

**Assessing the impact of e-voting
technologies on electoral outcomes:
an analysis of Buenos Aires' 2005
Congressional Election**

Gabriel Katz, Michael Alvarez

Ernesto Calvo, Marcelo Escolar and Julia Pomares

I. Motivation and summary

- Increasing number of countries have adopted/ are adopting electronic voting systems in national/local elections.
- Academic literature focused on the reliability/accuracy of different electronic voting technologies. Few studies examined the effect on election outcomes.
- No studies for multiparty electoral systems.

- We analyze how different voting technologies influence voters' choice and election outcomes in multi-party races.
- Evidence from a voting pilot during the 2005 congressional election in Buenos Aires, in which four e-vote prototypes were tested.
- **Main results:**
 - voters alter their electoral behavior and their vote choice in response to different e-vote technologies
 - this might translate into different electoral outcomes across voting devices, potentially altering election results.

II. The e-voting experiment in Buenos Aires

II.1 The electoral/political context

- Congressional election held in November 2005.
- Voters chose National Representatives and State Legislators using a party-list paper ballot system that included candidates for all offices.
- Thirty (forty one) parties presented candidate lists for National representatives (State Legislature).

- Three parties – FPV, ARI, PRO - captured approximately 66% of the valid votes in both elections.
- The campaign for national representatives was very intense, with high spending in support of the candidates of the three major parties.
- In particular, high name-recognition for the candidates of FPV and PRO.
- In contrast, candidates to the local legislature spent almost no money during the campaign.

