

Voting Technology, Ballot Measures and Residual Votes

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Abstract

An increasing number of public policy issues are decided by ballot propositions in the United States. We examine residual votes (the difference between the total ballots cast and the votes cast in a particular contest) on ballot issues and the presidential contest in 34 states that had propositions on the ballot in the 2004 election. Residual vote levels for ballot issues are substantially higher and more varied than for the presidential contest. Residual votes in both types of contests are a function of ballot features, voting technology, campaign context, and demographic measures. However, some factors, especially voting machinery, have different effects on residual votes for president than on residual votes for ballot issues. A case study further indicates that full-face ballots sharply increase the number of residual votes on ballot measures. The results have implications for direct democracy and election reform in the United States.

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Introduction

Ballot initiatives and referenda are used to decide many public policy issues, from taxes and bonds to marriage and booze. Even election laws have been the subject of ballot propositions. Most states allow some type of process for citizens to vote on ballot issues. Furthermore, the United States has experienced a surge in the use of ballot initiatives over the last thirty years (Smith 2005, 407; Matsusaka 2005, 159).

The growing use of ballot propositions demands a closer look at voting behavior on ballot measures. There is an ongoing debate about the contribution of ballot propositions to democracy in the United States.¹ We examine why some voters fail to cast a vote for or against some ballot issues. Many studies focus on the degree to which ballot propositions foster citizen engagement, yet little assess the quality of voter participation on the propositions themselves. We assess the quality of voting on ballot initiatives them by measuring residual votes (the difference between the total number of ballots cast and the number of valid votes cast for or against a ballot measure). If the point of direct democracy is to have citizens make public policy decisions, then it is important to measure the degree to which full voting participation is achieved on ballot issues. Residual votes can be the result of undervotes (not selecting any choice on the ballot) or overvotes (selecting too many choices). If abstention from ballot propositions is a function of voting technology and ballot design, then we might question whether election results reflect the will of the voters.

Prior to the 2000 election citizens rarely questioned whether their votes were counted as cast, and there was little existing research on residual votes. However, the recount battle in Florida focused attention on voting methods and election procedures in the United States, leading to passage of the Help America Vote Act of 2002 and a shift to new voting equipment in many

¹ See Bowler, Donovan and Tolbert (1998) for a collection of essays assessing ballot initiatives.

parts of the country. In assessing the impact of new voting equipment, scholars have often examined races near the top of the ballot. However, they have rarely examined the effects of equipment on voting in contests far down the ballot (but see Sinclair and Alvarez 2004), such as initiatives or referenda. We are particularly concerned with the ability of voters to cast valid votes on ballot measures, since prior research indicates that voting equipment and ballot design have an effect on residual votes on offices at or near the top of the ballot. Earlier studies on ballot design and voting equipment have examined ballot propositions in a few selected states (Nichols 1998; Bowler, Donovan and Happ 1992; Darcy and Schneider 1989; Magleby 1984).

In this study, we compare and analyze residual votes for president and for ballot propositions at the county level in the 34 states that had issues on the ballot in the 2004 general election. We find that residual vote levels for ballot issues were substantially higher and more varied than for the presidential contest. Residual votes in both types of contests were a function of ballot features, voting technology, campaign context, and demographic measures. However, some factors, especially voting machinery, have different effects on residual votes for president than on residual votes for ballot issues. A case study of the 2006 election in New Jersey provides additional evidence that full-face ballots sharply increase the frequency of residual votes for ballot measures. These results suggest that we should not base inferences about the performance of new voting machines solely on presidential and other top-of-the-ballot contests.

The Impact of Direct Democracy

There is a great deal of recent literature about the “educative effects” of direct democracy in encouraging citizen participation, knowledge and confidence in government (Tolbert and Smith 2005; Tolbert, Grummel and Smith 2001; Smith 2002, 2001; Tolbert, McNeal and Smith

2003; Lacey 2005). For example, ballot propositions may create “a sense of civic duty and political efficacy” (Morrell 1999; Pateman 1970; Tolbert, Grummel and Smith 2001), which energizes voter participation and knowledge (Smith 2002; Tolbert, McNeal and Smith 2003). Direct democracy may also stimulate voter interest because of the nature of the propositions—they may address timely and controversial public policy debates (Smith 2001). Ballot initiatives can also shape the agenda of concurrent candidate campaigns (Nicholson 2005). Even though ballot initiatives typically appear near the bottom of the ballot, less attention has been devoted to whether many voters actually make selections on ballot propositions (but see Nichols 1998; Bowler, Donovan and Happ 1992). It is possible that voting equipment, ballot design, or other administrative features may influence whether voters cast valid votes for ballot issues.

Residual Votes

A growing body of literature examines the predictors of residual votes. Theories explaining the occurrence of residual votes can be divided into three main perspectives. First, there is evidence that some residual votes are intentional, the result of lack of interest in a contest, unappealing candidates, little information, or voter fatigue on long ballots with many contests (Magleby 1984; Bullock and Dunn 1996; Kimball, Owens, and Keeney 2004; Knack and Kropf 2003a; Vanderleeuw and Utter 1993; Wattenberg et al. 2000). However, contests at the top of the ballot, especially the presidential race, have very low rates of intentional undervotes (Knack and Kropf 2003b; Tomz and Van Houweling 2003).

A second perspective suggests that some residual votes are the unintentional result of faulty voting technology or confusing ballot features. For example, Votomatic punch card ballots tend to produce higher rates of residual votes in top-of-the-ballot contests than other

voting methods (Caltech/MIT 2001; Bullock and Hood 2002; Knack and Kropf 2003a; Alvarez, Sinclair, and Wilson 2003; Kimball, Owens, and Keeney 2004; Buchler, Jarvis, and McNulty 2004; Ansolabehere and Stewart 2005). Furthermore, error prevention and correction mechanisms (such as precinct counters for optical scan ballots) tend to reduce residual votes (Nichols and Strizek 1995; Knack and Kropf 2003a; Kimball, Owens, and Keeney 2004; Bullock and Hood 2002; Tomz and Van Houweling 2003).

