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PAPER BALLOTS, COMPUTERS, AND EVERYTHING ELSE IN BETWEEN: THE IMPACT OF VOTING DEVICES ON BALLOT ROLL-OFF

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Abstract

This paper examines the impact of different types of voting devices in encouraging or discouraging ballot roll-off, the phenomenon in which some voters who do show up to vote fail to complete their ballots. Nichols and Strizek (1995) have shown that voting machines which have a flashing red light next to each contest on the ballot that goes out only after the voter casts a vote in that race significantly limit roll-off. More subtle differences in voting devices are examined in this paper with the findings indicating that roll-off differs across five different types of voting devices used in a single primary election. Those devices, such as the lever machine and computers, that “detach” the voter from his/her vote are related to higher rates of roll-off than are voting methods that rely only on the voter using a writing instrument to cast a vote. While the promotion or limitation of roll-off can have clear political implications, the paper argues that normative implications related to whether participation by less informed voters should be encouraged or discouraged are even more significant, particularly in an era when many local governments are making decisions about the purchase of new voting devices.

A cursory glance at election returns in the morning newspaper the day after an election in the United States indicates that a significant portion of voters who turn out to vote do not cast ballots in every race. This phenomenon of voting for salient races at the top of a ballot, but not completing the ballot, has been termed ballot “roll-off” (Burnham 1965). As Converse (1972) and others have noted, widespread ballot roll-off is a fairly modern occurrence in the United States, becoming common with the demise of the party slate ballot in the latter years of the Nineteenth Century.¹ A number of studies over the years have sought to shed light on this practice by examining a number of potential factors in determining the amount of roll-off in a particular electoral locale. In an era in which a variety of different voting devices are being used in American elections, this paper examines roll-off by once again focusing on the impact of different voting devices in encouraging/discouraging voters from completing their ballots.

At one time, it was commonly assumed that the introduction of new voting devices did promote roll-off. Most importantly, after the widespread introduction of lever voting machines in the United States, studies indicated that voters using the machines were likely to be confused by the technology and to respond by not completing their ballots (White 1960; Mather 1964). While recent studies have indicated that odd positioning of races, e.g. alone on the back of a ballot, does promote roll-off (Darcy and Schneider 1989), the impact of different mechanical/punchcard voting devices has generally been found to have only a minimal impact on roll-off in the modern era (Asher and Snyder 1990). It appeared that contemporary voters had become familiarized with new voting technology over the decades.

However, the last several years have seen a proliferation of voting devices as new (and increasingly affordable) computer and optical scanning technology has begun to be taken advantage of in the realm of casting and counting votes. And, counter to other recent analyses (e.g. Asher and Snyder 1990), Nichols and Strizek (1995) found that indeed technology itself **can** have an impact on roll-off in the modern era.

Nichols and Strizek examined the impact of the introduction of unique voting devices in Columbus, Ohio, for the 1992 general election. The uniqueness of the machines marketed by the R. F. Shoup Corporation comes from the presence of a flashing red light above each contest on the ballot that goes off only after a vote is cast in that race. Not surprisingly, in comparison to standard voting machines, this less-than-subtle reminder was found to have a significant limiting impact on roll-off, even when controlled for important socioeconomic variables.

While these results indicate that technology can matter in producing roll-off variation, the importance of the findings were limited by two factors. First, the flashing lights on the machines in question produce a blunt, almost Pavlovian, demand for voters to complete the ballot, a quality almost never found in other new voting devices. Second, the test was completed in a high-turnout presidential year election in which many low-information voters—the most likely to roll off—are drawn to the polls. Therefore, it remains important to examine the impact of the new variety of voting devices in a setting where dramatic impacts would not be expected *prima facie*.

Variations in Roll-off Based on Voting Methodology

The state of Arkansas in the mid-1990s presents a particularly good case to study an even more diverse collection of voting methods than previous studies have examined. In 1994, five different voting methods of casting votes were in use in the precincts in the state's 75 counties.² The plurality of counties (30) used the optical scanning device in which voters draw a line connecting an arrow next to the candidate of their choice on a paper ballot which is then automatically read by a scanning device located in the polling place. It is a method which differs from the traditional paper ballot—still in use in nearly a third of the rural state's counties (24) in 1994—in that a special pen is needed to mark the ballots for the optical scanner to read and that traditional paper ballots are counted by humans rather than by scanning device.