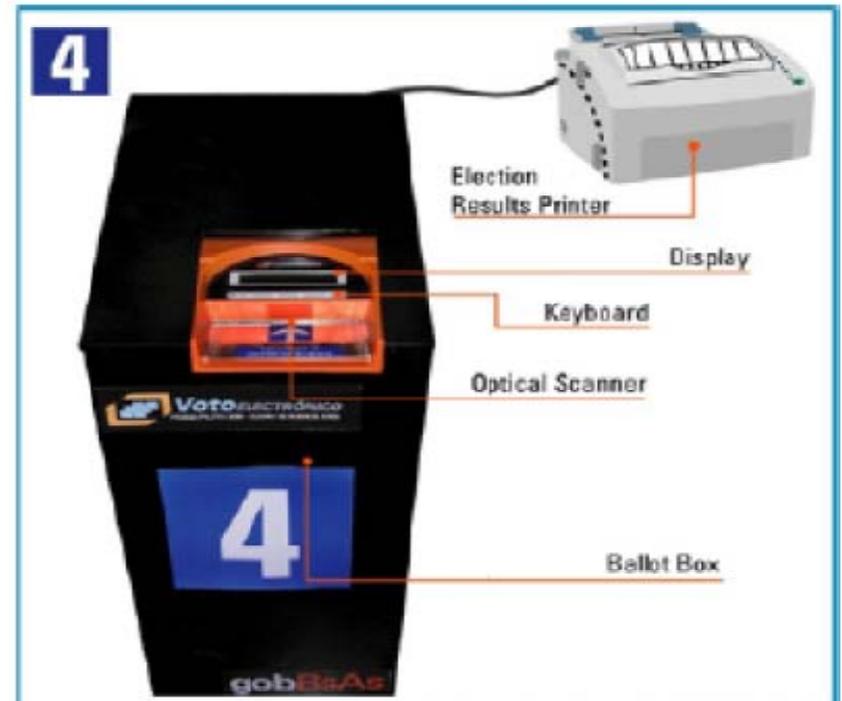
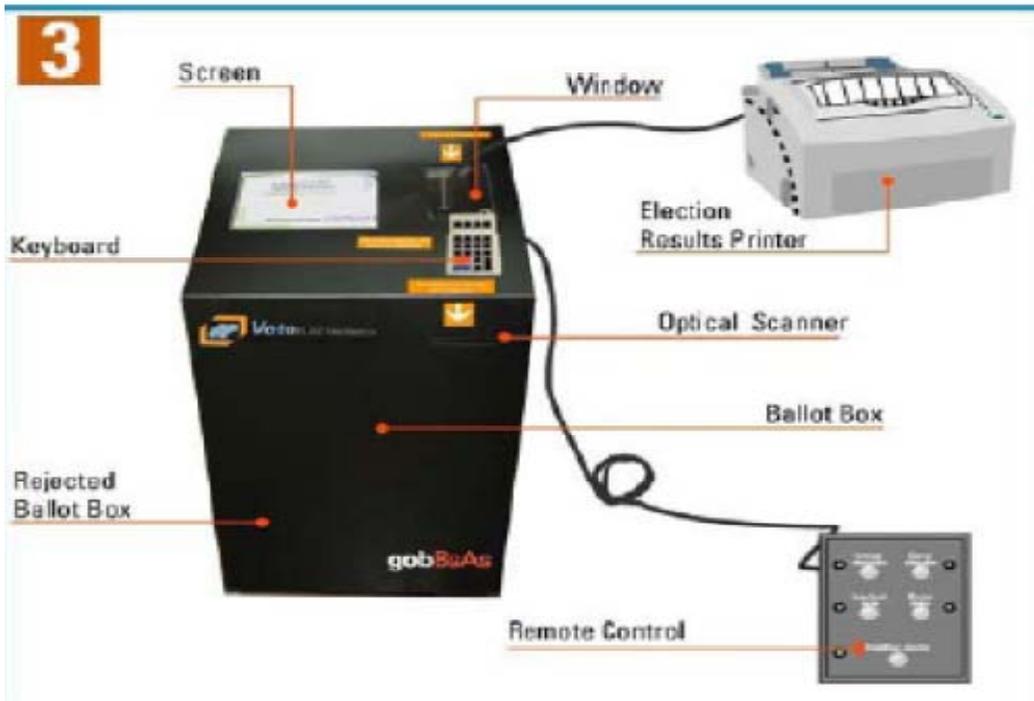
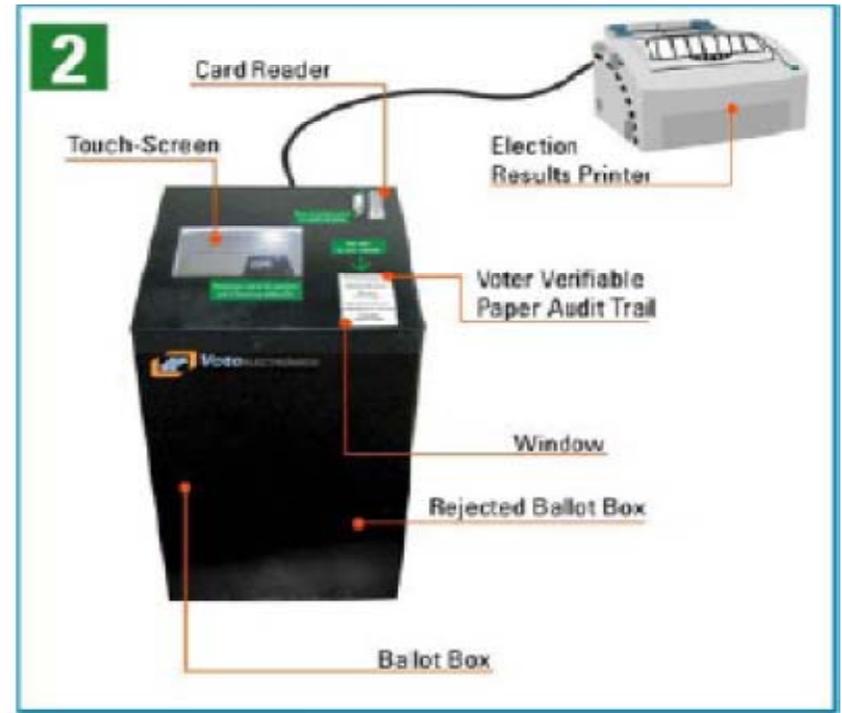
II.2 Characteristics of the e-voting pilot

- Conducted in 41 precincts randomly distributed throughout the city, with 14,800 participants.
- After voting in the official election, participants were asked to participate in a non-binding election.
- Subjects were randomly assigned to one of four possible voting devices and were asked to vote a list of national deputies and a list of local legislators.

- After the vote, participants were asked to complete two surveys:
 - short survey with questions dealing with general perceptions about the e-vote experience and usability issues specific to each device.
 - a fourth of the participants also answered a longer exit poll with questions asking about their political sophistication, familiarity with technology, patterns of political participation, and attitudes towards e-voting.

II.3 The four e-voting devices tested.

- *Prototype 1* DRE design with a numerical keypad.
- *Prototype 2* was a touch-screen *DRE* machine with a voter verifiable paper trail.
- *Prototype 3* was an OS prototype. The voter picked a paper ballot and inserted the ballots into a rolling scanner. Separate ballots for each race.
- *Prototype 4* was an OS device with a single ballot listing all in the two races. The voter marked her preferences with a pencil and inserted the ballot into the scanner.



- Important differences in the way in which voters were required to search for the candidates:
 - in the DRE prototypes (1 and 2), party labels were randomly rotated on the screen with a limited number of labels were displayed on each screen.
 - in *Prototype 3*, poll workers sorted the paper ballots numerically, according to the parties' official list number.
 - in *Prototype 4*, party names were listed by their number in increasing order.