In addition, recent studies focus on ballot design features that tend to produce residual votes. For example, the occasional practice of listing candidates for the same office in multiple columns or on multiple pages produces higher rates of unrecorded votes (Sinclair et al. 2000; Jewett 2001; Herron and Sekhon 2003; Kimball, Owens, and Keeney 2004). Another study identifies several ballot features associated with residual votes, overvotes and undervotes in gubernatorial elections (Kimball and Kropf 2005).

A third research perspective focuses on equal protection issues, analyzing the relationship between residual votes and demographic variables such as ethnicity or age. For example, there is extensive evidence that residual votes are more common in precincts and counties with large populations of racial and ethnic minorities, low-income residents, less-educated citizens, or elderly voters (Walker 1966; Vanderleeuw and Engstrom 1987; Darcy and Schneider 1989; Sheffield and Hadley 1984; Nichols and Strizek 1995; Nichols 1998; Herron and Sekhon 2003; Knack and Kropf 2003a; Tomz and Van Houweling 2003; Sinclair and Alvarez 2004).

Furthermore, there appears to be an interaction between demographic variables and some voting methods and ballot features. The association between socioeconomic measures and residual votes is weaker in places using equipment or ballot features that make it easier for voters to complete a valid ballot (Knack and Kropf 2003a; Tomz and Van Houweling 2003; Kimball,

Owens, and Keeney 2004; Buchler, Jarvis and McNulty 2004; Kimball and Kropf 2005). By the same token, the elevated rate of residual votes associated with confusing ballots and voting technology tends to fall disproportionately on precincts and counties with high concentrations of poor, elderly, or minority voters (Darcy and Schneider 1989; Nichols 1998; Kimball, Owens, and Keeney 2004; Herron and Sekhon 2003; Alvarez, Sinclair and Wilson 2004).

Residual Votes and Ballot Measures

Most of the studies on residual votes are based on analyses of highly salient and competitive contests at the top of the ballot (such as presidential or gubernatorial elections), where residual votes are less common. Since down-ballot contests (where most ballot measures reside) tend to receive less media scrutiny and campaign activity, ballot features may have a greater impact in those races by drawing the voter's attention away from those contests. The few studies that have examined down-ballot contests find significantly higher rates of residual votes than in top-of-the-ballot races (e.g., Magleby 1984; Nichols and Strizek 1995). These studies also find voting technology and ballot effects that are much larger than effects found in top-of-the-ballot contests (Darcy and Schneider 1989; Nichols and Strizek 1995; Nichols 1998; see also Sinclair and Alvarez 2004). For example, fewer votes are cast for lengthy initiatives with complicated language (Magleby 1984; Bowler, Donovan and Happ 1992; Karp 1998).

Scholars also note that residual votes tend to be higher on ballot propositions when they are placed farther down the ballot or on the back side of a paper ballot (Magleby 1984; Bowler, Donovan and Happ 1992; Darcy and Schneider 1989; see also Sinclair and Alvarez 2004; Hamner and Traugott 2004). Other studies note that residual vote rates for ballot propositions tend to be higher when lever voting machines are used (Mather 1964; Thomas 1968; Nichols and

Strizek 1995; Nichols 1998). As we describe in more detail below, on ballots that display all contests at once (especially in the party column layout common in lever machines) it is a challenge to place ballot measures in a section where voters will notice them (Roth 1998).

Further, residual votes are more common on referenda proposed by the legislature than on citizen-proposed initiatives (Mueller 1969; Magleby 1984; Bowler, Donovan and Happ 1992). Legislative proposals tend to reach the ballot with little publicity, while citizen-proposed initiatives tend to be part of a larger marketing campaign. Overall, existing research suggests that a number of factors may influence residual votes on ballot propositions. Also, given the rapidly changing voting technology in the United States, further research is needed to examine the impact of technology and ballot features at both ends of the ballot.

Data and Methods

Since elections are administered at the county level in all but six states, our data collection includes the number of ballots cast, vote totals for president and for selected ballot initiatives, voting technology, and demographic characteristics for each American county in the 2004 general election. In states where elections are administered by municipalities or townships, we aggregate the vote totals and voting technology data to the county level. In four states (Illinois, Missouri, Maryland, and Virginia), some cities have separate election administration authorities. These cities are treated as separate jurisdictions in this dataset. We treat Alaska as one observation since elections are administered by the Alaska state government. Adding the District of Columbia as another observation produces a total of 3,123 geographic units that cover the entire country.

There were 34 states with measures on the ballot in the 2004 general election. For each state with more than one proposition, we selected a ballot measure that was both salient (i.e., it was the subject of substantial news coverage and organized campaigning) and competitive (a result within a 60 percent to 40 percent margin). If none of the state measures satisfied both criteria, then we picked one that was salient even if not competitive (as happened in several states with gay marriage amendments that passed easily). If multiple measures satisfied both criteria, then we picked the most salient measure. See Appendix A for the list of ballot issues and states in our dataset. These states provide a dataset of 1,999 counties for the analyses in this paper.²

To measure the frequency of residual votes for ballot initiatives and for president in each county, we calculate the difference between the total number of ballots cast and the number of votes cast for a contest. We then measure that difference in votes as a percentage of total ballots cast for the dependent variable in the analyses that follow. The distribution of residual votes across counties is somewhat skewed, with outliers at the high end. In our sample of 1,999 counties, there were 872,117 residual votes for president. Residual vote percentages for presidential contests range from 0.02% to 20.6%, with a median of 1.2%, a mean of 1.7%, and a standard deviation of 1.8%. By comparison, residual votes were much more common on ballot issues. In the same sample of counties, there were 6,790,140 residual votes for the selected ballot issues. Residual vote percentages for ballot issues range from 0.3% to 76.1%, with a median of 7.6%, a mean of 11.5%, and a standard deviation of 10.2%. Residual vote percentages tend to be much higher and more varied for ballot issues than for president. More than 95% of the counties

² Official data on total ballots cast and vote totals in particular contests are available on many state web sites or from state election offices. However, some states do not collect such data at the county level, which forced us to contact county election officials. We excluded 43 counties which could not provide reliable data on the total number of ballots cast, and hence the residual votes for each contest.

in our sample had residual vote rates less than 5% in the presidential contest. By comparison, almost 75% of the counties had residual vote rates greater than 5% for ballot issues.

