.0680***
	(0.2319)	(0.3337)
Constant	28.9886***	29.0856***
	(1.4221)	(1.9954)
Adj. R-squared	0.4563	0.4710
AIC	9,493.51	4,063.94
BIC	9,523.84	4,089.20
Observations	1,158	498

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Gubernatorial candidates may run multiple mayoral candidates down their ballots; the first model includes all the parties in the sample, while the second one includes tickets with only one mayoral candidate.

Results indicate that incumbents outperform the average candidate by 29 to 32 points, depending on the model specification. Provincial legislators, either former or current ones, also outperformed the average mayoral candidate, but the bonus they enjoyed was about a half of incumbents, laying between 10 to 15 points.

Table II-4-2. The Influence of Gender: Women running in Mayoral Elections
Candidate Votes (%). Province of Salta, 2007-2019

	All candidates	Single candidates
Women candidate (dummy)	-5.0159**	-2.5659
	(1.5775)	(2.2383)
Incumbent governor's ticket (dummy)	9.8815***	30.1162***
	(1.2045)	(4.3073)
Number of mayoral candidates	-3.9129***	-4.1323***
	(0.3009)	(0.4175)
Number of women candidates	1.7941†	1.6861
	(0.9797)	(1.3612)
Constant	39.1966***	38.0278***
	(1.7366)	(2.3149)
Adj. R-squared	0.1787	0.2692
AIC	9,971.25	4,224.84
BIC	10,001.58	4,250.11
Observations	1,158	498

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Models in Table II-4-2 examine the influence of candidate gender on the vote share, between 2007 and 2019, using municipality-level candidate data.

As in the previous table, models including all candidates and candidates running in tickets with only one mayoral candidate are presented separately.

Evidence shows that women candidates running for mayor underperform the average candidate by 5 percentage points; this finding holds even after controlling for the incumbency of gubernatorial candidate at the top of the ticket and the number of mayoral candidates in the race. The relationship is however smaller and not significant when looking at parties with only one mayoral candidate in the district.

Table II-4-3. The Influence of Experience:
Incumbents and Legislators running in Mayoral Elections
Mayor v. Governor (%). Province of Salta, 2007-2019

	All candidates	**Single candidates**
Incumbent mayor (dummy)	17.7644***	3.8803*
	(1.5081)	(1.8678)
Provincial legislator (dummy)	6.4915**	-1.3600
	(2.4142)	(2.9989)
Electronic Voting (dummy)	0.3595	-1.9591*
	(0.8651)	(0.9703)
Incumbent governor's ticket (dummy)	-3.6761***	-11.5793***
	(0.9050)	(3.1211)
Number of mayoral candidates	0.3356	-0.0141
	(0.2085)	(0.2303)
Incumbent mayor x Electronic Voting	5.8259**	10.3022**
	(2.0943)	(3.6900)
Provincial legislator x Electronic Voting	-4.0110	6.1675†
	(2.9803)	(3.6773)
Constant	-4.1291**	-1.3253
	(1.3761)	(1.4855)
Adj. R-squared	0.2425	0.0437
AIC	9,240.08	3,685.30
BIC	9,285.57	3,723.20
Observations	1,158	498

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Models in Table II-4-3 examine the influence of candidate experience, comparing the electoral performance of mayoral candidates, relative to the gubernatorial candidate at the top of the ticket, between 2007 and 2019, using municipality-level candidate data.

Model predictions show that incumbent mayors running in municipalities using electronic devices are outperforming by 6.2 percentage points incumbents competing in municipalities still using paper ballots, and this gap is statistically significant. Instead, candidates with a legislative background do not do better in elections using electronic devices.

Moreover, if we compare the performance of provincial legislators against the one of incumbent mayors, the performance gap has widened considerably under electronic devices, going from 11.3 to 21.1 percentage points.

Predictions based on models in the table are presented in Figure 12, p. 48, in Chapter 4.