- A second difference was how voters accessed information:
 - *Prototype 1* displayed party names, number and logo on screen. To view the list of candidates, the voter had to enter the party number.
 - The screen in *Prototype 2* displayed the name of the first candidate in addition.
 - Ballots for *Prototype 3* included the party name, logo, number, and a complete list of candidates for each race.
 - Ballots in *Prototype 4* listed only party name, number and logo. A separate booklet provided the list of candidates.

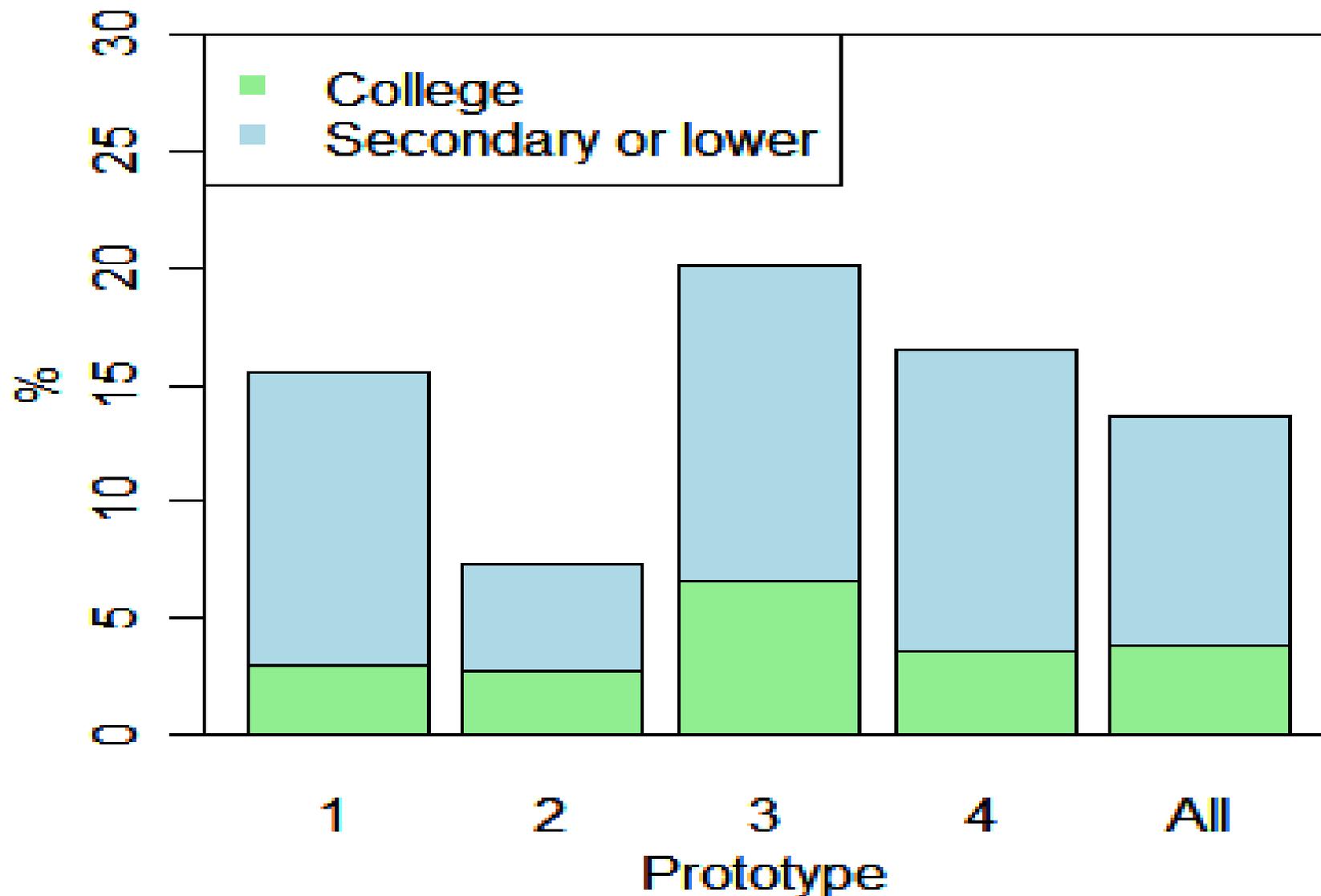
III. A first look at the effect of the e-voting technologies

- The survey data lets us examine:
 - how voters interacted with each prototype
 - how the different voting technologies and associated ballot designs affected voters' choices.
- Significant differences regarding ballot features used to identify the candidates across prototypes: the type/way/amount of information displayed affects the information used as voting cues.

