DEMOCRACY AT RISK:

The 2004 Election in Ohio

DEMOCRATIC NATIONAL COMMITTEE
VOTING RIGHTS INSTITUTE

Democracy at Risk: The 2004 Election in Ohio

Table of Contents

Democracy at Risk: The 2004 Election in Ohio

Section I
Letter of Introduction to DNC Chairman Howard Dean

DEMOCRATIC NATIONAL COMMITTEE

June 22, 2005

Governor Howard Dean, Chair
Democratic National Committee
430 South Capitol Street
Washington, D.C.20003

Dear Governor Dean:

On behalf of the Ohio Election Investigation Team and the Democratic National Committee's (DNC) Voting Rights Institute, we are pleased to submit an investigative study and analysis of the 2004 general election as it occurred in Ohio. The focus of our review, as stated in our press release of December 6, 2004, was not to contest the results of the election, but to "fulfill the Democratic Party's commitment to ensuring that every eligible voter can vote and that every vote cast is counted."

Although voters across America voiced concerns which questioned the fairness and the accuracy of the 2004 general election, President George W. Bush's narrow victory in Ohio (a pivotal state) provided sufficient electoral votes to ensure his reelection. There was a myriad of litigation surrounding the general election in Ohio that targeted controversial conduct on the part of the Office of the Secretary of State. Following the election recount, the House Judiciary Committee Democratic Staff published an exhaustive report "Preserving Democracy: What Went Wrong in Ohio" that is replete with anecdotal evidence of numerous, serious election irregularities in the Ohio presidential election which resulted in a significant disenfranchisement of voters.

There were insufficient resources available to our Party to conduct a thorough investigation into the thousands of claims of election irregularities in every state. The decision was made to focus this study in the State of Ohio with the expectation that information gleaned from our report will strengthen the election process in every state in America.

Our review demonstrates that numerous irregularities characterized the Ohio election: we find evidence of voter confusion, voter suppression, and negligence and incompetence of election officials. The evidence we highlight in our review leads us to harbor deep concerns about the administration of elections in Ohio and the need for improved training of election officials and poll workers.

Our investigation and analysis reveal that more than one quarter of all voters in Ohio reported some kind of problem on Election Day, including long lines, problems with registration status and polling locations, absentee ballots and provisional ballots and unlawful identification requirements at the polls.

African American voters had a starkly different Election Day experience than white voters. African Americans reported waiting an average of 52 minutes in line to vote while white voters reported waiting an average of 18 minutes. African Americans were also more likely to have their registration status challenged, have their identification checked, and express feelings of intimidation on or before Election Day. These differences by race hold even when we control for registration history and party identification.

There is a direct correlation between the number of (functioning) voting machines and votes cast for President being counted. With fewer machines per voter, polling places become more crowded and voters are less likely to take the time to check or correct their ballots.

Delays by local election officials in processing new voter registrations led to an increase in the number of provisional ballots cast. Incoherent directives from the office of the Ohio Secretary of State fostered confusion and led to the rejection of many qualified voter applicants. Delays in processing absentee ballot applications meant that many applicants did not receive ballots before Election Day, and, therefore, had to vote in person; many of these voters were turned away at the polls without being given the opportunity to vote provisionally.

Our team has analyzed the effectiveness of the various voting machines used in Ohio and has strong recommendations favoring precinct-count optical scan machines, assuming they can be improved to accommodate disabled voters.

Current DRE voting systems, in addition to being extremely expensive to procure and maintain, are vulnerable to fraud. Existing standards and practices for certification of voting systems are insufficient to provide security for existing DRE systems, and significant effort will be required to remedy these deficiencies in the future.

Public elections – if they are to work, must be transparent. Private secrets have no place in public elections and, in fact, engender a system that is vulnerable to tampering, covert manipulation and fraud. Voting machine vendors should be required by law to disclose equipment designs to the public. Paper trail audits offer an improvement over current DRE systems that provide no paper trail but they do not guard against tampering, improper equipment calibration and faulty aggregation of the votes cast. The only way to ensure every vote cast is properly registered and counted is through a transparent system that is verifiable by the public (not just the vendor) at every stage of the voting process.

The Democratic Party must impress upon Members of Congress, state lawmakers, local election administrators and community leaders that in order to ensure that every qualified citizen is properly registered, local officials must have adequate resources and training to accommodate a successful voter registration drive and the Party must invest in voter education programs to inform voters of their rights. The use of existing DRE machines must be discontinued unless or until they are perfected. A transparent system for aggregating votes cast at the precinct, county, state and national level must be developed in order to ensure that every vote cast is counted. Finally, election officials and laypersons who participate in voter suppression and intimidation tactics and fraud must be prosecuted to the full extent of the law.

The findings and recommendations gleaned from our report, albeit from one state's experience on November 2, 2004, are a clear signal to Congress, Governors, Secretaries of State, the U.S. Election Assistance Commission and election officials across America that they must work together to ensure that every qualified citizen is given the right to vote and every vote cast is counted. We must remain vigilant in our efforts to educate voters on their rights to participate in the electoral arena and to work with election officials to properly train all poll workers.

Our report would not have been possible without the support of the DNC leadership, a first-rate Investigative and Research Team, the Ohio Advisory Team, generous support and participation among the people of Ohio, the assistance of Congressman John Conyers, Jr. and his dedicated staff, and the invaluable information and suggestions provided by election protection activists across America who are committed to uncovering the truth behind Election Day in Ohio in 2004. We look forward to sharing our findings with the Democratic Party and to working with you to help strengthen our electoral process.

Sincerely,

Donna Brazile
Chair
Voting Rights Institute

cc: Senator John Kerry
Senator John Edwards
DNC Executive Committee
ASDC

Democracy at Risk: The 2004 Election in Ohio

Section II
Executive Summary

DEMOCRACY AT RISK: THE 2004 ELECTION IN OHIO

EXECUTIVE SUMMARY

1. Background

In December 2004, the DNC announced a comprehensive investigative study and analysis of election administration issues arising from the conduct of the 2004 general election in Ohio. The DNC decided to undertake this study because of the many reports, made to the Democratic Party, appearing in the press and made to advocacy groups, immediately after the election, of problems in the administration of the election in that state—problems that prevented many Ohio citizens who showed up at the polls to be able to vote and to have their vote counted. Although significant problems were reported in several states, the DNC decided to concentrate on Ohio because it was a pivotal state in the election and was the focus of extensive litigation and questions relating to administration of the election, both before and after Election Day.

The purpose of this investigation was not to challenge or question the results of the election in any way. Rather, the purpose of this effort was to fulfill the Democratic Party's commitment to ensuring that every eligible voter can vote and that every vote is counted. This study, accordingly, was intended to address the legitimate questions and concerns that have been raised and to develop factual information that would be important and useful in crafting further necessary election reforms.

The investigation sought to address the following key questions, among others:

- Were the numbers of voting machines, official pollworkers and other resources adequate? If not, did the shortage, in effect, lead to people waiting much longer than they should have in order to vote? Were there differences in how long people had to wait based on race, income or other factors?

- The Help America Vote Act ("HAVA"), passed by Congress in the wake of the 2000 Florida election problems, requires that voters who show up at the polls and believe they are registered but aren't on the voter list be allowed to cast a "provisional ballot"—a special, paper ballot that is put aside, separate from other ballots, and considered later. Different states and counties had different rules about how and under what circumstances to count those ballots. It's much better to be able to cast a regular vote than a provisional ballot: In Ohio more than 20 percent of provisional ballots cast were not counted. The number of voters forced to cast provisional ballots in Ohio was very high compared with other states.

What accounted for that? Were there problems in the timely processing of registration applications, or with purges and/or with other issues in the development and maintenance of registered voter lists?

- Why were approximately one quarter of the provisional ballots cast found to be invalid? Were there more invalid provisional ballots in particular jurisdictions or among particular race or income groups? Why were so many people who thought they had registered in the correct precinct, ultimately found not to be on the registered voter list for that precinct?

- Were there anomalies in the reported voting results compared, for example, with exit polls or with a county's voting history that cannot be explained by factors other than machine malfunction, misreporting and/or mistabulation?

- Did the DRE (touchscreen) voting machines in use for the first time function properly? Were proper security, logic and accuracy testing and other procedures consistently followed?

2. Study Team and Methodology

To address these questions, the DNC assembled the following team:

Voting Experience in Ohio—Survey Research:

Diane Feldman, The Feldman Group

Cornell Belcher, brilliant corners Research and Strategies

Quantitative Analysis of Precinct Level Data:

Michael C. Herron, Ph.D., Associate Professor of Government, Dartmouth College; Former Research Fellow, Center for Basic Research in the Social Sciences, Harvard University; former Faculty Associate, Institute for Policy Research, Northwestern University

Walter Richard Mebane, Jr., Ph.D., Professor of Government, Cornell University; former Visiting Scholar Center for Basic Research in the Social Sciences, Harvard University and former Visiting Associate Professor, Dept. of Social and Decision Sciences, Carnegie Mellon University

Jasjeet Singh Sekhon, Ph.D., Associate Professor of Government, Harvard University

Voting Machine Technology:

Juan M. Jover, Ph.D., Chairman and Co-Founder of Phyten Technologies; former Partner, Silicon Design Experts; former Director of Business Planning, American Express

Dan S. Wallach, Ph.D., Associate Professor of Computer Science and Electrical and Computer Engineering, Rice University

Data Collection and Assembly:

Eric Greenwald, Esq., Deputy Voter Protection Director for Ohio, 2004, Democratic National Committee/Kerry-Edwards 2004

Julie Andreeff Jensen, Esq. Voter Protection Coordinator, Cuyahoga County, Ohio, 2004, Democratic National Committee/Kerry-Edwards 2004

Project Management:

Donna Brazile, Chair, DNC Voting Rights Institute

Lina Brunton, DNC Targeting Director

Vincent Fry, Executive Director, DNC Voting Rights Institute

Monica Marvin, Esq., Brazile & Associates, Project Coordinator

Joseph E. Sandler, Esq., DNC General Counsel

The study methodology consisted of several basic components, which are described in detail in the individual chapters of the report:

(1) A statewide random survey of Ohioans (conducted January 30 – February 2, 2005) who voted or went to the polls with the intention of voting in the 2004 general election; sample size: 1,201.

(2) Two surveys related to provisional ballot voters: a survey of 400 provisional ballot voters in Cuyahoga County (includes Cleveland and surrounding cities) and a survey of non-provisional voters in Cuyahoga County, each of whom was paired with a geographically similar person from the provisional ballot survey. In order to do this survey in the most thorough manner possible, it was necessary to do these two separate polls, which was costly and time-consuming. It was therefore necessary to limit the surveys to one county. Cuyahoga County was selected because a higher percentage of provisional ballots were NOT counted in that county compared to other counties.

(3) Comprehensive analysis of all available precinct data on voter registration, turnout, election results, absentee ballots cast, provisional ballots cast and counted, number of voting machines/booths in each precinct, and number of poll workers in each precinct.

(4) Analysis of above data by voting machine technology team.

(5) Comprehensive collection and analysis of available reports received by DNC Voter Protection teams in Ohio on Election Day.

3. Highlights of Findings

A. Substantial numbers of voters experienced problems in voting and these problems varied significantly by race, geography and type of voting machine and tabulation system that was used.

- Overall, 28 percent of Ohio voters reported problems with their voting experience, including ballot problems, locating their proper polling place and/or intimidation.

- Twice as many African American voters as white voters reported experiencing problems at the polls (52 percent vs. 25 percent).

- Touchscreen voting machines—also known as "direct recording equipment" or "DRE" machines—were used for the first time in a number of counties. Voters in counties using touchscreen voting machines reported experiencing far more problems than voters in other counties—56 percent vs. 28 percent statewide.

- This problem was particularly acute in Franklin County (which includes Columbus and surrounding areas) where 70 percent of voters reported problems with their voting experience. Franklin is one of the major urban counties in Ohio with a significant percentage of lower-income and minority voters.

- There was a vast disparity in the level of confidence in the election system among Ohio voters based on race: 71 percent of whites are very confident their vote was counted correctly versus 19 percent of African Americans.

- Overall, nearly one-quarter of all Ohio voters reported that their experience in 2004 has made them less confident about the reliability of elections in Ohio.

B. Scarcity of voting equipment caused long lines and deterred people from voting. These problems varied significantly by race and type of voting machine.

- Scarcity of voting machines caused long lines that deterred many people from voting. Three percent of voters who went to the polls left their polling places and did not return due to the long lines.

- Counties using DRE (touchscreen) voting machines witnessed longer waits, with more than half (52 percent) of voters in these counties waiting more than twenty minutes.

- Of the counties using DRE (touchscreen) voting machines, Franklin County (Columbus and surrounding cities) was the worst— 74 percent of voters waited more than twenty minutes to vote. There were also proportionally fewer voting machines in Franklin County's minority neighborhoods than in its predominantly white neighborhoods.

- Statewide, African American voters reported waiting an average of 52 minutes before voting while white voters reported waiting an average of 18 minutes.

- Overall, 20 percent of white Ohio voters reported waiting more than twenty minutes, while 44 percent of African American voters reported doing so.

C. Provisional ballots were vastly overused in Ohio and the types of voters forced to vote provisionally varied significantly by registration status, residential mobility and race. Anecdotal evidence suggests these problems were due to extremely faulty election administration.

- 158,642 provisional ballots were cast in Ohio, equaling 2.8 percent of all votes cast for President—compared with 0.9 percent for Pennsylvania and 0.3 percent for Florida. Indeed, only 27,742 provisional ballots were cast in Florida, which had 135 percent more votes cast for President than were cast in Ohio.

- New registrants were much more likely to be required to cast ballots provisionally: 26.5 percent of voters who first registered to vote in 2004 were required to cast a provisional ballot versus 2.5 percent of voters who registered before 2004.

- Residential mobility was also associated with the likelihood of casting a provisional ballot: Voters who had moved since the last time they voted were 6.7 times more likely to vote provisionally.

Voters who had lived at their current address for less than five years were seven times more likely to cast provisional ballots than those who have lived at their current address for more than five years.

- Persons who rent their homes were 2.1 times more likely to cast provisional ballots than homeowners.

- Again, in order to do a more intensive study, the DNC team did two surveys of voters in Cuyahoga County (Cleveland and surrounding areas)—a survey of those who cast provisional ballots in Cuyahoga County and a survey of non-provisional voters in Cuyahoga County. Of provisional voters in Cuyahoga County, 35 percent were African American, compared to 25 percent of non-provisional voters, matched by geography. African American voters were 1.2 times more likely than white voters to be required to vote provisionally.

- These racial differences hold even when related differences in mobility are accounted for: *African American voters who had voted in the past but had moved since the last time they voted were nearly twice as likely to be forced to vote provisionally than white voters who had voted in the past but had moved since the last time they voted*.

- Voters between the ages of 18 and 54 were far more likely to be forced to vote provisionally than voters over the age of 55, even when registration and residential mobility effects were taken into account.

- Overall, 78 percent of provisional ballots in Ohio were counted whereas only 66.2 percent of provisional ballots in Cuyahoga County were counted.

- Reports submitted to the DNC's Voter Protection Teams made it clear that many election officials and poll workers did not understand the provisional ballot rules and made many significant mistakes:

    1. in requiring voters to vote provisionally;
    2. in not offering ballots to voters when they should have been allowed to vote provisionally;
    3. in running out of provisional ballots; or
    4. in failing to handle ballots as legally required.

.

D. Identification requirements were illegally administered and the effects varied significantly by race and age.

- Under Ohio law, the only voters who should have been asked for identification were those voting in their first Federal election who had registered by mail but did **not** provide identification in their registration application. Although only 7 percent of all Ohio voters were newly registered (and only a small percentage of those voters registered by mail and failed to provide identification in their registration application), more than one third (37 percent) reported being asked to provide identification.—meaning large numbers of voters were illegally required to produce identification.

- For example, only 23 percent of provisional ballot voters in Cuyahoga County were in fact newly registered, but 71 percent were forced to provide identification.

- African American voters statewide were 47 percent more likely to be required to show identification than white voters. Indeed, 61 percent of African American men reported being asked to provide identification at the polls.

- Although statewide only 22 percent of voters under age 30 were in fact newly registered, 67 percent of these voters reported being required to provide identification.

- Overall, 36 percent of previously registered voters reported being required to provide identification.—a requirement that was both unnecessary and illegal.

E. There were significant problems in processing new registrations and these problems varied by race and county.

- Statewide, 2 percent of voters overall reported having their registration status challenged at the polls—but only 1 percent of white voters who were actually registered reported such problems versus 4 percent of African American voters who were actually registered.

- African American women and younger African Americans experienced the most registration problems.

- Ballot problems varied across counties, with Cuyahoga County (3 percent) experiencing the most trouble.

- Reports received by DNC Voter Protection Teams indicated that local boards of election were simply unprepared to process the dramatic surge in voter registration applications. This problem was compounded by contradictory and incoherent directives from the Ohio Secretary of State.

F. Many voters experienced intimidation and this experience varied significantly by race.

- 6 percent of all voters reported feelings of intimidation.

- Statewide, 16 percent of African Americans reported experiencing intimidation versus only 5 percent of white voters.

- Reports received by the DNC Voter Protection Teams included voters being told falsely that if they had outstanding parking tickets or car payments they would be arrested at the polls.

G Voters were less likely to have their votes counted in counties using punchcard machines and optical scan machines that were centrally tabulated.

- There is a difference in the residual vote rate (i.e., many ballots cast with few valid presidential votes counted) depending upon the type of machine used: optical scan voting machines that were tabulated at the precinct where the votes were cast (precinct-tabulated optical scan machines); optical scan voting machines that were tabulated at a central terminal (centrally tabulated optical scan machines); DRE (touchscreen) machines; or punchcard machines.

- The median residual vote rate in those precincts using precinct-tabulated optical scan machines is within a normal range—while that rate in punchcard precincts is more than twice as large, and is clearly unacceptable.

- Unexpectedly high residual vote rates also occurred in centrally tabulated optical scan precincts.

- In DRE (touchscreen) and precinct-tabulated optical scan precincts, the higher number of machines per voter, increased the odds that the votes would be counted. With fewer machines per voter—a widespread problem in Ohio this time, as noted above—polling places became more crowded and voters were less likely to take the time to check or correct their ballots.

- The residual vote rate is higher in precincts where the proportion voting for Kerry was higher.

H. The study findings and independent analysis indicate that the use of DRE (touchscreen) machines is highly problematic and the use of precinct-tabulated optical scan systems is vastly preferable if accessibility issues can be successfully addressed.

- As the study findings summarized above indicate, use of DRE (touchscreen) machines was problematic in terms of deterring voters, voters reporting experiencing problems, long waits and, where machines were scarce, which was widespread, actual loss of votes—i.e., votes cast but not counted.

- Team experts have confirmed that DRE (touchscreen) systems are consistently shown to have higher residual vote rates than optical scan systems even though DRE systems are specifically designed to produce high valid vote rates.

- Our team expert points out that current DRE (touchscreen) systems are extremely expensive to procure and maintain—which makes it unlikely that sufficient numbers could ever be purchased to remedy the scarcity problems detected in the study.

- While there is no reliable evidence of actual fraud in the use of these machines in Ohio in 2004, our expert advises that DRE (touchscreen) machines are not sufficiently safeguarded against fraud and are less usable for the broad population of voters than earlier simpler technologies; and that existing standards and practices for certification are insufficient to ensure the security requirements of DRE (touchscreen) systems.

- A voter-verified paper trail or equivalent system would address the security of DRE (touchscreen) systems while preserving their attractive features such as enhanced accessibility for disabled voters.

- Precinct based optical scan systems remain superior, however, with respect to ensuring that everyone's vote is counted.

- One attractive alternative is the use of a computer-assisted optical scan ballot marking device, which would enable voters who need the accessibility feature of DRE (touchscreen) systems to use a computer to actually mark the optical scan ballot. Other voters would use a standard marking pen. Only one computer device per precinct would likely be necessary.

I. The statistical study of precinct-level data does not suggest the occurrence of widespread fraud that systematically misallocated votes from Kerry to Bush.

- The tendency to vote for Kerry in 2004 was the same as the tendency to vote for the Democratic candidate for governor in 2002 (Hagan). That the pattern of voting for Kerry is so similar to the pattern of voting for the Democratic candidate for governor in 2002 is, in the opinion of the team's political science experts, strong evidence against the claim that widespread fraud systematically misallocated votes from Kerry to Bush.

- Kerry's support across precincts also increased with the support for Eric Fingerhut, the Democratic nominee for U.S. Senate, and decreased with the support for Issue 1 (ballot initiative opposing same-sex marriage) and increased with the proportion of African American votes. Again this is the pattern that would be expected and is not consistent with claims of widespread fraud that misallocated votes from Kerry to Bush.

Democracy at Risk: The 2004 Election in Ohio

Section III
Voting Experience Survey

THE FELDMAN GROUP, INC.

brilliant corners Research & Strategies

March 3, 2005

TO: The Democratic National Committee

FR: Diane Feldman
Cornell Belcher

RE: DNC Voting Experience Survey

Our recent survey of voters in Ohio[1] shows that many Ohioans experienced problems voting on Election Day, and that these difficulties were particularly acute among African American voters. Indeed, the Election Day experience for most African American voters was starkly different from that of most white voters in Ohio. Nevertheless, the survey also indicates that the difficulties experienced by African American and other voters at the polls did not, in and of themselves, cost John Kerry the election in Ohio.

More than one quarter of all voters in Ohio reported some kind of problem voting in the November election. For the bulk of voters, these problems had to do with long waits on line to vote. Smaller but significant minorities of voters also experienced problems with absentee ballots, problems with their registration statuses, problems finding polling places, and problems due to voter suppression and intimidation tactics. In addition to these problems, millions of Ohio voters were subjected to unlawful identification checks at the polls.

Though more than one in four Ohio voters experienced some sort of problem, the incidence of voting problems across demographic groups and geography was far from

---

[1] Conducted 1/30-2/2 among 1,201 Ohioans who voted (or went to the polls with the intention of voting) in the 2004 general election on November 2nd.

uniform. African Americans were far more likely to have experienced voting problems, as were voters in Franklin and Cuyahoga counties.

African Americans experienced more ballot and polling place problems than whites, and were more likely to have felt intimidated on Election Day. The high number of newly registered African American voters does not explain the disparity in experiences between white voters and African American voters. In fact, registration history had little to do with the different experiences, as African Americans registered to vote before 2004 were far more likely to have experienced problems than white voters who were registered before 2004. The disparity is also not a function of party registration, as African American Democrats had far more problems than white Democrats.

Voting problems also varied widely by geography. Polling place problems and long lines were heightened in Franklin County, which used DRE voting machines, as well as in the other counties that used this electronic voting equipment. Voters in Cuyahoga County also experienced significant voting problems, particularly in terms of ballot problems and intimidation.

Despite the problems on Election Day, there is no evidence from our survey that John Kerry won the state of Ohio. Two (2) percent of voters who went to the polls on Election Day decided to leave their polling locations due to the long lines. This resulted in approximately 129,543 lost votes. However, these potential voters would have divided evenly between George Bush and John Kerry. A smaller group of potential voters (0.08 percent) were not given ballots at all due to registration challenges. These approximately 4,798 voters favored Kerry, according to the poll (extreme sample size caution).

Finally, a third group of voters (equivalent to 0.83 percent of the voting population) did not go to the polls at all because they did not receive their absentee ballots, or had heard about long lines, registration challenges, and confusing polling sites. We do not know the voting preferences of these approximately 47,979 voters. However, even if they had all chosen Kerry, his overall gain of 52,777 votes would not have erased Bush's 118,000 vote margin in the state.

Polling Place Problems

More than one-fourth (26 percent) of voters experienced polling place problems.[2] These problems included going to more than one poll, waiting on line to vote for more than twenty minutes, or leaving the polling place without voting. African Americans and voters using DRE machines experienced the most polling place problems.

African Americans were twice as likely to experience polling place problems as white voters. As Table 1 shows, nearly half (46 percent) of African Americans

[2] There were two subdivisions of voters in the survey: Those who voted by absentee and those who went to the polls to vote. Most percentages cited in this memo refer voters *who went to the polls*, rather than all voters. Exceptions include the "Ballot Problems" and "Demographic Differences" sections, which use percentages referencing *all* voters.

encountered problems at their polling locations, as compared with only 23 percent of white voters. Again, this difference had nothing to do with registration history, as previously registered African Americans were just as likely (43 percent) to have experienced problems at the polls. The difference also had little to do with party identification, as far fewer white Democrats (26 percent) reported experiencing troubles at the polls.

Other groups of voters, including those under 45, those who rent their homes, and those who voted before 8 AM, also ran into more polling place problems than the rest of the electorate. Nearly one-third (32 percent) of voters under 45 had some problem at the polls, slightly more than older voters. Renters experienced more problems (35 percent) than home owners (24 percent). Finally, problems swelled earliest in the day, with one-third (33 percent) of voters who voted before 8 AM experiencing some voting problems. The problems tapered off later in the day, with only 21 percent of voters who came to the polls after 3 PM experiencing some problems.

Table 1:
Polling Place Problems

	Polling Place Problems
Total	**26**
Whites	23
Af Am	46
Punch Card	17
DRE	54
Optical Scan	17
Cuyahoga	24
Franklin	73
Hamilton	18
Under 45	32
Over 45	22
Rent home	35
Own home	24
Before 8 AM	33
After 8 AM	24

Lines were long on Election Day, as nearly one-fourth (23 percent) of voters waited more than twenty minutes and 8 percent of voters waited more than an hour. African Americans waited on line far longer than white voters. Forty-four (44) percent of African American voters waited for more than twenty minutes while only 20 percent of white voters waited that long. African Americans waited an average of 51.8 minutes before voting while white voters waited only 17.9 minutes.

DRE counties also witnessed longer waits, with more than half (52 percent) of voters in these counties waiting more than twenty minutes. Franklin County was the most troublesome, with fully three-fourths (74 percent) of voters waiting more than twenty minutes. African Americans in Franklin County had more polling place problems (91 percent) than their white counterparts there (67 percent), although extremely low sample sizes make that conclusion speculative.

Three (3) percent of voters who went to the polls left their polling places and did not return due to the long lines. Although African Americans were more likely to leave their polling places due to long lines, they were also more likely to return to vote later in the day. Thus, an equal share (3 percent) of African Americans and whites did not vote due to the long lines.

Two (2) percent of voters had to go to more than one polling place before finding the correct location. As might be expected, transient voters had the most trouble finding the correct polling location. Four (4) percent of voters who had lived in their house for less than a year went to more than one polling place, as did 3 percent of home renters.

Meanwhile, voters in Franklin County experienced the most problems finding their location, with 3 percent going to more than one polling place. Franklin County voters were also least likely to have been to their polling place in previous elections. Thirty-seven (37) percent of Franklin County voters had never been to their polling place in the past, as compared with 26 percent of all voters.

Identification Checks

Nearly half of African American voters were asked to present identification in order to vote. Poll workers in Ohio did not properly administer the law on checking identification on Election Day. The law states that poll workers should only ask identification of newly registered voters who did not present identification when they registered. However, while only 7 percent of voters were newly registered, more than one-third (37 percent) of the electorate report being asked to show identification. In addition, 36 percent of *previously* registered voters were asked to show identification.

Table 2: Asked to Present Identification

	ID Checked	Newly Registered
Total	**37**	**7**
Newly registered	56	100
Previously registered	36	0
White	35	7
African American	47	9
Men	43	8
Women	32	7
Under 30	67	22
30 to 44	47	8
45 to 54	33	6
55 to 64	26	4
65 and older	23	3
Cuyahoga	46	8
Franklin	47	13
Hamilton	37	9

As Table 2 shows, 47 percent of African Americans were asked to present identification, as compared with only 35 percent of whites. Previously registered African Americans encountered similar conditions, as 46 percent had to show identification. African American men, in particular, faced identification checks, as a clear majority (61 percent)[3] were asked for identification.

The gender gap nearly equaled the racial gap, as 43 percent of men and only 32 percent of women were asked to show identification. Younger voters, who were more likely to be newly registered, were also more likely to be asked for identification. Poll workers in Cuyahoga and Franklin were most overzealous in asking for identification.

Intimidation

Six (6) percent of voters who went to the polls reported feelings of intimidation. This group includes voters who heard that police would be at the polls to arrest people who had outstanding child support or car payments, and voters who said they felt intimidated on Election Day.

[3] Extreme sample size caution

Table 3: Intimidation	
	Intimidation
Total	**6**
Whites	5
Af Am	16
Cuyahoga	13
Franklin	6
Hamilton	10
Dem	9
Rep	3
Kerry voter	9
Bush vote	4

Again, African Americans reported more feelings of intimidation than white voters. As Table 3 shows, 16 percent of African Americans reported feelings of intimidation while only 5 percent of white voters report similar sentiments. African American men (29 percent) felt particularly intimidated at the polls. Unlike with the polling place problems, intimidation occurred more often in Cuyahoga County (13 percent) than in Franklin County (6 percent).

Democrats and Kerry supporters also reported more intimidation. Nine (9) percent of Democrats, including 7 percent of white Democrats, reported feelings of intimidation while only 3 percent of Republicans felt the same way. Similarly, Kerry voters (9 percent) were more likely to feel intimidated than Bush voters (4 percent).

Polling problems had only a very small correlation with feelings of intimidation. Only 9 percent of those with polling place problems report feelings of intimidation while a similar 6 percent of voters who did not have polling place problems reported feelings of intimidation.

Ballot Problems

Two (2) percent of voters experienced ballot problems in Ohio. These voters either had trouble receiving their absentee ballots or had their registration status challenged at the polls.

African American voters experienced more ballot problems than white voters. Four (4) percent of African Americans had problems with their ballots while only 1 percent of white voters experienced similar problems. Registration history had nothing to do with this racial disparity. Four (4) percent of previously registered African Americans experienced ballot problems while only 1 percent of previously registered white voters encountered similar obstacles. African American women and younger African Americans experienced the most ballot problems.

Ballot problems varied across counties, with Cuyahoga (3 percent) experiencing the most trouble. Younger voters and newly registered voters experienced the same proportion of ballot problems as older and previously registered voters. Similarly, ballot problems occurred evenly throughout the day.

Demographic Differences

Overall, 28 percent of voters had problems with their voting experience, which includes ballot problems, polling place problems, and feelings of intimidation, as shown in Table 4.

Table 4: Total Voting Problems	
	Total Problems
Any voting problem	**28**
Any polling place problems	26
More than 20 minute wait	*23*
Had to go to multiple polling places	*2*
Left without voting, did not return	*3*
Any ballot problems	2
Absentee ballot problems	*5*[4]
Registration challenge/ problem	*2*
Feelings of intimidation	6

African Americans had the most difficult voting experience of any demographic group. As Table 5 shows, more than half (52 percent) of African Americans had problems during their voting experience, compared with one-fourth (25 percent) of whites. And registration history did not drive these problems as an equal 52 percent of newly and previously registered African American voters encountered problems. Younger African Americans (54 percent) and African American men (56 percent) dealt with more problems but obstacles existed in all parts of the African American community.

The polling place problems in Franklin County, and other counties using DRE machines, made these counties the most problematic. Seventy (70) percent of voters in Franklin County had problems with their voting experience, as did 56 percent of voters in all DRE counties.

Table 5: Total Problems	
	Total Problems
Total	**28**
Whites	25
Af Am	52
Punch Card	23
DRE	56
Optical Scan	24
Cuyahoga	31
Franklin	70
Hamilton	22
Under 45	37
Over 45	23
Rent home	36
Own home	26
Before 8 AM	36
After 8 AM	30

Similarly, voters under 45 (37 percent), home renters (36 percent), and voters who came to the polls before 8 AM (36 percent) encountered more problems than their respective counterparts.

Surprisingly, registration history and party identification had very small effects on the voting experience of Ohioans. Newly registered voters were only slightly more likely to have problems (34 percent) than previously registered voters (28 percent). Although Democrats had more problems (32 percent) than Republicans (23 percent), white Democrats experienced a similar level of problems (27 percent) as the rest of the electorate. Independents, in fact, encountered more problems (31 percent) than white Democrats or Republicans.

[4] This means that 5 percent of voters who used absentee ballots had problems receiving them

Attitudes toward Voting Experience

On the whole, voters in Ohio believe their votes were counted correctly and report satisfaction with their overall voting experience. But African American voters and white voters have very different perceptions of their overall voting experience and the reliability of the election system in Ohio.

Nearly three-fourths of all voters (71 percent) say they are very confident their vote was counted correctly, and an additional 18 percent are somewhat confident, as shown in Table 6. Nine (9) percent are not confident. Similarly, two-thirds of voters (65 percent) are very satisfied with their overall voting experiences, 23 percent are somewhat satisfied, and 11 percent are dissatisfied.

Though large majorities of voters express confidence about the integrity of their *own* vote and satisfaction with their *own* personal experience, they are somewhat less likely to express confidence when it comes to a more generalized assessment of the reliability of elections in the state of Ohio. While 30 percent said that their 2004 experience made them much more confident and 32 percent said it made them somewhat more confident, nearly one quarter (23 percent) of voters said their experience in 2004 has made them less confident about the reliability of elections in Ohio. Not surprisingly, among voters who had some voting problem, 38 percent express a lack of confidence.

Table 6: Attitudes toward Voting Experience

	Vote Counted (Very Confident)	Voting Experience (Very Satisfied)	Reliability of Elections (Much More Confident)
Total	**71**	**65**	**30**
Whites	77	70	33
Af Am	19	26	5
Punch Card	73	70	33
DRE	62	48	28
Optical Scan	75	57	22
Cuyahoga	56	57	21
Franklin	57	35	22
Hamilton	71	74	27
Under 45	64	57	27
Over 45	75	70	33
Rent home	52	54	22
Own home	75	68	32
Democrat	50	50	15
Republican	93	83	49
Independent	74	67	30
Under $30K	61	61	28
$30K to $50K	68	63	28
$50K to $75K	76	69	32
Over $75K	79	70	34
Had problems	54	43	20
No problems	78	74	34

As Table 4 indicates, African Americans are considerably less confident that their vote was counted correctly, less satisfied with their voting experience, and less confident in the reliability of elections in the state.

Voters in Cuyahoga and Franklin counties also report less confidence and satisfaction after their voting experiences this year. The long lines especially affected Franklin County voters, as only 35 percent say they are very satisfied with their Election Day experience. Again, younger voters and home renters express more skepticism and less satisfaction about elections and voting.

Democrats and Republicans have very different feelings about their Election Day experiences, likely reflecting their reaction to the election result itself. White Democrats have more confidence that their vote was counted properly (57 percent very confident) and report more satisfaction with their voting experience (56 percent very satisfied) than African Americans, but still are less optimistic than their Republican counterparts. Only 17 percent of white Democrats say they are much more confident in the reliability of elections in Ohio after voting in 2004.

###

Democracy at Risk: The 2004 Election in Ohio

Section IV
Provisional Ballot Survey

THE FELDMAN GROUP, INC.

brilliant corners Research & Strategies

April 28, 2005

TO: The Democratic National Committee

FR: Diane Feldman
Cornell Belcher

RE: DNC Provisional Ballot Survey

Newly registered voters and voters with more residential mobility in Cuyahoga County were more likely to cast provisional ballots last November than the county electorate as a whole. Additionally, younger voters and African Americans were more likely to vote provisionally than older voters and whites, even when we account for differences in registration and residential mobility.

Other demographic and political characteristics—such as education, income, marital status, and presidential preference—did not affect the likelihood of voting provisionally, although some of these were related to whether the provisional ballot was ultimately counted.