Table II-4-4. A Micro-level Examination of an Incumbent Candidate: Miguel Isa
City of Salta, 2007 and 2011

	Model #1	Model #2
Partial implementation (dummy)	-7.8149***	-7.8149***
	(0.6819)	(0.5880)
Treatment group (dummy)	-0.6655	-0.3476
	(0.6819)	(0.6087)
Incumbent governor vote (%)		0.2106*
		(0.0893)
Complete high-school or higher (%)		-0.0496
		(0.0529)
Poverty rate (%)		-0.6524*
		(0.2789)
Partial implementation x Treatment group	2.9086**	2.9086**
	(0.9643)	(0.8316)
Constant	3.9825***	-1.5986
	(0.4821)	(5.1732)
Adj. R-squared	0.8713	0.9043
AIC	98.78	92.75
BIC	105.44	103.40
Observations	28	28

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Models in Table II-4-4 examine the interaction between incumbency and voting procedure in the mayoral election in the City of Salta, based on the 2007 and 2011 elections, using precinct-level candidate data.

Looking at precinct-level data, the performance of the incumbent mayor Miguel Isa in 2011 significantly differed depending on the ballot form: Isa ran 4.05 percentage points behind Urtubey in precincts using paper ballots, while he ran only 1.49 points behind in precincts using electronic devices—a statistically significant 2.6-point gap. Instead, there were no significant differences between treatment and control precincts in the previous election cycle, when all voters used paper ballots.

Predictions based on model 1 in the table are presented in Figure 13, p. 49, in Chapter 4.

Table II-4-5. The Influence of Gender: Women running in Mayoral Elections
Mayor v. Governor (%). Province of Salta, 2007-2019

	All candidates	Single candidates
Women candidate (dummy)	-2.5638	-1.1130
	(1.9787)	(1.9193)
Electronic voting (dummy)	1.2740	-0.8089
	(0.9502)	(1.0038)
Incumbent governor's ticket (dummy)	0.7207	-3.3445
	(1.0038)	(2.5681)
Number of mayoral candidates	-0.4479†	-0.2022
	(0.2514)	(0.2486)
Number of women candidates	1.1558	0.3948
	(0.8182)	(0.8168)
Women candidate x EV	-3.2732	-1.8214
	(2.5181)	(2.4966)
Constant	2.5786†	-0.0028
	(1.5562)	(1.4661)
Adj. R-squared	0.0095	0.0023
AIC	9,549.71	3,705.45
BIC	9,590.15	3,739.13
Observations	1,158	498

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Models in Table II-4-5 examine the influence of candidate gender, comparing the electoral performance of mayoral candidates, relative to the gubernatorial candidate at the top of the ticket, between 2007 and 2019, using municipality-level candidate data.

Women competing under the electronic devices seem to present poorer electoral performances than women doing it under partisan paper ballots: a female candidate competing under e-voting underperforms the gubernatorial candidate by 3.07 points, while an equivalent candidate is expected to underperform by only 1.08 points, but differences are statistically not significant.

Predictions based on models in the table are presented in Figure 14, p. 50, in Chapter 4.

Chapter 5. The Decline of Territorial Machines: The Implications for Parties

Models in Table II-5-1 examine the influence of the ballot form on vote concentration for Province House elections and Senate House elections.

Table II-5-1. Vote Concentration in Provincial House and Senate Elections
Province of Salta, 2009-2019

	Province House	
	Model #1	Model #2
Electronic voting	-0.4424***	-0.3561***
	(0.0628)	(0.0593)
Party votes (%)	-0.0622***	-0.0601***
	(0.0053)	(0.0047)
Votes (%) squared	0.0004***	0.0003**
	(0.0001)	(0.0001)
Number of ballot boxes		-0.0007**
		(0.0002)
Concurrent gov. election (dummy)		0.0267
		(0.0459)
District magnitude		-0.0362***
		(0.0081)
Complete high-sch. or higher (%)		-0.0369***
		(0.0105)
Poverty rate (%)		-0.0147
		(0.0224)
Urban housing (%)		-0.0047**
		(0.0018)
Population density (log)		0.1549***
		(0.0340)
District area (in thousands km2)		0.0276***
		(0.0061)
Electronic voting x Party votes	0.0120**	0.0109**
	(0.0038)	(0.0034)
Constant	0.1264*	0.4319*
	(0.0571)	(0.2144)
AIC	-925.60	-1,070.36
BIC	-895.77	-1,010.70
Observations	524	524

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Table II-5-1, *continuation…*