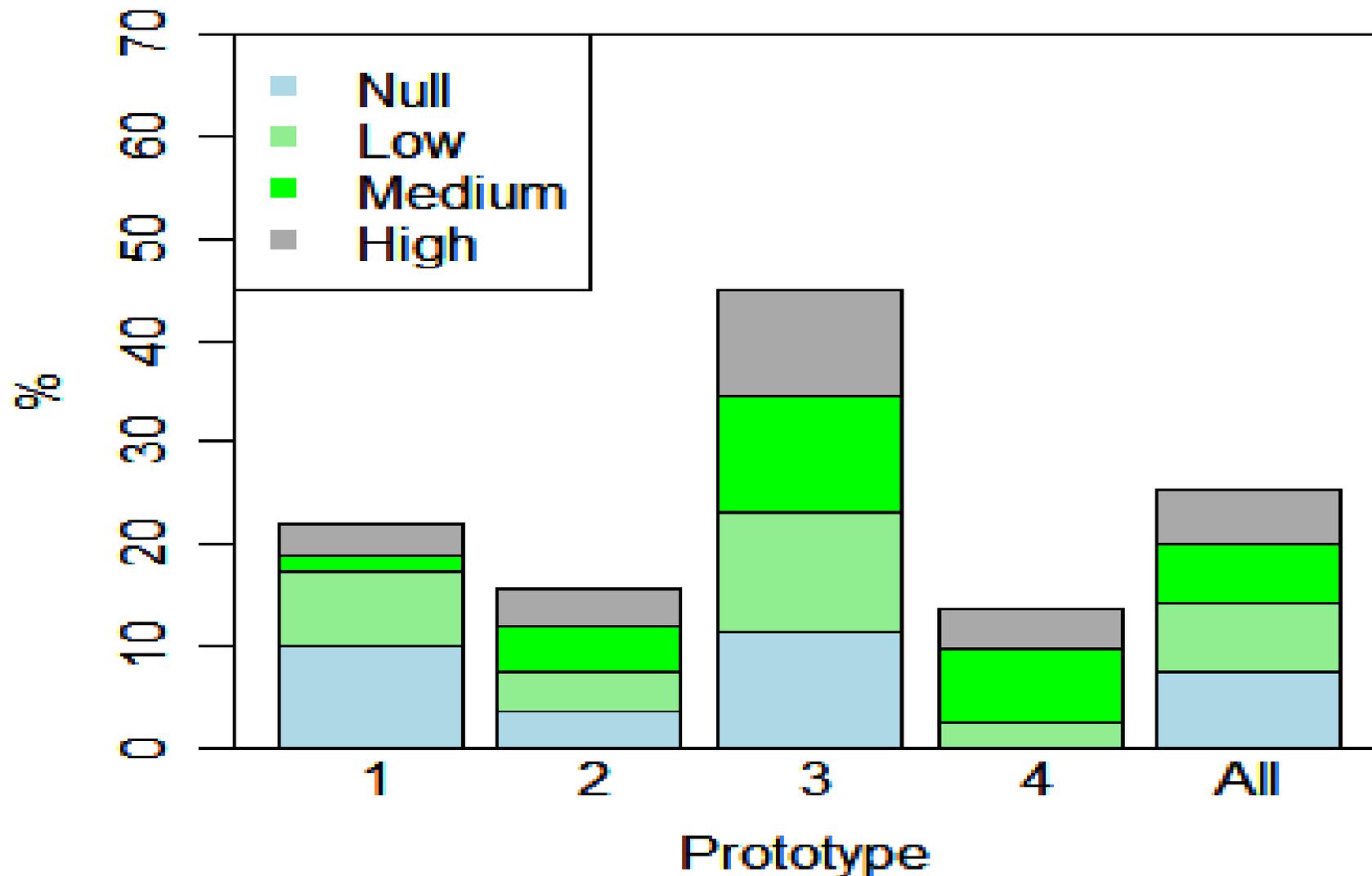
Cues used to choose candidates	Prot. 1 (%)	Prot. 2 (%)	Prot. 3(%)	Prot. 4 (%)	All (%)
Party name	51.4	51.0	44.3	53.4	49.4
First candidate's name	33.3	50.1	47.1	45.0	44.2
Party Logo	27.3	30.3	22.4	7.4	25.8
Party number	35.4	21.0	19.9	28.6	25.3
Other features	4.1	2.7	7.5	6.4	4.6
N	879	1,158	858	189	3,084

- The different prototypes also mediate how education and political information affect voter's ability to cast their vote.
- Less educated voters experienced more difficulties to find/select their preferred candidates for of the prototypes.
- However, the educational gap was much smaller for *Prototype 2*, suggesting that it imposed lower barriers to voting on less educated voters.
- Also, *Prototype 2* was effective in enabling voters with low information levels to vote for their preferred choice.