Three other devices were used by a number of counties which placed a mechanical device in between the voter and the casting of his/her vote. As of 1994, ten counties employed the mechanical lever machines in which voters, behind a curtain, pull down levers over the candidates for whom they wish to vote, then have their votes recorded when they open the curtain. A number of counties—nine in 1994—used the punchcard ballot in which voters use a stylus to create a hole in the ballot next to the name of their candidate. These two methods have been used for a fairly long period of time in the state.

Finally, two counties—probably not accidentally two of Arkansas' counties with the greatest tradition of election malfeasance³—have recently purchased computer voting devices in which voters punch buttons on the frame of the computer corresponding to the candidates' names on the screen on the computer, much like the commands on an ATM machine. Unlike the machines in question in the Nichols and Strizek analysis, there are no prompts from the computer encouraging voters to complete the ballot.

The 1994 Democratic primary had a number of built-in controls for examining the phenomenon of voting device impact on ballot roll-off, controls that would be absent in a typical presidential year general election. First, "voter fatigue," one factor that has been shown to make roll-off more likely, should not have been a problem. Voter fatigue is the tendency for voters to grow bored with the monotony of a long ballot and therefore stop voting before the end. While a number of Arkansas' counties

did have local races on the same ballot, only 5 statewide races were on the ballot, with only 12 candidates in the 5 races.

Most importantly, for the first election cycle since 1912, there was no Democratic gubernatorial primary. And, there was a primary for a seat in the U.S. House in only one of the state's four congressional districts. This resulted in a 25.6 percent drop in Democratic primary turnout between 1990 and 1994. So, one can assume that a comparatively informed electorate, absent the large number of voters who are drawn to the polls primarily by a high-profile race, voted in the primary. Also, the low turnout in the May primary should encourage complete participation in that long lines at the precincts that would encourage voters to rush to finish should have been rare. In short, if roll-off variation presents itself because of voting devices in this case, we can be confident that it will occur, and likely be exacerbated, in elections with more races and naturally more salient races (i.e. presidential, senatorial, gubernatorial) on the ballot.

In lieu of a gubernatorial race, the "high profile" race in the 1994 Democratic primary was the race for Attorney General. The popular incumbent Winston Bryant was challenged by State Representative Mark Pryor, a potential threat because of the immense popularity and fund-raising potency of Pryor's father, three-term U.S. Senator David Pryor. Both candidates ran extensive television and radio campaigns during the spring, and, while Bryant ended up winning the race rather easily, many political observers in the state considered the contest a "toss-up" going into primary day. The "low profile" statewide race on the ballot was that for Auditor of State, a race between two essentially unknown state legislators from the southwest corner of the state. Only one of the two candidates purchased any television time during the campaign, a fairly minimal buy in the Little Rock market; the other candidate spent nearly as much money overall, but focused on a old-fashioned billboard campaign. Not surprisingly, nearly 45,000 fewer ballots were cast in the Auditor's race than in the Attorney General's contest.

Therefore, for this study, "roll-off" is defined as the percentage of a county's voters who cast a vote for Attorney General but did not vote for State Auditor. Based on previous studies, since the devices used in Arkansas are either quite straightforward or have been employed over a number of election cycles, we should expect to find little variation across counties based on the type of voting device employed in that county, with two exceptions. First, while there is little practical difference between the traditional paper balloting and optically scanned balloting methods, the optical scanning method was being used for the first time in a number of the state's counties in 1994 which could have produced some one-time confusion among voters that might enhance roll-off, if only slightly, in those counties. More importantly, the new computer voting devices used for the first time in the two counties could be confusing to voters unaccustomed to using them. Therefore, we would expect the average roll-off to be somewhat higher in these two counties than in the other 73 counties.

For the most part, these expectations are not met, as indicated in Table 1, which shows the average roll-off in the counties in each of the five categories. Indeed, there are large gaps in the roll-off percentages in counties based on the voting device in use in that county. The average roll-off in counties with traditional paper balloting and optical scanning of paper ballots are remarkably similar and quite low, although, as expected, there is slightly more roll-off in the latter counties. Fewer than one in ten voters who cast a ballot in the Attorney General's race in these counties failed to cast a vote in the State Auditor's contest.