	Province Senate	
	Model #3	Model #4
Electronic voting	-0.3704***	-0.4302***
	(0.0738)	(0.0644)
Party votes (%)	-0.0648***	-0.0638***
	(0.0059)	(0.0052)
Votes (%) squared	0.0005***	0.0004***
	(0.0001)	(0.0001)
Number of ballot boxes		0.0001
		(0.0002)
Concurrent gov. election (dummy)		0.1026†
		(0.0603)
District magnitude		0.0896*
		(0.0378)
Complete high-sch. or higher (%)		-0.0069
		(0.0086)
Poverty rate (%)		-0.0010
		(0.0250)
Urban housing (%)		-0.0100***
		(0.0019)
Population density (log)		0.0811*
		(0.0402)
District area (in thousands km2)		0.0204**
		(0.0067)
Electronic voting x Party votes	0.0102**	0.0130***
	(0.0038)	(0.0033)
Constant	-0.0405	0.4332*
	(0.0590)	(0.1962)
AIC	-687.78	-806.69
BIC	-664.17	-755.53
Observations	378	378

Standard errors, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Predictions based on models in the table are presented in Figure 16, p. 59, in Chapter 5.

Chapter 6. The Consequences of Weakened Gubernatorial Coattails: The Implications for Small Parties

Models in Table II-6-1 examine the strategic defection of voters in three elections cycles: 2007, 2011, and 2015, respectively.

The 2007 election was the most competitive gubernatorial race in the sample: Juan Manuel Urtubey prevailed by about six thousand votes, only 1.2% of the province votes. The competitive environment created strong pressures for electoral coordination among voters. Looking at the election results in the Capital Department, such incentives were clearly at work. Both Wayar (PJ) and Urtubey (FPV-PRS) performed significantly better than their legislative ticket, by 5.7 and 8.7 points, respectively, indicating that many voters voted strategically, defecting from hopeless gubernatorial candidates, but still supporting the legislative ticket of these third parties. Voters of three parties significantly engaged in this strategic defection: the legislative ticket of Partido Obrero, Propuesta Salteña, and Concertación Salteña outperformed the gubernatorial ticket by 0.6% to 1.8%. As expected, voters in treatment and control groups did not differ, when all the precincts used the same voting procedures.

The remaining two elections were much less competitive, hence the pressures for electoral coordination were much smaller. Governor Urtubey ran for reelection in 2011, winning by a landslide: he obtained 59.6% of the province votes. Election results in the Capital Department show that Urtubey (FREJUREVI) and Wayar again performed significantly better than their legislative ticket, by 4.5 and 4.0 points, respectively; and to a lesser degree, a small party candidate, Carlos Morello, did it too. Instead, despite being the strongest challenger in the race, Olmedo significantly underperformed the legislative ticket, by an average of 5.2 points. Voters of another two parties, Partido Obrero and Unión Cívica Radical, seem to have strategically defected from their gubernatorial candidates as well, though results are weaker. Only the two smallest parties in the race (MIJD and CC-ARI), both winning less than 1% of the department vote share, did not see an uptick in split tickets; it is likely that, with very little uncertainty (and hope) about their chances of securing enough votes to win a seat in the legislature, they only kept their most committed voters.

The last election in the sample was not very competitive either. Governor Urtubey ran for a third and last term in 2015, defeating former three-term governor Juan Carlos Romero by a sizable margin, 47.2% v. 33.7%, while Partido Obrero finished in a distant third place with 7.3% of the province votes. Election results in the Capital Department show that Romero and Miguel Nanni (UCR-UNEN-PS) performed significantly better than their legislative ticket, by 3.0 and 4.5 points, respectively. Instead, despite being the incumbent governor and front-runner in the race, this time Urtubey significantly underperformed the legislative ticket, by an average of 4.1 points. Voters of Partido Obrero kept the same pattern of strategically defecting from their gubernatorial candidate: the slate of legislative candidates bested Claudio del Plá by an average of 2.3 points. Similar to the model results from the first election in the data, there were no statistically significant differences between treatment and control groups in the last sample, when all the voters again used the same voting procedure.

Table II-6-1. Relative Performance of Provincial House's Tickets
Capital Department, 2007-2015