To examine various factors that may influence residual votes, we estimate two multivariate models of residual votes, one for the presidential contest and one for ballot propositions. In considering independent variables that may affect residual vote rates, we argue there are factors that predict intentional casting of residual votes and factors that predict unintentional casting of residual votes. A major focus of this paper is the unintended effects of voting technology on residual votes, especially for ballot propositions. We collected data on voting technology used in the November 2004 general election in each county, gathered from state and local election officials. Generally, five different methods of voting are used in the United States: hand-counted paper ballots, lever machines, punch card ballots, optical scan systems, and direct recording electronic (DRE) machines. With punch card ballots, voters use a tool to punch out holes in the ballot card next to their chosen candidates. Votes are then counted by a card reader machine. In lever machines, all contests are listed on the face of the machine and voters pull down a lever next to their chosen candidate. Votes are counted mechanically inside the lever machine. In optical scan systems, voters mark a paper ballot with a pen or pencil and votes are counted by a scanning machine. With DREs, candidates are listed on a computer screen and voters push a button or touch the screen next to their chosen candidate. The DRE machine records and counts the votes.³

Within some of these general categories, further distinctions can be made. Optical scan systems vary depending on where ballots are counted: at a central location (like the county courthouse) or at the voting precinct. One advantage of the precinct-count optical scan systems

³ One can find a detailed description of each type of voting equipment in a variety of sources (Fischer 2001; Caltech/MIT Voting Technology Project 2001).

is that they give voters a chance to discover and correct potential mistakes (overvotes and undervotes). The central-count systems do not have such an error-correction feature.⁴ Thus, we expect to find lower residual vote rates on precinct-count optical scan machines.

DRE machines can be divided into older and newer varieties. Older DREs (such as the Shouptronic 1242) were designed to mimic lever machines and present the entire full-faced ballot at once and typically use a push-button interface (Caltech/MIT Voting Project 2001). The newer generation of DREs (such as the iVotronic and Accuvote-TS machines) typically use a touch-screen interface in which voters scroll through the offices and issues on the ballot, with only one or two contests appearing on the screen at one time.⁵

We create dummy variables for each of the different types of voting technology described above. The regression model excludes central-count optical scan as the comparison category since it was used in more counties than any other method. Since DRE voting machines and optical scan systems are replacing punch card ballots and lever machines, partly due to deficiencies in the latter systems and HAVA requirements, one would expect to find lower residual vote rates with the newer technologies. However, there is reason to believe that down-ballot contests, particularly ballot measures, may be overlooked by some voters using lever machines and older generation DREs with a full-face ballot. Earlier studies found lower participation rates in ballot initiatives when lever machines were used as compared to paper

⁴ Some counties have precinct-count optical scan balloting but do not activate the error correction feature when scanning the ballots. These counties are coded as central-count systems.

⁵ In some states, mainly in the Northeast, not all ballots are cast using the same technology. In those cases, we code the voting technology as the equipment used by at least 75% of the voters. If no single method was used by at least 75% of the voters, the county's voting technology is coded as a "mixed" system. Punch card methods can be divided between Votomatic varieties (in which the punch card is separate from the booklet listing the offices and issues up for election) and the Datavote system (in which offices and candidates are printed directly on the punch card). Datavote ballots were used in only a handful of counties in 2004, so we lump all punch cards together, with no change in the results reported below.

ballots (Mather 1964; Thomas 1968) and punch card ballots (Asher, Schussler, and Rosenfield 1982).

The lever machine and the full-face DRE list all contests (and thus all of the voter's choices) at once, which may overwhelm some voters and cause them to end the voting session prematurely. Research in psychology indicates that people become paralyzed when offered too many choices (Schwartz 2004). For example, a study of employer-based 401(k) plans found that fewer employees participated in the plans when more investment options were offered (Iyengar, Jiang and Huberman 2004). Thus, listing all contests at once on a screen or ballot may cause more voters to quit before they have completed the ballot. In fact, it is easy for the voter to end the voting session before considering all contests on lever machines or full-face DREs, by simply pulling the main lever (Roth 1998) or pushing the "Vote" button that is always available to end the session (Herrnson et al. 2007). A related problem is that many full-face ballots use a party column layout, a grid in which offices are listed in rows and candidates are listed in columns according to their party affiliation. This layout makes it easy for voters to locate all of the candidates from a particular party. However, ballot measures are nonpartisan and cannot be placed easily on the party column grid. Ballot measures tend to be placed above, below, or to the side of the party column grid on full-face ballots, often in locations where voters are less likely to notice them.

In contrast, scrolling DREs tend to spoon-feed choices to voters, listing one or two contests on the computer screen at a time and then asking the voter to scroll to the next screen to continue voting. Furthermore, several models of scrolling DREs force voters to scroll through every contest on the ballot before the option of ending the voting session is offered. Consistent with our suspicions, one usability study found that several voters failed to see the ballot

initiatives on lever voting machines (Roth 1998). Another study found that voters had more difficulty using full-face DREs than scrolling DREs (Herrnson et al. 2007). Thus, we expect to find higher residual vote rates for ballot propositions on lever machines and full-face DREs than other voting methods.