Nearly three-fourths (72 percent) of provisional voters whom we surveyed had their ballots counted by the Board of Elections, according to the lists provided by the board.[1] Voters outside Cleveland in our survey (74 percent) were more likely than their Cleveland counterparts (68 percent) to have their ballots counted. In addition, Bush supporters (79 percent) were more likely to have their provisional ballots counted than Kerry supporters (69 percent).

---

[1] Provisional voters in our survey were more likely to have their ballots counted than all provisional voters in Cuyahoga County, where 66.2 percent of provisional ballots were counted. The difference is likely attributable to the inability to obtain phone number for people whose registration was not verified.

The survey also suggests that provisional voters faced problems at the polls. Seventy-one (71) percent of provisional voters reported they were required to show identification, even though the law states that only new registrants, who comprised 23 percent of the provisional electorate, have to show identification. Additionally, many provisional voters were not fully aware that they were voting with a special ballot, one reason why only a small share actually checked with the Board of Elections to see if their vote was counted.

These surveys of Cuyahoga County voters constituted the second phase of the DNC Ohio Election Investigation Project's public opinion research. The first phase analyzed the voting experience for voters statewide in Ohio. Voters were selected at random, using random digit dialing, for the first survey. That survey found that the Election Day experience for most African American voters was starkly different from that of most white voters in Ohio. African American voters waited in line longer to vote, experienced more registration challenges, and were more likely to feel intimidated. Nevertheless, the survey also indicated that the difficulties experienced by African Americans and other voters at the polls did not, in and of themselves, cost John Kerry the election in Ohio.

This second project began with a survey of 400 provisional ballot voters in Cuyahoga County who were contacted by phone from a list provided by the Cuyahoga County Board of Elections. We then surveyed 400 non-provisional voters, each of whom was paired with a geographically proximate respondent from the provisional ballot survey[2] to obviate biases by geography rather than demographics, and to minimize the impact on sampling of imbalances in the availability of phone numbers for more and less mobile voters. The project explored the demographic, residential, and registration differences between provisional and non-provisional voters, and looked at the Election Day experience of provisional ballot voters.

The frequencies for the two surveys are attached. Additionally, Professor Walter Mebane of Cornell University used the survey data to calculate the probability of voting provisionally given certain characteristics, such as having registered to vote in 2004 or being African American so we could address the causes of provisional voting. His study, which examines these probabilities in more technical depth, is also included in this report.

[2] Respondents were matched using zip codes. Each provisional respondent was matched with a non-provisional respondent in the same Zip-9 area code, if possible. If that was not possible, we removed one digit from the end of the zip code until we found a match.

Residential and Registration Effects

Newly registered voters and voters with more residential mobility were more likely to cast provisional ballots.[3] Looking at the frequencies, for example, 23 percent of provisional voters in Cuyahoga County first registered to vote in 2004 and only 3 percent of matched, non-provisional voters first registered to vote in 2004. Professor Mebane used these frequencies to calculate the probability that a newly registered voter had to cast a provisional ballot and the probability that a previously registered voter had to cast a provisional ballot.

Table 1 shows the probability of a voter having to cast a provisional ballot, given that the voter belonged to a certain group. Using this example, Professor Mebane calculated that 26.5 percent of voters who first registered to vote in 2004 voted with a provisional ballot while only 2.5 percent of voters who were already registered to vote had to vote provisionally. Newly registered voters, therefore, were 10.6 times more likely to vote with a provisional ballot than voters who were already registered.

Table 1: Registration and Mobility Effects

	Percent Provisional
Reg to Vote in 2004	26.5
Already Reg	2.5
Ever voted in Ohio? No	9.4
Ever voted in Ohio? Yes	3.1
Moved Since Last Voted in Ohio? Yes	11.4
Moved Since Last Voted in Ohio? No	1.7
Did not vote in past at polling place	11.2
Voted in past at polling place	1.7
At current address: Five years or less	9.1
At current address: More than five years	1.3
Rent home	5.7
Own home	2.7

Using the same methods, Professor Mebane calculated that voters who had never voted in Ohio prior to 2004 were 3.0 times more likely to cast provisional ballots, with 9.4 percent of those who had never voted in an Ohio election casting a provisional ballot and 3.1 percent of those who had voted in a prior election casting one.

Voters with more residential mobility cast provisional ballots at a significantly higher rate than voters with less residential mobility. The relationship between residential mobility and provisional voting came in many forms. Voters who had moved since the last time they had voted (11.4 percent cast provisional ballots) were 6.7 times more likely to vote provisionally than voters who had not moved (1.7 percent provisional); voters who had never voted at the polling place they used in 2004 (11.2 percent provisional) were 6.6 times more likely to vote provisionally than voters who had voted at the same polling place (1.7 percent provisional). Similarly, voters who have lived at their current address for fewer than five years (9.1 percent provisional) were 7 times more likely to cast provisional ballots than those who have lived at their current address for more than five years (1.3 percent); voters who rent homes (5.7 percent

[3] Our confidence level that the differences in provisional voting probabilities are *not* random is 90 percent, using a one-tailed test. Please reference Professor Mebane's accompanying report for further explanation of the statistical confidence tests.

provisional) were 2.1 times more likely to cast provisional ballots than home owners (2.7 percent provisional).

Demographic Effects

African American voters and voters under age 55 were more likely to cast provisional ballots than their white and older counterparts, again using Professor Mebane's calculations. African American voters (4.1 percent) were 1.2 times more likely than white voters (3.5 percent) to vote provisionally. Voters under age 55 (6.6 percent provisional) were 4.1 times more likely to cast provisional ballots than voters over age 55 (1.6 percent provisional). The differences remain when we combine the effects of registration history and residential stability with those of race, as we will discuss in the next section.

Table 2: Demographic Effects

	Percent Provisional
White	3.5
Af Am	4.1
18 to 54	6.6
55 and Over	1.6
Men	3.2
Women	3.8
<$20K	4.4
$20K to $40K	3.8
$40K to $60K	4.9
>$60K	5.1
High school	3.4
Some college	3.9
College grad	4.4
Post grad	2.9
Married	3.8
Single	3.6
Kerry voter	4.2
Bush voter	4.1

Similarly, as you can see from the attached frequencies, 35 percent of provisional voters are African American compared to only 25 percent of non-provisional voters matched by geography in Cuyahoga County. Seventy-two (72) percent of provisional voters are under age 55, compared to only 35 percent of matched voters.

Statistically, we can say with 90 percent confidence that African Americans were more likely to vote provisionally than whites. This follows, as well, from the conclusions of the earlier survey that African Americans were more likely to be challenged, and more likely to wait in line, than were white voters.

There are no statistically significant differences in the rates of provisional voting across other demographic or political characteristics, including income, education, marriage status, and presidential candidate preference.

Table 3: Race, Registration, and Mobility

	Percent Provisional
Already Registered: Af Am	3.2
Already Registered: White	2.4
Ever voted in Ohio? Yes: Af Am	3.9
Ever voted in Ohio? Yes: White	3.0
Moved Since Last Voted in Ohio? Yes: Af Am	16.2
Moved Since Last Voted in Ohio? Yes: White	8.8
Moved Since Last Voted in Ohio? No: Af Am	2.1
Moved Since Last Voted in Ohio? No: White	1.6

Differences by race and age in voting provisionally hold even when we account for related differences in mobility. Table 3, using Professor Mebane's calculations, show that the most striking difference is between African Americans who had voted in the past but had moved since the last time they voted and the corresponding white voters who had voted in the past but had moved since the last time they voted. African American movers (16.2

percent provisional) were 1.8 times more likely than white movers (8.8 percent provisional) to vote with a provisional ballot.

When we look at new registrants, new voters, and non-movers, African Americans were also more likely to cast provisional ballots than their white counterparts. African Americans who were already registered to vote before 2004 (3.2 percent provisional) were 1.3 times more likely to vote provisionally than white voters who were registered prior to 2004 (2.4 percent provisional). Similarly, African Americans who had voted previously in Ohio (3.9 percent provisional) were 1.3 times more likely to cast provisional ballots than white voters with a prior voting history in the state (3.0 percent provisional). In addition, African Americans who had not moved since the last time they voted (2.1 percent provisional) were 1.3 times more likely to vote provisionally than white voters who had not moved in that time period (1.6 percent).

Table 4: Age, Registration, and Mobility

	Percent Provisional
Already Registered: 18 to 54	4.7
Already Registered: 55 and Over	1.2
Ever voted in Ohio? Yes: 18 to 54	6.0
Ever voted in Ohio? Yes: 55 and Over	1.5
Moved Since Last Voted in Ohio? Yes: 18 to 54	11.7
Moved Since Last Voted in Ohio? Yes: 55 and Over	9.8
Moved Since Last Voted in Ohio? No: 18 to 54	3.7
Moved Since Last Voted in Ohio? No: 55 and Over	0.8

Voters between the ages of 18 and 54 were far more likely to vote provisionally than voters over the age of 55, even when registration and residential effects were taken into account. Younger voters who had been registered before 2004 (4.7 percent provisional) were 3.9 times more likely to vote provisionally than older voters who had been registered before 2004 (1.2 percent provisional), as Table 4 shows. In addition, younger voters who had previously voted in Ohio (6.0 percent provisional) were 4 times more likely to vote provisionally than older voters who had previously voted in Ohio (1.5 percent provisional). Finally, younger voters who had not moved (3.7 percent provisional) were 4.6 times more likely to cast provisional ballots than older voters who had not moved (0.8 percent provisional).

Table 5: Counting Provisional Ballots

	Ballot Counted
Total	**72**
Cleveland	68
Not Cleveland	74
Men	69
Women	74
White	71
Af Am	70
Under $40K	72
Over $40K	74
Under 55	73
55&Over	74
Married	76
Single	69
Own	71
Rent	75
Kerry voter	69
Bush voter	79

Counting Provisional Ballots

Seventy-two (72) percent of provisional voters in Cuyahoga County that we surveyed had their ballots counted while 28 percent had not, according to the list of provisional voters provided by the county Board of Elections. The Board of Elections counted 66.2 percent of all provisional ballots, meaning that voters in our survey were slightly more likely to have their ballots counted than the provisional voter electorate as a whole.

Bush supporters were more likely to have their provisional ballots counted than Kerry supporters as Table 5 shows. Seventy-nine (79) percent of Bush supporters had their provisional ballots counted while only 69 percent of Kerry supporters had theirs counted. Non-Cleveland residents and married voters were more likely to support Bush, which account for some, but not all, of this disparity.

Identification Checks

The law states that poll workers should only ask identification of newly registered voters who did not present identification when they initially registered to vote. However, 71 percent of provisional voters report having their identification checked while only 23 percent of voters were new registrants, as Table 6 shows.

Men (76 percent) report having their IDs checked more women do (69 percent), and younger voters (77 percent) report having their IDs checked more than older voters (57 percent), even while accounting for differences in new registrants. The problem was more acute in Cleveland, where 74 percent of provisional voters report having had their identification checked, than in the rest of Cuyahoga County, even though there were more new registrants outside of Cleveland.

Table 6: Identification Checks with Provisional Ballot Voters

	ID Check	New Reg
Total	**71**	**23**
Cleveland	74	19
Not Cleveland	69	24
Men	76	22
Women	67	23
White	70	24
Af Am	73	17
Under $40K	71	23
Over $40K	73	26
Under 55	77	24
55&Over	57	15
Married	72	25
Single	71	22
Own	73	27
Rent	71	19
Kerry voter	72	20
Bush voter	73	25

Provisional Voting Experience

Many provisional voters did not realize that their vote was provisional. Respondents were asked three questions that tested whether they were aware their vote was provisional. They were asked if they had any problems with their voting or registration experience; they were asked if anyone questioned their registration at the polls; and they were asked if they voted with a provisional ballot. Respondents who answered affirmatively to all three questions are classified as "very aware," those who voted affirmatively twice are classified as "somewhat aware," those who voted affirmatively once are classified as "not very aware." Finally, those who did not answer affirmatively to any of these questions are classified as "not at all aware."

Overall, only 29 percent of provisional voters are classified as being "very aware" that their vote was provisional, another 28 percent of provisional voters are classified as "somewhat aware," 23 percent of provisional voters are classified as "not very aware," and 21 percent of provisional voters are classified as "not at all aware."

Provisional voters in Cleveland are more likely to be less aware that their vote was provisional than provisional voters in the rest of Cuyahoga County, as Table 7 shows. Just over half (51 percent) of provisional voters in Cleveland are "very or somewhat aware" while 60 percent of provisional voters in the rest of Cuyahoga County are "very or somewhat aware." Similarly, nearly two-thirds (62 percent) of younger voters are "very or somewhat aware" compared with just over a third (36) percent of older voters.

Table 7: Awareness of Voting Experience

	Very Aware	Somewhat Aware	Not Very Aware	Not at all Aware
Total	**29**	**28**	**23**	**21**
Cleveland	26	25	22	27
Not Cleveland	30	30	23	17
Men	29	29	22	20
Women	28	28	24	21
White	28	28	22	21
Af Am	28	27	24	21
Under $40K	29	28	23	20
Over $40K	27	30	22	21
Under 55	31	31	20	18
Over 55	16	20	35	19
Married	31	28	19	22
Single	26	29	26	19
Own	30	29	19	21
Rent	27	29	26	18
Kerry voter	27	27	24	22
Bush voter	28	33	20	19

A large majority of provisional voters did not check with the Board of Elections to see if their vote was counted. Only 8 percent of voters report checking with the Board of Elections to see if their votes were counted. Meanwhile, 31 percent of voters said they did not check with the Board and a majority, 59 percent, said they did not know that it was possible to do so.

For the most part, poll workers offered provisional ballots to voters rather than voters having to ask for the ballots themselves. Sixty-one (61) percent of provisional voters had ballots offered to them while only 13 percent said they had to ask for a ballot.

Voters believe they had to cast provisional ballots due to registration and location problems. A 25 percent plurality of provisional voters says they moved their residence within 30 days of the election. Nineteen (19) percent of voters say their new registrations did not go through in time for Election Day. Provisional voters who had their ballots counted were more likely to say that they had moved recently (28 percent) while provisional voters who did not have their ballots counted were more likely to think that their registrations had not gone through in time (24 percent). Only 5 percent say they had requested an absentee ballot but decided to try to vote in person. Roughly one-fifth of voters (20 percent) attribute their status to mistakes at the Board of Election, the purging of voting registrations, or mistakes by poll workers.

###

Democracy at Risk: The 2004 Election in Ohio

Section V
Inferences from the Provisional Ballot Voter Survey

Inferences from the DNC Provisional Ballot Voter Survey

Walter R. Mebane, Jr.

April 27, 2005

The survey conducted in Cuyahoga County, Ohio,[1] shows that the single most important cause of voters casting a provisional ballot in the county in the November 2004 election was residential mobility. About 60 percent of the provisional ballots were cast by those who either were voting in Ohio for the first time or who had previously voted in Ohio but had since moved. Among those who had previously voted in Ohio and not moved since doing so, voters younger than 55 years of age were much more likely to cast a provisional ballot than older voters were. Among those who had previously voted in Ohio but since moved, African American voters were more likely than white voters were to cast a provisional ballot

Before considering the detailed results from the survey, note that the matched, case control design of the Cuyahoga survey means that when the appropriate sampling weights are used, the survey exactly estimates the overall frequency of casting a provisional ballot. From administrative records we know that the proportion of provisional ballots among all ballots cast is 0.03518, a value the survey estimate is constrained to reproduce exactly.[2] Estimates for the proportion of provisional ballots cast by groups of voters in Cuyahoga County will not be exact but will be subject to sampling error. A technical appendix to this memo describes the methods used to compute estimates from the survey data.

Despite the enforced accuracy of the overall proportion, the sample was implemented using a zipcode-level matching design that may introduce bias in the estimates of other quantities when making inferences about all voters in Cuyahoga County. A nonprovisional voter has a positive probability of being included in the second sample only if the voter lives in the same zipcode as a provisional voter. If there are zipcodes in which there are nonprovisional voters but no provisionals, then the nonprovisional voters in those zipcodes have zero probability of being included in the nonprovisional survey.[3] In this case estimates using the nonprovisional survey data are biased. Given the way the estimators for the survey proportions are derived, it may be reasonable to say the survey estimates are biased only if there are zipcodes in Cuyahoga County where it is *impossible* that any provisional ballots were cast.[4] Because the personal experiences and adminstrative problems that cause a provisional ballot may affect almost any voter (e.g., moving residences, misdirected absentee ballots, record keeping errors), it may be reasonable to rule out this source of bias. The estimates discussed in this report ignore this potential bias.

Tables 1, 2 and 3 show how often Cuyahoga voters cast provisional ballots given various personal attributes and election-day experiences they had. The first column of each table lists

[1] DNC Ohio Election Investigation Project Provisional Ballot Survey, Phase 1 and Phase 2, conducted by The Feldman Group and brilliant corners Research & Strategies. Phase 1 interviews were conducted March 2–3, 2005. Phase 2 interviews were conducted March 22–24, 2005.

[2] The administrative estimate is $0.03518049 = 24463/(687260 + 8097)$, where 24,463 is the "Total" from the file `rejected & ok provisionals 04.pdf`, 687,260 is "BALLOTS CAST TOTAL" from the file `110204_GE_Canvass.txt`, (RUN DATE:02/28/05 11:45 AM), and 8097 is the total number of all rejected provisional ballots from file `rejected & ok provisionals 04.pdf`.

[3] The sample of provisional voters includes voters from every residential five-digit zipcode area in Cuyahoga County. Nonprovisional voters were matched to provisional voters in more local domains, however, all the way down to some matches done in zip-9 areas. See the technical appendix for more details.

[4] I have in mind a superpopulation justification for the sample estimators.

Table 1: Provisional Ballots and Attributes Related to Residential Mobility

Attributes	Percent Provisional	Confidence (+ or –)	Percentage of Voters
Ever Voted in Ohio? Yes	3.1	0.2	89.6
Ever Voted in Ohio? No	9.4	7.1	7.3
Moved Since Last Voted in Ohio? Yes	11.4	4.4	15.0[a]
Moved Since Last Voted in Ohio? No	1.7	0.2	84.2[a]
Voted in Past at Polling Place	1.7	0.2	77.7
No Vote in Past at Polling Place	11.2	3.9	19.4
At Current Address: Five Years or Less	9.1	2.7	28.2
At Current Address: More than Five Years	1.3	0.2	67.3
Own Home	2.7	0.4	66.2
Rent Home	5.7	1.5	26.8
Registered to Vote in 2004	26.5	12.2	3.0
Already Registered	2.5	0.2	96.1

Notes: [a] Percentage of the 89.6% of voters who previously voted in Ohio.

various attributes that describe different voters. The second column shows the percentage of those voters estimated to have cast a provisional ballot, and the third column shows the range for a 95% confidence interval around the percentage estimate: we can be 95% confident that the true percentage falls within an interval defined as the estimated percentage plus or minus the reported confidence range. The final column shows the percentage of voters in Cuyahoga County who have the indicated attribute.

Why did voters cast provisional ballots? The single most important cause seems to be residential mobility. The first entry in Table 1 shows that of those who said they had previously voted in Ohio, 3.1 percent cast a provisional ballot, while 9.4 percent of those who said they had never voted in Ohio cast a provisional ballot. Because the number of people who said they had never voted in Ohio is small—they are only 7.3 percent of voters—the uncertainty in the estimated percentage of them who cast a provisional ballot is large. The 95% confidence interval ranges from 2.1 percent to 16.7 percent. The estimated percentage casting a provisional ballot among those who had previously voted in Ohio has very little uncertainty, however, so it is much more likely than not that the percentage is substantially smaller in this group.

The message about mobility is further conveyed by the estimated percentage casting a provisional ballot among those who said they had previously voted in Ohio but had moved since the last time they voted. Fifteen percent of those who said they had previously voted in Ohio said they had since moved. Among those movers, 11.4 percent cast a provisional ballot, compared to just 1.7 percent of those who said they had not moved since the last time they voted. The estimated percentage casting a provisional ballot among the movers is again somewhat uncertain. The 95% confidence interval ranges from 7.0 percent to 15.8 percent. But the percentage is clearly larger than the percentage among those who did not move.

If we focus on the point estimates for the percentage casting a provisional ballot among those

who said they had not previously voted in Ohio and those who said they had moved since they last voted in Ohio, it appears that more than 60 percent of the provisional ballots can be accounted for. If 9.4 percent of the first-time voters cast a provisional ballot and 11.4 of those who had moved cast a provisional ballot, that would imply that at least 2.2 percent of voters overall cast a provisional ballot.[5] Recall that among all voters in Cuyahoga County, 3.5 percent cast a provisional ballot. The provisionals associated with the foregoing measures of residential mobility would therefore account for 63 percent of all provisional ballots in the county.

Another indicator supporting the importance of residential mobility in explaining why voters cast provisional ballots is the percentage casting a provisional ballot among those who said they had not previously voted at the polling place where they voted in November 2004. Of the 19.4 percent of voters who said they had not previously voted at the November 2004 polling place, 11.2 percent are estimated to have cast a provisional ballot. The 95% confidence interval for that estimate ranges from 7.3 percent to 15.1 percent. Only 1.7 percent of those who said they had previously voted at the November 2004 polling place cast a provisional ballot. Subtracting the 7.3 percent of voters who said they had not previously voted in Ohio from the 19.4 percent who said they had not previously voted in the November polling place leaves 12.1 percent of voters having previously voted in Ohio but not in the November polling place. That number is close to the percentage of voters who said they had previously voted in Ohio but had since moved, which is 13.4 percent. The excess in the latter number may be accounted for by people who moved but remained within the same polling place boundaries.

Yet more indications of the importance of residential mobility come from other questions that relate to the permanence of each voter's residence. An estimated 9.1 percent of those who said they have lived at their current address less than five years cast a provisional ballot, but only 1.3 percent of those who have lived at their current residence more than five years cast a provisional ballot. Of those who said they rent their home, 5.7 percent are estimated to have cast a provisional ballot, but only 2.7 percent of those who own their home cast a provisional ballot.

Probably not all the voters who said they had never voted in Ohio were new Ohio residents. It is difficult to separate those who moved from those who were already resident in Ohio but were newly mobilized to vote in the 2004 election. Of those who said they were not registered to vote in their county before the presidential election and registered in order to vote in it, an estimated 26.5 percent cast a provisional ballot. Because only three percent of voters said they had newly registered in that way, the 95% confidence interval for that estimate is large, ranging from 14.3 percent to 38.7 percent. But even the lower bound of the interval is vastly higher than the estimated 2.5 percent (plus or minus 0.2 percent) of those who said they were already registered who cast a provisional ballot. Those who newly registered to vote in November 2004 are an undetermined mix of movers and newly mobilized voters.

Table 2 shows that the actions people took when voting were somewhat related to their chances of casting a provisional ballot, but the experience they had when trying to vote was strongly related to those chances. Of those who had requested an absentee ballot, 2.4 percent (plus or minus 1.0 percent) cast a provisional ballot, a number significantly lower than the percentage (3.4 percent, plus or minus 0.3 percent) casting a provisional ballot among those who did not request an absentee ballot. Neither voters' presidential candidate choices nor their reported partisan tendencies were associated with casting a provisional ballot. Among Kerry

[5]The calculation is $.094(7.3) + .114(.15)(89.6) = 2.21836$.

Table 2: Provisional Ballots and Election Experiences

Attributes	Percent Provisional	Confidence (+ or –)	Percentage of Voters
Requested Absentee Ballot	2.4	1.0	17.2
No Absentee Ballot	3.7	0.3	82.4
Voted for Kerry	4.2	0.6	51.4
Voted for Bush	4.1	1.4	23.3
Party Identification: Democrat	3.7	0.6	53.3
Party Identification: Republican	4.9	1.9	16.8
Party Identification: Other	2.5	1.0	16.6
Identification Request: Had ID	7.9	1.6	31.5
Identification Request: Not Asked	1.4	0.3	59.1
Registration Questioned	19.2	4.6	9.8
Registration Not Questioned	1.9	0.2	80.1

voters, 4.2 percent cast a provisional ballot, and among Bush voters 4.1 percent cast a provisional ballot. There is no statistically significant difference between the percentage of Democratic party identifiers who cast a provisional ballot and the percentage of Republican party identifiers who did so.

Voters who had their right to vote questioned when they appeared at the polls were much more likely to end up casting a provisional ballot. 7.9 percent (plus or minus 1.6 percent) of those who were asked to provide identification at the registration table at their polling place cast a provisional ballot, compared to 1.4 percent (plus or minus 0.3 percent) of those who were not asked for identification. Of those who had their registration questioned at the registration table, 19.2 percent (plus or minus 4.6 percent) cast a provisional ballot, versus 1.9 percent (plus or minus 0.2 percent) of those who did not have their registration questioned. Most likely these percentages do not measure causes for someone to cast a provisional ballot, but instead they represent part of the process of being directed to cast such a ballot.

Table 3 shows that some but not all of the personal attributes of voters that are often found to be related to political activity are related to the frequency of casting provisional ballots. Substantial differences in the frequency of casting a provisional ballot occur across age groups. Older voters are less likely to cast a provisional ballot. Eleven percent (plus or minus 5.1 percent) of voters 34 years of age or younger cast a provisional ballot, while only 5.3 percent (plus or minus 1.6 percent) of voters aged 35–55 years did so. Only 1.6 percent (plus or minus 0.4 percent) of voters aged 55 years or older cast a provisional ballot.

On the whole, voters who identify themselves as African American may be more likely to cast a provisional ballot than are voters who identify themselves as white, but the difference between the two groups is not statistically significant. 3.5 percent (plus or minus 0.5 percent) of white voters cast a provisional ballot, while 4.1 percent (plus or minus 1.0 percent) of African American voters did so. The uncertainty in the estimated percentage for African Americans is such that the 95% confidence interval for that estimate includes most of the 95% confidence interval of the estimated percentage for white voters, but the upper bound of the 95% confidence interval for

Table 3: Provisional Ballots and Personal Attributes

Attributes	Percent Provisional	Confidence (+ or –)	Percentage of Voters
Age: 34 Years or Younger	11.0	5.1	8.7
Age: 35-55 Years	5.3	1.6	28.3
Age: 55 Years or Older	1.6	0.4	52.1
White	3.5	0.5	54.8
African American	4.1	1.0	29.7
Male	3.2	0.7	48.7
Female	3.8	0.5	51.3
Voter is Union Member	3.0	1.4	10.1
Union Member in Household	3.8	2.7	5.9
No Union Member in Household	3.7	0.4	76.9
Education: High School or Less	3.4	0.7	43.5
Education: Some College	3.9	1.2	23.2
Education: College Graduate	4.4	1.5	18.6
Education: Post-graduate	2.9	1.8	9.3
Marital Status: Married	3.8	0.8	38.2
Marital Status: Not Married	3.6	0.5	55.5
Income: $20K or Less	4.4	1.3	17.8
Income: $20-40K	3.8	1.2	22.3
Income: $40-60K	4.9	2.8	10.2
Income: $60K or More	5.1	1.8	16.0
Income: Not Ascertained	1.7	0.5	33.7

white voters is less than the point estimate for African American voters. The estimated difference between the percentages (0.5) is slightly smaller than the estimated standard error of the difference (0.6).

Likewise, female voters may be more likely to cast a provisional ballot than male voters are, but the statistical significance of the difference is questionable. 3.8 percent (plus or minus 0.5 percent) of female voters cast a provisional ballot, while only 3.2 percent (plus or minus 0.7 percent) of male voters did so. The estimated difference between the percentages (0.5) is slightly larger than the estimated standard error of the difference (0.4).

Only one other statistically significant difference in the percentage casting provisional ballots occurs across the other groups shown in Table 3. There are no statistically significant differences associated with union membership, education, marital status or measured income.[6] Those for whom income was not ascertained were much less likely to cast a provisional ballot. Among those voters, 1.7 percent (plus or minus 0.5 percent) cast a provisional ballot, while among voters who responded to the income survey item the estimates range from 3.8 percent to 5.1 percent

[6]Within the group of unmarried voters, those who said they were widowed had a substantially lower frequency (1.4 percent, plus or minus 0.5 percent) of casting a provisional ballot. Presumably this difference is a reflection of older voters being less likely to cast a provisional ballot.

Table 4: Provisional Ballots, Personal Attributes and Residential Mobility

Attributes	Percent Provisional	Confidence (+ or –)
Ever Voted in Ohio? Yes: White	3.0	0.4
Ever Voted in Ohio? Yes: African American	3.9	1.0
Moved? Yes: White	8.8	4.4
Moved? Yes: African American	16.2	9.1
Moved? No: White	1.6	0.4
Moved? No: African American	2.1	0.7
Ever Voted in Ohio? Yes: Age 34 or Under	10.3	4.6
Ever Voted in Ohio? Yes: Age 35–54	5.1	1.6
Ever Voted in Ohio? Yes: Age 55 or Over	1.5	0.4
Moved? Yes: Age 34 or Under	19.6	13.1
Moved? Yes: Age 35–54	9.4	6.3
Moved? Yes: Age 55 or Over	9.8	5.1
Moved? No: Age 34 or Under	5.2	3.5
Moved? No: Age 35–54	3.4	1.3
Moved? No: Age 55 or Over	0.8	0.3

casting a provisional ballot.

Table 4 shows that the difference between African American voters and white voters in the probability of casting a provisional ballot becomes statistically significant when residential mobility is taken into account. When only voters who said they had previously voted in Ohio are considered, 3.9 percent (plus or minus 1.0 percent) of African American voters cast a provisional ballot while 3.0 percent (plus or minus 0.4) percent of white voters did so. When these previous Ohio voters are separated into those who said they had moved since the last time they voted and those who said they had not moved, the percent casting a provisional ballot is 16.2 (plus or minus 9.1 percent) among African American movers, 8.8 (plus or minus 4.4 percent) among white movers, 2.1 (plus or minus 0.7 percent) among African American nonmovers and 1.6 (plus or minus 0.4 percent) among white nonmovers. For all of these percentages the point estimate among African American voters is greater than the corresponding point estimate among white voters, and the estimated differences between the percentages (0.9, 7.4 and 0.5) are larger than their estimated standard errors (0.5, 5.2 and 0.4). But only the first two differences are statistically significant, at a 90 percent level (one-tailed). The sharpest thing to say is that there is a significant difference between African Americans and whites who previously voted but since moved, but not between African Americans and whites who previously voted but did not move. Comparing the point estimates between African Americans who moved and whites who moved shows the extra risk for African Americans of casting a provisional ballot is substantial. Among those who previously voted in Ohio but since moved, African American voters are 1.8 times more likely to cast a provisional ballot than white voters are.

In contrast, Table 4 shows there is no statistically significant difference in the probability of casting a provisional ballot between the oldest voters and middle-aged voters who moved since

the last time they voted in Ohio. Among movers, 9.4 percent (plus or minus 6.3 percent) of voters aged 35–54 cast a provisional ballot, while 9.8 percent (plus or minus 5.1 percent) of voters 55 or older did so. The 95% confidence intervals for these estimates substantially overlap. 19.6 percent (plus or minus 13.1 percent) of voters younger than 35 who moved cast a provisional ballot. The 95% confidence interval for this youngest group includes the point estimates for the older voters, but the upper bound of the 95% confidence intervals for the older voters is less than the point estimate for the youngest voters. The differences between the youngest group of movers and the two older groups are statistically significant at a 90 percent level (one-tailed). The difference between the oldest voters and the others persists in the group of voters who previously voted in Ohio and did not move since then. Among nonmovers, 5.2 percent (plus or minus 3.5 percent) of voters younger than 35 and 3.4 percent (plus or minus 1.3 percent) of voters aged 35–54 cast a provisional ballot, while 0.8 percent (plus or minus 0.3 percent) of voters 55 or older did so.

Technical Appendix

The survey consists of two samples from Cuyahoga County, one of voters who cast provisional ballots (henceforth "provisionals") and one of voters who did not. The provisionals are sampled from a list that contains all people who cast a provisional ballot. The voters are sampled from voters in the same local areas as the provisionals included in that sample: one voter is sampled from a local area for every provisional included in the sample who is from that local area. The local areas in practice are zip-code areas. Nonprovisional voter matches were found in 12 zip-9 areas, 135 zip-8 areas, 224 zip-7 areas, eight zip-6 areas, seven zip-5 areas and two zip-4 areas. For brevity I refer to each area simply as a zipcode. In thirteen instances two nonprovisional voters were sampled from the same zipcode. Each sample has size $n = 400$.

The goal is to estimate the conditional distribution of casting a provisional ballot with respect to various variables that were measured in the survey instruments used with each sample. This note sketches how to do that, given the matched sample design.

Let y denote the event "cast a provisional ballot" and let $\neg y$ denote the event "cast a nonprovisional ballot." Let p_y denote the probability of y and let $p_{y|x}$ denote the conditional probability of y given x. Let N denote the total number of voters turning out to vote in Cuyahoga County, with N_y being the number of provisionals and $N_{\neg y}$ being the number of nonprovisionals, $N = N_y + N_{\neg y}$. The sample of provisionals is S_y and the sample of nonprovisionals is $S_{\neg y}$, with respective sample sizes n_y and $n_{\neg y}$. The probability that individuals are included in the nonprovisional sample varies from person to person because for the matched sample the number of voters in each zipcode varies. The inclusion probability for provisional voter i is denoted π_i and the inclusion probability for voter i in the matched sample is denoted ν_i. For the provisional sample I assume simple random sampling without replacement, ignoring any phone number matching problems and complications related to getting respondents on the phone. Given the sample sizes $n_y = n_{\neg y} = 400$ and assuming equal probabilities of inclusion for all provisionals, the sampling fraction from the provisional population is $\pi_i = f_y = n_y/N_y$.

I make the simplifying assumption that everyone in the first sample cast a provisional ballot while no one in the second sample did. In fact, some respondents in the first sample deny that they cast a provisional ballot. They may be mistaken, or the telephone methodology may have reached the wrong person. The assumption about voters in the second sample seems to be close to correct.