Election cycle: **2007**		
	Model #1	**Model #2**
Treatment group	0.0653	0.5218
	(0.1055)	(0.9890)
Humanista	5.7263***	5.9915***
	(0.4812)	(0.6654)
MST	5.8715***	6.1046***
	(0.5052)	(0.6828)
Mov. Popular Salteño	5.7110***	6.0041***
	(0.4738)	(0.6829)
Obrero	7.5258***	7.6360***
	(0.5377)	(0.8322)
Propuesta Salteña	6.6825***	6.7468***
	(0.5108)	(0.7412)
Frente para la Victoria - PRS	-2.9483***	-2.3813***
	(0.6535)	(0.5552)
Encuentro Popular Amplio	5.8731***	6.0939***
	(0.5276)	(0.6911)
Unión Cívica Radical	6.3559***	6.6568***
	(0.5238)	(0.7488)
Humanista x Treatment		-0.5303
		(0.9818)
MST x Treatment		-0.4661
		(1.0341)
Mov. Popular Salteño x Treatment		-0.5861
		(0.9637)
Obrero x Treatment		-0.2205
		(1.1074)
Propuesta Salteña x Treatment		-0.1285
		(1.0529)
FPV- PRS x Treatment		-1.1339
		(1.3112)
Encuentro Pop. Amplio x Treatment		-0.4416
		(1.0814)
Unión Cívica Radical x Treatment		-0.6017
		(1.0676)
Constant	-5.7167***	-5.9450***
	(0.4879)	(0.6686)
Adj. R-squared	0.9319	0.9299
AIC	390.38	401.67
BIC	423.04	458.10
Observations	144	144

Standard errors, clustered by electoral precinct, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Table II-6-1, *continuation…*

Election cycle: **2011**		
	Model #3	**Model #4**
Treatment group	0.3117***	0.0978
	(0.0328)	(0.2195)
Obrero	0.0193	-0.0339
	(0.1175)	(0.1774)
Wayar Gobernador	-4.3897***	-3.0150***
	(0.4685)	(0.1996)
Coalición Cívica - ARI	-0.3310*	-0.3538**
	(0.1267)	(0.1238)
MIJD	-0.4955***	-0.4372***
	(0.1068)	(0.1206)
MORELLO-SUR-PS	-1.4099***	-1.0412***
	(0.1797)	(0.0881)
FREJUREVI	-4.8387***	-4.8559***
	(0.4433)	(0.3236)
Olmedo Gobernador	4.8161***	2.2520***
	(0.7694)	(0.3829)
Obrero x Treatment		0.1063
		(0.2404)
Wayar Gobernador x Treatment		-2.7494***
		(0.6010)
Coalición Cívica - ARI x Treatment		0.0456
		(0.2608)
MIJD x Treatment		-0.1167
		(0.2178)
MORELLO-SUR-PS x Treatment		-0.7373*
		(0.3101)
FREJUREVI x Treatment		0.0344
		(0.9139)
Olmedo Gobernador x Treatment		5.1280***
		(0.7265)
Constant	0.3697**	0.4766***
	(0.1119)	(0.1100)
Adj. R-squared	0.8088	0.9229
AIC	452.39	342.47
BIC	480.91	390.95
Observations	128	128

Standard errors, clustered by electoral precinct, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Table II-6-1, *continuation…*

Election cycle: **2015**		
	Model #5	**Model #6**
Treatment group	-0.0214	0.0433
	(0.0266)	(0.1464)
Frente Popular	0.0400	0.0061
	(0.0572)	(0.0940)
Obrero	2.3301***	2.5349***
	(0.1562)	(0.1956)
UCR-UNEN-PS	-4.5412***	-4.4334***
	(0.3013)	(0.3331)
FREJUREVI	4.0864***	4.7245***
	(0.5005)	(0.2760)
Romero + Olmedo	-3.0273***	-3.7501***
	(0.8045)	(0.4632)
Frente Popular x Treatment		0.0677
		(0.1162)
Obrero x Treatment		-0.4095
		(0.3013)
UCR-UNEN-PS x Treatment		-0.2157
		(0.6173)
FREJUREVI x Treatment		-1.2762
		(0.9690)
Romero + Olmedo x Treatment		1.4456
		(1.6080)
Constant	0.0016	-0.0307
	(0.0692)	(0.1241)
Adj. R-squared	0.7744	0.7778
AIC	368.81	371.78
BIC	389.32	405.12
Observations	96	96