Percentage of voters who could not vote for their preferred candidate



Respondents who could not vote for their preferred candidate, by information levels

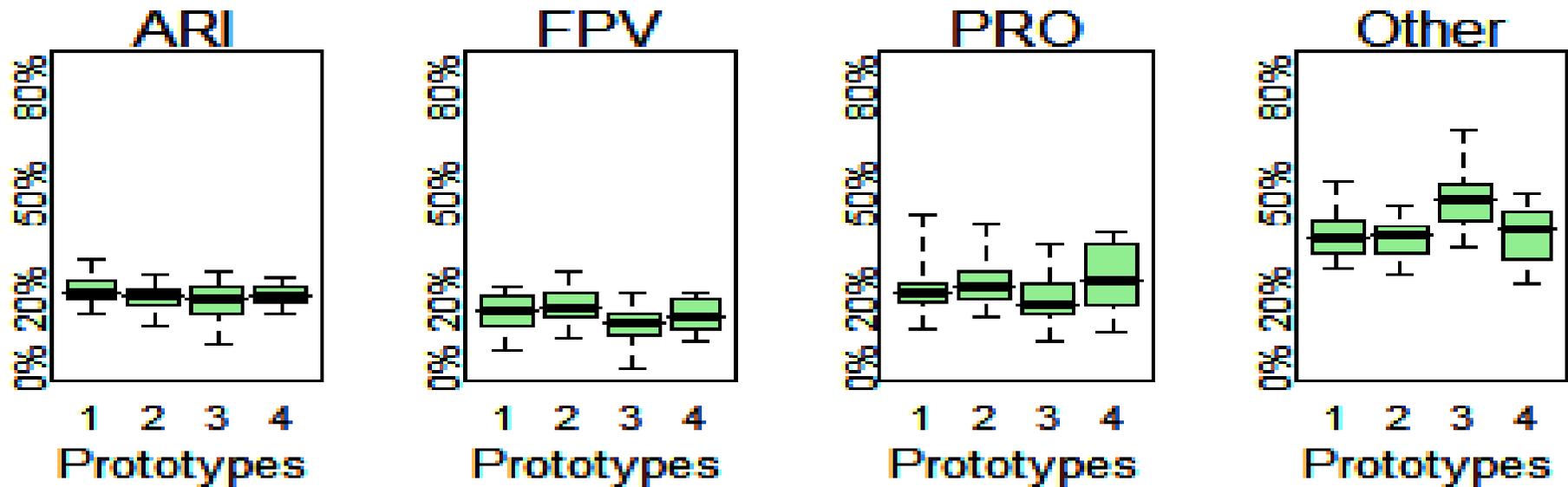


- These results suggests the different prototypes might have had systematic effects on electoral outcomes in the two races.

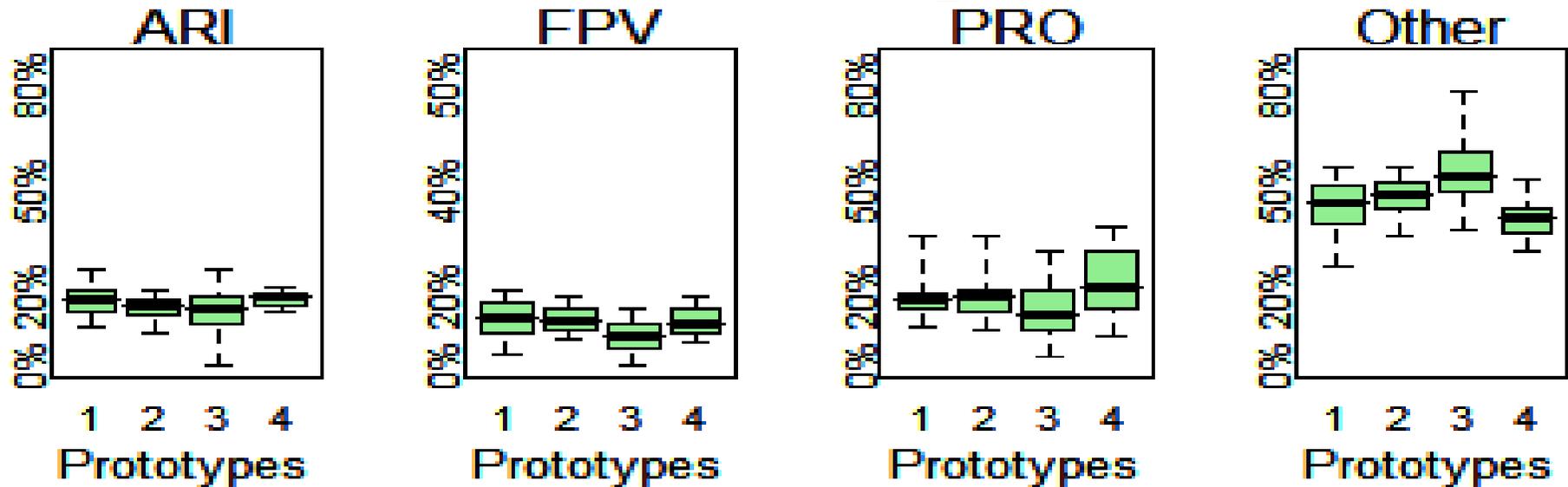
- For all the prototypes tested:
 - the three majority parties (*ARI, FPV, PRO*) had higher vote-shares in the national election;
 - minority parties obtained a higher vote-share in the less visible election (State Legislature).