For various attributes x, the goal is to estimate the proportion of voters who have x who cast a provisional ballot. Using N_{xy} to denote the number of voters who have x who cast a provisional ballot and $N_{x\neg y}$ to denote the number of voters who have x who did not cast a provisional ballot and $N_x = N_{xy} + N_{x\neg y}$ to denote the number of voters with x, the proportion of interest may be written $p_{y|x} = N_{xy}/N_x$. Neither N_{xy}, N_{negy} nor N_x is known, but if x is measured in the surveys the totals may be estimated using the survey data. Using $x_{yi} = 1$ if provisional voter i has attribute x and $x_{yi} = 0$ if not, Horvitz-Thompson estimators (stabilized for $\tilde{N}_{x\neg y}$) for the totals may be written

$$\tilde{N}_{xy} = \sum_{i=1}^{n_y} \frac{x_{yi}}{\pi_i}\,, \qquad \tilde{N}_{x\neg y} = N_{\neg y}\left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j}\right)^{-1} \sum_{j=1}^{n_{\neg y}} \frac{x_{\neg yj}}{\nu_j}\,, \qquad \tilde{N}_x = \tilde{N}_{xy} + \tilde{N}_{x\neg y}\,.$$

A natural estimator for the proportion of interest is then

$$\tilde{p}_{y|x} = \tilde{N}_{xy}/(\tilde{N}_{xy} + \tilde{N}_{x\neg y})\,.$$

Likewise, the estimator for $p_{\neg y|x}$ is

$$\tilde{p}_{\neg y|x} = \tilde{N}_{x\neg y}/(\tilde{N}_{xy} + \tilde{N}_{x\neg y}) = 1 - \tilde{p}_{y|x}\,.$$

A straightforward way to estimate the sampling variance of $\tilde{p}_{y|x}$ is to use Taylor linearization (Särndal, Swensson and Wretman 1992, 172–181; Wolter 1985, 221–225). First obtain the partial derivatives of $\tilde{p}_{y|x}$ with respect to $\tilde{N}_{xy}$ and $\tilde{N}_{x\neg y}$:

$$\frac{\partial \tilde{p}_{y|x}}{\partial \tilde{N}_{xy}} = \frac{\tilde{N}_{x\neg y}}{(\tilde{N}_{xy} + \tilde{N}_{x\neg y})^2}\,; \qquad \frac{\partial \tilde{p}_{y|x}}{\partial \tilde{N}_{x\neg y}} = -\frac{\tilde{N}_{xy}}{(\tilde{N}_{xy} + \tilde{N}_{x\neg y})^2}\,,$$

so that given estimators $\hat{V}(\tilde{N}_{xy})$ and $\hat{V}(\tilde{N}_{x\neg y})$ for the variance of each estimated total and a estimator $\widehat{cov}(\tilde{N}_{xy}, \tilde{N}_{x\neg y})$ for their covariance, a variance estimator for $\tilde{p}_{y|x}$ is

$$\begin{aligned}\hat{V}(\tilde{p}_{y|x}) = {} & \left(\frac{1 - \tilde{p}_{y|x}}{\tilde{N}_{xy} + \tilde{N}_{x\neg y}}\right)^2 \hat{V}(\tilde{N}_{xy}) + \left(\frac{\tilde{p}_{y|x}}{\tilde{N}_{xy} + \tilde{N}_{x\neg y}}\right)^2 \hat{V}(\tilde{N}_{x\neg y}) \\ & - 2\frac{\tilde{p}_{y|x}(1 - \tilde{p}_{y|x})}{(\tilde{N}_{xy} + \tilde{N}_{x\neg y})^2}\widehat{cov}(\tilde{N}_{xy}, \tilde{N}_{x\neg y})\,.\end{aligned}$$

Assuming simple random sampling among the provisionals we have

$$\hat{V}(\tilde{N}_{xy}) = N_y^2 \frac{1 - f_y}{n_y}\hat{s}_{yx}^2\,, \qquad \hat{s}_{yx}^2 = \sum_{i=1}^{n_y} \frac{(x_{yi} - \tilde{N}_{xy}/N_y)^2}{n_y - 1}\,.$$

The fact that the sample of nonprovisionals is matched to the realized sample of provisionals makes derivation of $\hat{V}(\tilde{N}_{x\neg y})$ and $\widehat{cov}(\tilde{N}_{xy}, \tilde{N}_{x\neg y})$ more complicated.

The probability that $j \in S_{\neg y}$, denoted ν_j, depends on S_y. If j is any nonprovisional voter, then $j \notin S_{\neg y}$ if j is not in the same zipcode as a provisional voter $i \in S_y$. Given S_y, the probability that $j \in S_{\neg y}$ depends on the number of voters in the zipcode of the corresponding provisional voter $i \in S_y$. Let $\nu_{j|S_y}$ denote that conditional probability. Let d_j denote the zipcode of voter j, and let $N_{\neg y d_j}$ denote the number of voters in that zipcode. If there are $n_{y d_j}$ provisionals in S_y from zipcode d_j, then

$$\nu_{j|S_y} = \frac{n_{y d_i}}{N_{\neg y d_j}}\,.$$

Using the fact that each $j \in S_{\neg y}$ is matched to one $i \in S_y$, we have

$$\nu_j = \frac{f_y}{N_{\neg y d_j}}\,.$$

Now using the joint inclusion probabilities[7]

$$\nu_{jk} = \begin{cases} \nu_j \nu_k & \text{if } j \neq k\,, \\ \nu_j & \text{if } j = k\,, \end{cases}$$

[7]This definition of the joint inclusion probabilties ignores the complications associated with the 13 instances where two nonprovisionals were in the same zipcode, as well as the complications due to matches being done in nested zipcode areas (e.g., one match occurring in zip-8 area 44040960 and another in zip-5 area 44040). Ignoring the nested zipcodes, which occur frequently in the sample, probably means the computed estimate $\widehat{cov}(\tilde{N}_{xy}, \tilde{N}_{x\neg y})$ is too small. Because that covariance is usually positive, the reported sampling variances may be slightly too large.

we have the stabilized estimator

$$\hat{V}(\tilde{N}_{x\neg y}) = N_{\neg y}^2 \left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j} \right)^{-2} \sum_{j=1}^{n_{\neg y}} (1-\nu_j) \left(\frac{x_{\neg yj}}{\nu_j} \right)^2 .$$

If j is matched to i then the joint inclusion probability for i and j is ν_j, otherwise it is $f_y \nu_j$. Let $i:j$ indicate the i that is matched to j. The stabilized covariance estimator is

$$\widehat{cov}(\tilde{N}_{xy}, \tilde{N}_{x\neg y}) = N_{\neg y} \left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j} \right)^{-1} \sum_{j=1}^{n_{\neg y}} (1-\pi_{i:j}) \frac{x_{yi:j}}{\pi_{i:j}} \frac{x_{\neg yj}}{\nu_j}$$

The variance estimator for $\tilde{p}_{y|x}$ is

$$\begin{aligned}
\hat{V}(\tilde{p}_{y|x}) = & \left(\frac{1-\tilde{p}_{y|x}}{\tilde{N}_{xy}+\tilde{N}_{x\neg y}} \right)^2 N_y^2 \frac{1-f_y}{n_y} \hat{s}_{yx}^2 \\
& + \left(\frac{\tilde{p}_{y|x}}{\tilde{N}_{xy}+\tilde{N}_{x\neg y}} \right)^2 N_{\neg y}^2 \left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j} \right)^{-2} \sum_{j=1}^{n_{\neg y}} (1-\nu_j) \left(\frac{x_{\neg yj}}{\nu_j} \right)^2 \\
& - 2 \frac{\tilde{p}_{y|x}(1-\tilde{p}_{y|x})}{(\tilde{N}_{xy}+\tilde{N}_{x\neg y})^2} N_{\neg y} \left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j} \right)^{-1} \sum_{j=1}^{n_{\neg y}} (1-\pi_{i:j}) \frac{x_{yi:j}}{\pi_{i:j}} \frac{x_{\neg yj}}{\nu_j} \\
= & \frac{1}{(\tilde{N}_{xy}+\tilde{N}_{x\neg y})^2} \left[\frac{(1-\tilde{p}_{y|x})^2 N_y^2 (1-f_y)}{n_y} \sum_{i=1}^{n_y} \frac{(x_{yi} - \tilde{N}_{xy}/N_y)^2}{n_y - 1} \right. \\
& + \tilde{p}_{y|x}^2 N_{\neg y}^2 \left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j} \right)^{-2} \sum_{j=1}^{n_{\neg y}} (1-\nu_j) \left(\frac{x_{\neg yj}}{\nu_j} \right)^2 \\
& \left. - \frac{2\tilde{p}_{y|x}(1-\tilde{p}_{y|x})(1-f_y)}{f_y} N_{\neg y} \left(\sum_{j=1}^{n_{\neg y}} \frac{1}{\nu_j} \right)^{-1} \sum_{j=1}^{n_{\neg y}} \frac{x_{yi:j} x_{\neg yj}}{\nu_j} \right] .
\end{aligned}$$

Values for the constants used in the estimators are in Table 5.

Table 5: Useful Constants

N	$695357 = 687260 + 8097$
N_y	24463
$N_{\neg y}$	$670894 = 687260 - 16366$
f_y	$0.016351224 = 400/24463$

Sources: N, 687260 is "BALLOTS CAST TOTAL" from `110204_GE_Canvass.txt`, (RUN DATE:02/28/05 11:45 AM), and 8,097 is the total number of all rejected provisional ballots from file `rejected & ok provisionals 04.pdf`; N_y, "Total" from file `rejected & ok provisionals 04.pdf`; 16,366 is the number of "OK" and "OKNTR" ballots from the file `rejected & ok provisionals 04.pdf`.

References

Särndal, Carl-Erik, Bengt Swensson, and Jan Wretman. 1992. *Model Assisted Survey Sampling*. New York: Springer-Verlag.

Wolter, Kirk M. 1985. *Introduction to Variance Estimation*. New York: Springer-Verlag.

Democracy at Risk: The 2004 Election in Ohio

Section VI
Turnout, Residual Votes and Votes in Precincts and Wards

Ohio 2004 Election: Turnout, Residual Votes and Votes in Precincts and Wards

Walter R. Mebane, Jr., and Michael C. Herron

June 9, 2005

During the first five months of 2005, the DNC Ohio 2004 Investigative Project collected extensive data from precincts throughout Ohio. Eric Greenwald spearheaded the data collection effort. The effort produced a combination of electronic spreadsheet files and many PDF files containing images from faxes of scanned documents. The most important spreadsheet was a file produced by the Ohio Secretary of State office that reported registered voter counts, counts of votes cast and voting returns for precincts from all Ohio counties. The image documents needed to be converted into spreadsheet format in order to be merged with the other data. Matthew Rado performed this work. Michael Herron was responsible for merging all the files in a comprehensive precinct-level database. That task was made difficult especially by a proliferation of naming conventions Boards of Elections (BoEs) used to refer to precincts. Herron hired an assistant to help with that name reconciliation task. Along the way there were also numerous ambiguities, errors and inconsistencies in the files provided by the county BoEs that especially Greenwald and Herron worked to resolve.

This report reviews the most important patterns we have uncovered in the precinct data as of this writing. We begin by summarizing the principal findings. Then we present explanations for the series of figures and tables that are computed from the data and presented in the latter part of this report. The figures and tables are intended to be viewed in order, and the discussion of them builds a story from beginning to end. The discussion there is organized in three phases: first, getting to the polls (voter turnout); second, getting one's vote to count (residual votes); third, getting one's preferences for a candidate accurately recorded (vote choices). Appendices included at the end of this report briefly describe the data and the statistical tools used to perform and report the analysis.

Summary of Principal Findings

1. Problems with election administration seriously affected the 2004 election. Not providing a sufficient number of voting machines in each precinct was associated with roughly a two to three percent reduction in voter turnout presumably due to delays that deterred many people from voting. The inferior voting machine technology used in most places throughout the state (punchcard machines instead of precinct-tabulated optical scan machines) was associated with an additional one percent of votes that were cast not being counted.

2. Increases in voter turnout above the rates expected based on the 2002 general election were strongly associated with the proportion voting Yes on Issue 1 (opposing gay marriage). Typical increases associated with support for Issue 1 range from a low of about one-half percent among precincts in Cuyahoga County and other counties using punchcard voting machine technology (except Hamilton County), to more than one percent in precincts in Hamilton County and in counties using centrally tabulated optical scan voting machine technology or direct record electronic (DRE) machines (except Franklin county), up to two percent or more in Allen, Franklin and Lucas counties. Support for Issue 1 mobilized many people to vote who may not have done so otherwise.

3. Strong similarities at the precinct level between the vote for Kerry (instead of Bush) in 2004 and the vote for the Democratic candidate for governor in 2002 (Hagan) present strong evidence against the claim that widespread fraud systematically misallocated votes from Kerry to Bush. In most counties we also observe the pattern we expect in the relationship between Kerry's support and other precinct-level factors: Kerry's support across precincts increases with the support for the Democratic candidate for Senator in 2004 (Fingerhut), decreases with the support for Issue 1 and increases with the proportion African American. Only in Cuyahoga County is the relationship between Kerry's vote and the support for Issue 1 significantly unusual.

4. If increases in registration reflect voter mobilization efforts, then mobilization tended to help Kerry in all the places included in this analysis except in precincts using precinct-tabulated optical scan machines (which are all in Allen County). But if increases in voter turnout are the standard for measuring mobilization efforts, then Kerry does not come off so well. Over all precincts and wards in the analysis, the proportion voting for Kerry decreases as turnout in 2004 increases, even when turnout in the 2002 election is taken into account. This suggests that voter mobilization efforts focused on turnout on balance hurt Kerry, at least if one takes 2002 as the baseline.

5. Changes in registration in a precinct are for the most part positively but weakly related to changes in turnout: for the most part, a proportional increase in registration means an increase in voter turnout. One interpretation is that in these precincts new registrants tend to be somewhat more likely to vote than previous registrants were. The exception occurs among precincts using precinct-tabulated optical scan machines, where a proportional increase in registration means a decrease in voter turnout.

6. The presidential residual vote rate (here defined as the fraction of ballots without a vote for either Bush, Kerry, Bedarnik or Peroutka) is inversely related to the number of voting machines per registered voter in both DRE precincts and precincts using precinct-tabulated optical scan machines: more machines meant a lower residual vote rate. The mechanism that most likely produces this effect is easy to understand: with fewer machines per voter, polling places become more crowded and voters are less likely to take the time to check or correct their ballots.

Explanation and Interpretation of Each Figure and Table

Table 1: This shows the Ohio counties that used each of four kinds of voting machine technology in the 2004 general election. Four machine technologies were used in Ohio in 2004: direct record electronic (DRE) or touchscreen machines; centrally tabulated optical scan machines; precinct-tabulated optical scan machines (used in only Allen County); and punchcards. The distinction between centrally tabulated and precinct-tabulated optical scan machines is that the latter allow what is known as "second chance voting," i.e., the opportunity for a voter to review the ballot if, after inserting it in a counting machine, the voter is made aware of problems in it.

Figure 1: This shows the distribution of voter turnout (number of votes cast divided by number of registered voters) across Ohio precincts by voting machine technology. Each boxplot shows the distribution for one of the technologies. As in all the figures in this report in which the

"Punchcard" category appears along with "Punchcard Cuyahoga" and "Punchcard Hamilton" categories, the set of "Punchcard" precincts excludes the precincts in Cuyahoga and Hamilton counties, which are reported separately. Turnout tends to be lowest in Cuyahoga and DRE precincts and highest in Hamilton and Optical Central precincts. Turnout in Punchcard precincts is typically about as high as in Optical Central precincts, but numerous Punchcard precincts have unusually low turnout. Optical Precinct precincts typically have turnout slightly higher than DRE precincts. *It is unlikely that the type of voting machine technology is in itself a reason for the median level of turnout in a county.* For instance, contrast Cuyahoga and Hamilton counties.

Table 2: This shows the Ohio counties (79 of them) for which we have specific information about the number of voting machines used in each precinct in the 2004 general election.

Table 3: This reports robust estimates of an overdispersed binomial regression model that has voter turnout depending on both the type of voting technology and the number of voting machines per registered voter in each precinct. The model is estimated separately for the precincts in each voting machine technology category, hence the interecept parameter measures the overall mean level of turnout among precincts in each category. The model also includes a parameter to measure the effect the ratio of voting machines to the number of registered voters has on turnout. Using MV to denote the voting machines per registered voter ratio
$\text{MV} = (\text{voting machines})/(\text{registered voters})$, a linear predictor for precinct i may be written as follows:

$$Z_i = b_0 + b_1 \text{MV}_i \ .$$

The fact that the estimate for b_1 is $\hat{b}_1 = 113$ for DRE precincts and is $\hat{b}_1 = 149$ for Hamilton precincts indicates a substantial dependence between the machine/voter ratio and voter turnout in those precincts: where the number of voting machines per person is higher, voter turnout tends to be higher. For Optical Central and Punchcard precincts there is also a significant albeit smaller positive relationship between the machine/voter ratio and voter turnout. For Cuyahoga and Optical Precinct precincts the relationship is small and negative, although the estimate is not statistically significant in the latter case. The display at the bottom of Table 3 illustrates the magnitude of these effects by computing expected turnout rates for precincts at the first quartile, the median and the third quartile of the MV values for precincts using each type of technology. *Moving from the first to the third quartile of the voting machines per registered voter ratio is associated with an increase of about 3.6 percent in voter turnout among DRE precincts, 2.5 percent among Hamilton precincts, two perceent among Punchcard precincts and 0.7 percent among Optical Central precincts.* Among Optical Precinct and Cuyahoga precincts the expected turnout rate declines by small amounts when moving in this simulated way from the first to the third quartile. *The key result here supports the claim that a scarcity of voting machines caused delays (i.e., long lines) that deterred many people from voting. The effect of the number of voting machines per registered voter is especially pronounced in precincts that used DRE technology (e.g., in Franklin County) and in Hamilton County.* The results are also compatible with an alternative explanation, however, which is that BoEs allocated machines to precincts in relationship to their expectations regarding voter turnout and those expectations tended to be accurate at least in terms of the differences in turnout between precincts. We try to assess this alternative explanation below. It is well known, however, that long lines and long waits characterized voters' experiences at many polling places in Ohio in 2004, and that BoEs did not do a uniformly good job anticipating voter turnout. Even though we lack data to be able to

measure the time it took to vote in each precinct, it is unreasonable to believe that all of the relationships shown here reflect the success of prior administrative plans. Instead the estimated relationships between the number of voting machines per registered voter and voter turnout reflect widespread administrative failures on election day in 2004.

Table 4: This lists the outlier precincts identified in the analysis reported in Table 3. Listed are the county name, the state precinct code and the studentized residual for each precinct that ultimately received zero weight in that analysis. The table groups the outlier precincts by the kind of voting machine technology used in each one. All the outliers have negative residuals, meaning that they all have observered voter turnout much lower than expected based on the technology and the number of voting machines per registered voter. A substantial number of precincts in Butler County (11 of 288 precincts) have observed voter turnout much lower than expected.

Table 5: This shows the Ohio counties that contained precincts that had the same boundaries in both the 2002 and 2004 elections. Overall, 5,423 precincts had constant boundaries between the two elections. The determination that a precinct's boundaries did not change is not perfectly reliable. In most cases we relied on reports from BoE officials about which precincts had changed, supplemented by plausibility checks conducted using voter registration data. We found that the reports from BoE officials were often mistaken, sometimes revised in response to our queries. Surely the data still include errors. For Cuyahoga County the constant-boundary determination was based not on official reports but on direct comparisons between the shapefiles for the precincts used in the 2002 and 2004 elections.

Table 6: This shows the Ohio counties containing precincts with constant boundaries between 2002 and 2004 for which we were able to obtain specific information about the number of voting machines used in each precinct in the 2004 general election.

Table 7: This shows results from a Poisson regression analysis of the number of voting machines in each precinct. The purpose is to address the argument that a relationship exists between voter turnout and the number of voting machines per registered voter because BoEs allocate more voter machines to precincts where they expect turnout to be higher. In this Poisson regression the number of voting machines in each precinct is specified to depend on two variables: the number of voters registered in the precinct in 2004; and the rate of voter turnout in the precinct in the 2002 general election. The Poisson regression specifies that the expected number of machines is an exponential function of a linear function of the regressors. Let RV2004 denote the number of registered voters in 2004 and let NV2002 denote the number of votes cast in 2002 (this model fits the data better than one that uses the 2002 voter turnout rate for the second regressor). The Poisson regression specifies

$$\text{Expected number of machines}_i = \exp(a_0 + a_1 \log(\text{RV2004}_i) + a_2 \log(\text{NV2002}_i)) \ ,$$

where a_0, a_1 and a_2 are unknown coefficients to be estimated. If the number of machines in a precinct tends to be proportional to the number of registered voters, then $a_0 < 0$, $a_1 = 1$ and $a_2 = 0$. If the expected number of machines in a precinct is higher given that turnout in 2002 was higher, then $a_2 > 0$. The analysis is restricted to precincts that had the same boundaries in both the 2002 and 2004 elections. No results appear in Table 7 for the Optical Precinct precincts, even though Allen County precinct boundaries were constant, because every precinct in Allen County had three machines. In no case does the estimate for a_1 equal 1.0, but the estimate is large and positive for Punchcard, Cuyahoga and Hamilton precincts. The estimate for a_1 is positive but

small and statistically insignificant for DRE precincts (note that these are only Mahoning County precincts). *In all these punchcard and DRE cases, the results indicate that the expected number of voting machines in a precinct tended to increase with the number of voters registered for the 2004 election, although the increase was less than proportional. Oddly, for Optical Central precincts the number of voting machines tends to decrease as the number of registered voters increases.* For DRE, Punchcard and Hamilton precincts the results also show that the expected number of voting machines in a precinct tended to increase with the number of votes cast in the 2002 general election. Oddly, among Cuyahoga precincts the expected number of voting machines tends to decrease as the number of votes cast in 2002 increases. *There is clear evidence that the allocation of machines among DRE, Punchcard and Hamilton precincts depends on the number of votes cast in the previous general election: more votes in a precinct in the previous election means more machines. In Cuyahoga, weirdly, the relationship is reversed: more votes in a precinct in the previous election means fewer machines.* A weakness in this analysis is that we lack data about the previous election results in Franklin County, where most of the DRE precincts in Table 3's analysis are located. Precincts with constant boundaries were lacking there. The fact that the number of machines increased with the votes cast in the previous election in Mahoning County tells us nothing about the situation in Franklin County.

Figures 2 and 3: These show that voter turnout is higher in precincts in which a lower proportion of the population is African American. It makes sense to take the relationship between race and voter turnout into account.

Table 8: This reports robust estimates of an overdispersed binomial regression model that has voter turnout depending on the type of voting technology, the number of voting machines per registered voter in each precinct and the proportion of the population in each precinct that is African American. The negative estimated coefficient shows that turnout is typically lower when the proportion African American is higher. But the results regarding voting machine technology and the number of voting machines per registered voter remain largely unchanged. *Even with the proportion African American taken into account, the results support the claim that a scarcity of voting machines caused delays that deterred many people from voting.* Using the estimated parameters to compute expected voter turnout when the proportion African American is fixed equal to the median value for that proportion among precincts that use the referent voting machine technology, moving from the first to the third quartile of the voting machines per registered voter ratio is associated with changes comparable to those reported in Table 3.

Table 9: This lists the outlier precincts identified in the analysis reported in Table 8. The list overlaps considerably with the list in Table 4.

Figure 4: This shows the distribution of voter turnout by voting machine technology across Ohio precincts that did not change boundaries between the 2002 general election and the 2004 general election. The picture is not all that different from Figure 1. This similarity is important because we will be looking at changes in turnout from 2002 to 2004, and it is reassuring that the subset of precincts that had constant boundaries is not grossly different from the set of all precincts.

Figure 5: This shows the distribution of voter turnout by voting machine technology across Ohio wards in four large counties. These wards did not change boundaries between the 2002 general election and the 2004 general election. As is the case with the precinct data, Hamilton wards are more similar to the Punchcard precincts with unchanged boundaries (which include Hamilton's precincts) than Cuyahoga wards are. Cuyahoga wards have substantially lower

turnout rates. Franklin wards have slightly lower turnout than the DRE precincts that have unchanged boundaries (all of which are in Mahoning County). Lucas wards have somewhat lower turnout than the Optical Central precincts that have unchanged boundaries.

Figure 6: This shows a scatterplot relating turnout in 2004 to turnout in the 2002 general election in precincts that had the same boundaries in both elections. The plot also shows the slope of the line produced by ordinary least squares regression of the 2004 turnout rate on the 2002 turnout rate. The positive slope of the line is not surprising, as we would expect the same precincts to have typically high or typically low turnout in different elections. *Turnout did not increase in every precinct throughout Ohio from 2002 to 2004. Several precincts show substantial drops in turnout.* In some cases these precincts include very small numbers of registered voters.

Figure 7: This shows a scatterplot relating turnout in 2004 to turnout in the 2002 general election in the selected wards that had the same boundaries in both elections, along with the ordinary least squares regression line. Unsurprisingly the slope of the line is positive. Turnout in 2004 is never lower than turnout in 2002.

Figure 8: This shows scatterplots relating turnout in 2004 to turnout in the 2002 general election in precincts that had the same boundaries in both elections, separating the precincts by the type of voting machine technology. In every case, turnout in 2004 is positively related to turnout in 2002. Among Optical Precinct, Punchcard and Cuyahoga precincts are several precincts that had higher turnout in 2002 than in 2004.

Figure 9: This shows scatterplots relating turnout in 2004 to turnout in the 2002 general election in the selected wards that had the same boundaries in both elections, separating the precincts by county. In every case, turnout in 2004 is positively related to turnout in 2002. Every ward has higher turnout in 2004 than in 2002. *The plots show clearly that at every level of 2002 turnout, wards in Hamilton and Lucas counties had higher 2004 turnout than did wards in Cuyahoga and Franklin counties.*

Table 10: This reports robust estimates of an overdispersed binomial regression model that has 2004 voter turnout depending on 2002 voter turnout. Estimates appear separately for technology groupings of the precincts that had the same boundaries in the two elections and for county groupings of the wards that had constant boundaries. Using V2002 to represent the rate of voter turnout in 2002, the linear predictor in the model may be written as follows:

$$Z_i = c_0 + c_1 \text{logit}(\text{V2002}_i)$$

(see the Appendix for an explanation of the logit function). If turnout in 2004 were the same as in 2002 except uniformly higher, then we would have $c_0 > 0$ and $c_1 = 1$ (the Appendix explains this). We already know from the scatterplots that that is not the pattern in these data. Indeed, the estimates for c_1 in Table 10 are positive but smaller than 1.0. Several precincts but no wards are outliers. *Turnout in 2002 is a good predictor but far from a perfect predictor of turnout in 2004.*

Table 11: This lists the outlier precincts identified in the analysis reported in Table 10. *Precinct outliers occur sporadically when turnout in 2002 is used to predict turnout in 2004. There are no ward outliers.*

Table 12: This reports robust estimates of an overdispersed binomial regression model that has 2004 voter turnout depending on 2002 voter turnout and the number of voting machines per registered voter. Estimates appear separately for technology groupings of the precincts that had the same boundaries in the two elections and for county groupings of the wards that had constant

boundaries. Using V2002 to represent the rate of voter turnout in 2002 and using MV to denote the voting machines per registered voter ratio MV $=$ (voting machines)/(registered voters), the linear predictor in the model may be written as follows:

$$Z_i = c_0 + c_1 \text{logit}(\text{V2002}_i) + c_2 \text{MV}_i$$

(see the Appendix for an explanation of the logit function). The estimator already adjusts turnout in each precinct for the number of voters registered to vote there in 2004, so this model represents one way to check whether the number of voting machines per registered voter has an effect on voter tunout independent of the efforts BoEs may undertake to allocated more voting machines to places where they expect voter turnout to be higher. This approach is far from perfect. For instance, the analysis produces the correct answer only if the relationship between turnout in 2002 and the allocation of voting machines in 2004 follows a particularly simple functional form (moreoever, not exactly the form used in the analysis reported in Table 7). *Caveats notwithstanding, the fact that the estimate for c_2 is statistically significant and positive for DRE, Punchcard and Hamilton precincts may further support a conclusion that a scarcity of voting machines caused delays in those places that deterred many people from voting. Net of the level of 2004 voter turnout expected based on voter turnout in 2002, there is no significant relationship between the number of voting machines per registered voter and 2004 voter turnout among Optical Precinct or Cuyahoga precincts. Weirdly, the net relationship between the number of voting machines per registered voter and 2004 voter turnout is negative among the Optical Central precincts in the analysis.*

Table 13: This lists the outlier precincts identified in the analysis reported in Table 12. The list of outliers is virtually the same as in the model that includes only the past voter turnout regressor. The turnout anomalies in these places seem to have little to do with the number of voting machines per registered voter.

Figure 10: This shows scatterplots relating the number of registered voters in 2004 to the number of registered voters in the 2002 general election in precincts that had the same boundaries in both elections, separating the precincts by the type of voting machine technology. The lines in this case are 45 degree lines, not regression lines. *Weirdness, defined as large reductions in the number of registered voters, occurs often among Optical Precinct (Allen County), Punchcard, Cuyahoga and Hamilton precincts.*

Figure 11: This shows scatterplots relating the number of registered voters in 2004 to the number of registered voters in the 2002 general election in the selected wards that had the same boundaries in both elections, separating the wards by county. The lines in this case are 45 degree lines, not regression lines. Only one ward in Franklin County shows a large reduction in the number of registered voters.

Figure 12: This shows scatterplots relating the change in turnout from 2002 to 2004 to the proportional change in voter registration from 2002 to 2004 in precincts that had the same boundaries in both elections, separating the precincts by the type of voting machine technology. The proportional change in registration is (RV2004 $-$ RV2002)/RV2002. The lines are the regression lines. *Changes in registration are for the most part positively but weakly related to changes in turnout: for the most part, a proportional increase in registration means an increase in voter turnout. One interpretation is that in these precincts new registrants tend to be somewhat more likely to vote than previous registrants were. The exception occurs among Optical Precinct precincts, where a proportional increase in registration means an decrease in voter turnout.*

Figure 13: This shows scatterplots relating the change in turnout from 2002 to 2004 to the proportional change in voter registration from 2002 to 2004 in the selected wards that had the same boundaries in both elections, separating the wards by county. The lines are the regression lines. *Among wards in Cuyahoga, Franklin, Hamilton and Lucas counties, a proportional increase in registration is associated with an increase in turnout, which suggests that in these wards new registrants tend to be more likely to vote than previous registrants were.*

Figure 14: This shows a scatterplot relating the proportion voting Yes on Issue 1 (opposing gay marriage) to 2004 voter turnout across all Ohio precincts. The line is the regression line. *Where a higher proportion of voters support Issue 1, turnout is higher.*

Figures 15 and 16: These show scatterplots relating the proportion voting Yes on Issue 1 (opposing gay marriage) to the change in voter turnout rates from 2002 to 2004 across all precincts that had the same boundaries in both elections, where both variables have been residualized by regressing each on 2002 turnout (each is regressed on 2002 turnout and the residuals from that regression are retained; these residuals appear in the scatterplots). This is one way to assess whether a higher proportion voting yes on Issue 1 in a precinct is associated with higher turnout in that precinct even when turnout in the previous election is taken into account. The line is the regression line. *Turnout in 2004 increases as support for Issue 1 increases, even when turnout in the 2002 election is taken into account. These results support the claim that support for Issue 1 mobilized some people to vote who may not have done so otherwise.*

Figures 17 and 18: These show scatterplots relating the proportion voting Yes on Issue 1 (opposing gay marriage) to the change in voter turnout rates from 2002 to 2004 across all precincts and selected wards that had the same boundaries in both elections, where both variables have been residualized by regressing each on 2002 turnout. Precincts are separated by the type of voting machine technology and the wards are separated by county. The lines are the regression lines. *For each subset of precincts grouped by voting machine technology, turnout in 2004 increases as support for Issue 1 increases, even when turnout in the 2002 election is taken into account. The relationship is extremely weak among wards in Cuyahoga County, but the analysis by precinct shows a relationship not much different from the one found in other places. It appears that Cuyahoga wards are internally heterogenoeous with respect to voter mobilization and support for Issue 1. These results support the claim that support for Issue 1 mobilized some people to vote who may not have done so otherwise.*

Table 14: This reports robust estimates of an overdispersed binomial regression model that has 2004 voter turnout depending on 2002 voter turnout and the support for Issue 1. Estimates appear separately for technology groupings of the precincts that had the same boundaries in the two elections and for county groupings of the wards that had constant boundaries. Using V2002 to represent the rate of voter turnout in 2002 and using I1 to denote the proportion voting Yes on Issue 1, the linear predictor in the model may be written as follows:

$$Z_i = c_0 + c_1 \text{logit}(\text{V2002}_i) + c_2 \text{logit}(\text{I1}_i)$$

(see the Appendix for an explanation of the logit function). The estimator already adjusts turnout in each precinct for the number of voters registered to vote there in 2004, so this model represents one way to check whether support for Issue 1 has an effect on voter tunout independent of the relationship between previous voter turnout and support for Issue 1. This approach is far from perfect. For instance, it omits consideration of the previously considered effects of the number of

voting machines per registered voter. *Caveats notwithstanding, the fact that the estimate for c_2 is statistically significant and positive for every collection of precincts and for the wards in Franklin and Lucas counties supports a conclusion that support for Issue 1 mobilized some people to vote who may not have done so otherwise.* The estimates for c_2 among wards in Cuyahoga and Hamilton counties are not statistically significant, but the fact that the estimates among precincts in those counties are significant suggests that the insignificant ward-level effects reflect the fact that those wards are internally heterogenoeous with respect to voter mobilization and support for Issue 1. A ward-level analysis simply misses the important politics relating to Issue 1 in Cuyahoga and Hamilton counties.

Table 15: This illustrates the magnitude of the Issue 1 effects estimated in Table 14, by computing expected turnout rates for precincts at the first quartile, the median and the third quartile of the proportion voting Yes on Issue 1 for precincts using each type of technology and for the wards in each county. *Moving from the first to the third quartile of the proportion voting Yes on Issue 1 is associated with an increase of about 1.9 percent in voter turnout among Optical Precinct precincts, 1.7 percent among DRE and Hamilton precincts, 1.2 percent among Optical Central precincts, and about one-half perceent among Punchcard and Cuyahoga precincts. Among wards in Franklin and Lucas counties moving from the first to the third quartile of the proportion voting Yes on Issue 1 is associated with an increase of slightly more than two percent in voter turnout. Support for Issue 1 mobilized many people to vote who may not have done so otherwise.*

Table 16: This lists the outlier precincts identified in the analysis reported in Table 14. The list of outliers is virtually the same as in the model that includes only the past voter turnout regressor. The turnout anomalies in these places seem to have little to do with the support for Issue 1.

Figures 19 and 20: These show scatterplots relating the proportion of votes for Kerry to the proportional change in voter registration from 2002 to 2004 in precincts and wards in selected counties that had the same boundaries in both elections, separating the precincts by the type of voting machine technology and the wards by county. The lines are the regression lines. A larger increase in registration is associated with a higher proportion of votes for Kerry everywhere except among the Optical Precinct precincts. Among Optical Precinct precincts, a larger increase in registration is associated with a lower proportion of votes for Kerry. *If increases in registration reflect voter mobilization efforts, then mobilization tended to help Kerry in all the places included in this analysis except the Optical Precinct precincts.*

Figure 21: This shows a scatterplot relating the proportion voting for Kerry to 2004 voter turnout across all Ohio precincts. The line is the regression line. *Where a higher proportion of voters vote for Kerry, turnout is lower.* Of course it is well known that core Democratic constituencies have lower turnout rates than core Republican constituencies. So this display says nothing about the efficacy of voter mobilization efforts in the state.

Figures 22, 23, 24 and 25: These show scatterplots relating the proportion voting for Kerry to the change in voter turnout rates from 2002 to 2004 across all precincts and selected wards that had the same boundaries in both elections, where both variables have been residualized by regressing each on 2002 turnout. Precincts are separated by the type of voting machine technology and the wards are separated by county. The lines are the regression lines. *Over all precincts and wards and for each subset of precincts grouped by voting machine technology and wards grouped by county, the proportion voting for Kerry decreases as turnout in 2004 increases, even when turnout in the 2002 election is taken into account. This suggests that voter mobilization*

efforts focused on turnout on balance hurt Kerry, at least if one takes 2002 as the baseline. The exception to this pattern occurs among Optical Central precincts where, with 2002 turnout taken into account, the proportion voting for Kerry increases as turnout in 2004 increases.

Figure 26: This shows the distribution of the residual vote rate across Ohio precincts by voting machine technology. A residual vote is conventionally measured as a ballot that does not have a valid vote for president. The residual vote rate is the proportion of such ballots out of all ballots cast. In the current data we have information about the number of votes cast and the number of ballots that have a vote for either Bush, Kerry, Bedarnik or Peroutka. We measure the residual vote rate as the proportion of votes cast that do not have a vote for one of those candidates. The difference in the median residual vote rate among precincts using each of the four voting machine technologies is not easy to see in the figure, so I report that here.