We also consider other ballot design issues as a source of unintentional residual votes. One ballot issue involves whether a straight party feature contributes to increased residual votes. Kimball, Owens and Keeney (2004) found that the straight party punch reduces fewer residual votes for the presidential race. However, ballot propositions are non-partisan and thus not covered by the straight-party device, even though people may believe they have completed their ballot once they use the straight party feature (Nichols 1998: 110; Darcy and Schneider 1989: 360; Niemi and Herrnson 2003). Thus, we hypothesize that residual votes on ballot issues are more common in states with the straight-party option.⁶ We also measure the number of contests on the ballot before the proposition in each state. Since ballot fatigue is a common source of residual votes, we expect that residual votes for ballot measures will be higher in states with more contests appearing before the measures.

Another ballot feature is the method for marking the ballot on optical scan systems. Some require voters to darken an oval, as in many standardized tests and government forms. Other optical scan systems require voters to draw a line connecting the point and tail of an arrow, a method which does not mimic other common written tests or forms. Previous studies find higher rates of residual votes on ballots with the connect-the-arrow format (Bullock and Hood 2002; Kimball and Kropf 2005), which we expect to find in this study.

⁶ North Carolina and South Carolina have a straight-party option but it comes after the presidential contest and thus does not apply to the presidential contest. We code these two states as not having a straight-party option for the presidential election analysis, but we code both states as having a straight-party feature for the analysis of ballot initiatives.

We also include two ballot features specific to the presidential contest. Nevada is the only state which includes a “None of these candidates” choice in federal and statewide candidate elections, a potentially appealing choice for voters who might otherwise abstain from the contest. In the 2004 presidential election in Nevada “None of these candidates” outpolled all third party candidates except Ralph Nader. Not surprisingly, Nevada has had one of the lowest residual vote rates in recent presidential elections (Kimball, Owens, and Keeney 2004). In addition, states vary in the way they handle write-in votes. Only fifteen states count all write-in votes, while the remaining states either do not allow write-ins for president or only count write-in votes for declared candidates. We include separate dummy variables for Nevada and for states that allow and count all write-in votes for president. We expect fewer residual votes for president in those states.

In terms of intentional residual votes, the campaign context plays a particularly important role. People are more likely to cast a vote in highly salient contests and more likely to abstain from boring contests. Some studies find that highly salient ballot initiatives boost voter turnout (Smith 2001; Lacey 2005). Measurement of salience of ballot propositions has been a topic of debate in the literature, the concept being “the awareness and concern about the propositions” (Smith 2001: 701). This awareness and concern is not just a product of media coverage, but also discussion among citizens about the proposition (Smith 2001). Thus, some measure the salience of specific ballot issues by examining the news coverage that the proposition garners (Smith 2001; Lacey 2005). Others measure the salience of the overall ballot proposition enterprise by counting the number of initiatives on the ballot in a given state for a particular election (Tolbert, Grummel, and Smith 2001; Tolbert and Smith 2005).

To assess the impact of issue salience on residual votes, we opt for a measure of news coverage similar to the one used by Smith (2001) because “[t]he profit motive should lead news organizations to extensively cover important and controversial initiatives while reporting less on those perceived by citizens to be of minor relevance to their lives” (Smith 2001: 701). For each state, we measure the salience of a ballot proposition by finding all articles on an issue in the state’s largest newspaper from September 1 to November 9, 2004.⁷ In most cases, we use the News Library database (<http://www.newslibrary.com>) to find articles, editorials, and letters to the editor written about the subject of the ballot proposition. Then we sum the number of words in all newspaper coverage of the ballot issue as our measure of issue salience.⁸ The newspaper and search keywords for each state are listed in Appendix B.⁹ We expect residual votes on ballot issues to decrease as issue salience increases.

A second factor that may indicate whether citizens will take the time to vote on an issue is the manner in which the initiative reaches the ballot—whether a citizen proposal or a legislative-initiated proposition. Voters may have more information about citizen-initiated proposals because they require voter input in a signature gathering process before they reach the ballot (Bowler, Donovan and Happ 1992; Nichols 1998: 106; Magleby 1984). In contrast, legislative propositions reach the ballot without a similar sustained public campaign. Our issue

⁷ We used circulation figures reported in *Newspaper Directory* to find the largest newspaper in each state. The one exception is California, where we searched *The San Francisco Chronicle*, the state’s second largest newspaper. The newspaper with the largest circulation in California, *The Los Angeles Times*, was not available in several databases for the time period we needed.

⁸ Some of the largest circulation newspapers were not available on News Library, so we used either Lexis/Nexis or the archive of the paper itself. We used Lexis/Nexis for *The Omaha World-Herald* (Nebraska) and *The Arkansas Democrat-Gazette* (Arkansas). We used the newspaper archives located on the paper’s website for *The Fargo Forum* (North Dakota), *The Casper Star Tribune* (Wyoming), *The Billings Gazette* (Montana) and the *Providence Journal* (Rhode Island).

⁹ Another possible measure of issue salience would be the amount of money spent by proponents and opponents of the ballot measure. Using data provided by The Institute on Money in State Politics (<http://www.followthemoney.org>), we analyze how much money was spent for and against each issue. Unfortunately, these data are not available for all of our states (no data are available for Indiana, Louisiana, New Mexico, Rhode Island, Virginia or West Virginia), so we chose not to use that measure. However, for the states we do include, the total amount spent correlates with our media coverage measures.

salience measure provides some support for the claim that legislative proposals generate a lower public profile than other ballot initiatives. Ballot propositions received significantly fewer articles and words of newspaper coverage in states where the legislature put the issue on the ballot. We create a dummy variable to indicate whether or not a proposition was put on the ballot by the legislature.¹⁰ We expect higher rates of residual votes on propositions placed on the ballot by the legislature.

For the presidential contest, we attempt to create a similar measure of campaign salience. We create a dummy variable to identify the “battleground” states in the presidential campaign.¹¹ These are states where the presidential vote was close. Thus, voters are more likely to cast a vote for president since their vote is more likely to make a difference in those states. In addition, the bulk of the presidential campaign, in terms of advertising, candidate visits, and staff activity, took place in the relatively small number of battleground states. The disproportionate location of presidential campaign activity likely produced greater interest in the election among voters in battleground states. As a result, we expect lower rates of residual votes for president in the battleground states.