- Considerable variations across prototypes:
 - support for minority parties in both races was much higher under *Prototype 3*;
 - the three larger parties did better under the two DRE devices.

Election of National Representatives



Election of State Legislators



IV. Estimating the effect of e-voting technologies on election outcomes

- We estimate the impact of the different prototypes on voters' choice and the support for the different parties, net of socio-demographic and attitudinal variables.
- We can analyze the aggregate electoral and survey data from 128 voting stations, defined by “crossing” each of the precincts with the 4 e-voting devices

- What variables explain vote choice?

1) Voters' socio-demographic characteristics

- *Education*
- *Political Information*
- *Interest in politics*
- *Use of Technology*

2) The characteristics of the e-voting device

- *Amount/type of information provided*
- *Ballot design and features*

- We used several alternative statistical techniques to analyze the data and assess the robustness of results
 - regression models (multinomial logit-models, compositional data models)
 - non-parametric matching methods (Genetic matching).

- We accounted for the experimental design (voters in precincts randomly assigned to different prototypes).

III.1 Empirical results

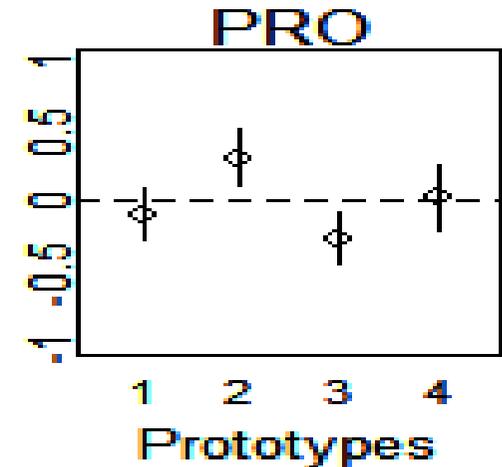
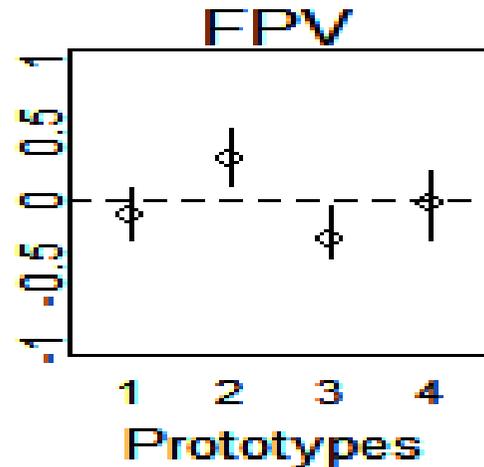
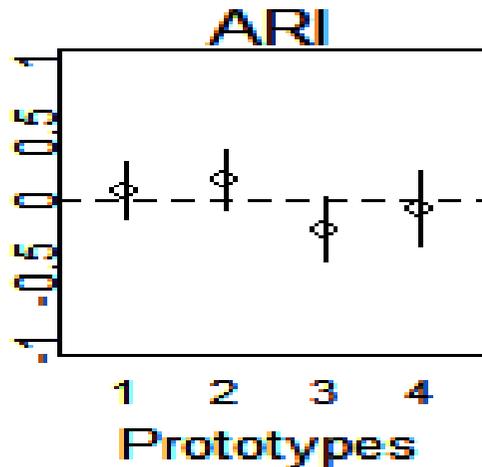
- Differences in the effect of voters' socio-demographic characteristics on the support for the different:
 - votes for PRO (FPV) increased (decreased) in voting stations with higher average levels of education
 - in contrast, higher average levels of political interest were associated with higher support for FPV.

- The main focus of the analysis, however, lies in the effect of the different e-voting technologies on the support for the competing parties.