Technology	Median
DRE	0.0097
Optical Central	0.0086
Optical Precinct	0.0076
Punchcard	0.0164
Cuyahoga	0.0147
Hamilton	0.0174

The median is smallest for the Optical Precinct (Allen County) precincts and largest for the Punchcard precincts. *The median residual vote rate among the Optical Precinct precincts is about the same as the proportion of people some have estimated voluntarily choose not to vote for president (based on survey data, Knack and Kropf 2003 estimate that 0.75 percent of voters voluntarily abstain from voting in the presidential race). The median rate among Punchcard precincts is more than twice as large and clearly unacceptable.* Using all four technologies there are a number of precincts that have substantially higher residual vote rates. Both the number of such precincts and the magnitude of the residual vote rate in each one are especially high for DRE, Optical Central, Punchcard, Cuyahoga and Hamilton precincts.

Table 17: This reports robust estimates of a separate overdispersed binomial regression model for the precincts using each type of voting technology, with the residual vote depending on the number of voting machines per registered voter in each precinct. The analysis here includes Cuyahoga and Hamilton precincts with the other precincts using punchcard voting machine technology. Using MV to denote the voting machines per registered voter ratio $\text{MV} = (\text{voting machines})/(\text{registered voters})$, for the set of precincts using each type of voting machine technology the linear predictor for precinct i is

$$Z_i = b_0 + b_1 \text{MV}_i \ .$$

The differences between the intercepts b_0 for the different models capture baseline differences between the precincts using the different voting machine technologies. The coefficients b_1 measure the effect the ratio of voting machines to the number of registered voters has on residual the vote for each set of precincts. The fact that the estimate for b_1 is $\hat{b}_1 = -30.9$ for DRE precincts and $\hat{b}_1 = -69.0$ for Optical Precinct precincts indicates a substantial dependence between the machine/voter ratio and the residual vote rate in those precincts. *The separate estimates show that the residual vote rate is related to the number of voting machines per*

registered voter in both DRE and Optical Precinct precincts: more machines meant a lower residual vote rate. The mechanism that most likely produces this effect is easy to understand: with fewer machines per voter, polling places become more crowded and voters are less likely to take the time to check or correct their ballots. The display at the bottom of Table 17 illustrates the magnitude of these effects by computing expected residual vote rates for precincts at the first quartile, the median and the third quartile of the MV values for precincts using each type of technology. Notwithstanding the statistically significant relationship between the machine ratio and the residual vote ratio, moving from the first to the third quartile of the voting machines per registered voter ratio is associated with small differences for both DRE and Optical Precinct precincts. Differences across voting technologies are large, however. *At the third quartiles of the voting machines per registered voter ratio observed for each of the voting machine technologies in 2004, the expected residual vote rate is more than 50 percent larger in DRE or Optical Central precincts than in Optical Precinct precincts, and the rate is more than 165 percent larger in Punchcard precincts than in Optical Precinct precincts. Nearly one percent of the votes cast for president in Ohio were lost because they were cast using punchcard technology instead of precinct-tabulated optical scan technology.* Many precincts are flagged as outliers. All the outliers have positive studentized residuals, which means that the observed residual vote rate in those precincts is substantially larger than the expected according to the model.

Table 18, Table 19, Table 20, Table 21 and Table 22: These list the outliers for each type of machine technology from the analysis reported in Table 17. *All of the outliers in the analysis of the residual vote are positive: many precincts have substantially more residual votes than expected according to the residual vote rate that prevails among precincts that used the same kind of voting machine technology.* The outliers for DRE precincts are predominantly precincts in Franklin County, and the outliers for Optical Central precincts are predominantly precincts in.Ashland County. Among Punchcard precincts, Hamilton has the most outliers, then Cuyahoga, Summit, Montgomery, Trumbull, Stark, Richland, Lorain and Holmes. A few other counties also have multiple outlier precincts.

Table 23: This reports robust estimates of a separate overdispersed binomial regression model for the precincts using each type of voting technology, with the residual vote depending on the number of voting machines per registered voter in each precinct and the proportion of the population in each precinct that is African American. Using MV to denote the voting machines per registered voter ratio $\text{MV} = (\text{voting machines})/(\text{registered voters})$ and AA to denote the proportion of the population that is African American, for the set of precincts using each type of voting machine technology the linear predictor for precinct i is

$$Z_i = b_0 + b_1 \text{MV}_i + b_2 \text{AA}_i \ .$$

If African Americans are more likely to cast a residual vote (see Herron and Sekhon 2005 for a literature review and discussion), then $b_2 > 0$. This is what we find, everywhere except among Optical Central precincts. There, unusually, a higher proportion of African Americans in a precinct is associated with a lower residual vote rate. Results regarding the effect the ratio of voting machines to the number of registered voters has on residual the vote are much the same as in the analysis reported in Table 17. The display at the bottom of Table 23 illustrates the magnitude of these effects by computing expected residual vote rates for precincts at the first quartile, the median and the third quartile of the MV values for precincts using each type of technology, setting the proportion African American equal to the median value observed among

precincts of the referent type. Moving from the first to the third quartile of the voting machines per registered voter ratio is associated with small differences for both DRE and Optical Precinct precincts. Differences across voting technologies are again large, however. *The expected residual vote rate at the third quartile of the machines per registered voter ratio falls to 0.54 percent for Optical Precinct machines. At the third quartiles of the voting machines per registered voter ratio observed for each of the voting machine technologies in 2004, the expected residual vote rate is more than 50 percent larger in DRE or Optical Central precincts than in Optical Precinct precincts, and the rate is more than 165 percent larger in Punchcard precincts than in Optical Precinct precincts. Nearly one percent of the votes cast for president in Ohio were lost because they were cast using punchcard technology instead of precinct-tabulated optical scan technology.* Many precincts are flagged as outliers, although fewer than when the proportion African American is not included as a regressor.

Table 24 Table 25 Table 26 Table 27: These list the outliers for each type of machine technology from the analysis reported in Table 23. *All of the outliers in the analysis of the residual vote are positive: many precincts have substantially more residual votes than expected according to the residual vote rate that prevails among precincts that used the same kind of voting machine technology.*

Table 28: This shows the median residual vote rates among the outliers identified in the analysis reported in Tables 23 through 27, along with the median residual vote rates among precincts that are not outliers. The medians among non-outlier precincts match the results computed at the bottom of Table 23. *The outliers have substantially higher residual vote rates, with median rates nearly four times those of the nonoutlier precincts.*

Table 29: This shows estimates of binary logit regression models for the probability that a precinct is an outlier in the analysis reported in Table 23, given the proportion reported voting for Kerry instead of Bush in the precinct. Statistically significant relationships occur for Optical Central and Punchcard precincts. Among Optical Central precincts, the higher the proportion of votes recorded for Bush in a precinct, the higher the probability that the precinct is an outlier that has an extraordinarily high residual vote rate. *Among Punchcard precincts, the higher the proportion of votes recorded for Kerry in a precinct, the higher the probability that the precinct is an outlier that has an extraordinarily high residual vote rate. The number of votes potentially affected by these extreme political biases in the distribution of the outliers is relatively small, however.* The following table reports the total number of residual votes among the outliers for each type of voting machine technology.

Technology	Total
DRE	1,218
Optical Central	719
Optical Precinct	89
Punchcard	6,644

Even if every one of those residual votes represents an intended vote that was not counted due to mechanical or other problems, the total number of them is not enough to change the outcome of the election. Indeed, even if we consider all precincts that have residual vote rates that are unexpectedly high given the model of Table 23, the total number of votes potentially affected by apparently anomalous events remains relatively small. The following table reports the total

number of residual votes among precincts that have a studentized residual greater than 2.0 for each type of voting machine technology.

Technology	Total
DRE	3,264
Optical Central	1,349
Optical Precinct	164
Punchcard	17,901

That is surely enough potentially lost votes to be a serious concern, but not enough to change the election outcome in Ohio in 2004. Residual vote anomalies were not enough, on their own, to change the election outcome.

Figure 27: This shows a scatterplot relating residual vote rate to the proportion voting for Kerry across all precincts. The line is the regression line. *The residual vote rate is slightly higher in precincts where the proportion voting for Kerry was higher. This suggests that losing those votes on balance hurt Kerry.*

Figure 28: This shows a scatterplot relating residual vote rate to the proportion voting Yes on Issue 1 (opposing gay marriage) across all precincts. The line is the regression line. The variability of the residual vote rate is smaller among precincts that heavily opposed Issue 1, but there is no linear relationship between votes on the issue and the residual vote rate.

Figure 29: This shows a scatterplot relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for governor (Tim Hagan) in the 2002 election, across all precincts that had the same boundaries in both elections. The line is the regression line. *Votes for Kerry and for Hagan are strongly and positively related: in precincts where Hagan did better, Kerry tended to do better. In most precincts Kerry received a higher proportion of the vote than Hagan did.*

Figure 30: This shows a scatterplot relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for governor (Tim Hagan) in the 2002 election, across all precincts that had the same boundaries in both elections, separating the precincts by the type of voting machine technology. The lines are the regression lines. *For each subset of precincts grouped by voting machine technology, votes for Kerry and for Hagan are strongly and positively related: in precincts where Hagan did better, Kerry tended to do better.*

Figure 31: This shows a scatterplot relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for governor (Tim Hagan) in the 2002 election, across the selected wards that had the same boundaries in both elections, separating the wards by county. The line is the regression line. *Votes for Kerry and for Hagan are strongly and positively related: in wards where Hagan did better, Kerry tended to do better. In most wards Kerry received a higher proportion of the vote than Hagan did.*

Figure 32: This shows a scatterplot relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for governor (Tim Hagan) in the 2002 election, across the selected wards that had the same boundaries in both elections, separated respectively by voting machine technology and by county. The lines are the regression lines. *For the wards viewed separately by county, votes for Kerry and for Hagan are strongly and positively related: in wards where Hagan did better, Kerry tended to do better.*

Table 30: This reports robust estimates of an overdispersed binomial regression model that has the proportion voting for Kerry depending on the proportion voting for the Democratic

candidate for governor (Tim Hagan) in the 2002 election. Estimates appear separately for the precincts that had the same boundaries in the two elections and for the wards that had constant boundaries. Using D2002 to represent the proportion voting for Hagan, the linear predictor in the model may be written as follows:

$$Z_i = d_0 + d_1 \text{logit}(\text{D2002}_i)$$

(see the Appendix for an explanation of the logit function). If the vote for Kerry were the same as the vote for Hagan except uniformly higher, then we would have $d_0 > 0$ and $d_1 = 1$ (the Appendix explains this). Indeed, the estimate for d_1 is not substantially different from 1.0 in either the precinct analysis or the ward analysis, and in both cases the estimate for d_0 is greater than zero. *The tendency to vote for Kerry in 2004 is the same as the tendency to vote for Hagan in 2002, except it is uniformly higher. The fact that the pattern of voting for Kerry is so similar to the pattern of voting for the Democratic candidate for governor in 2002 in these precincts and wards is strong evidence against the claim that widespread fraud systematically misallocated votes from Kerry to Bush* (unless someone wants to go further and make the unsupported claim that the 2002 election for governor was stolen in exactly the same way, precinct by precinct and ward by ward). Relatively few precincts or wards are outliers in this analysis.

Table 31: This lists the outlier precincts identified in the analysis reported in Table 30. A few precincts but no wards from Hamilton County are outliers.

Table 32: This reports robust estimates of an overdispersed binomial regression model that has the proportion voting for Kerry depending on the proportion voting for the Democratic candidate for governor (Tim Hagan) in the 2002 election and on the proportion voting Yes on Issue 1 (opposing gay marriage). Estimates appear separately for the precincts that had the same boundaries in the two elections and for the wards that had constant boundaries. Kerry did well in precincts and wards where Hagan did well, and he did poorly where Hagan did poorly, and in addition support for Kerry was lower where support for Issue 1 was higher. No surprises here.

Table 33: This lists the outlier precincts identified in the analysis reported in Table 32. By and large the outliers are the same as when the Issue 1 vote is not included in the model.

Figure 33: This shows the distribution of the proportion voting for Kerry across Ohio precincts by voting machine technology.

Figure 34: This shows the distribution of the proportion voting for the 2004 Democratic candidate for Senator (Eric Fingerhut) across Ohio precincts by voting machine technology.

Figure 35: This shows a scatterplot relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for Senator (Eric Fingerhut) across all precincts. The line is the regression line. *Votes for Kerry and for Fingerhut are strongly and positively related: in precincts where Fingerhut did better, Kerry tended to do better. In most precincts where Fingerhut received more than 40 percentof the vote, Kerry received a higher proportion of the vote than Fingerhut did.*

Figure 36: This shows scatterplots relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for Senator (Eric Fingerhut) across all precincts, separating the precincts by the type of voting machine technology. The lines are the regression lines. *For each subset of precincts grouped by voting machine technology, votes for Kerry and for Fingerhut are strongly and positively related: in precincts where Fingerhut did better, Kerry tended to do better.*

Figures 37 and 38: These show the distribution of the proportion voting for Kerry across Ohio precincts by voting machine technology, separately for precincts that have fewer than ten percent African American population and precincts that have greater than ten percent African American population. *Kerry's support is substantially higher in the precincts that have the higher proportion African American.*

Figure 39 and 40: These show scatterplots relating the proportion voting for Kerry to the proportion voting for the Democratic candidate for Senator (Eric Fingerhut) across all precincts, separately for precincts that have fewer than ten percent African American population and precincts that have greater than ten percent African American population, separating the precincts by the type of voting machine technology. The lines are the regression lines. *For each subset of precincts grouped by voting machine technology, votes for Kerry and for Fingerhut are strongly and positively related: in precincts where Fingerhut did better, Kerry tended to do better. Kerry's support and Fingerhut's support are both substantially higher in precincts that have the higher proportion African American.*

Figure 41: This shows the distribution of the proportion voting Yes on Issue 1 (opposing gay marriage) across Ohio precincts by voting machine technology. In most precincts there was a majority in favor of Issue 1, but there were many precincts where Issue 1 was heavily rejected.

Figure 42: This shows a scatterplot relating the proportion voting for Kerry to the proportion voting Yes on Issue 1 (opposing gay marriage) across all precincts. The line is the regression line. *Votes for Kerry and for Issue 1 are strongly and negatively related: in precincts where Issue 1 did better, Kerry tended to do worse. The variation among precincts in the vote for Issue 1 is greater among the precincts where support for Kerry was the highest than it is among the precincts where Kerry's support was lowest.*

Figure 43: This shows scatterplots relating the proportion voting for Kerry to the proportion voting Yes on Issue 1 (opposing gay marriage) across all precincts, separating the precincts by the type of voting machine technology. The lines are the regression lines. For each subset of precincts grouped by voting machine technology, votes for Kerry and for Issue 1 are strongly and negatively related: in precincts where Issue 1 did better, Kerry tended to do worse. There is a telling separation in the plot for DRE precincts, among the precincts where support for Kerry was the highest. *Evidently there are precincts where voters strongly oppose Issue 1 and strongly support Kerry, and there are precincts where a majority of voters support Issue 1 and strongly support Kerry.* Both kinds of precincts are included in the DRE and Punchcard sets of precincts. Precincts that strongly opposed Issue 1 do not appear among the Optical Central and Optical Precinct precincts, even though in both of those sets there are precincts that strongly support Kerry.

Figure 44 and 45: This shows scatterplots relating the proportion voting for Kerry to the proportion voting Yes on Issue 1 (opposing gay marriage) across all precincts, separately for precincts that have fewer than ten percent African American population and precincts that have greater than ten percent African American population, separating the precincts by the type of voting machine technology. The lines are the regression lines. *Kerry's support is substantially higher and support for Issue 1 is lower in precincts that have the higher proportion African American.*

Table 34: This reports robust estimates of overdispersed binomial regression models that have the proportion voting for Kerry depending on the proportion voting the proportion voting for the 2004 Democratic candidate for Senator (Eric Fingerhut), the proportion voting Yes on Issue 1 (opposing gay marriage) and the proportion of the population in each precinct that is African

American. A separate model is estimated for each Ohio county. Motivated by evidence that, on the whole, the support for Kerry was strongly related to each of these three variables, the idea is to use the coefficients estimated for each county's precincts to help identify places where the relationship between the three variables and Kerry's support is anomalous. Anomalous values for a county's coefficients may be evidence that the election returns were manipulated in that county. Specifically, let DS denote the proportion voting for the Democratic candidate for Senator, let I1 denote the proportion voting Yes on Issue 1, and let AA denote the proportion of the population that is African American. The linear predictor in the model for each precinct i may be written as follows:

$$Z_i = b_0 + b_1 \text{logit}(\text{DS}_i) + b_2 \text{logit}(\text{I1}_i) + b_3 \text{AA}_i \ .$$

(see the Appendix for an explanation of the logit function). We expect Kerry's support to increase with the support for Fingerhut, decrease with the support for Issue 1 and increase with the proportion African American. Hence we expect to see $b_1 > 0$, $b_2 < 0$ and $b_3 > 0$. At the very least we do not expect to see statistically significant estimates having the opposite signs for these parameters. *For the most part we observe the pattern we expect: Kerry's support increases with the support for Fingerhut, decreases with the support for Issue 1 and increases with the proportion African American.* The results for Hamilton County in Table 34 are typical. All the coefficient estimates for Hamilton are statistically different from zero, and $\hat{b}_1 > 0$, $\hat{b}_2 < 0$ and $\hat{b}_3 > 0$. Only seven of Ohio's 88 counties deviate significantly from that pattern. One of the deviations occurs for Cuyahoga County, where there is a significant estimate for b_2 that has the wrong sign. Cuyahoga is the only county in Ohio for which the estimate for b_2 is positive and statistically significant. Harrison County is the only other county for which the point estimate for b_2 is positive, but that estimate is not statistically significant ($\hat{b}_2 = 0.126$, SE $= 0.242$). *Among all Ohio's counties, only in Cuyahoga is there a tendency for Kerry's support to be higher in precincts where the support for Issue 1 is higher, given the support for Fingerhut and the proportion African American.* Six other counties have anomalous coefficients following the pattern shown in Table 34 for Crawford County: there is a statistically significant estimate for b_3 that has the wrong sign. The estimate suggests that Kerry's support is higher in precincts where the proportion of African Americans is lower. The other five counties for which this pattern occurs are Jackson, Vinton, Washington, Williams and Wyandot. Crawford and these other five counties have respectively 46, 38, 19, 36, 44 and 24 precincts in the analysis. Because the proportion African American in these counties is so small, and the counties are so small they do not have many precincts, it is possible that this result does not reflect problems in the election. It may be that the African American voters in these counties tend to vote Democratic but are surrounded by especially Republican neighbors. Or the African American voters who live in these counties may themselves be especially Republican. *Close inspection by someone who is familiar with the voters in these counties is warranted.*

Table 35: This lists the outlier precincts identified for all Ohio counties in the analysis for which the illustrative results are reported in Table 34. *Most of the outliers are located in Cuyahoga county, and all of the residuals for those Cuyahoga outliers are negative. That warrants investigation. On the whole the number of outliers is too small to support a belief that the tallied votes were subject to widespread misallocation from Kerry to Bush.*

Table 1: Voting Machine Technologies Used in Ohio Counties in 2004

Direct record electronic (DRE): Auglaize, Franklin, Knox, Lake, Mahoning, Pickaway, Ross.

Centrally tabulated optical scan (Optical Central): Ashland, Clermont, Coshocton, Erie, Geauga, Hancock, Hardin, Lucas, Miami, Ottawa, Sandusky, Washington.

Precinct-tabulated optical scan (Optical Precinct): Allen.

Punchcard: Adams, Ashtabula, Athens, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clinton, Columbiana, Crawford, Cuyahoga, Darke, Defiance, Delaware, Fairfield, Fayette, Fulton, Gallia, Greene, Guernsey, Hamilton, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Lawrence, Licking, Logan, Lorain, Madison, Marion, Medina, Meigs, Mercer, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Paulding, Perry, Pike, Portage, Preble, Putnam, Richland, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Wayne, Williams, Wood, Wyandot.

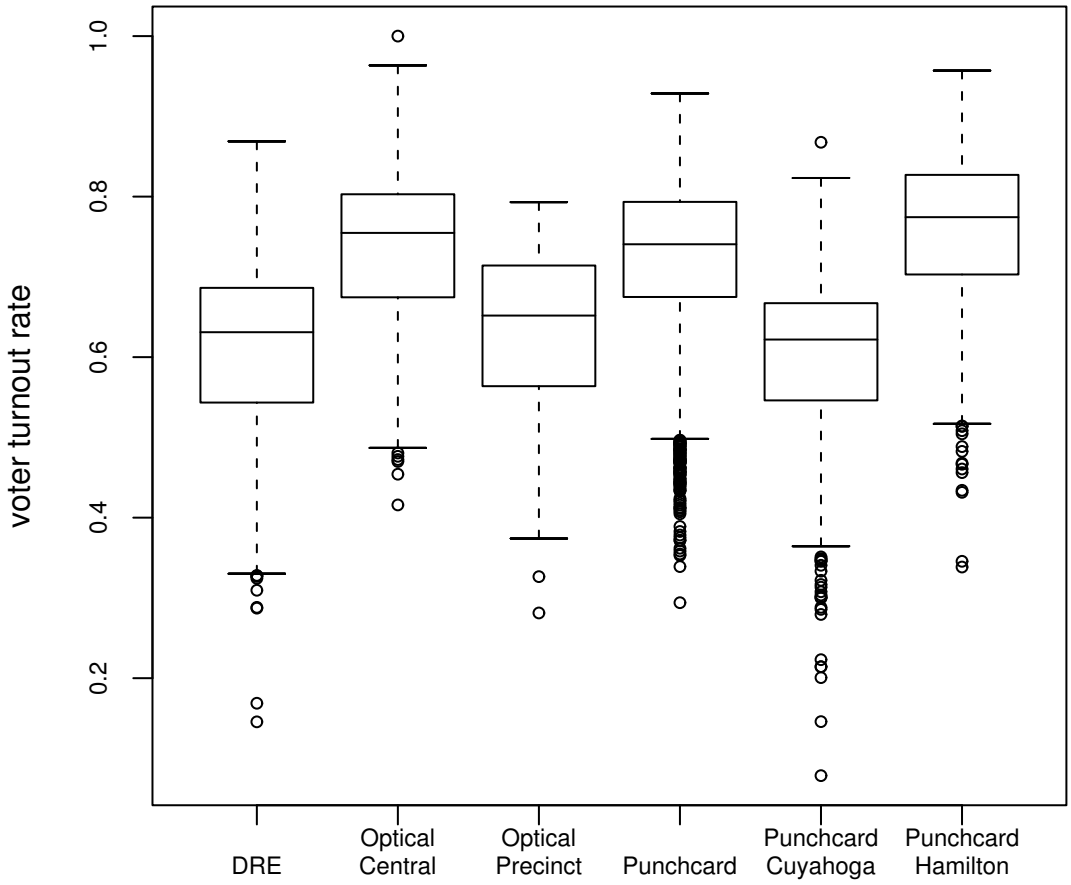


Figure 1: Turnout in Ohio 2004 Precincts by Machine Type

Table 2: Ohio Counties with Information on Number of Voting Machines Used in Each Precinct in 2004

Direct record electronic (DRE): Auglaize, Franklin, Knox, Lake, Mahoning, Pickaway, Ross.

Centrally tabulated optical scan (Optical Central): Ashland, Erie, Hardin, Lucas, Ottawa, Sandusky.

Precinct-tabulated optical scan (Optical Precinct): Allen.

Punchcard: Adams, Ashtabula, Athens, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clinton, Columbiana, Crawford, Cuyahoga, Darke, Defiance, Delaware, Fairfield, Fayette, Fulton, Gallia, Greene, Guernsey, Hamilton, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Lawrence, Licking, Logan, Lorain, Madison, Marion, Meigs, Mercer, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Paulding, Perry, Pike, Portage, Preble, Putnam, Richland, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Wayne, Williams, Wood, Wyandot.

Table 3: Voter Turnout: Machines per Voter Regressor

	DRE			Punchcard		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	-0.0143	0.0352	-0.406	0.739	0.0226	32.6
Machines per Registered Voter	113.0000	8.1800	13.900	35.000	2.7400	12.8
	Optical Central			Cuyahoga		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.859	0.0445	19.30	0.502	0.0271	18.50
Machines per Registered Voter	29.800	6.6100	4.51	-8.200	2.9900	-2.74
	Optical Precinct			Hamilton		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.614	0.138	4.460	-0.137	0.179	-0.763
Machines per Registered Voter	-10.700	20.400	-0.524	140.000	19.000	7.390

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. DRE precincts: LQD $\sigma = 5.61$; $\tanh$ $\sigma = 5.56$; $n = 1,535$; 2 outliers. Optical Central precincts: LQD $\sigma = 4.22$; $\tanh$ $\sigma = 4.26$; $n = 807$; 4 outliers. Optical Precinct precincts: LQD $\sigma = 4.45$; $\tanh$ $\sigma = 4.31$; $n = 139$; 1 outlier. Punchcard precincts: LQD $\sigma = 4.68$; $\tanh$ $\sigma = 4.43$; $n = 5,478$; 35 outliers. Cuyahoga precincts: LQD $\sigma = 4.14$; $\tanh$ $\sigma = 4.07$; $n = 1,411$; 7 outliers. Hamilton precincts: LQD $\sigma = 4.45$; $\tanh$ $\sigma = 4.41$; $n = 979$; 6 outliers. Punchcard precincts exclude Cuyahoga and Hamilton precincts.

Expected Voter Turnout at Machine Ratio Quartiles

	Quartile		
Precinct Technology	25%	50%	75%
DRE	0.584	0.598	0.622
Centrally Tabulated Optical Scan	0.734	0.738	0.741
Precinct Tabulated Optical Scan	0.636	0.633	0.630
Punchcard	0.726	0.735	0.744
Cuyahoga	0.607	0.607	0.606
Hamilton	0.753	0.765	0.778

Table 4: Outliers: Voter Turnout: Machines per Voter Regressor

DRE			Optical Central			Optical Precinct		
County	Code	SRes	County	Code	SRes	County	Code	SRes
Franklin	ABY	−4.10	Erie	AED	−4.75	Allen	ABB	−4.19
Franklin	AZB	−4.43	Erie	AEE	−4.49			
			Lucas	AHJ	−5.73			
			Lucas	ADQ	−4.09			

Punchcard								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Butler	AAK	−4.18	Delaware	ABV	4.05	Richland	ABN	−4.21
Butler	AAF	−5.47	Fairfield	AEP	−4.55	Richland	ABO	−5.02
Butler	AAO	−4.38	Greene	AGJ	−4.20	Stark	AAT	−4.02
Butler	ACQ	−4.79	Greene	AIN	−4.94	Stark	ABB	−4.33
Butler	ACU	−4.12	Holmes	AAC	−4.87	Stark	ABC	−4.30
Butler	ADQ	−4.34	Holmes	AAM	−4.19	Stark	ABU	−4.64
Butler	AEY	−4.73	Holmes	AAW	−4.05	Summit	ABE	−4.80
Butler	AFA	−4.06	Montgomery	ABC	−7.93	Summit	ADU	−4.49
Butler	AFD	−5.92	Montgomery	ABP	−4.09	Wood	AAC	−5.75
Butler	AFE	−5.76	Montgomery	API	−6.52	Wood	AAH	−4.28
Butler	AJR	−5.57	Montgomery	AQS	−4.25	Wood	AAI	−4.18
Darke	ABD	−4.88	Portage	AGL	−4.15			

Cuyahoga			Hamilton		
County	Code	SRes	County	Code	SRes
Cuyahoga	ANR	−4.24	Hamilton	AFQ	−5.31
Cuyahoga	APF	−6.70	Hamilton	AHD	−6.21
Cuyahoga	AYP	−10.08	Hamilton	AKL	−4.34
Cuyahoga	AYT	−5.84	Hamilton	ALW	−4.70
Cuyahoga	AZO	−4.03	Hamilton	BDP	−0.04
Cuyahoga	CXC	−5.59	Hamilton	BQD	−2.32
Cuyahoga	DDR	−4.72			

Table 5: Ohio Counties including Precincts with Constant Boundaries from 2002 to 2004

Direct record electronic (DRE): Mahoning.

Centrally tabulated optical scan (Optical Central): Ashland, Clermont, Coshocton, Geauga, Hardin, Miami, Ottawa.

Precinct-tabulated optical scan (Optical Precinct): Allen.

Punchcard: Adams, Athens, Belmont, Butler, Carroll, Clinton, Columbiana, Cuyahoga, Darke, Greene, Hamilton, Harrison, Hocking, Lawrence, Licking, Logan, Lorain, Madison, Marion, Meigs, Monroe, Morgan, Morrow, Noble, Paulding, Perry, Pike, Portage, Preble, Shelby, Trumbull, Tuscarawas, Van Wert, Vinton, Wayne, Williams.

Table 6: Ohio Counties with Information on Number of Voting Machines Used in Each Precinct in 2004 and including Precincts with Constant Boundaries from 2002 to 2004

Direct record electronic (DRE): Mahoning.

Centrally tabulated optical scan (Optical Central): Ashland, Hardin, Ottawa.

Precinct-tabulated optical scan (Optical Precinct): Allen.

Punchcard: Adams, Athens, Belmont, Butler, Carroll, Clinton, Columbiana, Cuyahoga, Darke, Greene, Hamilton, Harrison, Hocking, Lawrence, Licking, Logan, Lorain, Madison, Marion, Meigs, Monroe, Morgan, Morrow, Noble, Paulding, Perry, Pike, Portage, Preble, Shelby, Trumbull, Tuscarawas, Van Wert, Vinton, Wayne, Williams.

Table 7: Number of Machines: 2004 Registered Voters and 2002 Votes Cast Regressors

	DRE		
Variable	Coef.	SE	t-ratio
(Intercept)	-1.42	0.78	-1.8
Log(Registered Voters in 2004)	0.12	0.14	0.8
Log(Votes Cast in 2002)	0.36	0.11	3.3
	Optical Central		
Variable	Coef.	SE	t-ratio
(Intercept)	2.18	0.48	4.5
Log(Registered Voters in 2004)	-0.45	0.20	-2.2
Log(Votes Cast in 2002)	0.32	0.22	1.4
	Punchcard		
Variable	Coef.	SE	t-ratio
(Intercept)	-2.55	0.16	-16.3
Log(Registered Voters in 2004)	0.58	0.03	17.9
Log(Votes Cast in 2002)	0.08	0.03	2.6
	Cuyahoga		
Variable	Coef.	SE	t-ratio
(Intercept)	-3.13	0.31	-10.1
Log(Registered Voters in 2004)	0.80	0.05	15.6
Log(Votes Cast in 2002)	-0.06	0.03	-1.7
	Hamilton		
Variable	Coef.	SE	t-ratio
(Intercept)	-3.29	0.34	-9.8
Log(Registered Voters in 2004)	0.72	0.06	11.9
Log(Votes Cast in 2002)	0.07	0.04	1.8

Notes: Poisson regression estimates. For each precinct, the dependent variable is the number of voting machines. DRE $n = 312$ precincts. Optical Central $n = 181$ precincts. Punchcard $n =$ 2,400 precincts. Cuyahoga $n = 927$ precincts. Hamilton $n = 1{,}013$ precincts. Punchcard precincts exclude Cuyahoga and Hamilton precincts.

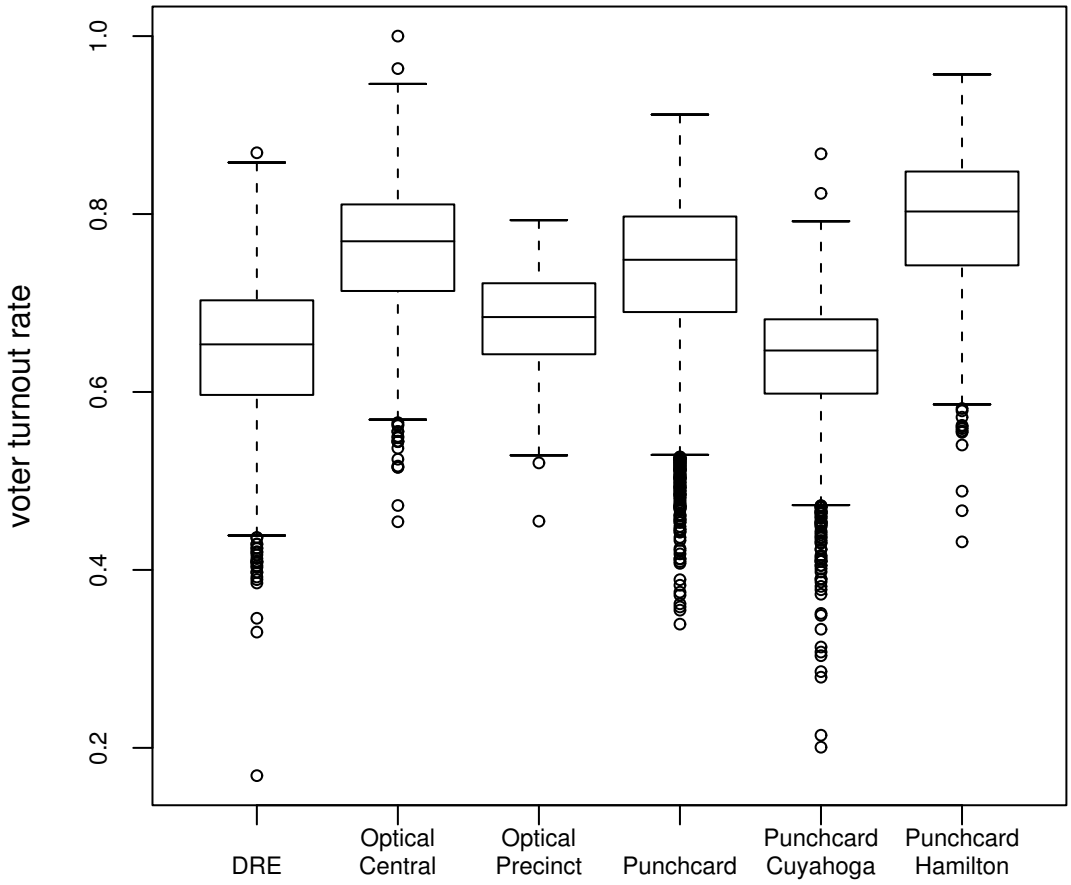


Figure 2: Turnout in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Less Than 10 Percent

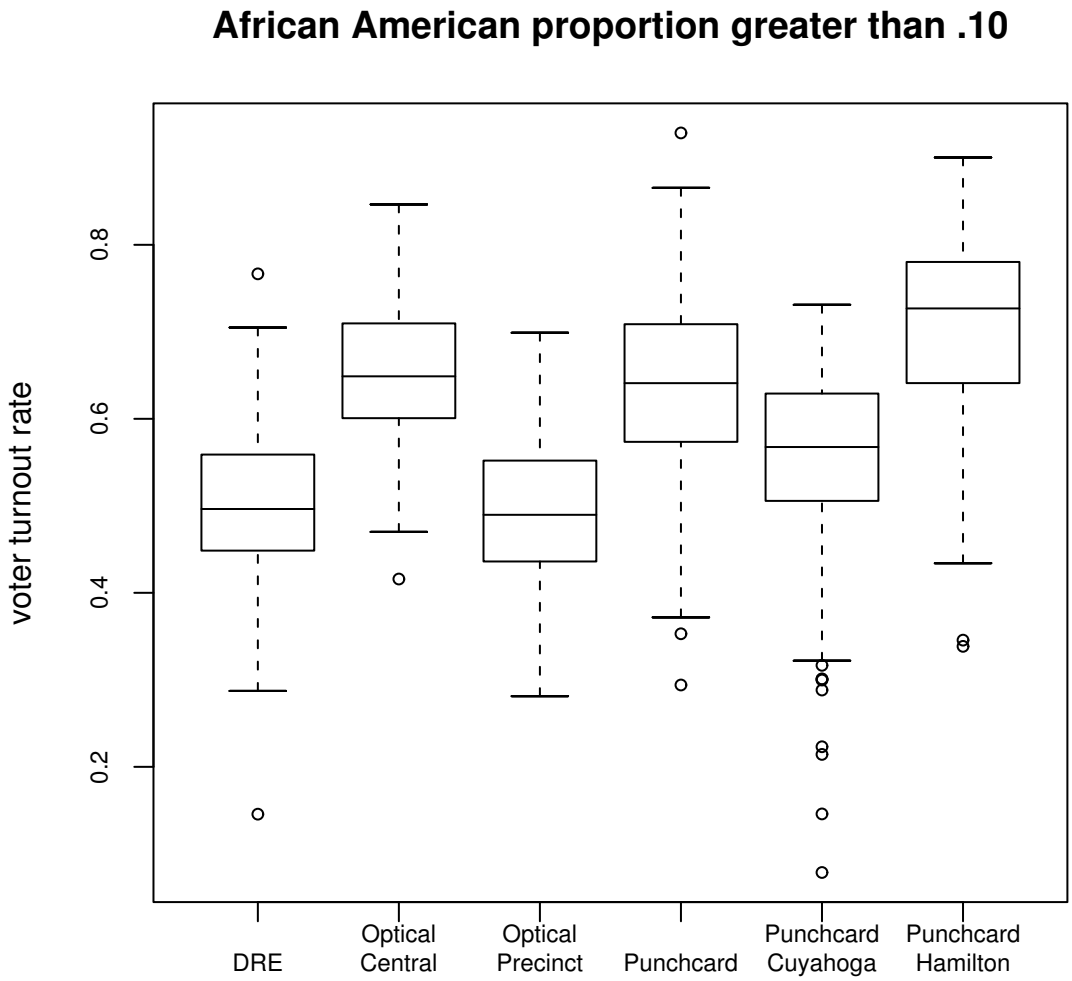


Figure 3: Turnout in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Greater Than 10 Percent

Table 8: Voter Turnout: Machine Technology, Machines per Voter and Precinct Racial Composition Regressors

	DRE			Punchcard		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.26	0.0318	8.17	0.754	0.0221	34.1
Machines per Registered Voter	74.60	7.0100	10.60	38.600	2.6900	14.3
Proportion African American	−0.98	0.0438	−22.40	−0.851	0.0380	−22.4
	Optical Central			Cuyahoga		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.976	0.0432	22.60	0.630	0.0289	21.80
Machines per Registered Voter	23.500	6.3300	3.71	−10.100	3.2100	−3.13
Proportion African American	−0.689	0.0545	−12.70	−0.371	0.0201	−18.50
	Optical Precinct			Hamilton		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.783	0.0976	8.020	0.212	0.167	1.27
Machines per Registered Voter	−5.770	14.3000	−0.402	117.000	17.500	6.67
Proportion African American	−2.360	0.2630	−8.940	−0.610	0.044	−13.90

Notes: Robust (tanh) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. DRE precincts: LQD $\sigma = 4.82$; $\tanh\ \sigma = 4.66$; $n = 1,535$; 7 outliers. Optical Central precincts: LQD $\sigma = 3.91$; $\tanh\ \sigma = 3.92$; $n = 807$; 6 outliers. Optical Precinct precincts: LQD $\sigma = 3.08$; $\tanh\ \sigma = 3.11$; $n = 139$; 1 outlier. Punchcard precincts: LQD $\sigma = 4.51$; $\tanh\ \sigma = 4.26$; $n = 5,478$; 28 outliers. Cuyahoga precincts: LQD $\sigma = 3.67$; $\tanh\ \sigma = 3.53$; $n = 1,411$; 15 outliers. Hamilton precincts: LQD $\sigma = 4.14$; $\tanh\ \sigma = 4.10$; $n = 979$; 4 outliers. Punchcard precincts exclude Cuyahoga and Hamilton precincts.