Finally, there is a set of control variables potentially explaining residual votes that are often associated with equal protection issues. Previous studies find that they tend to be significant predictors of residual votes. In addition, some of the demographic variables may exacerbate the potentially negative effects of ballot design and voting equipment (Darcy and Schneider 1989; Kimball and Kropf 2005). As control variables, we include the percentage of a

¹⁰ In order to ascertain whether a measure was initiated by petition or was placed on the ballot by the legislature, we consulted the Initiative and Referendum Institute’s newsletter Ballotwatch ([http://www.iandrinstitute.org/BW%202004-0%20\(List\).pdf](http://www.iandrinstitute.org/BW%202004-0%20(List).pdf)) and the National Conference of State Legislatures list of statewide ballot issues (<http://www.ncsl.org/programs/legismgt/stateVote/measures.lst.htm>).

¹¹ In our sample, battleground states are Colorado, Florida, Maine, Michigan, Nevada, New Hampshire, New Mexico, Ohio, and Oregon. The other four battleground states (Iowa, Minnesota, Pennsylvania, and Wisconsin) did not have any ballot propositions in 2004.

county's residents who are African-American, the percentage of the population who are Latino, the percentage over the age of 65, the natural log of the median income and the natural log of the county's population, all obtained from the Census Bureau. Based on previous studies, we expect residual votes to be positively correlated with the size of the African-American, Latino, poor and elderly populations, and negatively correlated with the percentage of college graduates. As for population, previous studies indicate that the smaller the county, the larger the number of residual votes (Knack and Kropf 2003a, 887; Kimball, Owens, and Keeney 2004; Brady et al. 2001; Ansolabehere and Stewart 2005). This finding may be due to election administration—larger urban counties tend to have more professional operations than smaller rural counties. Thus, we expect the natural log of the population to be negatively correlated with residual votes.

The dependent variable is the percentage of ballots cast in each county that fail to record a valid vote for the contest (the residual vote percentage). Our data consist of counties clustered within states, and some of the independent variables are measured at the county level while others are measured at the state level. Thus, the variation in residual vote rates across American counties can be separated into between-state and within-state components. We estimate a hierarchical model to take advantage of the multi-level nature of the data (Raudenbush and Bryk 2002). The state-level variables help account for between-state variation in residual votes, while within-state variation is explained by county-level variables. Since we are mainly interested in the effects of voting technology (a county-level variable that often varies within the same state), we compare a random effects model and a fixed effects model in the multi-level analysis. The random effects model assumes that any unexplained between-state variation is not correlated with the independent variables. Thus, the random effects model depends on the state variables to correctly account for between-state differences in residual votes. In the fixed effects model, all

state-specific effects are accounted by state dummy variables so that only within-state variation is left to be explained by county-level variables. The fixed effects model is important to control for state effects that we have not measured (such as differences in state laws, election administration, or political culture).¹²

Results

The results of our multi-level model estimation of residual vote percentages in the 2004 president election are presented in Table 1. The results of the hierarchical analysis of residual votes on ballot initiatives are in Table 2. The first column in each table includes estimates from the random effects model, while the second column presents the fixed effects model estimates (where the state variables are dropped out). Overall, the results indicate very similar county effects in both models.¹³ More generally, we find that residual votes are partly a function of voting technology and ballot features, but that some of these effects vary by contest.

First, we find some very different effects of voting equipment on residual votes for president versus ballot initiatives. As expected, punch cards perform significantly worse than any other type of equipment in terms of residual votes for president. Holding other factors constant, the expected residual vote rate is 0.6% higher in counties using punch card ballots than in counties using centrally-counted optical scan ballots. This is a substantial effect considering that the average residual vote for president in 2004 was 1.7%. The results also suggest that residual votes on ballot initiatives are more common with punch cards than some other voting methods.

[Table 1 here]

¹² We have used other modeling techniques, such as negative binomial regression, and achieve similar results to those presented below.

¹³ A Hausman (1978) specification test finds no significant difference in the county coefficient estimates in the two models in Tables 1 and 2.

However, when it comes to residual votes on ballot initiatives, even punch cards do not perform as badly as lever machines or full-face DREs. Lever machines stand out as a very poor voting technology at handling ballot measures. Residual vote rates on ballot propositions are a whopping 19 percentage points higher on lever machines than on central-count optical scan systems, holding other factors constant. The average residual vote rate on ballot issues in counties using lever machines in 2004 was 33 percent, compared to the national average of 11.5 percent. Lever voting machines act as a considerable barrier to voting on ballot propositions.

Our results also indicate that full-face DREs produce significantly higher residual vote rates on ballot propositions than other voting systems (4 percent higher than central-scan systems, other factors being equal). The relatively poor performance of full-face DREs on ballot propositions is expected, since full-face DREs were designed to mimic lever machines in ballot layout. It appears that some voters simply miss ballot initiatives on a large full-face DRE ballot.

[Table 2 here]

There is evidence that other ballot design elements influence residual votes. Consistent with previous studies, we find that the connect-the-arrow ballot format produces significantly higher rates of residual votes for president and for ballot measures (although the effect on ballot initiatives is only marginally significant). More specifically, holding other factors constant, the residual vote rate for president was 0.5 percent higher in counties with the arrow method for completing the ballot. In addition, the error correction feature of precinct-count optical scanners seems to produce lower residual vote rates for president than the central-count method. As

expected, residual votes for president were less common in Nevada (the only state offering a “None of these candidates” choice for president). However, the effects of rules for counting write-in votes and the straight-party option have the expected sign but fall short of statistical significance, suggesting that those features had little impact on residual votes in 2004.