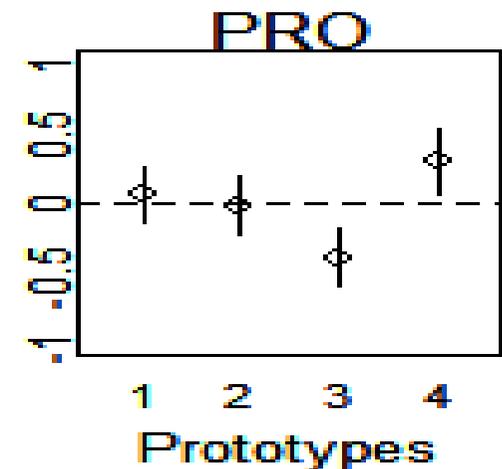
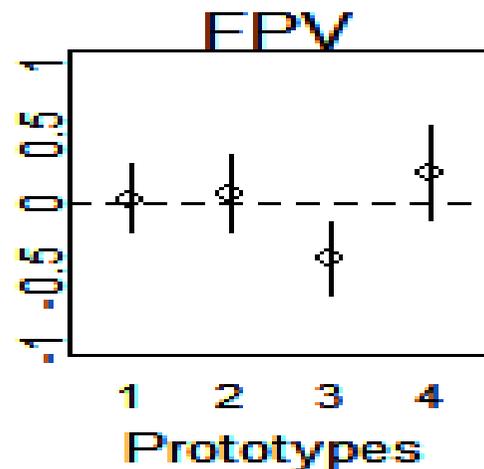
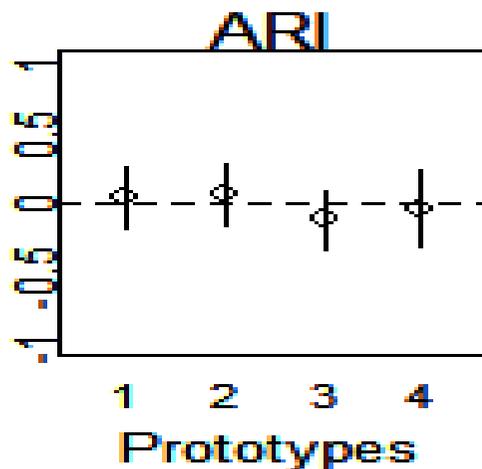
- For the two congressional elections under analysis, we examined:
 - the effect of the voting technologies on the support of the three majority parties *vis a vis* minority parties
 - pairwise differences in the probabilities of supporting each party across prototypes.