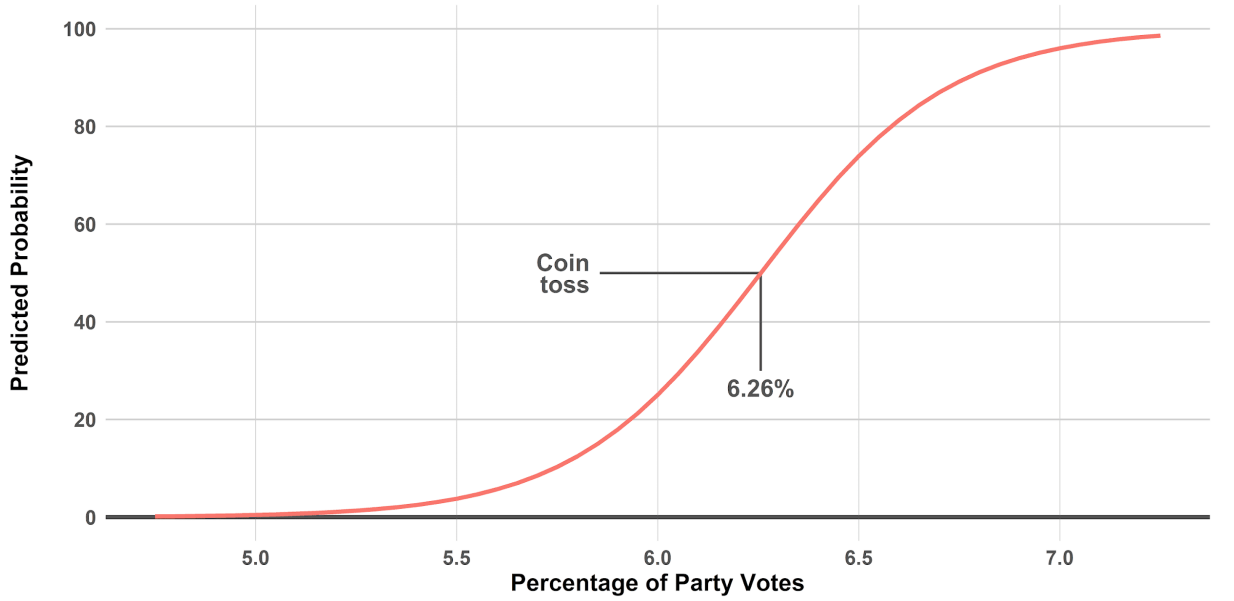
Standard errors, clustered by electoral precinct, between parentheses.
† p < 0.1; ***** p < 0.05; ****** p < 0.01; ******* p < 0.001

Predictions based on models in the table are presented in Figure 18, p. 68, in Chapter 6.

Appendix III. Mechanical Threshold for Winning a Seat: An Election Simulation

Are the effects of the ballot form on vote splitting large enough to have electoral implications? To evaluate this, we simulated election results over the observed distributions of party votes from the 2007 to 2019 election cycles to identify the mechanical vote threshold for winning a seat. The simulation is based on 100,000 independent random draws, and the probability of winning a seat is calculated according to the set of electoral rules governing the province legislative election in the Capital Department: a district magnitude of 9, with a 5% formal vote threshold for winning a seat, and vote to seat allocation calculated based on the D'Hondt formula.

Figure III-1. Predicted Probability of Winning a First House Seat, in the Capital Department
Based on 100,000 independent random draws



Note: Predicted probability of winning a first seat in the provincial House (y-axis) as the percentage the party wins increases (x-axis), based on 100,000 independent random draws. The predicted probabilities are calculated based on the electoral rules in place in the Capital Department—a 9 seat electoral district, 5% formal threshold, and D'Hondt seat allocation formula.

Figure III-2 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 10.3% when a party obtains 5.75% of the votes, it grows to 49.3% when the party obtains 6.25%, and it reaches an 89.2% chance for parties winning 6.75% of votes. In the appropriate "voting region," a variation of half a percentage may make a huge difference for the opportunities of getting parliamentary representation.

Hence, for parties winning only a small share of votes, 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 electronic 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 devices.

Indeed, for small parties, centering the campaign efforts around the legislative ticket is more likely a dominant strategy the larger is the district magnitude. The performance of Partido Obrero (PO) brings an example of it. Despite being a small force, the party regularly competed in provincial elections, electing seven representatives over the seven election cycles in the sample. However, election after election, the party's legislative ticket attracted more votes than the gubernatorial candidate in the Capital Department—on average, the legislative ticket garnered 1.3 percentage points more, which for a party of this size represents 26.3% more than the gubernatorial candidate. According to our simulations, a gap of that magnitude is likely to have large implications for the chances of getting a seat for a party attracting 5% to 6% of the department's votes. One seat is not trivial, as there are only nine seats up for grabs in the district: all the remaining House districts have magnitudes from one to three seats, making the Capital Department the only place where a small party may obtain legislative representation.