We also find evidence that the campaign context influences residual votes for ballot propositions. Issue salience tends to reduce the frequency of residual votes for ballot issues. Residual votes on ballot propositions were less common in states with voluminous newspaper coverage of the proposition. In addition, the method of placing the proposition on the ballot has a substantial impact on residual votes. We observe substantially higher residual vote rates on measures placed on the ballot by the legislature, rather than by citizen petition. Furthermore, residual vote rates for initiatives tend to rise as more contests appear before them on the ballot, consistent with a ballot fatigue hypothesis.

Finally, demographic factors produce somewhat comparable results. Consistent with previous work, counties with more African Americans and low income voters see higher levels of residual ballots for both the presidency and ballot initiatives. Other studies suggest that the effect of county size on residual votes may be a proxy for unmeasured administrative features (Ansolabehere and Stewart 2005). Consistent with these studies, we find that counties with a higher population tend to produce lower percentages of residual votes for the presidential contest and for ballot initiatives.

Case Study: The 2006 General Election in New Jersey

The huge impact of lever machines on residual votes for ballot initiatives is mitigated by the knowledge that lever machines will soon be replaced by other voting methods in the United

States. The apparent impact of full-face DREs, however, is more disturbing because there are no plans to replace them and some states, such as New York, have laws requiring a full-face ballot. To compare full-face and scrolling DREs further, we provide a brief case study of the 2006 general election in New Jersey. When New Jersey recently replaced its lever voting machines, a natural experiment took place. Nineteen New Jersey counties switched to full-face DREs (with all but one of them choosing the same vender and model), while two counties switched to scrolling DREs. In addition, in the 2006 general election, there were four statewide contests on the ballot: (1) the competitive U.S. Senate race between Robert Menendez and Tom Kean, Jr; (2) a constitutional amendment to allocate part of the state's sales tax revenue to property tax relief; (3) a constitutional amendment to increase the proportion of state corporate tax revenues devoted to recreation and land conservation; and (4) a constitutional amendment to devote more of the state's gas tax revenues to the transportation system. The three amendments were part of a tax reform package passed by the state legislature. There were few other contests on New Jersey ballots in 2006 (contests for the General Assembly and some municipal races in many cities).

The New Jersey case allows us to examine residual votes in a setting where other state features (such as state laws, election regulations, and statewide campaigns) are constant. Table 3 presents a direct comparison of residual vote rates for the U.S. Senate race and for the three constitutional amendments on each of the two types of electronic voting machines.¹⁴ The residual vote rate on each of the three constitutional amendments was almost five times higher on full-face DREs than on scrolling DREs. The U.S. Senate race was expensive and competitive and garnered a lot of media attention, which tends to mitigate the effects of voting equipment and ballot design on residual votes. Nevertheless, the residual vote rate in the Senate contest was still more than one percentage point higher on the full-face DREs than on the scrolling DREs. These

¹⁴ Multivariate analysis of precincts yields similar results. These results are available from the authors.

results support the conclusion that full-face DREs produce higher residual vote rates than scrolling DREs.

[TABLE 3 HERE]

We examine the 2006 election results in New Jersey at the municipal level to uncover an interaction between voting equipment and the demographic profile of local communities. Figure 1 plots the residual vote rate for the first constitutional amendment for municipalities in New Jersey with at least 50 voters. In municipalities using scrolling DREs (the triangles in Figure 1), residual vote rates are relatively low (less than 6% in each city) and unrelated to a municipality's poverty level (note that the regression line for those observations is flat). In contrast, the residual vote rate is considerably higher in municipalities using full-face DREs (the circles in Figure 1) and increases substantially as the level of poverty rises. Note how high the numbers go on the vertical axis: in some municipalities using full-face DREs more than half of the voters failed to cast a valid vote on the constitutional amendment. It again appears that full-face DREs tend to obscure ballot propositions, and the resulting increase in residual votes tends to fall disproportionately on poor communities.

Conclusion

Given the substantial debate that has developed about the educative effects of ballot propositions in the United States, it is important to study the quality of participation on these questions. Not unexpectedly, we find that residual votes are much higher on ballot propositions than they are in the presidential contest. Nevertheless, in both types of contests residual votes are

a function of ballot features, voting technology, the campaign context, and demographic factors. However, some ballot features and voting methods appear to influence residual votes in different ways, depending on the type of contest. Our evidence seems to indicate that some people may be thwarted by voting technology and ballot features in their efforts to participate in ballot proposition elections.

Some may wonder if any of these residual vote effects could change the outcome of an election on a ballot proposition. We cannot answer this question with certainty, but we can point to a suggestive case from our sample. One of our cases is an Alabama proposition (amendment 2) to remove segregation language regarding education and voting from the state constitution. Amendment 2 narrowly failed in 2004 (by less than 2,000 votes). Out of almost 1.9 million ballots cast, over 505,000 failed to cast a vote on amendment 2 (a residual vote rate of roughly 27%). In addition, there is a positive correlation ($r=.43$) between a county's residual vote rate on amendment 2 and its share of African-American residents, a somewhat surprising finding given the substance of the amendment. As it happens, Mobile and Montgomery counties, two of the largest in the state, used full-face DRE voting machines in the 2004 general election. Both counties voted in favor of the amendment, but with very high residual vote rates (39% in Mobile and 37% in Montgomery). Our analysis suggests that full-face DREs helped produce higher rates of residual votes in those two counties. If those two large counties used different voting technology, perhaps there would have been enough votes for the amendment to pass.

The fact that ballot features and voting technology have substantial effects on whether voters make a selection on ballot initiatives raises some questions about the quality of direct democracy in the United States. Those interested in promoting full voter participation on ballot propositions should take note of the ballot features and voting methods that reduce residual votes

in those types of contests. Highly salient initiatives may draw people to the polls and motivate them to vote on the measures, but voting technology and ballot design may inhibit full voter participation. One bit of good news is that punch card ballots (which increase residual votes substantially for the presidency and for ballot propositions) and lever machines (which dramatically increase residual votes for ballot propositions) are being replaced by newer voting methods in the United States. Of greater concern is the dramatic impact of full-face DREs, which likely will not be replaced soon.