Table 1. Average Ballot "Roll-off" Between Attorney General Race and State Auditor Race in the 1994 Democratic Primary in Arkansas' 75 Counties, by Type of Voting Device

Type of Voting Device	# of Counties with Device	Avg. "Roll-off"
Traditional Paper Ballot	24	9.43%
Optical Scanned Ballot	30	9.77%
Punchcard	9	11.01%
Computer	2	13.45%
Lever Machine	10	19.95%

However, the average roll-off in counties employing the other devices—particularly the computers and lever machines—was higher. About 11 percent of Attorney General voters in punchcard counties failed to finish their statewide ballots, an average of 13.45 percent of voters "rolled off" in the computer device counties, and, very surprisingly, an average of nearly one in five Attorney General voters failed to vote for State Auditor in the ten lever machine counties—over twice the rate in paper ballot counties.

That voters would show differences in roll-off patterns when voting on machines and with paper ballots several decades ago is not surprising. Voters who had always cast votes using a pencil to mark a paper ballot were suddenly required to adjust to a dramatically different way of doing things. However, that such disparity in roll-off exists decades after the introduction of lever machines is particularly surprising. First-time voters might be intimidated by voting machines, but a relatively small percentage of voters in each election are new to the process. Voter confusion about the use of the machines is no longer a satisfactory explanation for this large deviation in roll-off.

If confusion is not the answer, what might explain these persistent differences in roll-off? As a whole, the findings seem to suggest that voters feel a greater need to complete a ballot when they are completing it with only their hand and a writing instrument than when they are using a stylus or, particularly, when a machine becomes their instrument for voting. It is almost as though a detachment between the individual and his/her vote occurs when a machine places itself in the way. Voters with the same amount of political information may not feel as great a responsibility to complete the voting process when they are not physically marking the ballot. It has long been clear that sometimes difficult to explain psychological factors play significant roles in determining **how** individuals vote; this finding indicates that there is a psychological element in **whether** individuals vote in lower level races based on their reaction to the instrument they use to vote.

A Multivariate Analysis: Controlling for Demographic Variables

While the initial comparisons indicate that the type of voting device used in a locale does impact ballot roll-off, it is important to determine whether or not these

findings are spurious. That is, other demographic or political characteristics of a county, rather than the voting device, could be driving the variation in roll-off. It could, for instance, be the case that the socioeconomic characteristics of a county determine which kind of voting device that county can afford to purchase and that SES is truly driving roll-off differences. Therefore, to be confident of the reliability of the initial findings and to gauge the statistical significance of the variation across categories, it is important to develop a multivariate model that controls for the other potential causes of voter roll-off.

Based on previous research about political participation generally and roll-off specifically, it seems crucial to control for the education level, socioeconomic status, racial composition, age composition, and residential mobility of a county. In addition, it is important to control for the home counties of the candidates in the "low profile" race on the ballot.

Education: Walker (1966) showed that a significant correlation exists between low education levels of voters and a tendency not to complete their ballots. Better educated voters are more likely to have access to the information needed to feel confident in making vote decisions in low-profile races. Therefore, it would be assumed that, all things being equal, voter roll-off should be lower in counties with better educated populations. Educational attainment will be measured by the percentage of a county's 1990 population that were college graduates (4 year degree), and will be labeled EDUCATION.⁴

Socioeconomic Status: Individuals with higher levels of socioeconomic status, independent of their education level, are more likely to participate in almost all aspects of American politics (Verba and Nie 1972). Therefore, it would not be surprising if a negative correlation were also found between the SES of a county's population and ballot roll-off. A county's median household income in 1990 (INCOME) is included in the model as an indicator of SES.

Racial composition: There does seem to be some indication that African-American voters are less likely to complete their ballots than white voters, at least when there are no black candidates on the ballot—as was the case in Arkansas' 1994 primary (Darcy and Schneider 1989; Vanderleeuw and Engstrom 1987). While Verba and Nie (1972) have shown that socioeconomic variables explain most of the difference in participation rates between whites and nonwhites in the United States, Bobo and Gilliam (1990) have shown that African-Americans living in "low-empowerment" areas remain less political attached than whites, even taking their SES into account. While statewide voter turnout dropped considerably between the 1990 and 1994 primaries, the primary vote decreased by much greater percentages in those areas of the state in which nonwhites are most prevalent in their voting-age population (Barth 1994). This suggests that African-Americans felt particularly unempowered in the 1994 Democratic primary and indicates that those black voters who did participate might have been less likely than white voters to complete their ballots. Therefore, the percentage of nonwhites in a county's 1990 population will be included as another independent variable (NONWHITE).