Expected Voter Turnout at Machine Ratio Quartiles with Median African American Proportions

	Quartile		
Precinct Technology	25%	50%	75%
DRE	0.616	0.625	0.640
Centrally Tabulated Optical Scan	0.749	0.751	0.754
Precinct Tabulated Optical Scan	0.662	0.660	0.658
Punchcard	0.732	0.742	0.752
Cuyahoga	0.630	0.629	0.628
Hamilton	0.773	0.783	0.794

Table 9: Outliers: Voter Turnout: Machine Technology, Machines per Voter and Precinct Racial Composition Regressors

DRE			Optical Central			Optical Precinct		
County	Code	SRes	County	Code	SRes	County	Code	SRes
Franklin	AAO	−4.01	Erie	ABV	−4.06	Allen	ABZ	4.47
Franklin	ABT	−4.04	Erie	AED	−4.93			
Franklin	ABY	−4.86	Erie	AEE	−4.65			
Franklin	AIF	−4.23	Erie	AEH	−4.06			
Franklin	AMZ	−4.01	Lucas	AOG	−4.39			
Franklin	AZB	−5.24	Lucas	AHJ	−5.11			
Lake	AEG	−4.66						

Punchcard								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Athens	AAL	−4.07	Butler	AFE	−5.90	Holmes	AAW	−4.37
Butler	AAK	−4.21	Butler	AJR	−5.84	Montgomery	ABC	−8.31
Butler	AAF	−5.48	Columbiana	AAL	−4.13	Montgomery	ANP	−4.09
Butler	AAO	−4.45	Columbiana	AAM	−4.03	Montgomery	API	−6.29
Butler	ACQ	−5.02	Darke	ABD	−5.20	Montgomery	AYV	−4.10
Butler	ADQ	−4.22	Delaware	ABV	4.14	Portage	AGL	−4.28
Butler	AEY	−4.93	Fairfield	AEP	−4.34	Summit	ABE	−4.60
Butler	AFA	−4.26	Holmes	AAC	−5.18	Wood	AAC	−5.84
Butler	AFD	−6.18	Holmes	AAM	−4.50	Wood	AAH	−4.44

Hamilton			Cuyahoga		
County	Code	SRes	County	Code	SRes
Hamilton	AFQ	−4.00	Cuyahoga	ABM	−4.00
Hamilton	AHD	−5.10	Cuyahoga	ABP	−4.21
Hamilton	BDP	−0.06	Cuyahoga	ANR	−4.73
Hamilton	BNY	−4.55	Cuyahoga	APF	−6.75
			Cuyahoga	AYP	−11.27
			Cuyahoga	AYR	−4.03
			Cuyahoga	AYT	−7.12
			Cuyahoga	AZO	−4.63
			Cuyahoga	BAC	−4.51
			Cuyahoga	BAQ	−4.66
			Cuyahoga	BAT	−4.18
			Cuyahoga	BDQ	−4.02
			Cuyahoga	CGB	−4.51
			Cuyahoga	CXC	−6.78
			Cuyahoga	DDR	−5.04

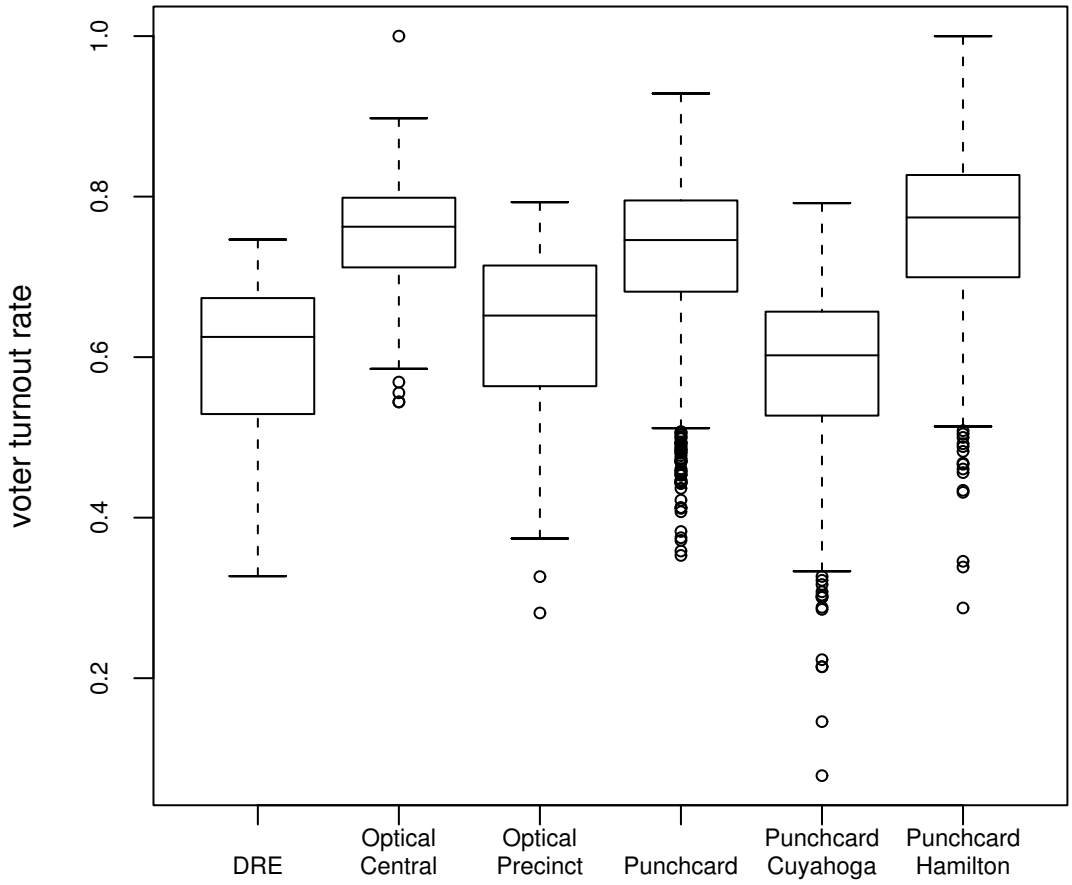


Figure 4: Turnout in Ohio 2004 in Precincts with Constant Boundaries Since 2002 by Machine Type

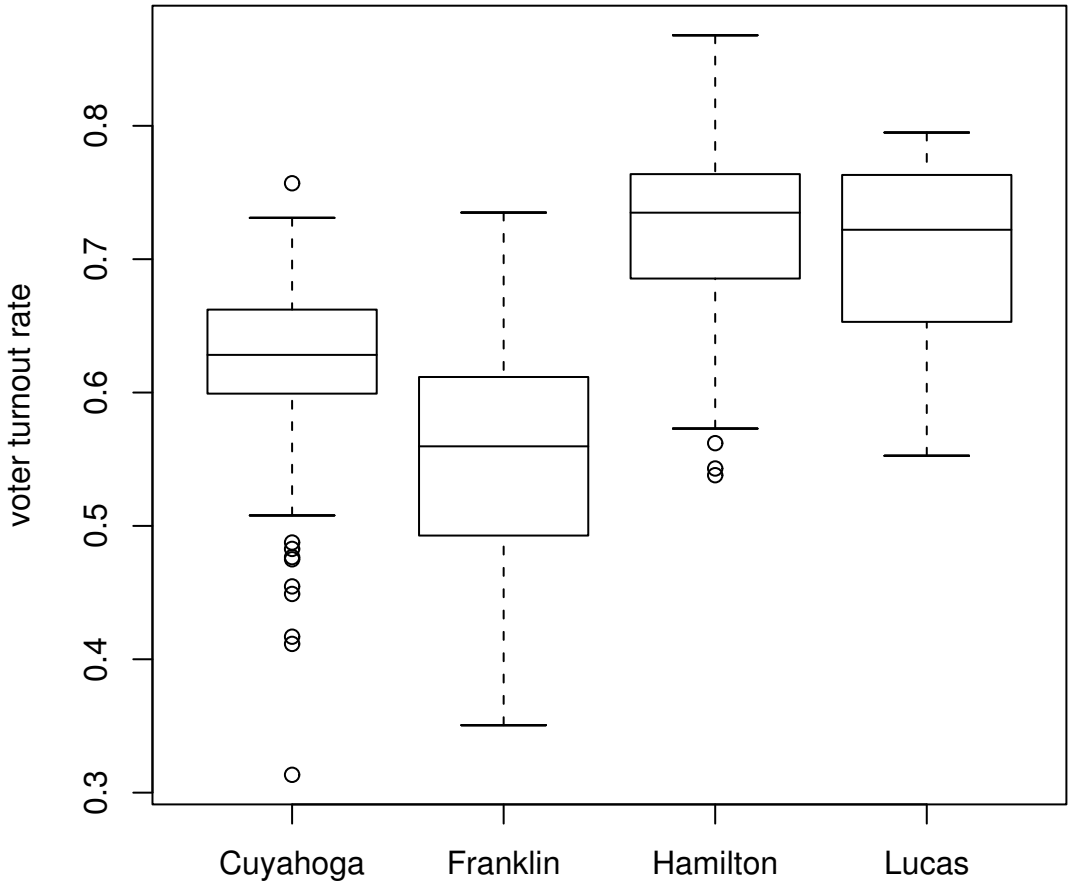


Figure 5: Turnout in Ohio 2004 in Wards with Constant Boundaries Since 2002 by County

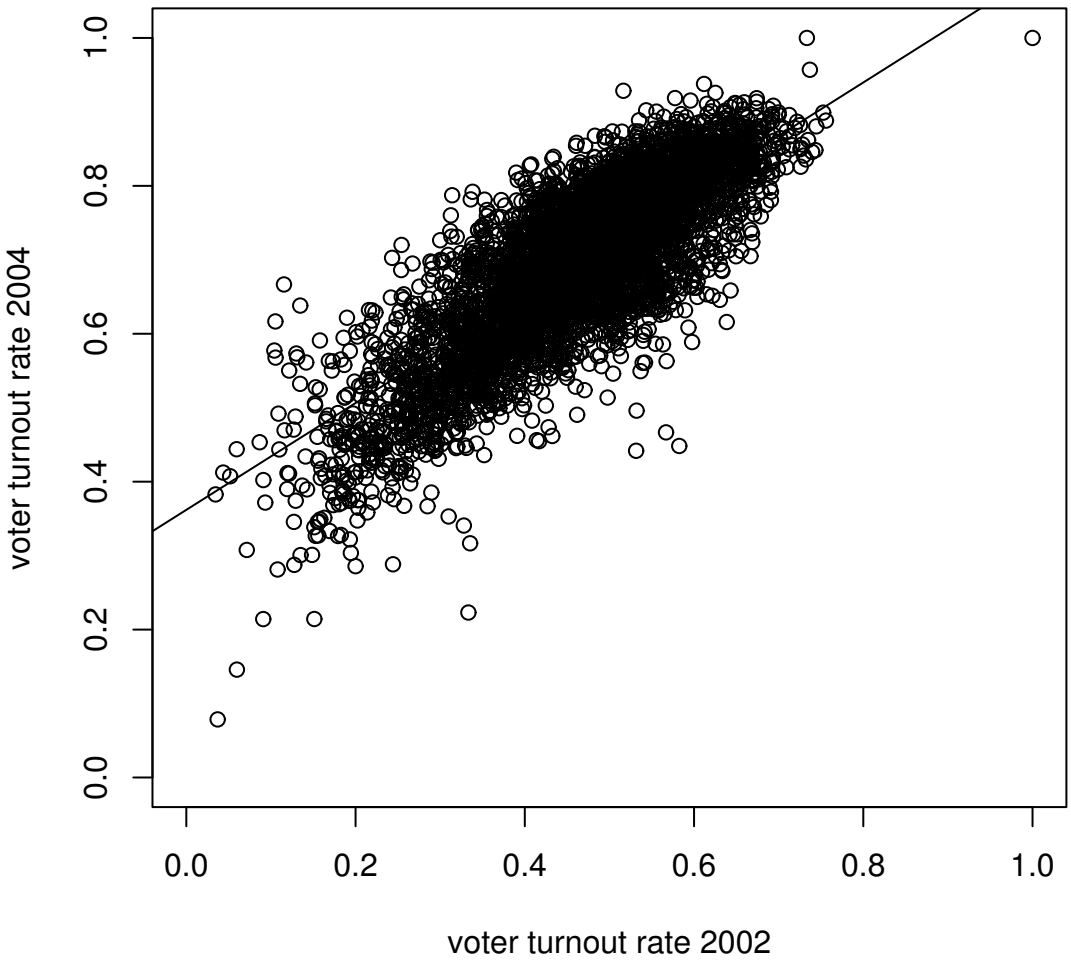


Figure 6: Turnout in Ohio 2004 by Turnout in 2002 in Precincts with Constant Boundaries Since 2002

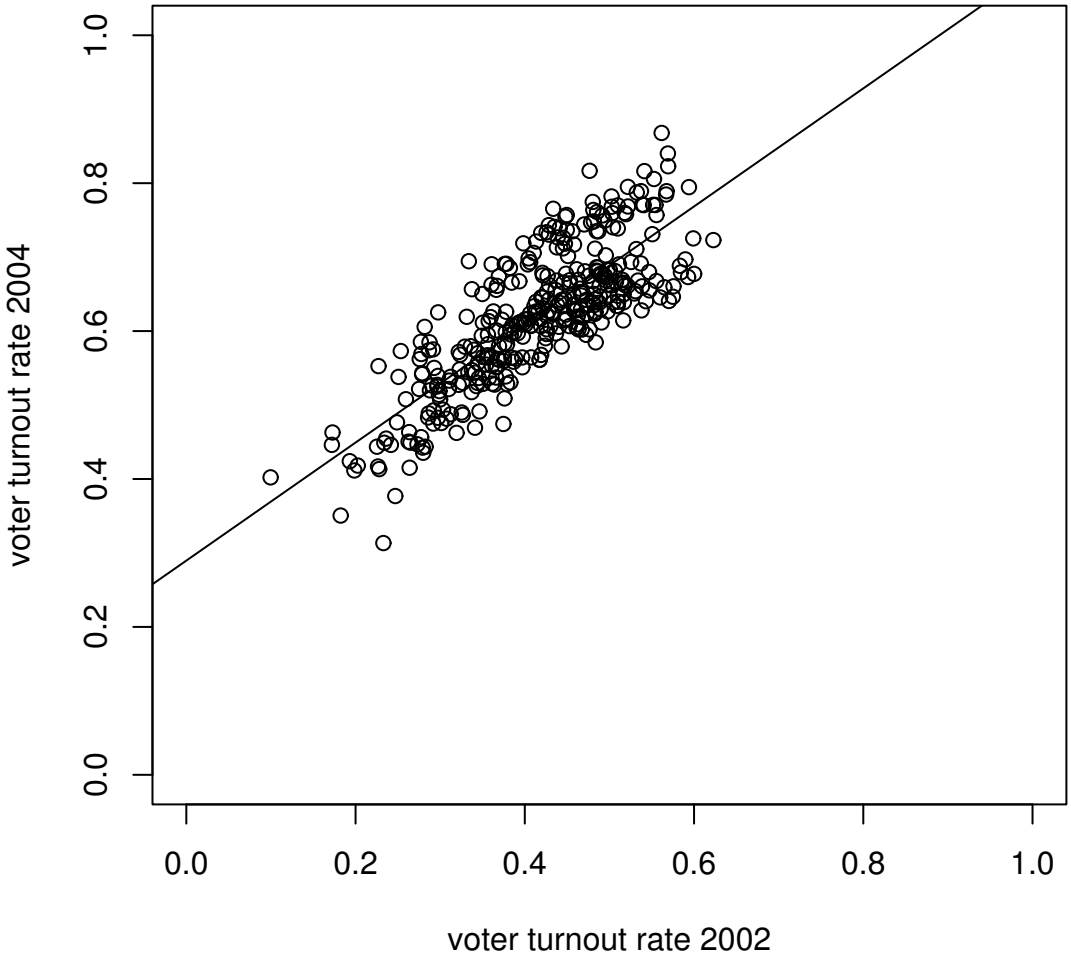


Figure 7: Turnout in Ohio 2004 by Turnout in 2002 in Wards with Constant Boundaries Since 2002

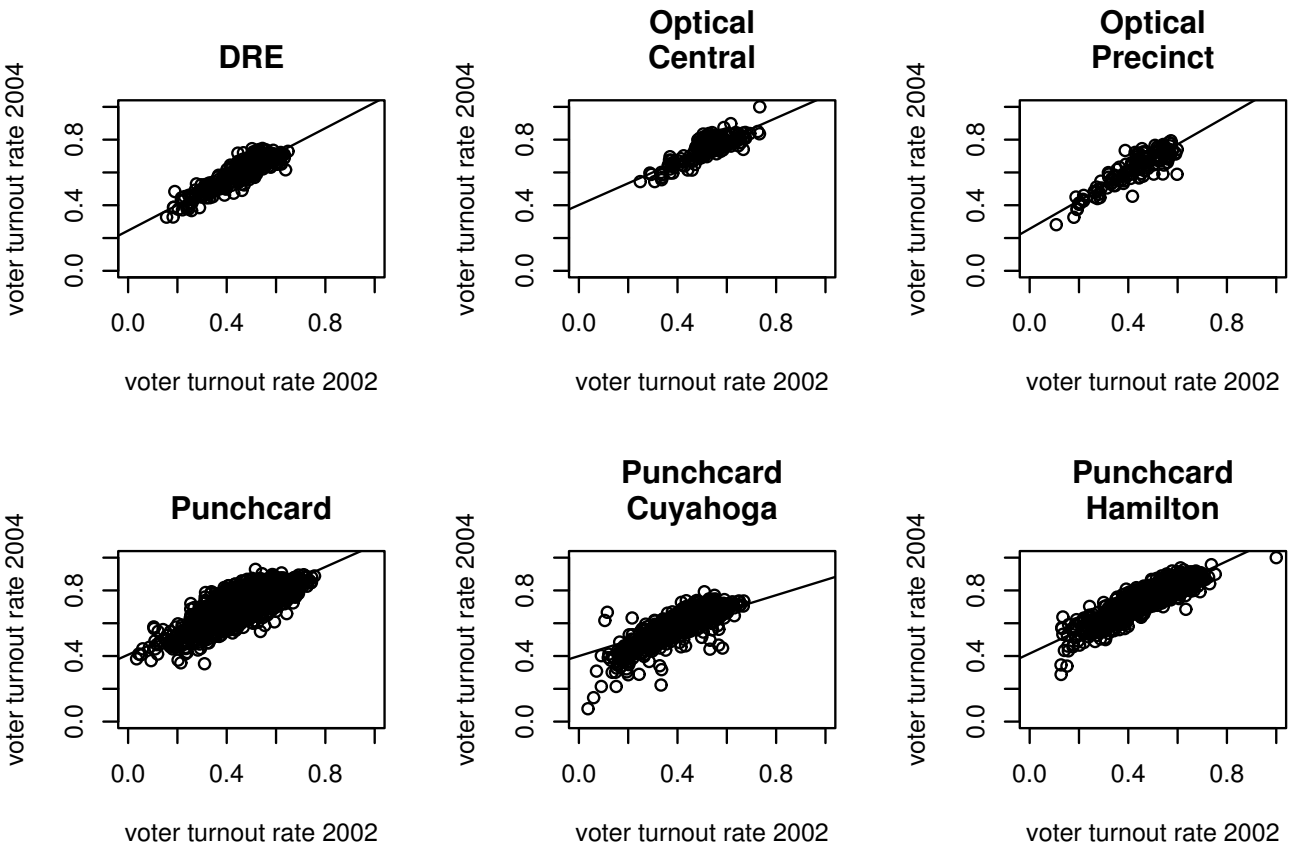


Figure 8: Turnout in Ohio 2004 by Turnout in 2002 in Precincts with Constant Boundaries Since 2002 by Machine Type

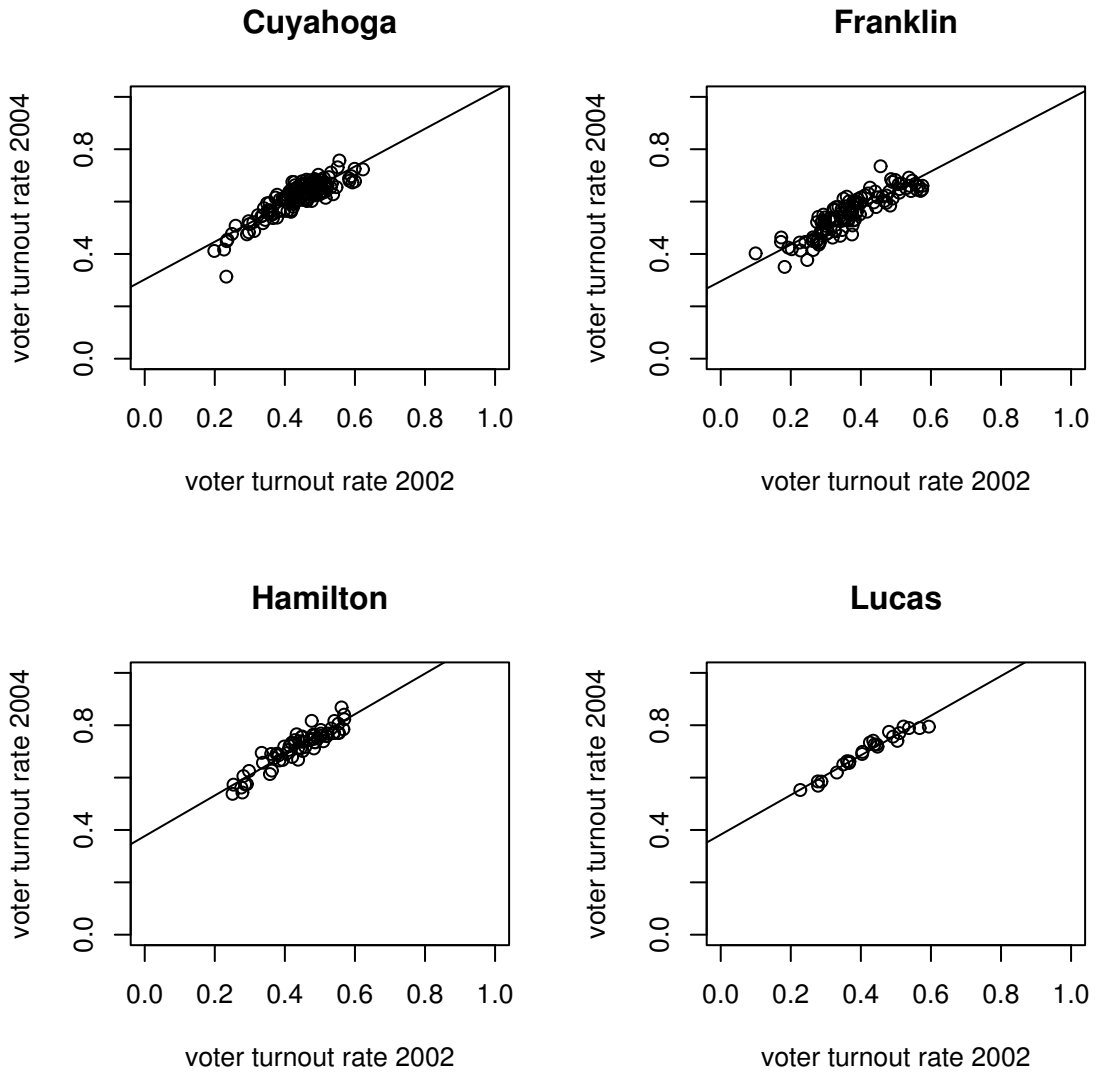


Figure 9: Turnout in Ohio 2004 by Turnout in 2002 in Wards with Constant Boundaries Since 2002 by County

Table 10: 2004 Voter Turnout: 2002 Voter Turnout Regressor

	DRE			Cuyahoga Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.566	0.00993	57.0	0.671	0.0120	55.7
Logit(Voter Turnout in 2002)	0.770	0.01720	44.7	0.711	0.0229	31.1
	Optical Central			Franklin Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	1.150	0.00885	130.0	0.584	0.0235	24.9
Logit(Voter Turnout in 2002)	0.665	0.01710	39.0	0.613	0.0379	16.2
	Optical Precinct			Hamilton Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.799	0.0187	42.7	1.140	0.0198	57.8
Logit(Voter Turnout in 2002)	0.848	0.0224	37.8	0.867	0.0389	22.3
	Punchcard			Lucas Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	1.100	0.0053	207.0	1.160	0.0221	52.5
Logit(Voter Turnout in 2002)	0.777	0.0125	62.3	0.846	0.0387	21.9
	Cuyahoga			Hamilton		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.665	0.0074	90.0	1.250	0.0067	187.0
Logit(Voter Turnout in 2002)	0.671	0.0114	58.7	0.883	0.0136	64.7

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. DRE precincts: LQD $\sigma = 1.94$; $\tanh\ \sigma = 1.81$; $n = 312$; no outliers. Optical Central precincts: LQD $\sigma = 2.41$; $\tanh\ \sigma = 2.21$; $n = 591$; 4 outliers. Optical Precinct precincts: LQD $\sigma = 1.96$; $\tanh\ \sigma = 1.74$; $n = 139$; 1 outlier. Punchcard precincts: LQD $\sigma = 2.92$; $\tanh$ $\sigma = 2.72$; $n = 2,402$; 10 outliers. Cuyahoga precincts: LQD $\sigma = 2.16$; $\tanh\ \sigma = 1.95$; $n = 929$; 12 outliers. Hamilton precincts: LQD $\sigma = 2.10$; $\tanh\ \sigma = 2.00$; $n = 1,013$; 3 outliers. Cuyahoga wards: LQD $\sigma = 3.73$; $\tanh\ \sigma = 3.44$; $n = 151$; no outliers. Franklin wards: LQD $\sigma = 5.90$; $\tanh\ \sigma = 5.54$; $n = 117$; no outliers. Hamilton wards: LQD $\sigma = 3.17$; $\tanh\ \sigma = 3.01$; $n = 65$; no outliers. Lucas wards: LQD $\sigma = 2.48$; $\tanh\ \sigma = 2.81$; $n = 24$; no outliers. Punchcard precincts exclude Cuyahoga and Hamilton precincts.

Table 11: Outliers: 2004 Voter Turnout: 2002 Voter Turnout Regressor

Optical Central		
County	Code	SRes
Geauga	ACA	−5.08
Miami	ABX	−6.83
Miami	ABY	4.87
Miami	ABZ	5.64

Optical Precinct		
County	Code	SRes
Allen	AFJ	−4.24

Hamilton		
County	Code	SRes
Hamilton	AAN	−6.90
Hamilton	ANZ	4.66
Hamilton	AOD	4.01

Punchcard		
County	Code	SRes
Athens	AAE	5.54
Athens	AAG	6.22
Athens	AAW	4.78
Butler	AEY	4.77
Butler	AFD	5.27
Butler	AFE	5.94
Greene	AIN	5.23
Licking	ACY	−5.62
Wayne	ACP	−4.90
Williams	AAJ	−4.41

Cuyahoga		
County	Code	SRes
Cuyahoga	AMO	−6.25
Cuyahoga	APD	−6.08
Cuyahoga	APJ	0.71
Cuyahoga	APV	−4.64
Cuyahoga	AYP	−4.28
Cuyahoga	AYT	10.99
Cuyahoga	CQY	−5.42
Cuyahoga	CRU	−6.23
Cuyahoga	CSB	4.40
Cuyahoga	CZZ	6.54
Cuyahoga	DAB	−5.90
Cuyahoga	DAF	−2.69

Table 12: 2004 Voter Turnout: 2002 Voter Turnout and Machines per Voter Regressors

	DRE			Punchcard		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.409	0.0555	7.36	0.941	0.0209	45.10
Logit(Voter Turnout in 2002)	0.731	0.0227	32.20	0.771	0.0125	61.60
Machines per Registered Voter	25.000	8.6100	2.90	19.900	2.5300	7.85
	Optical Central			Cuyahoga		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	1.120	0.0275	40.90	0.670	0.0195	34.300
Logit(Voter Turnout in 2002)	0.859	0.0310	27.70	0.671	0.0114	58.800
Machines per Registered Voter	−12.900	3.3500	−3.86	−0.496	2.1400	−0.232
	Optical Precinct			Hamilton		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.778	0.0458	17.000	1.180	0.0484	24.4
Logit(Voter Turnout in 2002)	0.848	0.0226	37.600	0.882	0.0136	64.8
Machines per Registered Voter	3.330	6.4900	0.514	7.090	5.0500	1.4

Notes: Robust (tanh) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. DRE precincts: LQD $\sigma = 1.96$; tanh $\sigma = 1.81$; $n = 312$; no outliers. Optical Central precincts: LQD $\sigma = 1.64$; tanh $\sigma = 1.59$; $n = 181$; 1 outlier. Optical Precinct precincts: LQD $\sigma = 1.94$; tanh $\sigma = 1.74$; $n = 139$; 1 outlier. Punchcard precincts: LQD $\sigma = 2.91$; tanh $\sigma = 2.70$; $n = 2,400$; 11 outliers. Cuyahoga precincts: LQD $\sigma = 2.15$; tanh $\sigma = 1.95$; $n = 929$; 12 outliers. Hamilton precincts: LQD $\sigma = 2.09$; tanh $\sigma = 1.99$; $n = 1,013$; 3 outliers. Punchcard precincts exclude Cuyahoga and Hamilton precincts.