This work also adds to the growing body of evidence that indicates that not all voting technology is created equal, with a slightly different twist. In particular, when one compares residual votes on down-ballot initiatives with those of the presidency, it may be that some equipment is not as advantageous as first thought. For example, lever voting machines perform quite well in the presidential election but perform poorly on ballot propositions. Precinct count optical scan machines provide no advantage over central count machines for ballot measures. We suspect this is probably because of the problem of many voters still needing to turn over the optical scan ballot when voting on initiatives, referenda and recall issues. Down-ballot contests are often placed on a second page (or back page), and thus may be missed by some voters.¹⁵ Research on voting technology and residual votes should focus on down-ballot contests, because some of the effects may be different than what we observe in presidential elections.

¹⁵ Only one state in our sample, Washington, places ballot measures first on the ballot, though for some hand-counted paper counties, the contests appear on different pages so a voter could theoretically complete the ballot issues first.

Appendix A
List of States and Ballot Propositions Examined in 2004

State	Initiative Number	Initiative Topic
Alabama	Amendment 2*	Repeal sections on race and education in the Alabama Constitution
Alaska	Measure Number 2	Legalize marijuana
Arizona	Proposition 200	Policies to combat illegal immigration
Arkansas	Amendment 3	Ban gay marriage
California	Proposition 71	\$3 billion bond issue for stem cell research
Colorado	Amendment 37	Require more renewable energy
Florida	Amendment 4	Gaming in Broward and Miami-Dade counties
Georgia	Amendment 1*	Ban gay marriage
Hawaii	Amendment 3*	Confidentiality of communication between crime victim and doctor
Indiana	Public Question 1*	Allow General Assembly to exempt certain property from property taxes
Kentucky	Amendment 1*	Ban gay marriage
Louisiana	Amendment 4	Support for farming and fishing industries
Maine	Question 2	Ban bear hunting with bait, traps or dogs
Michigan	State Proposal 04-1	Require state and local approval for new gambling facilities
Mississippi	Amendment 1	Ban gay marriage
Missouri	Amendment 3	Allocation of fuel taxes
Montana	Initiative 147	Allow cyanide in mining
Nebraska	Measure 417	Initiative can allow new casinos
Nevada	State Question 2	Require per-pupil spending to meet or exceed national average
New Hampshire	Amendment Question	Clarify legislative and court powers
New Mexico	Bond Question C*	\$16.3 million bond for libraries
North Carolina	Amendment 1*	Bonds for local development
North Dakota	Amendment 1	Ban gay marriage
Ohio	Issue 1	Bay gay marriage
Oklahoma	State Question 707*	Local government bond payments
Oregon	State Measure 35	Limit pain and suffering awards in medical malpractice suits
Rhode Island	State Question 9*	\$14 million bond for library at URI
South Carolina	Amendment 1*	End requirement that alcohol be sold in mini-bottles
South Dakota	Amendment B*	State food and transportation funding to religious schools
Utah	Amendment 3*	Ban gay marriage
Virginia	Amendment 1*	Redistricting only done every 10 years
Washington	Referendum Measure 55	Repeal law creating charter schools
West Virginia	Amendment 1*	\$8 million bond for veterans
Wyoming	Amendment C*	Alternative dispute resolution before suit filed against health care provider

* Proposed by legislature (source: Initiative and Referendum Institute and the National Conference of State Legislatures).

Appendix B
Sources for Ballot Proposition Salience Measures

State	Measure	Newspaper	Search Strategy
Alabama	Amendment 2	<i>Birmingham News</i>	amendment 2 or Alabama constitution
Alaska	Measure Number 2	<i>Anchorage Daily News</i>	ballot measure 2 or legalize marijuana
Arizona	Proposition 200	<i>Arizona Republic</i>	proposition 200 or illegal immigration
Arkansas	Amendment 3	<i>Arkansas Democrat-Gazette</i>	Amendment 3 or gay marriage
California	Proposition 71	<i>San Francisco Chronicle</i>	proposition 71 or stem cell research
Colorado	Amendment 37	<i>Denver Post</i>	amendment 37 or renewable energy
Florida	Amendment 4	<i>Miami Herald</i>	amendment 4 or slot machines
Georgia	Amendment 1	<i>Atlanta Journal-Constitution</i>	amendment 1 or gay marriage
Hawaii	Amendment 3	<i>Honolulu Advertiser</i>	amendment 3 or crime victim
Indiana	Public Question 1	<i>Indianapolis Star</i>	question 1 and election or property tax
Kentucky	Amendment 1	<i>Louisville Courier-Journal</i>	amendment 1 or gay marriage
Louisiana	Amendment 4	<i>New Orleans Times-Picayune</i>	amendment 4
Maine	Question 2	<i>Portland Press Herald</i>	question 2
Michigan	State Proposal 04-1	<i>Detroit Free Press</i>	proposal 04-1 or gambling
Mississippi	Amendment 1	<i>Jackson Clarion-Ledger</i>	amendment 1 or gay marriage
Missouri	Amendment 3	<i>St. Louis Post-Dispatch</i>	amendment 3
Montana	Initiative 147	<i>Billings Gazette</i>	headline search for mining, cyanide, I-147
Nebraska	Measure 417	<i>Omaha World-Herald</i>	Measure 417 and casinos
Nevada	State Question 2	<i>LV Review Journal</i>	Question 2 or school spending or national average
New Hampshire	Amendment Question	<i>Manchester Union Leader</i>	Constitutional Amendment Question or court practices or separation of power
New Mexico	Bond Question C	<i>Albuquerque Journal</i>	Bond Question C or librar(ies)
North Carolina	Amendment 1	<i>Charlotte Observer</i>	Amendment One or community development or economic development
North Dakota	Amendment 1	<i>Fargo Forum</i>	Amendment One, Amendment 1, ban gay marriage
Ohio	Issue 1	<i>Cleveland Plain Dealer</i>	Issue 1 or ban gay marriage