Centered Prototype random coefficients for both congressional elections

Election of National Representatives

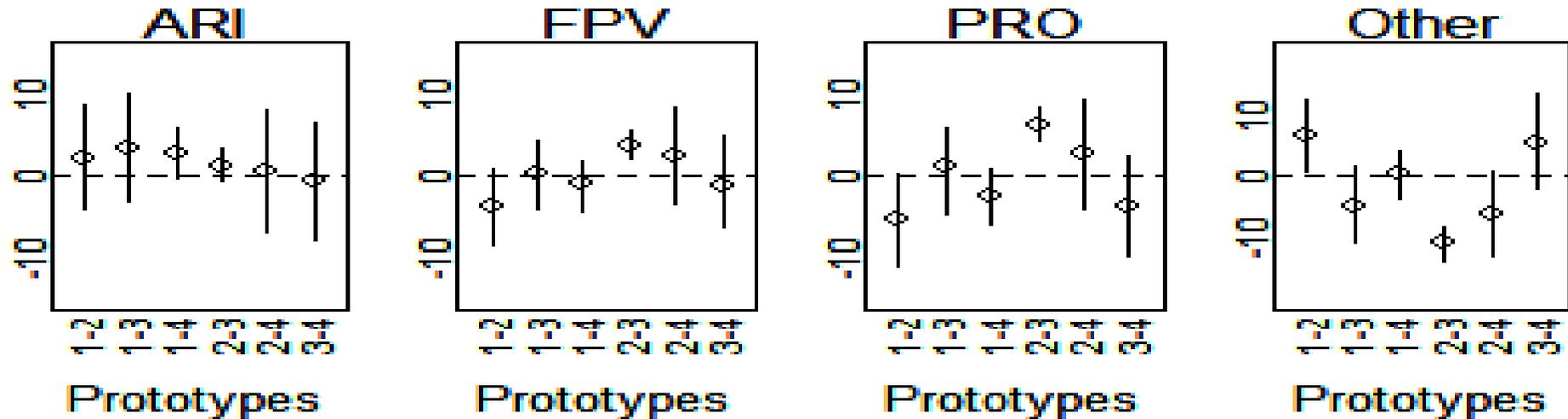


Election of State Legislators

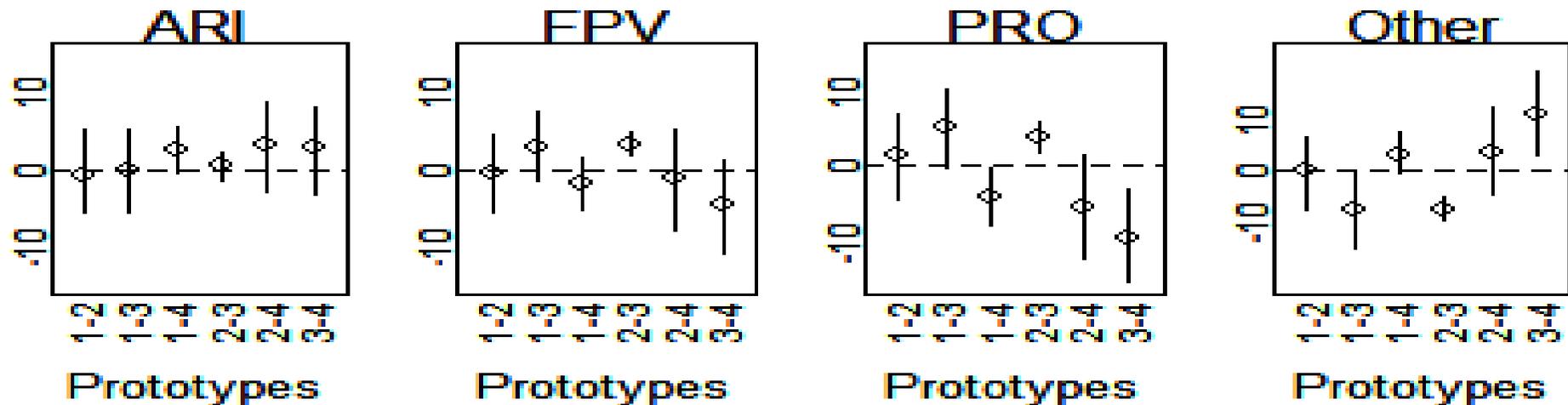


Pairwise differences in the probability of support for each party across prototypes (in p. points)

Election of National Representatives



Election of State Legislators



- The results indicate that:
 - the support for the largest parties tends to be higher for the two DRE devices than for *Prototype 3* in both races;
 - in contrast, the support for the smaller parties is maximized under *Prototype 3*;
 - the vote-share of the two parties with more visible candidates, is highest under *Prototype 2*;
 - in contrast, the support for minority parties is 11 percentage points lower under *Prototype 2 vis a vis Prototype 3*.

- There is strong evidence in support of the hypothesis that alternative voting technologies may have substantive influence on the support for different parties.
- The relevant question thus becomes: how would the election outcomes vary under different voting technologies?
- To answer this question, we estimate the expected electoral outcome assuming only one prototype had been used in each voting-station, holding the remaining variables constant.

- The results of these contra-factual simulations show that different e-voting technologies would have led to different election results:
 - If only *Prototype 1* had been used, ARI (rather than PRO) would have had the highest expected support in the national election.
 - The vote-shares of PRO and FPV in the would have been maximized under *Prototype 2*.
 - The support for minor parties in both races would have increased by almost 6 percentage points under *Prototype 3*.

Expected and actual election outcomes, in percentage points

	ARI	FPV	PRO	Other Parties
Election of N. Representatives				
Prototype 1	22.77	14.52	21.59	41.12
Prototype 2	20.64	18.13	26.74	34.49
Prototype 3	19.36	14.33	20.4	45.91
Prototype 4	19.89	15.52	23.99	40.6
Actual outcome in the experiment	21.03	15.58	23.16	40.24
Election of S. Legislators				
Prototype 1	18	12.97	21.87	47.16
Prototype 2	18.57	13.52	20.38	47.53
Prototype 3	18.16	10.25	16.59	55
Prototype 4	15.47	14.64	25.84	44.05
Actual outcome in the experiment	18.04	12.31	20.43	49.22

V. Concluding remarks

- Multi-party races impose substantial demands on voters, who have to gather enough information to be able to distinguish between the positions of the different parties and to identify their preferred choice.
- In this paper, we present the first study on the potential impact of e-voting technologies on election outcomes in multi-party races, analyzing data from a large-scale pilot in Buenos Aires.

- We find that that different e-voting devices could have considerable influence on the support for different parties across races.
- In particular, the amount and the form in which information is presented might influence the propensity to choose some parties over other.
- This effect could be large enough to actually affect the election results.
- This raises the possibility that some voting technologies may in fact shape the electoral outcomes, rather than merely recording voters' choices.

- Difference with relevant studies on this topic for U.S. elections, most of which found negligible effects (Card and Moretti, 2007; Herron and Wand, 2007; Herron, et al., 2008) .
- In this sense, our results are in line with Reynolds and Steenbergen (2006): some aspects of the ballot design (symbols, photographs, layout, and color), play a crucial role as political cues and may have a considerable influence in multi-party elections.