Table 13: Outliers: 2004 Voter Turnout: 2002 Voter Turnout and Machines per Voter Regressors

Optical Central		
County	Code	SRes
Ottawa	ACN	0.18

Optical Precinct		
County	Code	SRes
Allen	AFJ	−4.28

Hamilton		
County	Code	SRes
Hamilton	AAN	−6.81
Hamilton	ANZ	4.70
Hamilton	AOD	4.03

Punchcard		
County	Code	SRes
Athens	AAE	6.12
Athens	AAG	7.04
Athens	AAW	5.59
Belmont	AAO	−4.10
Butler	AEY	4.52
Butler	AFD	5.35
Butler	AFE	5.85
Greene	AIN	5.29
Licking	ACY	−5.05
Wayne	ACP	−4.73
Williams	AAJ	−4.32

Cuyahoga		
County	Code	SRes
Cuyahoga	AMO	−6.28
Cuyahoga	APD	−6.10
Cuyahoga	APJ	0.63
Cuyahoga	APV	−4.66
Cuyahoga	AYP	−4.30
Cuyahoga	AYT	9.42
Cuyahoga	CQY	−5.46
Cuyahoga	CRU	−6.25
Cuyahoga	CSB	4.41
Cuyahoga	CZZ	6.55
Cuyahoga	DAB	−5.92
Cuyahoga	DAF	−2.35

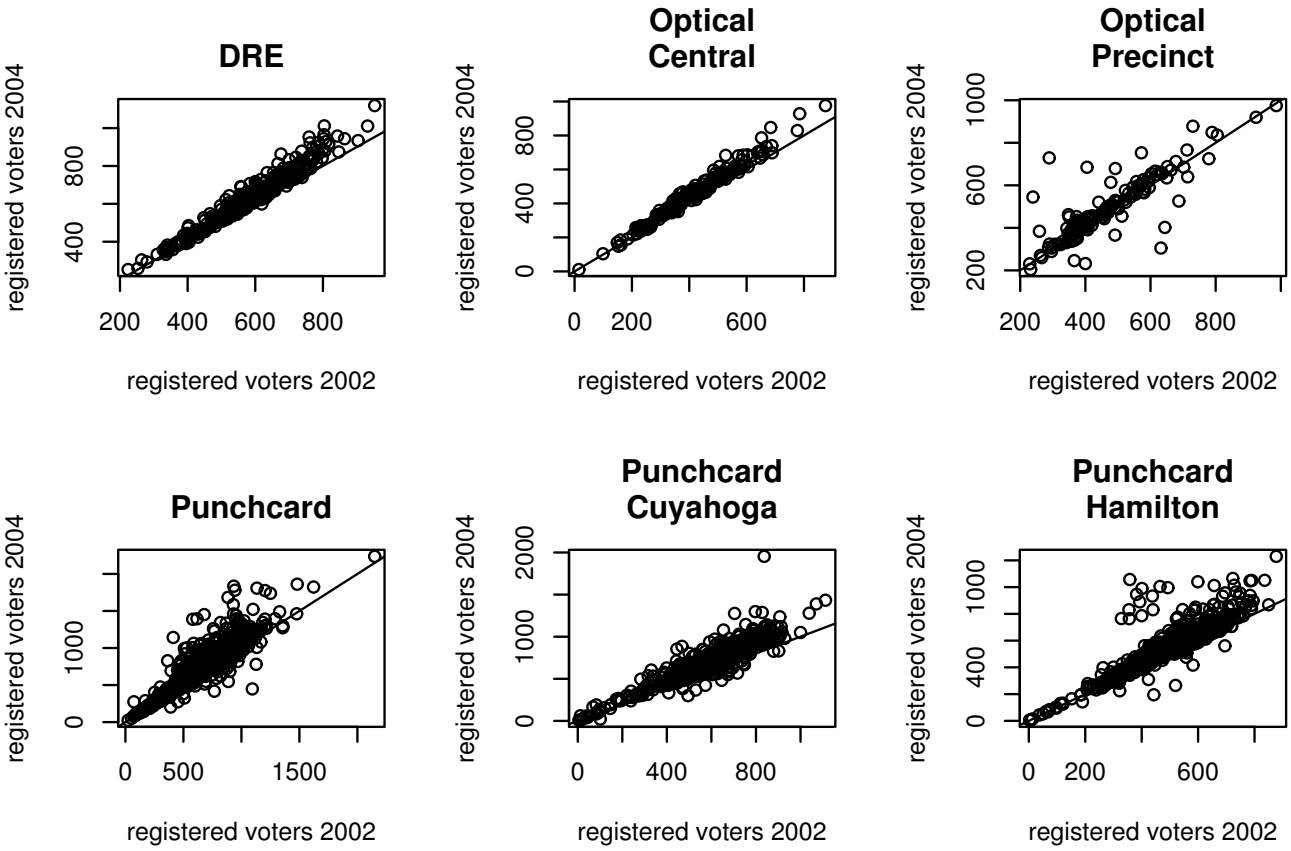


Figure 10: 2004 Registered Voters by 2002 Registered Voters in Precincts with Constant Boundaries Since 2002 by Machine Type

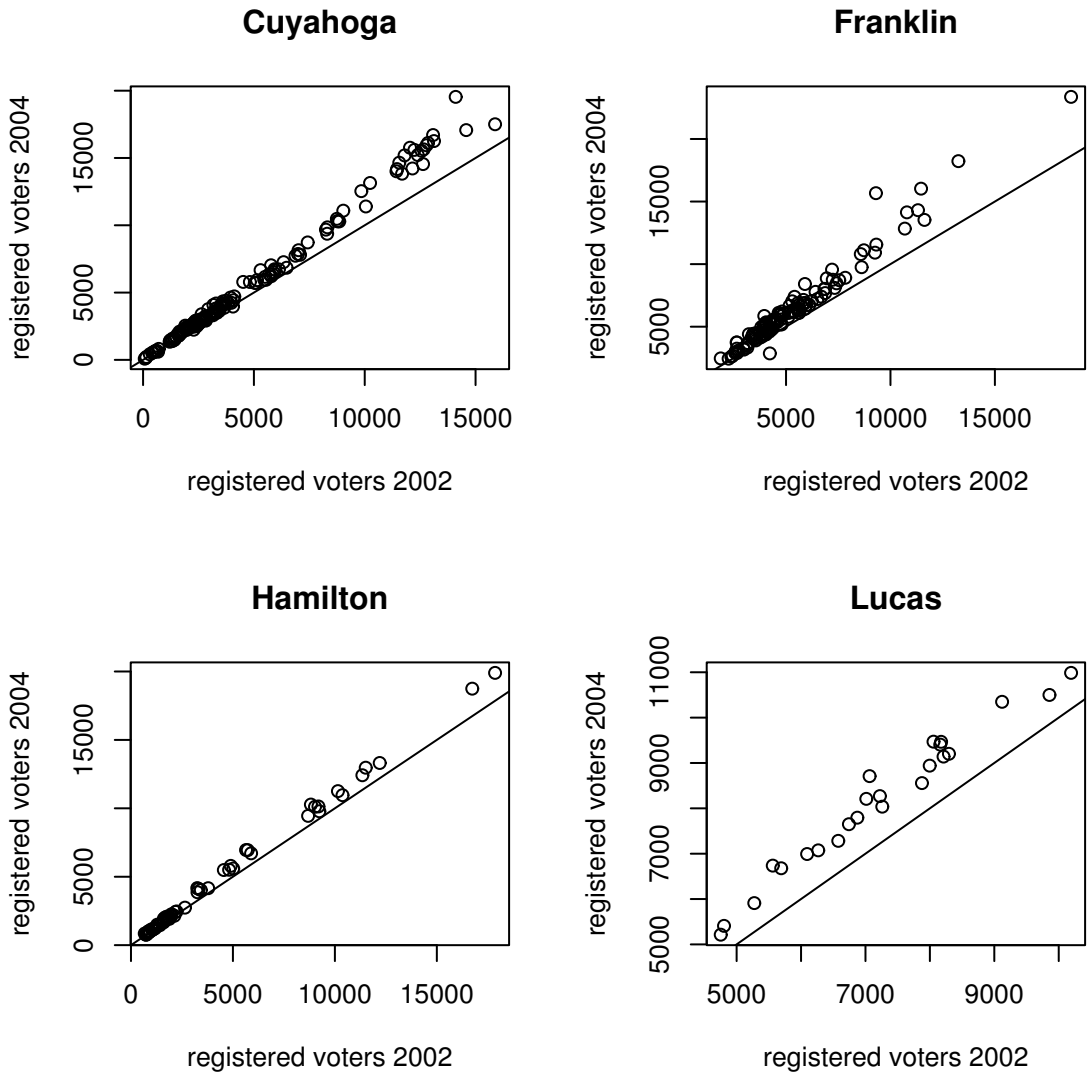


Figure 11: 2004 Registered Voters by 2002 Registered Voters in Wards with Constant Boundaries Since 2002 by County

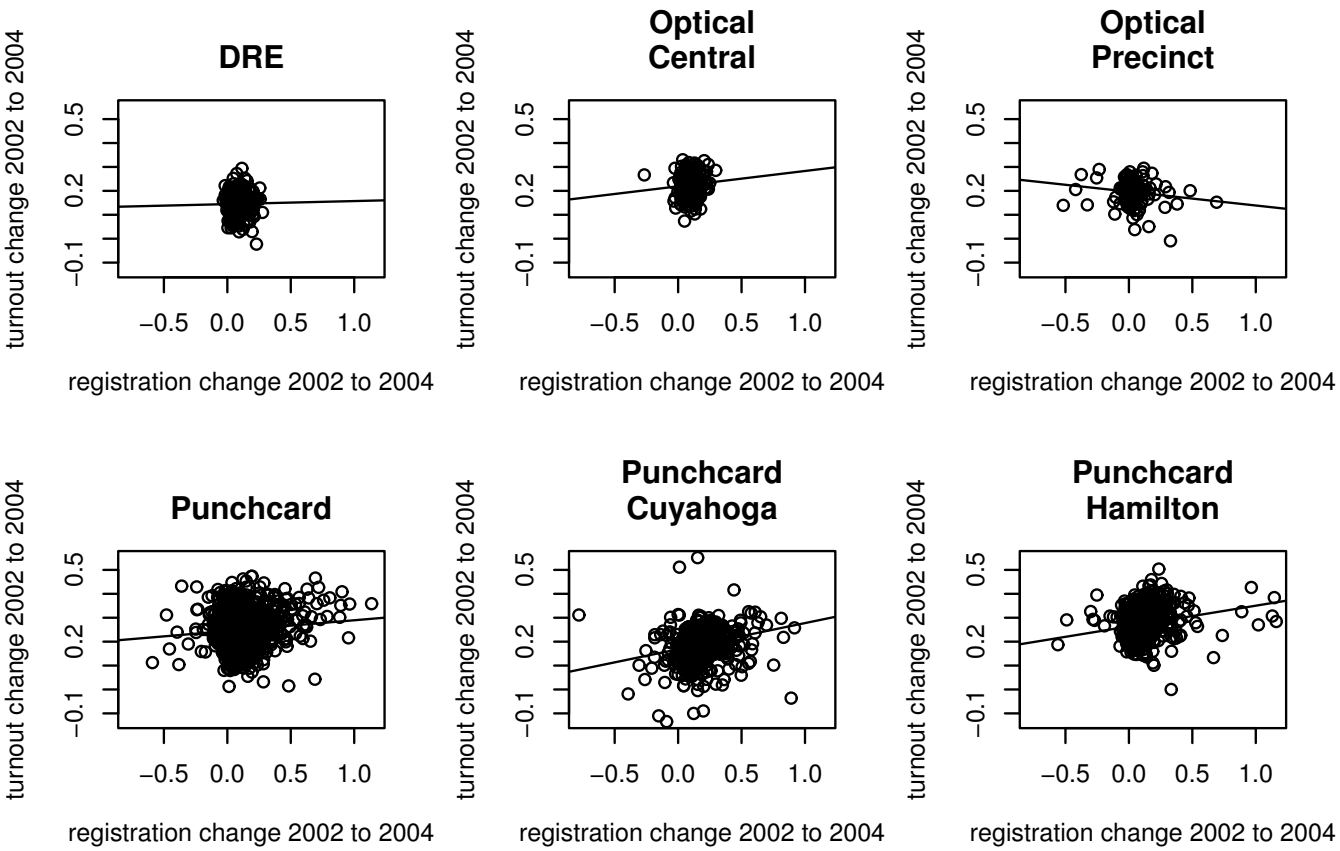


Figure 12: Change in Turnout by Change in Registration in Ohio from 2002 to 2004 in Precincts with Constant Boundaries Since 2002 by Machine Type

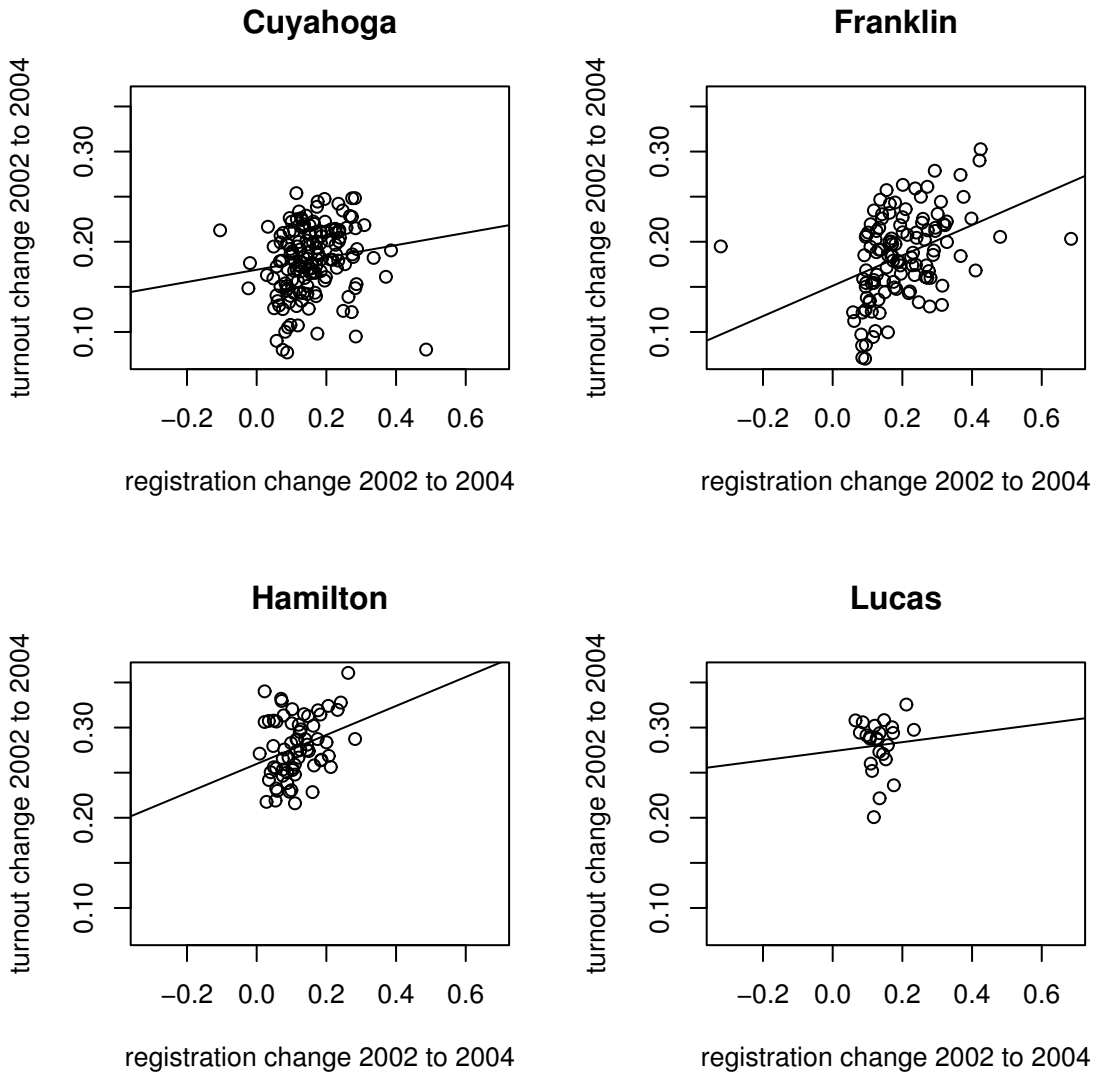


Figure 13: Change in Turnout by Change in Registration in Ohio from 2002 to 2004 in Wards with Constant Boundaries Since 2002 by County

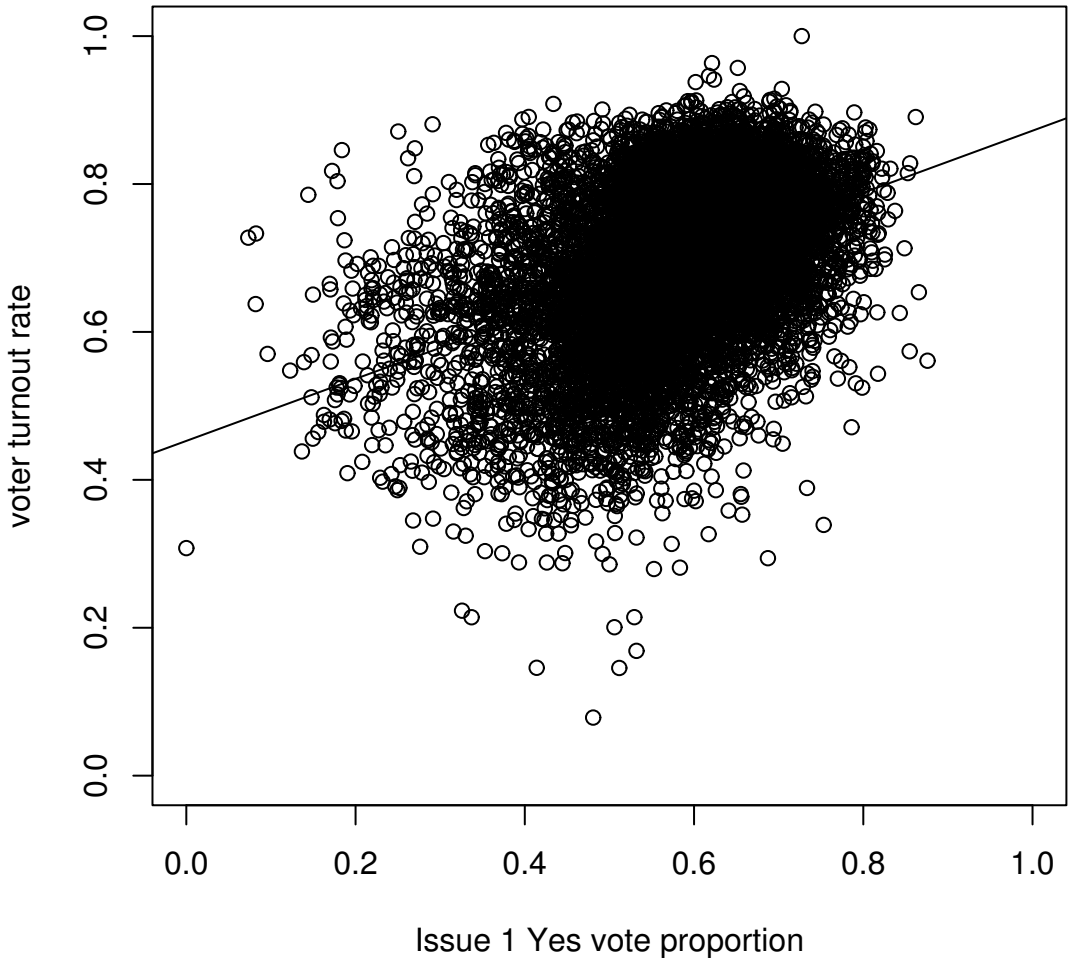


Figure 14: Turnout in Ohio 2004 Precincts by Issue 1 Proportion Yes

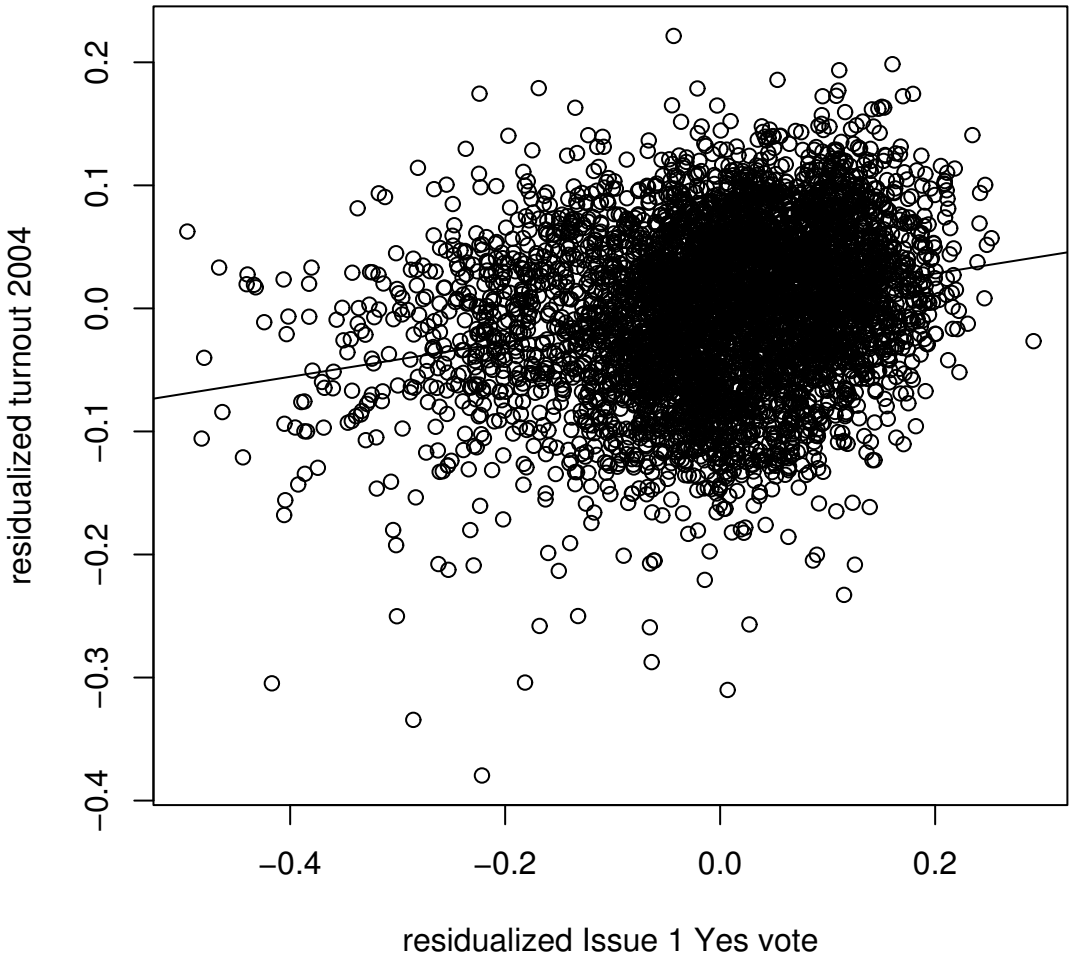


Figure 15: 2004 Turnout by Issue 1 Proportion Yes (Residualized) in Precincts with Constant Boundaries Since 2002

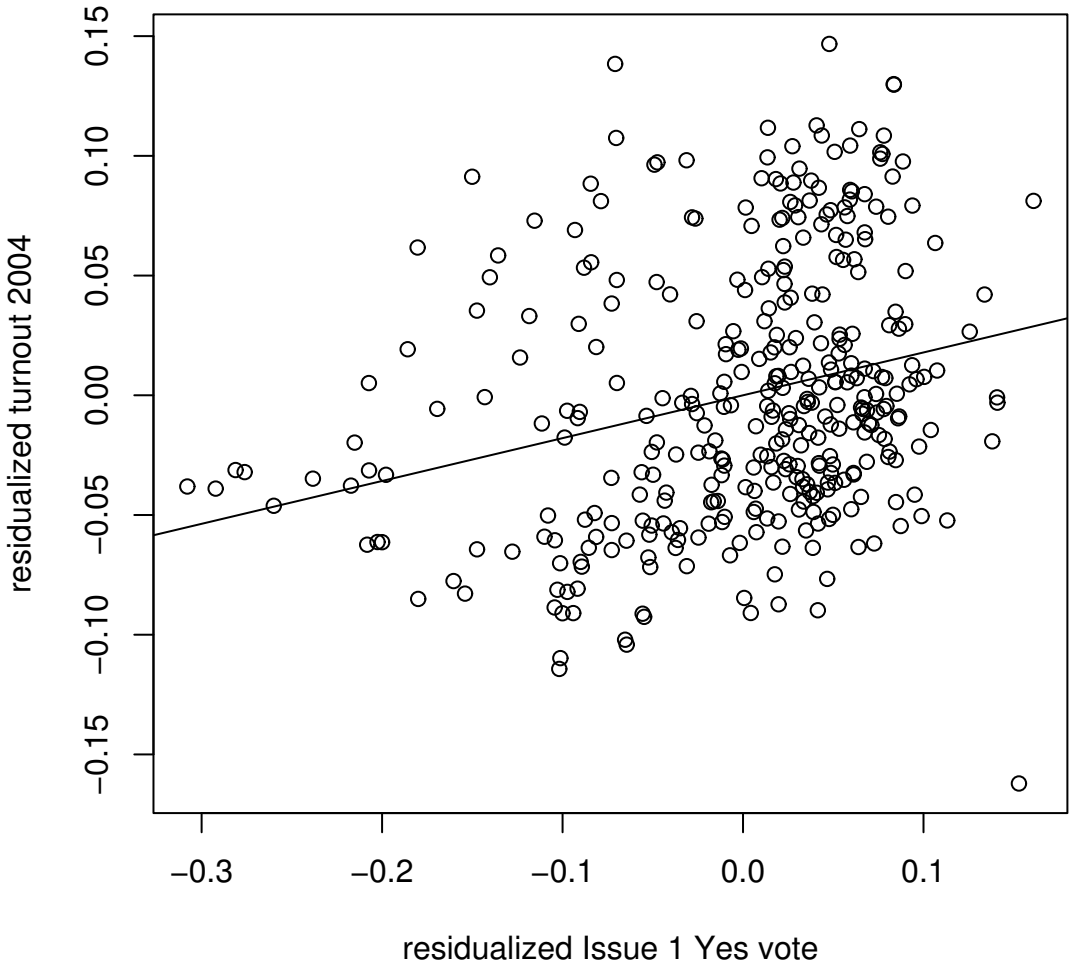


Figure 16: 2004 Turnout by Issue 1 Proportion Yes (Residualized) in Wards with Constant Boundaries Since 2002

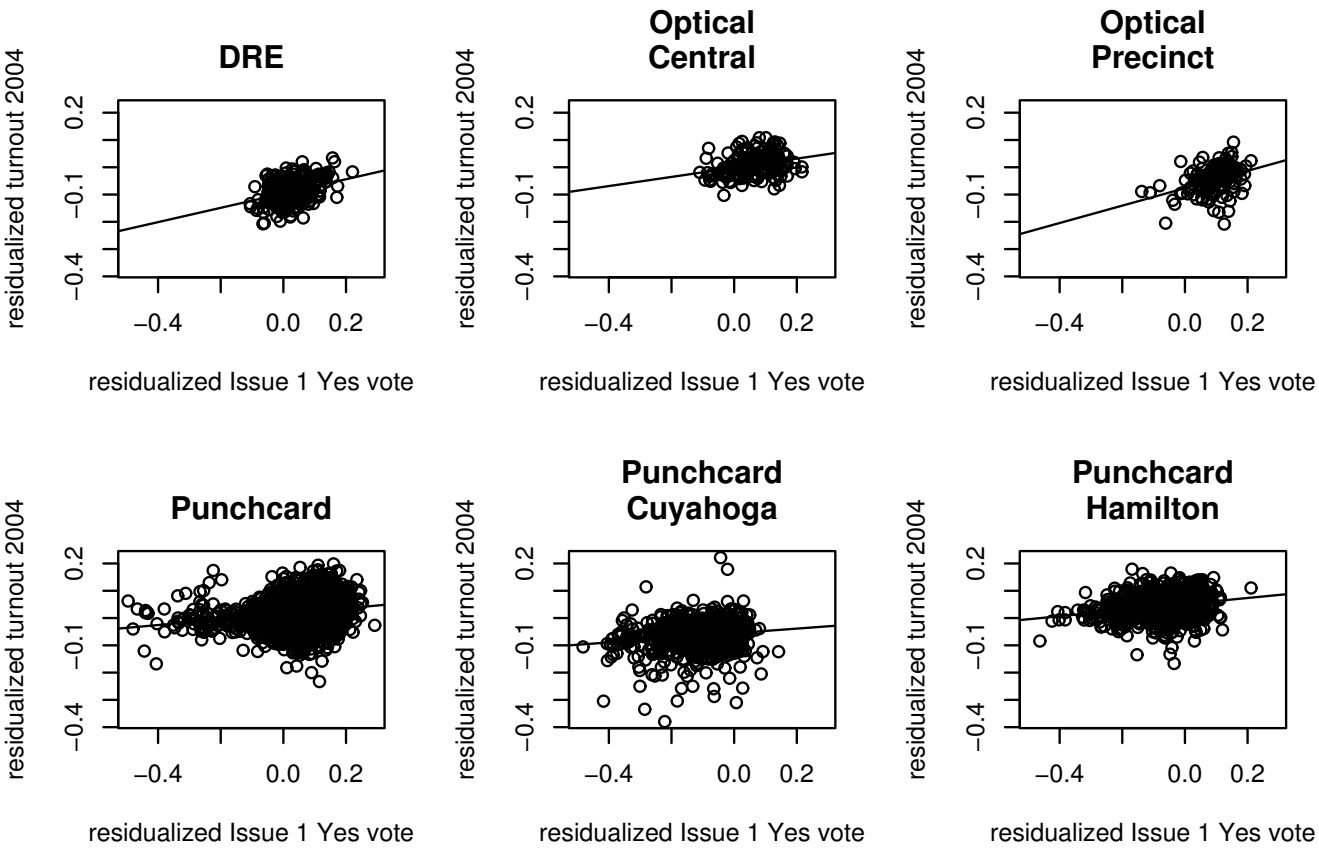


Figure 17: 2004 Turnout by Issue 1 Proportion Yes (Residualized) in Precincts with Constant Boundaries Since 2002, by Machine Type

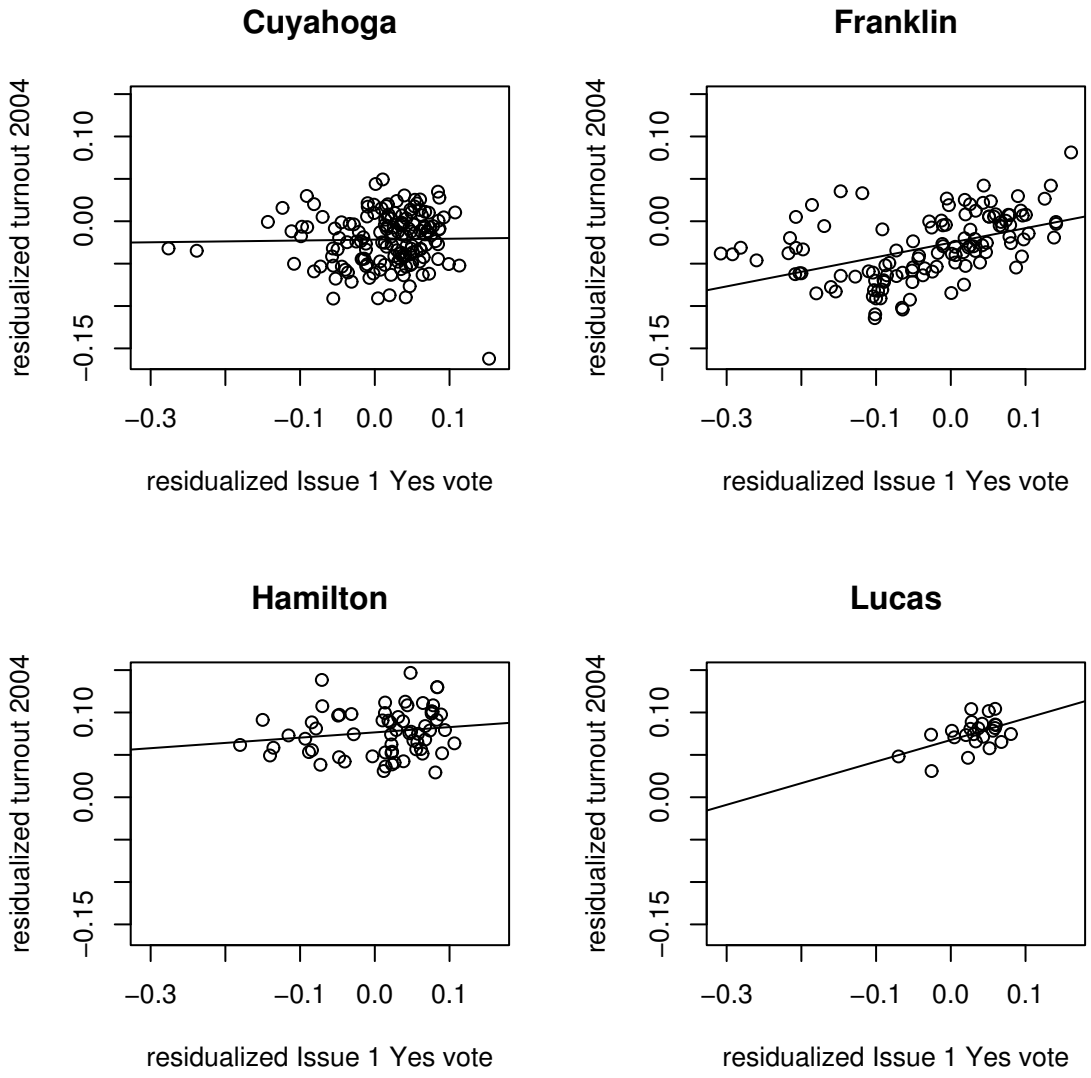


Figure 18: 2004 Turnout by Issue 1 Proportion Yes (Residualized) in Wards with Constant Boundaries Since 2002, by County

Table 14: 2004 Voter Turnout: 2002 Voter Turnout and Issue 1 Vote Regressor

	DRE			Cuyahoga Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.455	0.0200	22.80	0.6700	0.0120	55.800
Logit(Voter Turnout in 2002)	0.712	0.0182	39.20	0.7090	0.0228	31.200
Logit(Yes on Issue 1)	0.236	0.0392	6.03	0.0107	0.0281	0.381
	Optical Central			Franklin Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	1.040	0.0178	58.60	0.614	0.0217	28.30
Logit(Voter Turnout in 2002)	0.670	0.0155	43.20	0.611	0.0348	17.60
Logit(Yes on Issue 1)	0.191	0.0302	6.32	0.149	0.0312	4.78
	Optical Precinct			Hamilton Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.628	0.0599	10.50	1.1500	0.0197	58.200
Logit(Voter Turnout in 2002)	0.749	0.0426	17.60	0.8560	0.0410	20.900
Logit(Yes on Issue 1)	0.199	0.0651	3.06	0.0374	0.0432	0.865
	Punchcard			Lucas Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	1.0600	0.00854	124.00	1.120	0.0171	65.70
Logit(Voter Turnout in 2002)	0.7680	0.01240	61.70	0.796	0.0358	22.20
Logit(Yes on Issue 1)	0.0626	0.01240	5.03	0.336	0.0805	4.18
	Cuyahoga			Hamilton		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.6710	0.00742	90.40	1.230	0.00639	193.0
Logit(Voter Turnout in 2002)	0.6690	0.01130	59.20	0.833	0.01400	59.5
Logit(Yes on Issue 1)	0.0561	0.01400	4.01	0.169	0.01550	10.9

Notes: Robust (tanh) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. DRE precincts: LQD $\sigma = 1.89$; tanh $\sigma = 1.76$; $n = 312$; no outliers. Optical Central precincts: LQD $\sigma = 2.34$; tanh $\sigma = 2.13$; $n = 591$; 4 outliers. Optical Precinct precincts: LQD $\sigma = 1.93$; tanh $\sigma = 1.72$; $n = 139$; no outliers. Punchcard precincts: LQD $\sigma = 2.92$; tanh $\sigma = 2.71$; $n = 2,402$; 10 outliers. Cuyahoga precincts: LQD $\sigma = 2.14$; tanh $\sigma = 1.94$; $n = 929$; 12 outliers. Hamilton precincts: LQD $\sigma = 2.02$; tanh $\sigma = 1.91$; $n = 1,013$; 2 outliers. Cuyahoga wards: LQD $\sigma = 3.72$; tanh $\sigma = 3.45$; $n = 151$; no outliers. Franklin wards: LQD $\sigma = 4.98$; tanh $\sigma = 4.89$; $n = 117$; 1 outlier. Hamilton wards: LQD $\sigma = 3.20$; tanh $\sigma = 3.01$; $n = 65$; no outliers. Lucas wards: LQD $\sigma = 2.64$; tanh $\sigma = 2.64$; $n = 24$; no outliers. Punchcard precincts exclude Cuyahoga and Hamilton precincts.