Age composition: There is also evidence that older voters are more likely to be confused by new technology (Darcy and Schneider 1989). In this case, the computer devices used in two counties are the only new, potentially confusing, methods used in Arkansas in 1994. However, other counties did change methods, albeit to rather straightforward devices, which could have added some slight confusion that could have had a

minimal impact on roll-off. Therefore, the percentage of a county's population that was aged 65 or older in 1990 is included as a separate variable, labeled OVER65.

Mobility: All things being equal, voters who are more mobile, i.e. have lived in an election district a shorter period of time, are less likely to have the complete political information needed to finish a ballot from top-to-bottom. In examining statewide races, the best measure of mobility would be the percentage of a county's population that moved from out of state. Included in the model as a substitute is the percentage of a county's population who moved at all, even from one house to another in the same county, between 1985 and 1990. While not the preferred operationalization of this concept, this should capture the general stability of a county's population. This variable is labeled MOBILITY.

Home County of Candidates: As V. O. Key (1949) illustrated, "friends and neighbors" voting historically played an important role in Arkansas voting patterns with voters considerably more likely to support candidates from their part of the state. While in the media age, "friends and neighbors" voting may not be what it once was, it remains potent; in a 1993 special primary election for Arkansas Lieutenant Governor, a candidate won 92% of the vote in the "home" county he had not resided in since high school. We could expect that voters in the home county of a State Auditor candidate would vote for that candidate, and, more important for our purposes, make a point to actually vote in that race. Therefore, a dummy variable is included in the model in which the two home counties of the Auditor candidates are coded 1 and all other counties are coded 0. A negative relationship should be found between this variable (HOME COUNTY?) and roll-off. It seems unnecessary to take the home county of the Attorney General candidates into account since they each had two counties which they claimed as "home" and since they [or their father] had appeared on ballots in the state at least a dozen times each.

It first makes sense to determine to what degree these six demographic and political variables explain variation in ballot roll-off, not considering the particular voting device used in that county. This will provide a baseline for comparing the degree to which taking into account a county's voting device improves the specification of the model.

Therefore, the first model of roll-off is:

$$Y = b_0 + b_1 \text{EDUCATION} + b_2 \text{MOBILITY} + b_3 \text{INCOME} + b_4 \text{HOME COUNTY?} + b_5 \text{NONWHITE} + b_6 \text{OVER65} + e$$

It would be expected that the education, income, and home county variables would have negative coefficients and that the age, nonwhite, and mobility variables would be positively related to roll-off.⁵ The results of the OLS regression analysis are shown in Table 2.

These results indicate that only two of the independent variables are statistically significant. Median family income of a county and whether or not the county is home to an Auditor candidate are determined to be significant inhibitors of roll-off, as hypothesized. Each of the other four variables fails to reach significance. The goodness-of-fit of the model, as gauged by the adjusted R_2 , indicates that the demographic/political variable account for very little of the variation in roll-off; the adjusted R_2 is a scant .123.

Now that this baseline has been established, variables that represent the different voting devices used in the counties can be introduced. As is appropriate when five

Table 2. Parameter Estimates for the Model of Ballot "Roll-off" in the 1994 Democratic Primary in Arkansas' 75 Counties

EDUCATION	.212 (.280)
MOBILITY	.236 (.151)
INCOME	-6.035E-4+ (3.123E-4)
HOME COUNTY?	-9.708* (4.058)
NONWHITE	-.060 (.058)
OVER65	-.163 (.228)
Intercept	14.576
R ²	.194
Adj. R ²	.123
F	2.734*

+p<.10

*p<.05

different categories are present and dummy variables are used to introduce them into the analysis, variables corresponding to four of the categories will be included in the model. In this case, the mechanical lever will not be represented by a variable. The other four types of devices will be included in the model using dummy variables, labeled COMPUTER(Y/N), PAPER(Y/N), OPTICAL(Y/N), and PUNCHCARD(Y/N), respectively. If a county uses one of the devices, the variable representing that device will be coded 1; other variables will be coded 0. For counties using the mechanical lever device, all four variables will be coded 0. This coding scheme will allow both comparisons between the mechanical lever and the other four devices as well as the overall contribution of taking a county's voting device into account in improving the goodness-of-fit of the model.