Appendix B (continued)

State	Measure	Newspaper	Search Strategy
Oklahoma	State Question 707	<i>The Daily Oklahoman</i>	SQ 707 or TIF or tax increment financing
Oregon	State Measure 35	<i>The Oregonian</i>	Measure 35 or medical malpractice
Rhode Island	State Question 9	<i>The Providence Journal</i>	Question 9 or bond for library (searched projo.com)
South Carolina	Amendment 1	<i>The State</i>	Amendment 1 or Amendment One or mini-bottles
South Dakota	Amendment B	<i>Sioux Falls Argus Leader</i>	Amendment B or funds for religious schools
Utah	Amendment 3	<i>Deseret Morning News</i>	Amendment 3 or ban gay marriage
Virginia	Amendment 1	<i>Norfolk Virginian Pilot</i>	Amendment 1 or Redistricting or Apportionment
Washington	Referendum Measure 55	<i>Seattle Times</i>	Referendum 55 or Repeal charter schools/ Referendum 55 or charter schools
West Virginia	Amendment 1	<i>The Charleston Gazette</i>	Amendment 1 or bonuses and death benefits or veterans
Wyoming	Amendment C	<i>Casper Star Tribune</i>	"medical review" or lawsuit or "Amendment C"

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Table 1
Multilevel Model of Residual Votes for President in the 2004 Election

Explanatory Variable	Model 1		Model 2	
	Random Effects		Fixed State Effects	
	<u>Coefficient</u>	<u>(Std. error)</u>	<u>Coefficient</u>	<u>(Std. error)</u>
<i>County-Level Factors</i>				
Punch card ballot	0.56***	(0.15)	0.58***	(0.15)
Lever machine	-0.52*	(0.28)	-0.49	(0.30)
Hand-counted paper ballot	-0.10	(0.18)	-0.09	(0.18)
Full-face DRE	-0.07	(0.20)	-0.07	(0.22)
Touch-screen DRE	0.06	(0.23)	0.11	(0.23)
Optical scan precinct-count	-0.71***	(0.13)	-0.69***	(0.14)
Mixed voting system	-0.24	(0.18)	-0.27	(0.19)
Connect-the-arrow format	0.46***	(0.13)	0.47***	(0.13)
Percent Black	0.01**	(0.004)	0.01**	(0.004)
Percent Latino	0.01	(0.01)	0.01	(0.01)
Percent 65 or older	-0.01	(0.01)	-0.005	(0.01)
County population (natural log)	-0.12***	(0.03)	-0.12***	(0.03)
Median income (natural log)	-1.47***	(0.20)	-1.48***	(0.20)
<i>State-Level Factors</i>				
Battleground state	-0.05	(0.29)	----	
“None of These Candidates” (Nevada)	-1.37***	(0.35)	----	
Count all write-ins	-0.41	(0.31)	----	
Straight-party ballot feature	-0.32	(0.28)	----	
Constant	18.42***	(2.14)	18.17***	(2.07)
Number of Counties	1999		1999	
Number of States	34		34	
Within state R ²	.11		.11	
Between state R ²	.38			

The dependent variable is the percentage of ballots cast that failed to record a valid vote for the contest. Cell entries are coefficient estimates. Robust standard errors are in parentheses.

***p < .01, ** p<.05, * p < .1, two-tailed

Table 2
Multilevel Model of Residual Votes for Ballot Initiatives in the 2004 Election

Explanatory Variable	Model 1		Model 2	
	Random Effects		Fixed State Effects	
	<u>Coefficient</u>	<u>(Std. error)</u>	<u>Coefficient</u>	<u>(Std. error)</u>
<i>County-Level Factors</i>				
Punch card	1.52**	(0.48)	1.55**	(0.49)
Lever machine	19.46***	(1.50)	19.41***	(1.50)
Hand-counted paper ballot	0.13	(0.50)	0.10	(0.49)
Full-face DRE	4.00***	(0.67)	4.00***	(0.69)
Touch-screen DRE	-0.75	(0.68)	-0.75	(0.71)
Optical scan precinct-count	0.35	(0.35)	0.32	(0.37)
Mixed voting system	1.85	(1.29)	1.79	(1.20)
Connect-the-arrow format	0.52	(0.37)	0.56	(0.38)
Percent Black	0.09***	(0.02)	0.08***	(0.02)
Percent Latino	0.02	(0.01)	0.02	(0.01)
Percent 65 or older	0.03	(0.03)	0.03	(0.03)
County population (natural log)	-0.25**	(0.11)	-0.27**	(0.11)
Median income (natural log)	-5.46***	(0.73)	-5.54***	(0.73)
<i>State-Level Factors</i>				
Ballot position of initiative	0.33*	(0.18)	----	
Issue salience (words in thousands)	-0.13***	(0.05)	----	
Legislative proposal	5.47***	(1.90)	----	
Straight-party ballot feature	2.60	(2.53)	----	
Constant	61.58***	(7.85)	68.05***	(7.33)
Number of Counties	1999		1999	
Number of States	34		34	
Within state R ²	.43		.43	
Between state R ²	.72			

The dependent variable is the percentage of ballots cast that failed to record a valid vote for the contest. Cell entries are coefficient estimates. Robust standard errors are in parentheses.

***p < .01, ** p<.05, * p < .1, two-tailed

Table 3
Residual Vote Rates in New Jersey Statewide Contests by Voting Equipment
2006 General Election

Contest	Residual vote rate on scrolling DREs	Residual vote rate on full-face DREs
U.S. Senate	1.4%	2.9%
Public Question 1	5.8%	28.4%
Public Question 2	6.1%	29.3%
Public Question 3	5.8%	29.8%

Figure 1: Residual Vote Rate on Question 1
New Jersey Municipalities