Table 15: Expected 2004 Voter Turnout: 2002 Voter Turnout and Issue 1 Vote Regressor

Expected Voter Turnout at Issue 1 Vote Quartiles
with Median 2002 Voter Turnout

	Quartile		
Precinct Technology	25%	50%	75%
DRE	0.611	0.619	0.628
Centrally Tabulated Optical Scan	0.746	0.752	0.758
Precinct Tabulated Optical Scan	0.639	0.650	0.658
Punchcard	0.742	0.745	0.748
Cuyahoga	0.601	0.604	0.606
Hamilton	0.766	0.776	0.783
	Quartile		
Wards	25%	50%	75%
Cuyahoga	0.628	0.628	0.629
Franklin	0.548	0.561	0.570
Hamilton	0.723	0.725	0.727
Lucas	0.710	0.717	0.721

Table 16: Outliers: 2004 Voter Turnout: 2002 Voter Turnout and Issue 1 Vote Regressor

County	Ward	SRes
Franklin	Columbus City 41	4.28

Optical Central		
County	Code	SRes
Geauga	ACA	−5.16
Miami	ABX	−6.97
Miami	ABY	5.03
Miami	ABZ	5.84

Hamilton		
County	Code	SRes
Hamilton	AAN	−6.66
Hamilton	ANZ	4.39

Optical Central		
County	Code	SRes
Athens	AAE	6.02
Athens	AAG	6.88
Athens	AAW	5.47
Butler	AEY	5.15
Butler	AFD	5.63
Butler	AFE	6.28
Greene	AIN	5.17
Licking	ACY	−4.83
Wayne	ACP	−4.91
Williams	AAJ	−4.39

Cuyahoga		
County	Code	SRes
Cuyahoga	AMO	−5.77
Cuyahoga	APD	−5.96
Cuyahoga	APJ	0.59
Cuyahoga	APV	−4.55
Cuyahoga	AYP	−4.24
Cuyahoga	AYT	8.97
Cuyahoga	CQY	−5.14
Cuyahoga	CRU	−6.05
Cuyahoga	CSB	4.79
Cuyahoga	CZZ	6.56
Cuyahoga	DAB	−5.85
Cuyahoga	DAF	−2.22

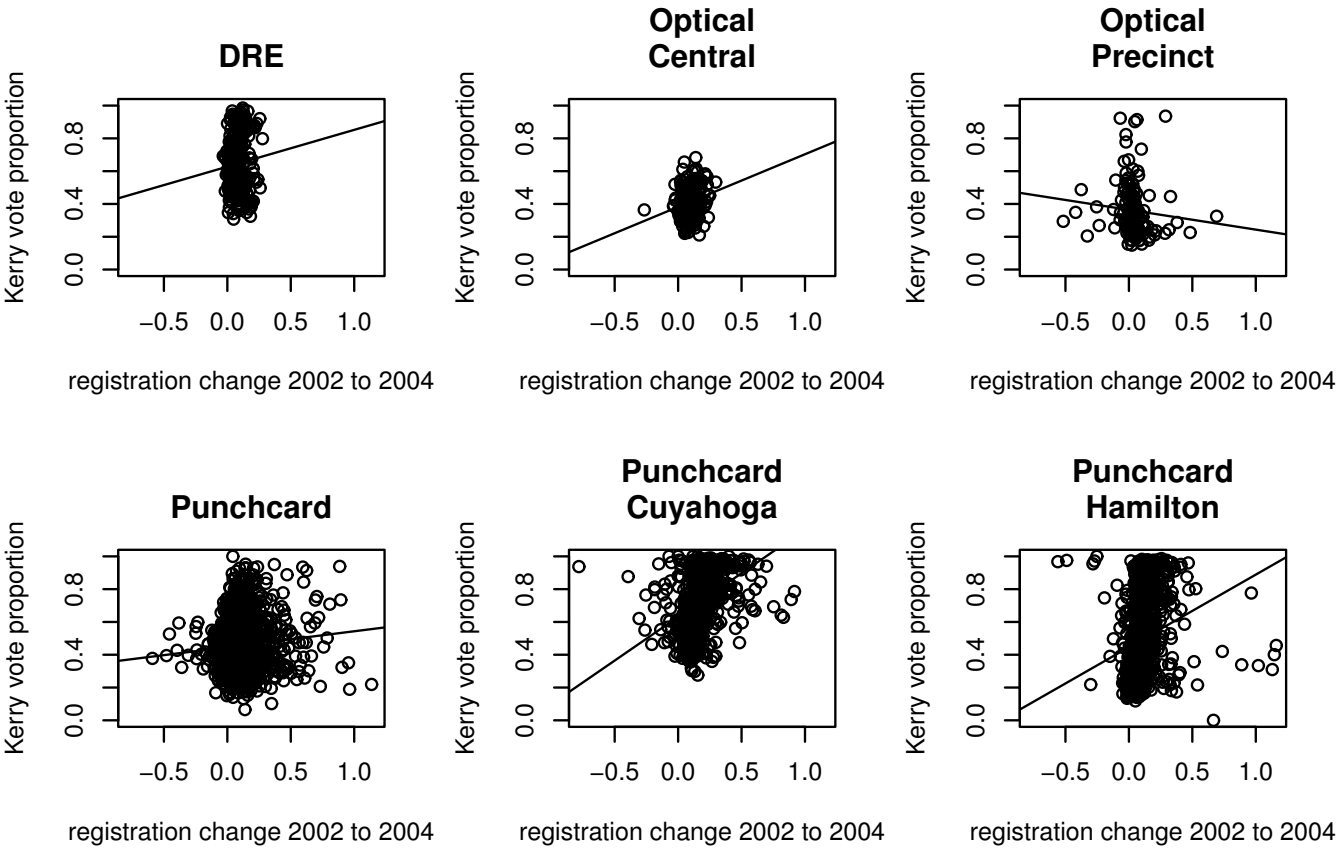


Figure 19: Democratic President Proportion by Change in Proportional Change Registration in Ohio from 2002 to 2004 in Precincts with Constant Boundaries Since 2002 by Machine Type

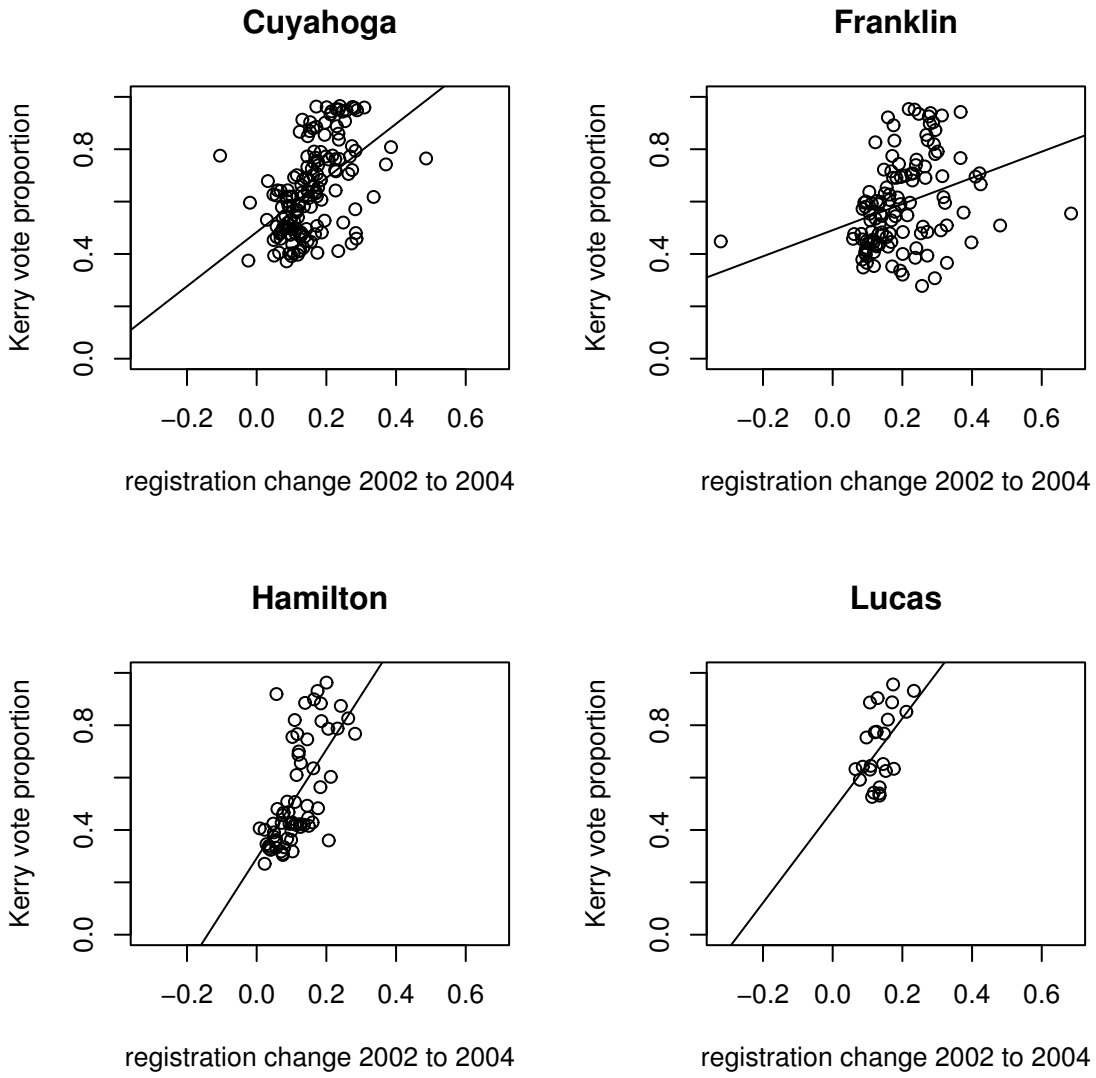


Figure 20: Democratic President Proportion by Change in Proportional Change Registration in Ohio from 2002 to 2004 in Wards with Constant Boundaries Since 2002 by County

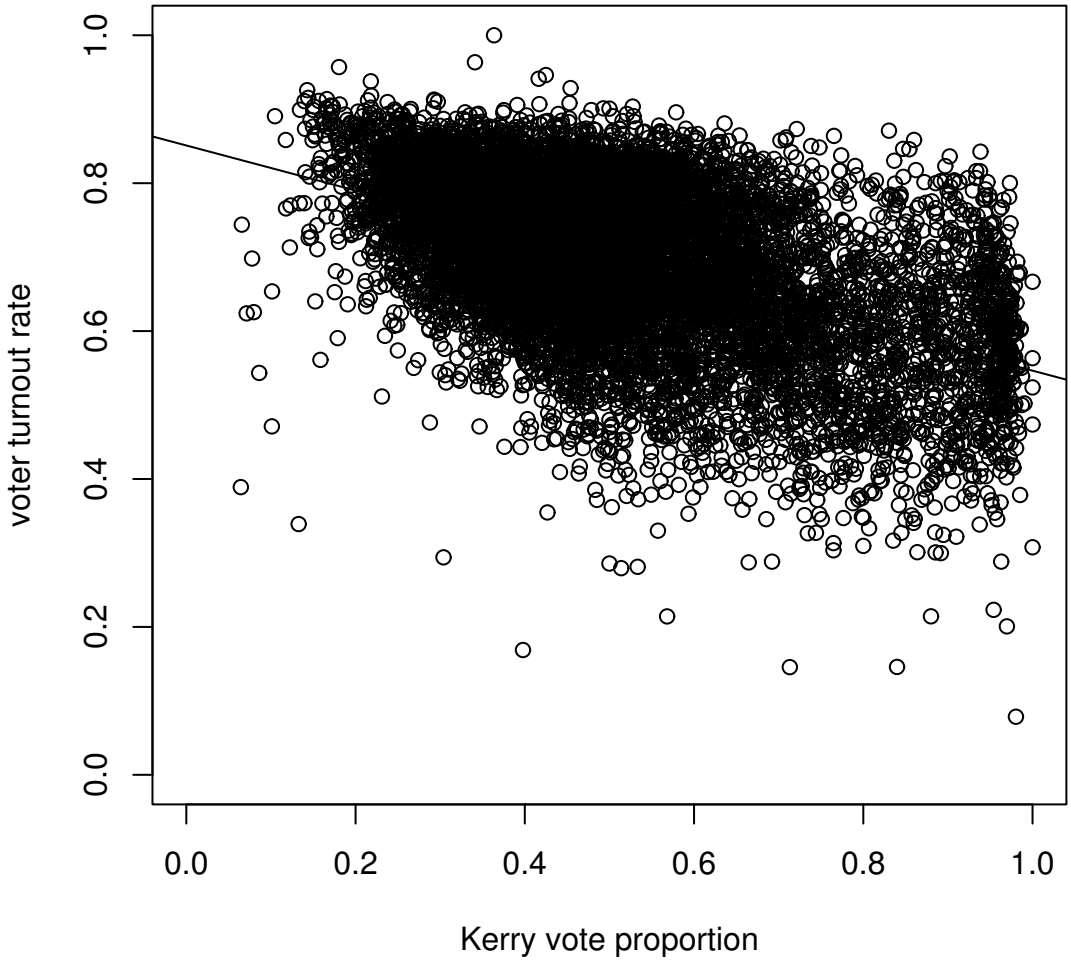


Figure 21: Turnout in Ohio 2004 Precincts by Democratic President Proportion

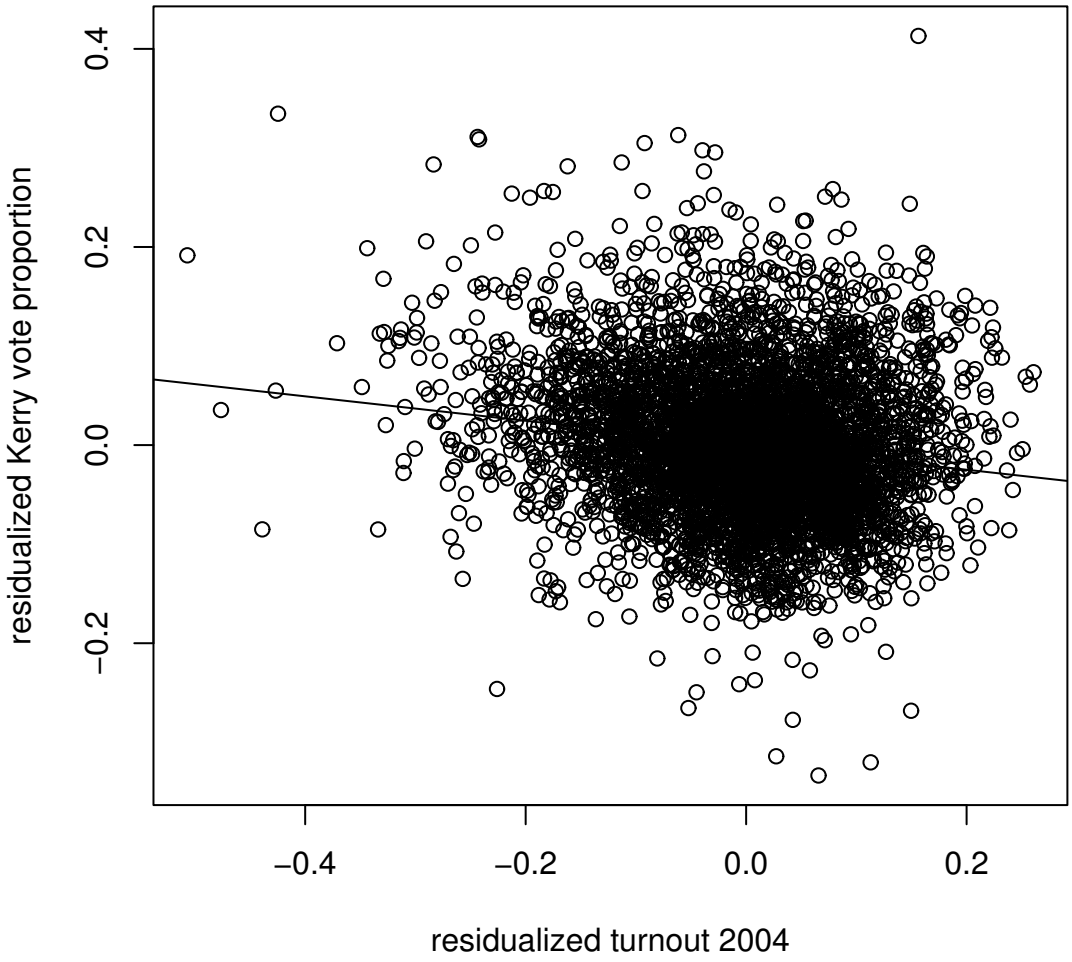


Figure 22: Democratic President Proportion by 2004 Turnout (Residualized) in Precincts with Constant Boundaries Since 2002

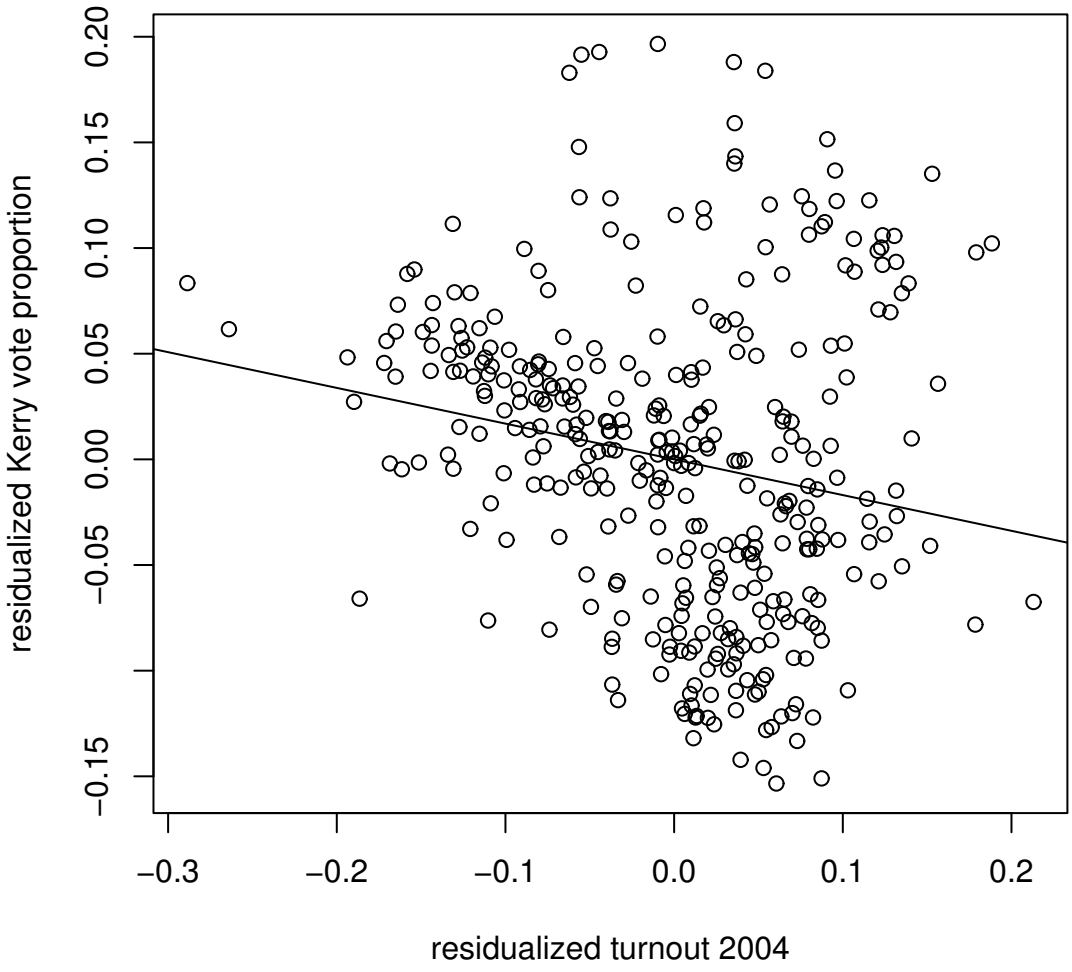


Figure 23: Democratic President Proportion by 2004 Turnout (Residualized) in Wards with Constant Boundaries Since 2002

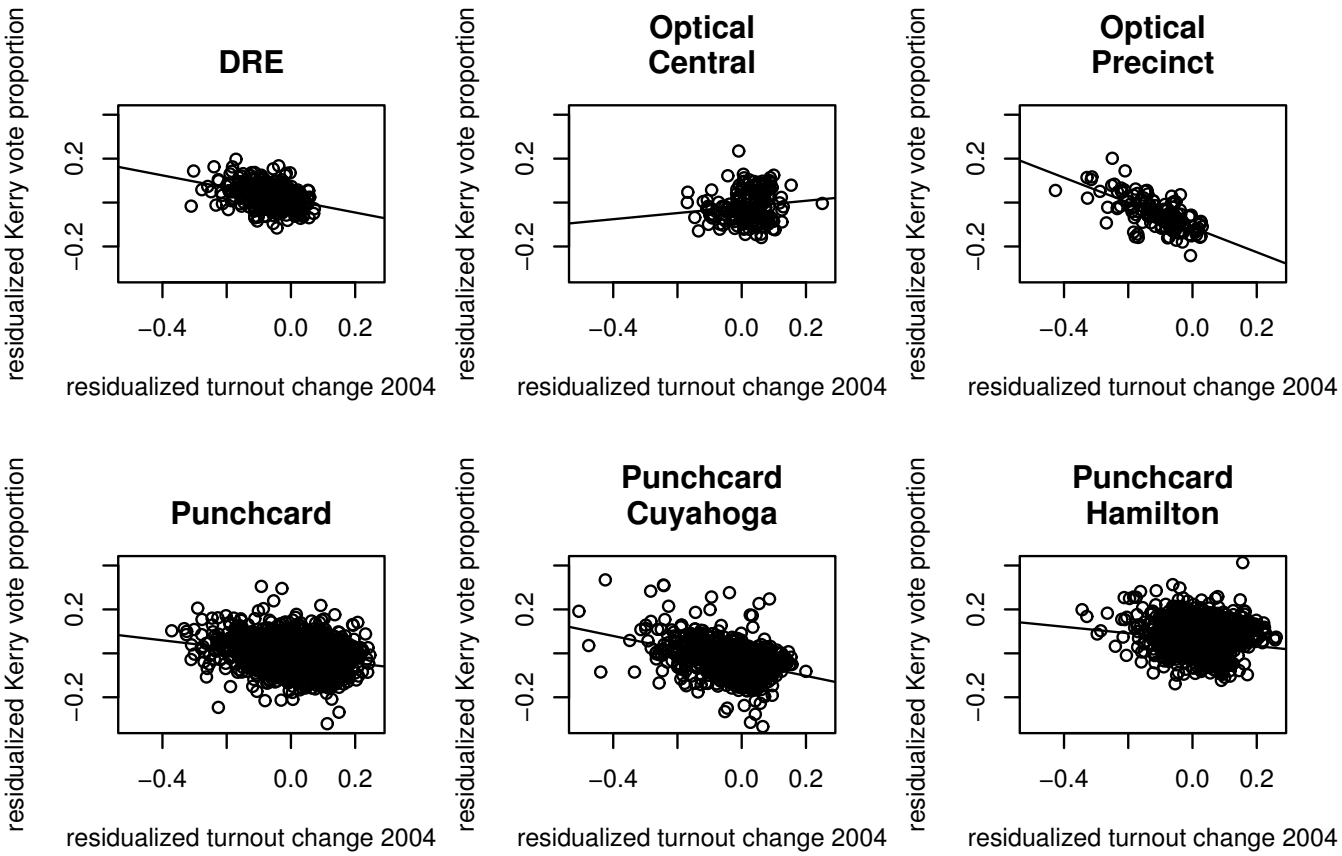


Figure 24: Democratic President Proportion by 2004 Turnout (Residualized) in Precincts with Constant Boundaries Since 2002, by Machine Type

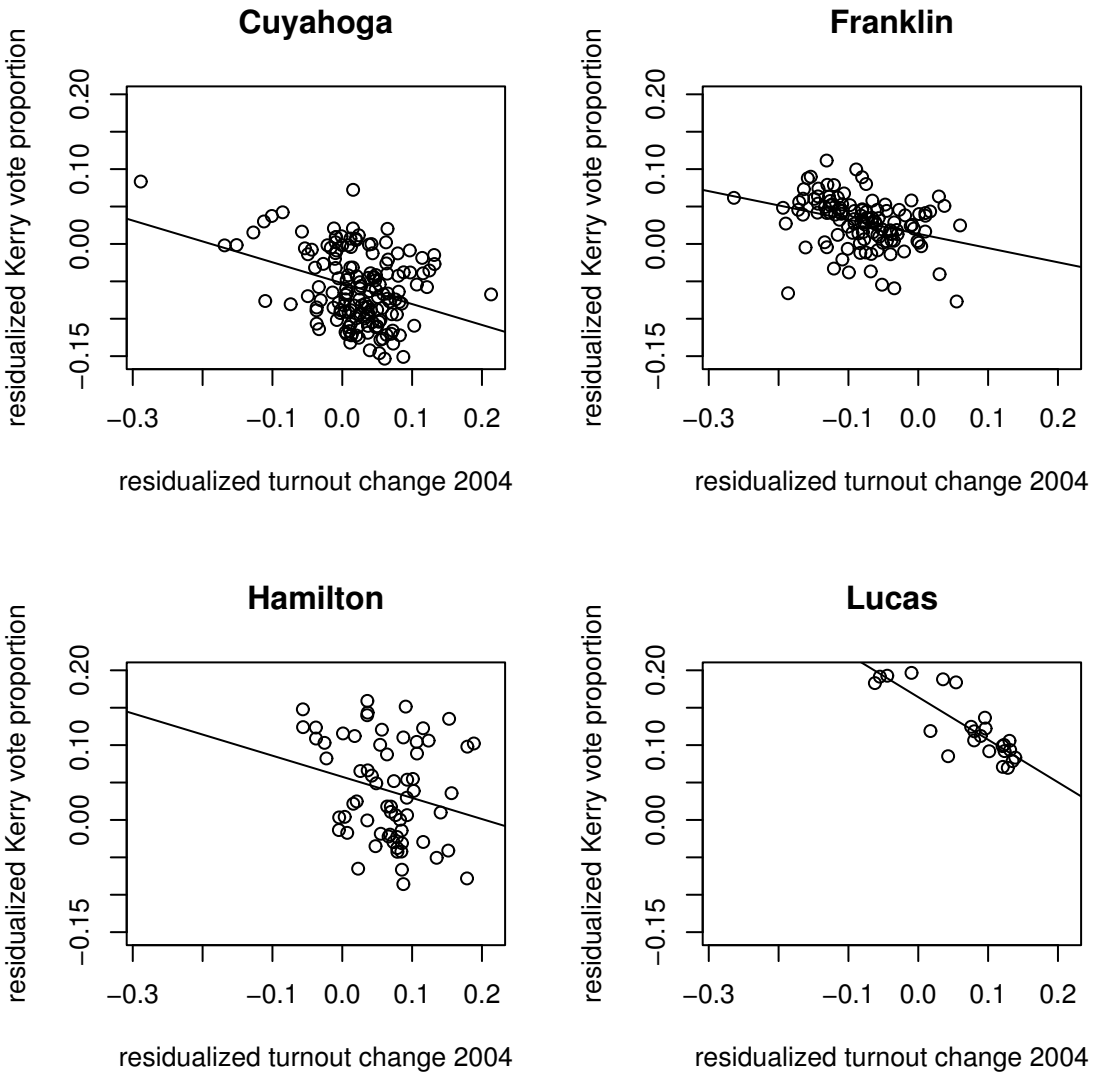


Figure 25: Democratic President Proportion by 2004 Turnout (Residualized) in Wards with Constant Boundaries Since 2002, by County

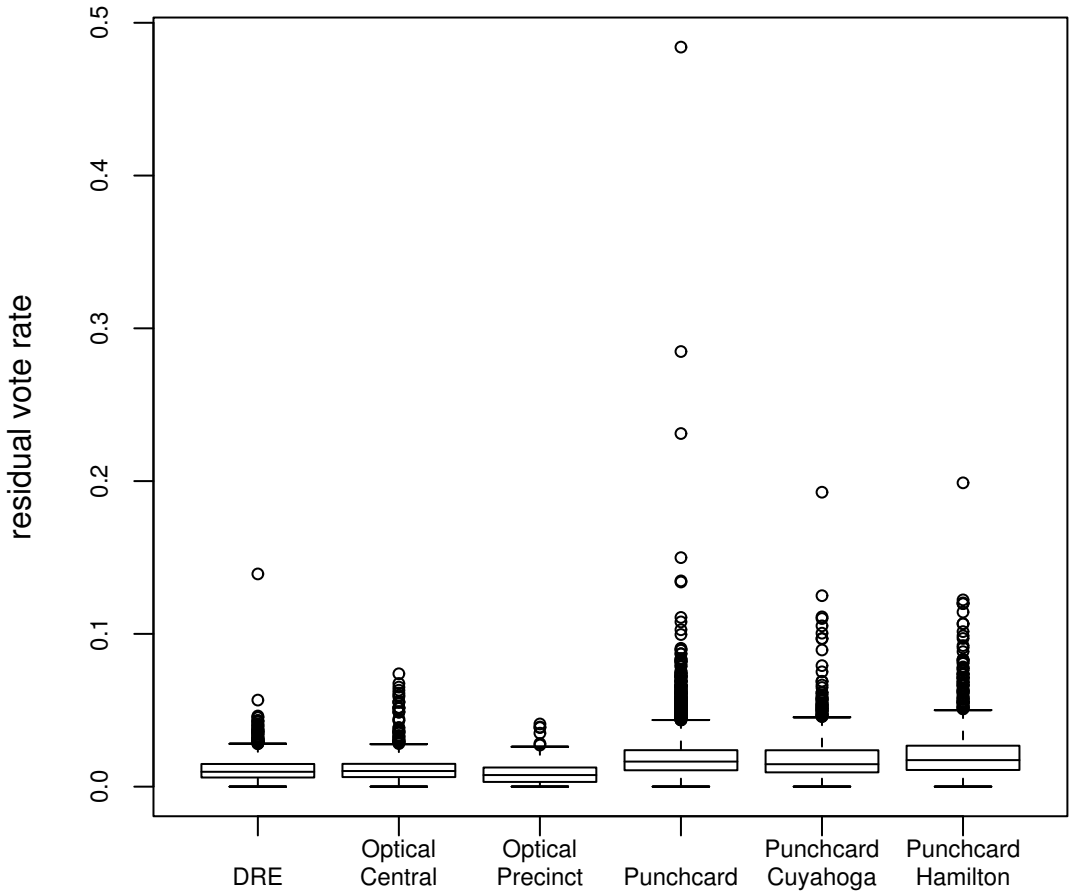


Figure 26: Residual Vote Rate in Ohio 2004 Precincts by Machine Type

Table 17: Residual Vote: Machines per Voter Regressor

	DRE		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.53	0.0428	-106.00
Machines per Registered Voter	-30.90	10.4000	-2.97
	Optical Central		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.58	0.0477	-95.900
Machines per Registered Voter	-4.48	7.3100	-0.613
	Optical Precinct		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.59	0.22	-20.90
Machines per Registered Voter	-69.00	34.90	-1.98
	Punchcard		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.120	0.0235	-175.000
Machines per Registered Voter	-0.411	2.7800	-0.148

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of residual votes versus the number of votes for one of four presidential candidates (Bush, Kerry, Bedarnik or Peroutka). The residual vote is the number of ballots cast that did not include a vote for one of those four candidates. DRE: LQD $\sigma = 0.96$; $\tanh\ \sigma = 1.08$; $n = 1{,}535$ precincts; 77 precincts are outliers. Optical Central: LQD $\sigma = 0.86$; $\tanh\ \sigma = 0.98$; $n = 807$ precincts; 41 precincts are outliers. Optical Precinct: LQD $\sigma = 0.76$; $\tanh\ \sigma = 0.94$; $n = 139$ precincts; 9 precincts are outliers. Punchcard: LQD $\sigma = 1.28$; $\tanh\ \sigma = 1.35$; $n = 7{,}865$ precincts; 266 precincts are outliers. Punchcard precincts include Cuyahoga and Hamilton precincts.