The expanded model therefore is:

$$Y = b_0 + b_1 \text{EDUCATION} + b_2 \text{MOBILITY} + b_3 \text{INCOME} + b_4 \text{HOME COUNTY?} + b_5 \text{NONWHITE} + b_6 \text{OVER65} + b_7 \text{PAPER(Y/N)} + b_8 \text{PAPER(Y/N)} + b_9 \text{OPTICAL(Y/N)} + b_{10} \text{PUNCHCARD(Y/N)} + e$$

The results of the regression analysis are shown in Table 3.

Table 3. Parameter Estimates for the Expanded Model of Ballot "Roll-off" in the 1994 Democratic Primary in Arkansas' 75 Counties

PAPER (Y/N)	-8.320++ (1.783)
PUNCHCARD (Y/N)	-7.795+ (2.204)
OPTICAL (Y/N)	-9.021++ (1.627)
COMPUTER (Y/N)	-4.533 (3.606)
EDUCATION	.181 (.244)
MOBILITY	.242* (.130)
INCOME	-6.143E-4** (2.750E-4)
HOME COUNTY?	-8.631** (3.499)
NONWHITE	-.063 (.050)
OVER65	-.130 (.193)
Intercept	21.502**
R ²	.471
Adj. R ²	.388
F	5.691++

*p<.10

**p<.05

+p<.001

++p<.0001

First, three of the four voting devices are shown to be significantly different from the mechanical lever devices in their impact on roll-off, controlling for the important demographic and political variables. The traditional paper ballot, optically scanned paper ballot, and punchcard methods produce significantly less roll-off than the lever machines. Therefore, the initial findings that the type of device used in a locale does matter in whether or not voters complete their ballots are upheld by this portion of the regression analysis. Voters are less likely to complete their ballots when they have to

use a machine rather than their own hand and a pen or stylus to do so.

Next, the two variables shown to be significant indicators of roll-off in the first model, median family income and whether or not the county is a home of a candidate in the "low profile" race, remain significant. And, another variable which had neared significance in the first model, the mobility of a county's electorate, becomes statistically significant in the hypothesized, positive direction.

Finally, it is clear that the inclusion of the variables representing the different voting methods improves the specification of the model of roll-off considerably. While much of the variation in roll-off remains unexplained, the adjusted R² of .388 for this expanded model represents quite a jump from the .123 of the first model. At least for the variety of voting devices seen in Arkansas in 1994, voting methodology does matter in determining whether voters complete their ballots.⁶

The primary race for State Auditor was a close one. State Representative Gus Wingfield defeated fellow State Representative Bobby Tullis by just over 10,000 votes, winning 51.64% of the votes cast in the race. Having shown that roll-off is affected by the type of voting device employed, would the result have been altered if a single voting device had been used throughout the state rather than the five different types that were used?

To determine the potential impact of voting devices in altering the outcome of the race, I estimated the outcome in the race if either the traditional paper ballot or the lever machine, the devices resulting in the least and most roll-off respectively, had been the lone device used throughout the state. These estimations were achieved by taking the actual results for each of the candidates in counties with each of the five type of methods, then estimating the number of votes each candidate would have received in those counties if the paper ballot and the lever machine respectively had been used, based on the average roll-off for each of those devices.

Table 4. Estimates of Vote in 1994 Democratic Primary Vote for Arkansas State Auditor if Traditional Paper or Lever Machines Were Used Exclusively in Arkansas' 75 Counties

	Actual Vote (With Variety of Devices <u>Shown in Table 1</u>)	Estimated Vote, if Only Traditional <u>Paper Ballots</u>	Estimated Vote, if Only <u>Lever Machines</u>
Wingfield	166,159 (51.64%)	169,647 (51.60%)	149,942 (51.09%)
Tullis	155,629 (48.36%)	159,152 (48.40%)	143,533 (48.91%)
<u>Outcome:</u>	Wingfield wins by 10,530 votes (3.38%)	Wingfield wins by 10,495 votes (3.20%)	Wingfield wins by 6,409 votes (2.18%)

As shown in Table 4, very little change in the results of the race would have occurred if the traditional paper ballot had been used throughout the state; Wingfield's margin would have lessened by a minimal 35 votes. However, if lever machines had

been used in the state's 75 counties, the best estimate is that Wingfield's margin would have declined by over 4,000 votes. Rather than winning by 3.38% of the vote as he did, the best estimate is that he would have won by a less comfortable 2.18% if only lever machines had been used in the state. While the winner of the race would not have changed, this fairly dramatic shift in margin demonstrates the potential power of different voting devices in altering the outcome of lower-level races, based on the variation in roll-off produced by different devices.

Conclusions

In their recent study of roll-off in Atlanta and Fulton County, Georgia, Bullock and Dunn (1994) examine three potential explanations—voter fatigue, absence of the race's salience for voters, and ballot confusion—and find some evidence for the first two as promoters of roll-off. This paper's findings indicate that the different types of voting devices must still be taken into account in any analysis of ballot roll-off. Even controlling for crucial demographic factors, voters do respond differently to different methods of voting. In particular, voters seem to take more ownership in paper ballots in which they physically make a mark on the ballot, increasing their likelihood of finishing the ballot before turning it in. Technology can shape the outcomes of the electoral game.

One may respond to this paper's findings with a big "who cares," arguing that the races at the bottom of a ballot are irrelevant anyway so that the political impact of roll-off is minimal. While these races may not catch the attention of even relatively well informed voters, they are more important than most believe them to be. That is, the politics of most states remain structured in such a way that one normally works his or her way up over a political career to "high profile" offices (Schlesinger 1966; Barth 1993). "Low profile" offices are rungs on the political "ambition ladders" of a state. Ambitious candidates who first win statewide office as State Auditor may soon run for governor, e.g. Governor Ray Mabus of Mississippi, or some other higher profile office.

While the promotion or limitation of ballot roll-off can have political implications, of even more significance are the potential normative implications that result from technology's ability to alter roll-off rates. Throughout American political history, the issue of whether only the informed elites should participate fully in the political process or whether full participation by all should be promoted has been debated. These findings indicate that decisions regarding which type of voting device is adopted in a particular locale may have an impact on participation in "down-ticket" races. The question that arose in debates over the literacy test and at other points is relevant once again: Is representative democracy healthier if only informed citizens are encouraged to participate fully in the process?

Therefore, the basic findings of this paper lead to some fairly significant implications. While governments have little power to be sure that voters will be informed about candidates in a particular race when they go to the polls, governments—through their selection of the voting devices that voters will be asked to use—can determine the likelihood that voters with low information go ahead and vote in races down the ballot. If governing bodies making decisions about the purchase of new equipment decide that it is important for those voters who do turn out to participate as fully as possible, they should purchase that equipment that best approximates traditional paper ballot methods, e.g. the optically scanned paper ballots. This method has many of the

advantages of lever machines and computers in that the counting of votes is quick and avoids human error, intentional or not, but appears to be more “comfortable” for voters. If the governing bodies determine that limiting roll-off is not an important goal, then other tangible cost/benefit issues should dominate in the purchasing decision. Still, as new technology becomes more affordable, more and more localities in the United States will be moving away from the traditional paper ballot; one hopes that the normative issues discussed here will be taken into account as these shifts are made.

¹Walker (1966) showed that different ballot forms do indeed have significant impacts in producing different levels of roll-off, with “office block” ballots producing more roll-off than “party column” ballots. Less sophisticated voters were particularly affected by the move away from “party column” ballots, becoming much less likely to vote below the top of the ticket.

²Fortunately, for the purposes of analysis, voting devices in the state are adopted on a countywide basis, so no county employed more than one type of device in the election in question.

³A recent autobiography by the long time “boss” of one of the two counties, Sheriff Marlin Hawkins of Conway County, is entitled How I Stole Elections.

⁴The source for all demographic data is The Arkansas Statistical Abstract.

⁵Of course, the casting—or in this case the non-casting—of a vote is an individual act; using county-level data for analysis creates the threat of the ecological fallacy.

⁶An analysis of roll-off patterns in the 1994 general election in the state indicates that the type of voting device in use has a greater impact when the ballot is longer, as expected.

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