Expected Residual Vote Rate at Machine Ratio Quartiles

	Quartile		
Technology	25%	50%	75%
DRE	0.0097	0.0096	0.0093
Centrally Tabulated Optical Scan	0.0100	0.0099	0.0099
Precinct Tabulated Optical Scan	0.0071	0.0064	0.0060
Punchcard	0.0160	0.0160	0.0160

Table 18: Outliers, DRE Machine Technology: Residual Vote: Machines per Voter Regressor

DRE								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Franklin	AAQ	4.66	Franklin	AFS	4.01	Franklin	ATF	4.58
Franklin	ABF	6.48	Franklin	AFW	4.08	Franklin	ATN	5.94
Franklin	ABK	9.22	Franklin	AGG	5.24	Franklin	AUK	5.08
Franklin	ABL	4.64	Franklin	AGM	4.83	Franklin	AWA	4.98
Franklin	ABN	4.06	Franklin	AGQ	6.03	Franklin	AXK	6.40
Franklin	ABP	6.05	Franklin	AHF	5.48	Franklin	AXM	4.18
Franklin	ABR	4.70	Franklin	AHJ	5.28	Franklin	AXP	4.70
Franklin	ABS	5.09	Franklin	AHK	6.15	Franklin	AXZ	4.97
Franklin	ABU	9.64	Franklin	AHW	4.16	Franklin	AYQ	5.33
Franklin	ACB	4.10	Franklin	AHX	4.09	Franklin	AYU	9.19
Franklin	ACQ	7.94	Franklin	AIK	6.22	Franklin	AYZ	5.21
Franklin	ACX	5.25	Franklin	AIQ	4.15	Franklin	AZD	4.51
Franklin	ADF	4.49	Franklin	AIW	4.27	Franklin	AZH	7.79
Franklin	ADL	4.14	Franklin	AJJ	5.85	Franklin	BAB	4.60
Franklin	ADO	4.56	Franklin	AJY	4.59	Franklin	BAG	4.65
Franklin	ADP	5.48	Franklin	AKD	4.47	Franklin	BAJ	5.47
Franklin	AEJ	7.29	Franklin	AKG	8.71	Franklin	BAK	6.00
Franklin	AES	4.27	Franklin	AKP	5.33	Franklin	BBE	4.98
Franklin	AEU	5.39	Franklin	AKT	5.72	Franklin	BBK	4.76
Franklin	AEY	5.09	Franklin	AKU	5.52	Knox	AAR	4.20
Franklin	AFD	4.16	Franklin	AKY	7.02	Lake	ADN	5.73
Franklin	AFI	9.59	Franklin	ALR	4.46	Mahoning	ARC	24.93
Franklin	AFJ	4.81	Franklin	ALW	4.65	Mahoning	ARZ	4.24
Franklin	AFL	4.08	Franklin	AML	7.56	Mahoning	ASC	6.48
Franklin	AFN	6.53	Franklin	AOW	13.15	Ross	AAH	5.13
Franklin	AFO	5.88	Franklin	ATE	5.13			

Table 19: Outliers, Optical Scan Machine Technologies: Residual Vote: Machines per Voter Regressor

Optical Central

County	Code	SRes	County	Code	SRes	County	Code	SRes
Ashland	AAB	4.05	Ashland	ABQ	11.88	Erie	ADN	10.70
Ashland	AAC	12.47	Ashland	ABT	12.82	Erie	AEG	4.09
Ashland	AAD	10.41	Ashland	ABY	8.45	Hardin	ABE	4.83
Ashland	AAH	4.99	Ashland	ABZ	6.98	Lucas	ASN	4.63
Ashland	AAK	4.15	Ashland	ACC	12.77	Lucas	ABV	4.86
Ashland	AAQ	5.32	Ashland	ACD	5.90	Lucas	AAB	4.34
Ashland	AAR	10.01	Ashland	ACG	12.01	Lucas	ANQ	7.24
Ashland	AAU	11.13	Ashland	ACH	5.56	Lucas	AHJ	5.03
Ashland	AAV	9.93	Ashland	ACJ	4.04	Ottawa	ACE	4.25
Ashland	ABA	10.69	Ashland	ACK	6.96	Sandusky	AAM	4.23
Ashland	ABB	8.59	Ashland	ACL	6.69	Sandusky	ABE	6.07
Ashland	ABI	12.04	Ashland	ACO	11.11	Sandusky	ABK	6.51
Ashland	ABK	8.50	Ashland	ACP	8.01	Sandusky	ACS	4.22
Ashland	ABN	5.96	Ashland	ACS	13.08			

Optical Precinct

County	Code	SRes	County	Code	SRes	County	Code	SRes
Allen	ABF	4.64	Allen	ACG	8.48	Allen	AFJ	4.20
Allen	ABW	4.61	Allen	ACZ	4.51	Allen	AGI	9.13
Allen	ABX	8.41	Allen	AEK	7.61	Allen	AGK	5.57

Table 20: Outliers, Punchcard Machine Technology I: Residual Vote: Machines per Voter Regressor

Punchcard								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Adams	AAM	7.35	Cuyahoga	BAC	4.77	Hamilton	AIV	5.94
Adams	ABC	4.31	Cuyahoga	BAJ	4.47	Hamilton	AJF	6.73
Ashtabula	AAQ	7.65	Cuyahoga	BBQ	6.86	Hamilton	AJN	7.95
Ashtabula	AAS	4.30	Cuyahoga	BEF	4.25	Hamilton	AJQ	4.21
Athens	ABC	4.87	Cuyahoga	BMT	4.01	Hamilton	AKC	6.85
Belmont	AAC	6.59	Cuyahoga	BMV	4.02	Hamilton	AKK	15.13
Belmont	ACH	5.05	Cuyahoga	BNY	4.47	Hamilton	AKP	6.47
Butler	ADJ	7.98	Cuyahoga	BOB	4.54	Hamilton	AKT	5.82
Butler	AKV	6.10	Cuyahoga	BQB	11.15	Hamilton	AKU	5.10
Carroll	AAJ	4.20	Cuyahoga	BQW	8.05	Hamilton	ALE	4.10
Carroll	AAS	5.27	Cuyahoga	CFQ	6.98	Hamilton	ALO	5.33
Clark	AAO	4.19	Cuyahoga	CGD	5.30	Hamilton	ALU	11.09
Clark	AAQ	4.13	Cuyahoga	CTG	4.17	Hamilton	ALV	5.20
Clark	ACI	7.25	Cuyahoga	DDT	6.35	Hamilton	ALZ	6.51
Clark	ACM	6.32	Darke	AAG	63.32	Hamilton	AMD	12.27
Clark	ACV	5.29	Fairfield	ADY	5.73	Hamilton	AMI	4.83
Crawford	AAB	4.05	Greene	ADP	4.46	Hamilton	AMS	6.84
Cuyahoga	ABM	10.31	Hamilton	AAF	7.15	Hamilton	ANU	9.79
Cuyahoga	AHY	7.73	Hamilton	AAQ	4.65	Hamilton	ANZ	13.63
Cuyahoga	AJZ	4.60	Hamilton	ACB	4.83	Hamilton	AOE	6.51
Cuyahoga	AKV	4.44	Hamilton	ACG	5.31	Hamilton	AOK	6.12
Cuyahoga	AMM	5.26	Hamilton	ACV	7.52	Hamilton	APA	6.00
Cuyahoga	ANB	5.18	Hamilton	ADC	8.79	Hamilton	APQ	11.84
Cuyahoga	ANN	5.48	Hamilton	ADH	7.35	Hamilton	AQK	6.03
Cuyahoga	ANX	10.88	Hamilton	ADW	4.58	Hamilton	AQM	4.46
Cuyahoga	AOH	4.36	Hamilton	AEI	4.49	Hamilton	AQW	9.06
Cuyahoga	APT	8.11	Hamilton	AFF	5.20	Hamilton	ARW	5.37
Cuyahoga	APY	23.81	Hamilton	AFG	6.54	Hamilton	AUJ	4.84
Cuyahoga	AQG	4.42	Hamilton	AFK	10.04	Hamilton	AVK	6.71
Cuyahoga	AQM	6.02	Hamilton	AFP	7.42	Hamilton	AVV	4.09
Cuyahoga	ARP	5.59	Hamilton	AFU	6.61	Hamilton	AWP	4.00
Cuyahoga	ASL	12.31	Hamilton	AGE	10.72	Hamilton	AXI	4.94
Cuyahoga	ASV	4.22	Hamilton	AGP	11.14	Hamilton	BBQ	6.06
Cuyahoga	AUD	6.38	Hamilton	AGR	5.03	Hamilton	BDJ	5.15
Cuyahoga	AUI	5.45	Hamilton	AGS	5.54	Hamilton	BFK	5.48
Cuyahoga	AWA	4.13	Hamilton	AGU	8.77	Hamilton	BKZ	6.21
Cuyahoga	AWW	5.50	Hamilton	AHA	8.82	Hamilton	BLJ	8.10
Cuyahoga	AXU	5.13	Hamilton	AHC	4.19	Hamilton	BLK	7.10
Cuyahoga	AYJ	5.29	Hamilton	AID	9.00	Hamilton	BON	10.89
Cuyahoga	AYX	5.43	Hamilton	AIE	12.56	Hamilton	BOP	5.88

Table 21: Outliers, Punchcard Machine Technology II: Residual Vote: Machines per Voter Regressor

Punchcard								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Hamilton	BOR	7.12	Montgomery	ADG	5.85	Stark	ABF	5.55
Hamilton	BOS	4.80	Montgomery	ADT	4.83	Stark	ABQ	11.08
Harrison	AAX	6.74	Montgomery	AFJ	7.51	Stark	ABR	6.19
Harrison	ABF	4.34	Montgomery	AFL	5.22	Stark	ABT	5.07
Highland	AAF	4.58	Montgomery	AFV	5.30	Stark	ABV	6.50
Hocking	ABA	4.68	Montgomery	AFZ	4.29	Stark	ACA	4.24
Holmes	AAA	6.69	Montgomery	AGH	4.14	Stark	ACF	7.90
Holmes	AAB	5.71	Montgomery	AGM	5.48	Stark	AEH	5.78
Holmes	AAC	27.59	Montgomery	AGS	4.43	Stark	AFU	4.02
Holmes	AAM	21.07	Montgomery	AHJ	5.84	Summit	AAC	5.73
Holmes	AAP	18.84	Montgomery	AHW	5.65	Summit	AAI	5.04
Holmes	AAR	4.23	Montgomery	AHX	4.56	Summit	AAS	6.10
Holmes	AAW	19.52	Montgomery	AHZ	7.76	Summit	ABU	4.39
Huron	ACB	4.93	Montgomery	AIF	6.31	Summit	ABW	10.71
Jackson	AAQ	6.31	Montgomery	AQS	7.01	Summit	ABY	4.98
Jefferson	AAA	5.71	Montgomery	AQW	4.99	Summit	ABZ	4.78
Jefferson	AAM	7.17	Montgomery	ATX	4.40	Summit	ACB	12.74
Jefferson	AAN	4.83	Morgan	AAO	4.33	Summit	ACC	5.28
Lawrence	ABP	4.00	Morrow	AAL	5.81	Summit	ACE	7.59
Lawrence	ACY	6.02	Noble	AAI	6.72	Summit	ACF	6.00
Lawrence	ADD	5.78	Noble	AAP	6.87	Summit	ACG	10.46
Licking	AEL	5.37	Noble	AAZ	5.19	Summit	ACH	4.06
Lorain	ABW	4.29	Pike	AAL	6.23	Summit	ACO	7.73
Lorain	ACZ	4.23	Pike	AAQ	5.76	Summit	ACQ	6.59
Lorain	AEA	7.28	Pike	AAV	7.07	Summit	ACT	7.84
Lorain	AEW	6.31	Preble	ABD	4.22	Summit	ACV	4.79
Lorain	AEY	4.26	Richland	ABG	5.51	Summit	ACY	5.65
Lorain	AEZ	5.13	Richland	ABH	4.60	Summit	ADD	8.37
Lorain	AFB	5.59	Richland	ABJ	6.60	Summit	ADN	4.35
Lorain	AFG	4.67	Richland	ABL	6.11	Summit	ADQ	7.08
Madison	AAQ	8.71	Richland	ABM	6.09	Summit	ADS	8.42
Madison	AAV	5.64	Richland	ABQ	5.21	Summit	ADV	6.59
Mercer	AAI	4.18	Richland	ABR	6.46	Summit	ADX	11.49
Monroe	AAI	5.71	Richland	ABU	5.22	Summit	AFE	4.85
Monroe	AAQ	4.06	Richland	ABW	4.92	Summit	AFN	18.04
Montgomery	ABP	4.29	Richland	ADE	5.34	Summit	AIJ	6.52
Montgomery	ACF	7.00	Scioto	ADR	4.04	Summit	AJL	7.36
Montgomery	ACP	5.51	Stark	AAG	7.65	Summit	AJS	7.48
Montgomery	ACV	4.47	Stark	ABA	4.80	Summit	APT	10.71
Montgomery	ADA	5.28	Stark	ABB	8.11	Summit	AVS	5.81

Table 22: Outliers, Punchcard Machine Technology III: Residual Vote: Machines per Voter Regressor

Punchcard					
County	Code	SRes	County	Code	SRes
Summit	AVY	7.29	Trumbull	AEE	4.94
Trumbull	AAW	5.75	Trumbull	AEF	4.22
Trumbull	ABG	5.37	Trumbull	AEH	6.80
Trumbull	ACG	7.03	Trumbull	AEM	4.99
Trumbull	ACM	7.65	Trumbull	AGZ	4.40
Trumbull	ACR	4.24	Trumbull	AHO	4.24
Trumbull	ACW	4.07	Trumbull	AJZ	4.35
Trumbull	ADK	4.79	Trumbull	AKJ	4.37
Trumbull	ADN	4.75	Union	AAQ	5.63
Trumbull	ADP	4.11	Vinton	AAB	4.19
Trumbull	ADX	4.31	Vinton	AAG	4.85
Trumbull	AEB	10.66	Vinton	AAK	4.32
Trumbull	AEC	5.14	Wayne	ADH	4.20

Table 23: Residual Vote: Machines per Voter and Precinct Racial Composition Regressors

	DRE		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.650	0.0436	-107.00
Machines per Registered Voter	-20.400	10.3000	-1.97
Proportion African American	0.878	0.0559	15.70
	Optical Central		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.550	0.0533	-85.200
Machines per Registered Voter	-6.270	8.1000	-0.775
Proportion African American	-0.212	0.0905	-2.340
	Optical Precinct		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.70	0.204	-23.00
Machines per Registered Voter	-74.20	32.600	-2.28
Proportion African American	1.46	0.266	5.51
	Punchcard		
Variable	Coef.	SE	t-ratio
(Intercept)	-4.140	0.0243	-170.00
Machines per Registered Voter	-8.150	2.9000	-2.81
Proportion African American	0.873	0.0191	45.60

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of residual votes versus the number of votes for one of four presidential candidates (Bush, Kerry, Bedarnik or Peroutka). The residual vote is the number of ballots cast that did not include a vote for one of those four candidates. DRE: LQD $\sigma = 0.91$; $\tanh\ \sigma = 1.05$; $n = 1{,}535$ precincts; 68 precincts are outliers. Optical Central: LQD $\sigma = 0.86$; $\tanh\ \sigma = 0.98$; $n = 807$ precincts; 40 precincts are outliers. Optical Precinct: LQD $\sigma = 0.68$; $\tanh\ \sigma = 0.89$; $n = 139$ precincts; 13 precincts are outliers. Punchcard: LQD $\sigma = 1.18$; $\tanh\ \sigma = 1.26$; $n = 7{,}865$ precincts; 226 precincts are outliers. Punchcard precincts include Cuyahoga and Hamilton precincts.

Expected Residual Vote Rate at Machine Ratio Quartiles with Median African American Proportions

	Quartile		
Technology	25%	50%	75%
DRE	0.0090	0.0089	0.0088
Centrally Tabulated Optical Scan	0.0101	0.0101	0.0101
Precinct Tabulated Optical Scan	0.0065	0.0059	0.0054
Punchcard	0.0150	0.0149	0.0148

Table 24: Outliers, DRE Machine Technology: Residual Vote: Machines per Voter and Precinct Racial Composition Regressor

				DRE				
County	Code	SRes	County	Code	SRes	County	Code	SRes
Auglaize	AAF	4.48	Franklin	AIQ	4.34	Franklin	AYU	9.14
Franklin	AAQ	4.37	Franklin	AJJ	5.82	Franklin	AYZ	5.99
Franklin	ABK	5.11	Franklin	AKG	6.04	Franklin	AZD	5.09
Franklin	ABU	9.03	Franklin	AKL	4.32	Franklin	AZE	4.18
Franklin	ACP	4.35	Franklin	AKT	4.03	Franklin	AZH	8.80
Franklin	ACQ	8.83	Franklin	AKY	7.63	Franklin	AZK	4.61
Franklin	ADF	5.06	Franklin	AML	8.28	Franklin	BAB	5.22
Franklin	AEJ	8.17	Franklin	AOF	4.31	Franklin	BAG	5.08
Franklin	AEN	4.46	Franklin	AOW	13.78	Franklin	BAJ	5.09
Franklin	AER	4.12	Franklin	AQQ	4.47	Franklin	BAK	5.66
Franklin	AES	4.29	Franklin	ATD	4.41	Franklin	BBB	4.29
Franklin	AEU	5.83	Franklin	ATE	5.87	Franklin	BBE	5.67
Franklin	AEY	4.53	Franklin	ATF	5.28	Franklin	BBK	5.48
Franklin	AFD	4.40	Franklin	ATM	4.35	Franklin	BBV	4.21
Franklin	AFI	5.28	Franklin	ATN	6.75	Franklin	BCV	4.04
Franklin	AFN	4.37	Franklin	AUK	5.43	Knox	AAJ	4.21
Franklin	AFO	4.32	Franklin	AWA	5.64	Knox	AAR	4.76
Franklin	AFS	4.14	Franklin	AXE	4.45	Lake	ADN	6.49
Franklin	AGG	5.59	Franklin	AXK	6.88	Mahoning	AOV	4.27
Franklin	AGQ	6.37	Franklin	AXM	4.18	Mahoning	ARC	16.97
Franklin	AHF	5.20	Franklin	AXP	4.75	Mahoning	ASC	4.36
Franklin	AHW	4.30	Franklin	AXZ	5.45	Ross	AAH	5.63
Franklin	AIK	4.57	Franklin	AYQ	5.91			

Table 25: Outliers, Optical Scan Machine Technologies: Residual Vote: Machines per Voter and Precinct Racial Composition Regressor

Optical Central

County	Code	SRes	County	Code	SRes	County	Code	SRes
Ashland	AAC	12.28	Ashland	ABT	12.58	Hardin	ABE	4.73
Ashland	AAD	10.24	Ashland	ABY	8.32	Lucas	ASN	4.89
Ashland	AAH	4.91	Ashland	ABZ	6.84	Lucas	ABV	4.77
Ashland	AAK	4.09	Ashland	ACC	12.58	Lucas	AAB	4.27
Ashland	AAQ	5.24	Ashland	ACD	5.78	Lucas	ANQ	7.70
Ashland	AAR	9.86	Ashland	ACG	11.84	Lucas	AHJ	5.38
Ashland	AAU	10.93	Ashland	ACH	5.45	Lucas	AFC	4.27
Ashland	AAV	9.79	Ashland	ACK	6.83	Ottawa	ACE	4.21
Ashland	ABA	10.55	Ashland	ACL	6.55	Sandusky	AAM	4.21
Ashland	ABB	8.45	Ashland	ACO	10.93	Sandusky	ABE	6.03
Ashland	ABI	11.84	Ashland	ACP	7.87	Sandusky	ABK	6.51
Ashland	ABK	8.36	Ashland	ACS	12.90	Sandusky	ACS	4.13
Ashland	ABN	5.82	Erie	ADN	10.71			
Ashland	ABQ	11.69	Erie	AEG	4.33			

Optical Precinct

County	Code	SRes	County	Code	SRes	County	Code	SRes
Allen	ABF	4.25	Allen	ADF	4.14	Allen	AFJ	5.30
Allen	ABI	4.36	Allen	ADQ	4.11	Allen	AGI	11.21
Allen	ABX	4.67	Allen	ADT	4.63	Allen	AGK	6.90
Allen	ACG	9.53	Allen	AEK	8.39			
Allen	ACZ	5.32	Allen	AEV	4.07			

Table 26: Outliers, Punchcard Machine Technology I: Residual Vote: Machines per Voter and Precinct Racial Composition Regressor

Punchcard								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Adams	AAM	8.43	Cuyahoga	BQW	4.59	Hamilton	AQK	4.87
Adams	AAQ	4.48	Cuyahoga	CFQ	8.08	Hamilton	AQW	6.63
Adams	AAX	4.22	Cuyahoga	CGD	6.12	Hamilton	AUJ	5.52
Adams	ABC	5.02	Darke	AAG	71.15	Hamilton	AVF	4.13
Ashtabula	AAQ	6.65	Fairfield	ADY	6.34	Hamilton	AVK	7.59
Ashtabula	AAS	4.69	Fairfield	AEN	4.31	Hamilton	AVV	4.77
Ashtabula	ABA	4.05	Gallia	AAZ	4.14	Hamilton	AWP	4.23
Ashtabula	ABK	4.35	Gallia	ABA	4.26	Hamilton	AYW	4.28
Ashtabula	ACG	4.13	Greene	ADP	5.11	Hamilton	BBQ	6.28
Athens	ABC	5.49	Hamilton	AAF	5.72	Hamilton	BEG	4.71
Athens	ACO	4.37	Hamilton	AAQ	5.44	Hamilton	BFA	4.54
Belmont	AAC	7.45	Hamilton	ACV	5.92	Hamilton	BFK	6.14
Belmont	AAF	4.04	Hamilton	ADC	5.13	Hamilton	BLJ	5.74
Belmont	AAQ	4.30	Hamilton	ADH	4.00	Hamilton	BLK	6.75
Belmont	ACH	5.79	Hamilton	ADW	5.24	Hamilton	BON	6.91
Butler	ADJ	9.08	Hamilton	AEF	4.14	Harrison	AAX	7.76
Butler	AKV	4.04	Hamilton	AFK	6.19	Harrison	ABF	5.06
Carroll	AAJ	4.56	Hamilton	AFP	4.51	Highland	AAF	5.17
Carroll	AAS	6.08	Hamilton	AGE	7.24	Hocking	ABA	5.38
Carroll	AAY	4.58	Hamilton	AGP	6.78	Holmes	AAA	7.63
Clark	AAO	4.28	Hamilton	AGU	5.20	Holmes	AAB	6.51
Clark	ACI	5.62	Hamilton	AHA	6.48	Holmes	AAC	30.66
Clark	ACM	6.70	Hamilton	AID	5.68	Holmes	AAM	23.89
Crawford	AAB	4.63	Hamilton	AIE	8.01	Holmes	AAP	21.09
Crawford	ABF	4.20	Hamilton	AIV	4.62	Holmes	AAR	4.93
Cuyahoga	ABM	11.64	Hamilton	AJF	5.43	Holmes	AAW	21.98
Cuyahoga	AHY	4.16	Hamilton	AJN	7.63	Huron	AAV	4.35
Cuyahoga	ANX	6.34	Hamilton	AJS	4.01	Huron	ACB	5.59
Cuyahoga	APT	4.58	Hamilton	AKK	10.27	Jackson	AAC	4.60
Cuyahoga	APY	16.24	Hamilton	ALO	5.27	Jackson	AAQ	7.24
Cuyahoga	ASL	7.69	Hamilton	ALU	9.96	Jefferson	AAA	4.70
Cuyahoga	AXU	4.72	Hamilton	ALZ	4.82	Jefferson	AAM	6.96
Cuyahoga	AYJ	4.05	Hamilton	AMD	8.06	Jefferson	AAN	4.38
Cuyahoga	AYX	4.11	Hamilton	AMI	4.00	Lawrence	ABP	4.64
Cuyahoga	BAC	4.86	Hamilton	AMS	5.33	Lawrence	ACY	6.83
Cuyahoga	BAJ	5.02	Hamilton	ANU	7.70	Lawrence	ADD	6.18
Cuyahoga	BBQ	7.27	Hamilton	ANZ	8.80	Licking	AEL	6.21
Cuyahoga	BCI	4.31	Hamilton	AOK	6.53	Lorain	AEA	6.55
Cuyahoga	BEF	4.49	Hamilton	APA	6.61	Lorain	AEW	5.26
Cuyahoga	BQB	12.35	Hamilton	APQ	8.52	Lorain	AEZ	5.36

Table 27: Outliers, Punchcard Machine Technology II: Residual Vote: Machines per Voter and Precinct Racial Composition Regressor

Punchcard								
County	Code	SRes	County	Code	SRes	County	Code	SRes
Lorain	AFB	5.88	Preble	ABD	4.93	Summit	ADQ	4.85
Lorain	AFG	4.94	Richland	ABG	5.22	Summit	ADS	6.51
Lorain	AIP	4.39	Richland	ABJ	5.30	Summit	ADV	4.28
Madison	AAQ	9.74	Richland	ABL	4.89	Summit	ADX	10.00
Madison	AAV	6.60	Richland	ABM	5.10	Summit	AFE	5.18
Marion	AAI	4.17	Richland	ABQ	4.96	Summit	AFN	18.68
Meigs	ABA	4.16	Richland	ABR	6.05	Summit	AIJ	5.54
Mercer	AAI	4.75	Richland	ABW	5.05	Summit	AJL	7.15
Mercer	AAQ	4.32	Richland	ADE	6.01	Summit	AJS	8.56
Monroe	AAB	4.65	Richland	ADJ	4.31	Summit	APT	12.31
Monroe	AAI	6.64	Richland	ADV	4.08	Summit	ATZ	4.26
Monroe	AAJ	4.19	Scioto	ADR	4.64	Summit	AVS	6.78
Monroe	AAQ	4.70	Shelby	AAB	4.60	Summit	AVY	4.07
Montgomery	ABP	4.43	Shelby	ABD	4.19	Trumbull	AAR	4.46
Montgomery	ACF	4.37	Stark	AAG	7.58	Trumbull	AAW	6.65
Montgomery	ADT	5.52	Stark	AAW	4.34	Trumbull	ABG	6.22
Montgomery	ADW	4.26	Stark	ABA	4.76	Trumbull	ACG	7.35
Montgomery	AHZ	4.14	Stark	ABB	7.89	Trumbull	ACM	7.73
Montgomery	AQS	4.68	Stark	ABQ	8.28	Trumbull	ACR	4.75
Montgomery	ATX	5.11	Stark	ABV	6.20	Trumbull	ADK	5.16
Morgan	AAC	4.07	Stark	ACA	4.77	Trumbull	AEB	9.41
Morgan	AAO	4.89	Stark	ACF	7.21	Trumbull	AEH	4.69
Morrow	AAL	6.92	Stark	AEH	5.74	Trumbull	AGZ	5.01
Morrow	AAM	4.25	Stark	AFU	4.67	Trumbull	AHO	4.92
Noble	AAI	7.92	Summit	AAC	5.48	Trumbull	AII	4.09
Noble	AAP	7.91	Summit	AAI	5.70	Trumbull	AJZ	5.05
Noble	AAY	4.45	Summit	AAS	6.23	Trumbull	AKJ	5.12
Noble	AAZ	6.20	Summit	ABL	4.11	Tuscarawas	AAS	4.24
Paulding	AAG	4.09	Summit	ABW	6.89	Union	AAQ	6.52
Pike	AAF	4.58	Summit	ACB	8.98	Vinton	AAB	4.77
Pike	AAH	4.19	Summit	ACE	4.68	Vinton	AAG	5.55
Pike	AAL	6.40	Summit	ACG	7.17	Vinton	AAK	4.96
Pike	AAQ	6.47	Summit	ACO	4.13	Vinton	AAP	4.02
Pike	AAV	8.02	Summit	ACT	4.63	Wayne	ADH	4.82
Pike	AAX	4.33	Summit	ACY	5.08			
Preble	AAJ	4.22	Summit	ADD	4.44			

Table 28: Median Residual Vote Rates Among the Residual Vote Outliers

	Median Rate	
Technology	Outliers	Rest
DRE	0.0290	0.0094
Optical Central	0.0409	0.0099
Optical Precinct	0.0240	0.0067
Punchcard	0.0593	0.0159

Notes: Median residual vote rates among precincts using outliers identified in the analysis reported in Tables 23, 24, 25, 26 and 27. Punchcard precincts include Cuyahoga and Hamilton precincts.

Table 29: Residual Vote Outliers and Proportion Voting for Kerry

	DRE		
Variable	Coef.	SE	t-ratio
(Intercept)	-3.48	0.41	-8.6
Proportion Voting Kerry	0.74	0.69	1.1
	Optical Central		
Variable	Coef.	SE	t-ratio
(Intercept)	-0.36	0.61	-0.6
Proportion Voting Kerry	-5.27	1.32	-4.0
	Optical Precinct		
Variable	Coef.	SE	t-ratio
(Intercept)	-2.71	0.68	-4.0
Proportion Voting Kerry	1.17	1.60	0.7
	Punchcard		
Variable	Coef.	SE	t-ratio
(Intercept)	-5.20	0.21	-24.9
Proportion Voting Kerry	2.97	0.31	9.4

Notes: Binary logit regression estimates. For each precinct, the dependent variable has the value 1.0 if the precinct is an outlier in the analysis reported in Tables 23, 24, 25, 26 and 27, otherwise zero. DRE: $n = 1{,}535$ precincts. Optical Central: $n = 807$ precincts. Optical Precinct: $n = 139$ precincts. Punchcard: $n = 7{,}865$ precincts. Punchcard precincts include Cuyahoga and Hamilton precincts.

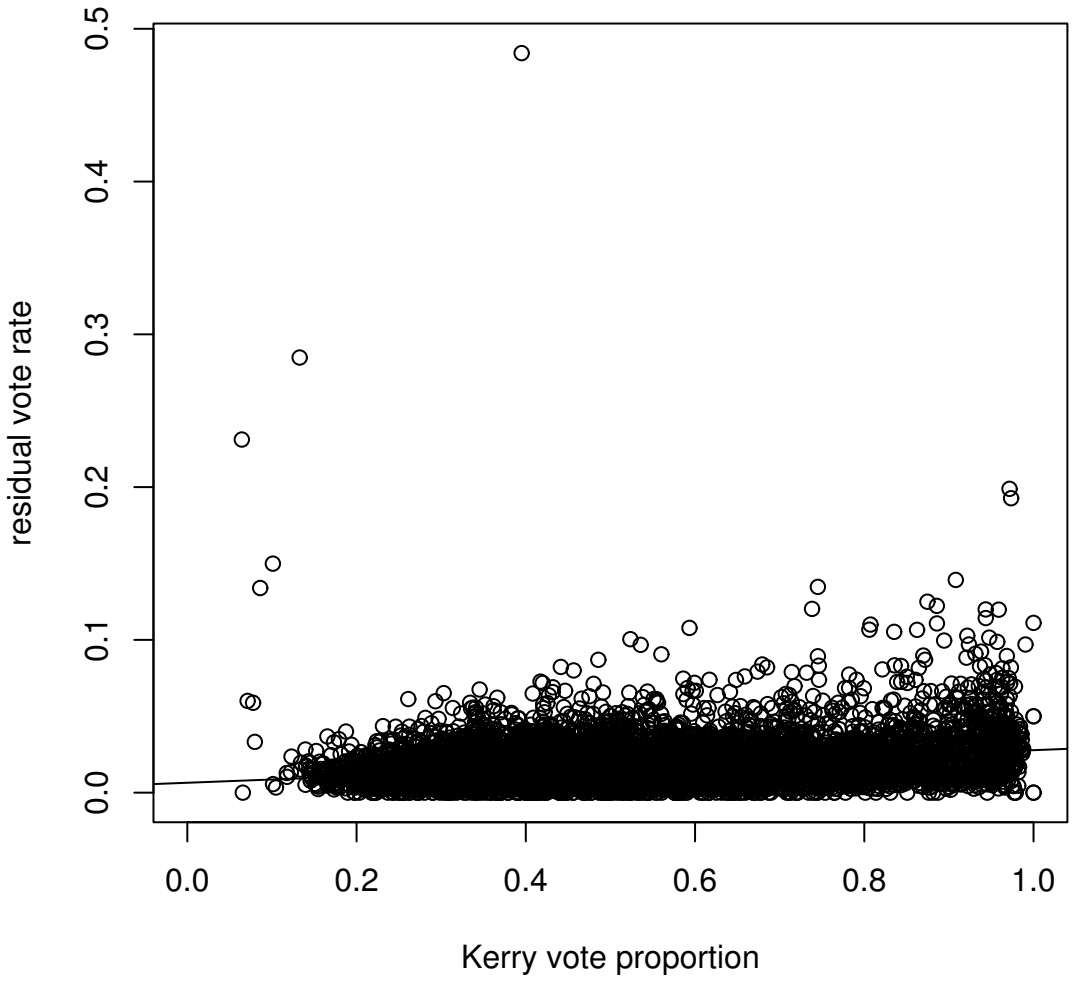


Figure 27: Residual Vote Rate in Ohio 2004 Precincts by Democratic President Proportion

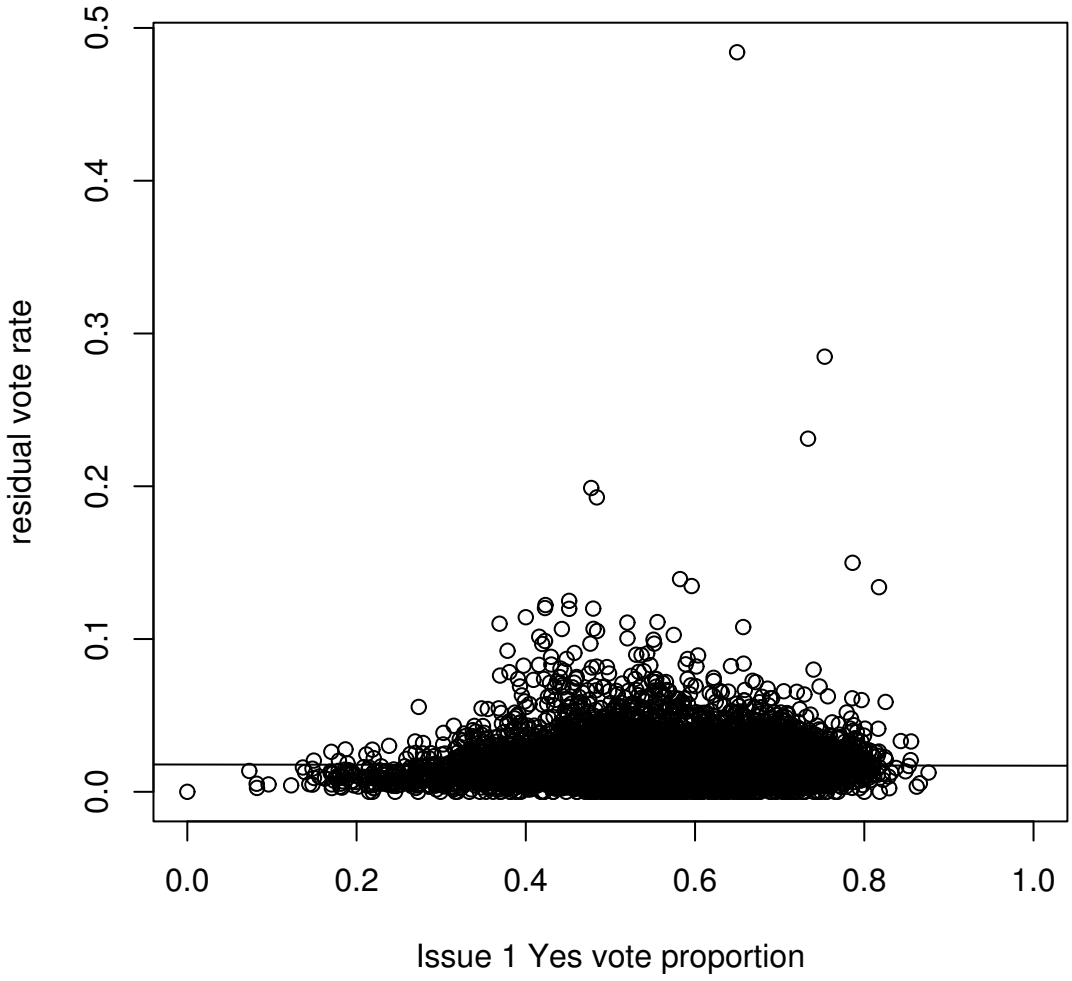


Figure 28: Residual Vote Rate in Ohio 2004 Precincts by Issue 1 Proportion Yes

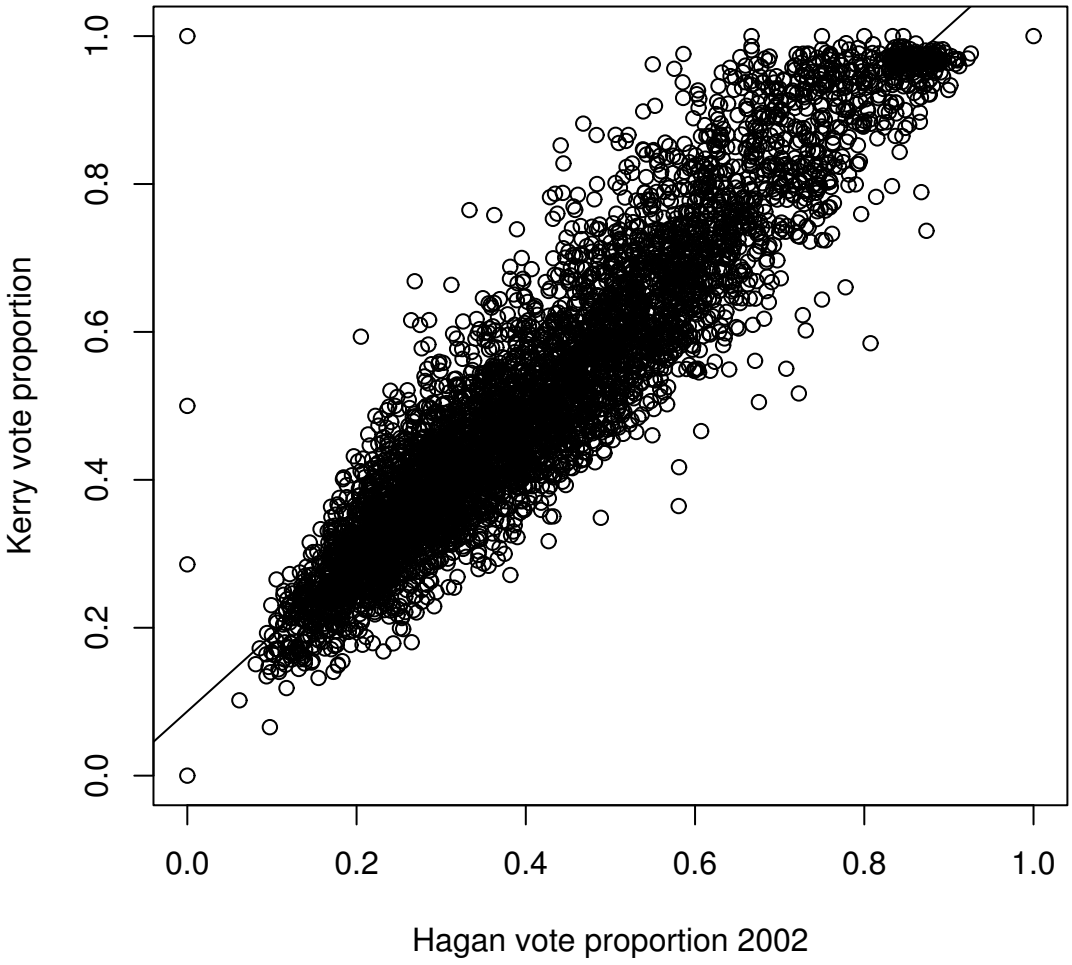


Figure 29: Democratic President Proportion by 2002 Democratic Governor Proportion in Precincts with Constant Boundaries Since 2002

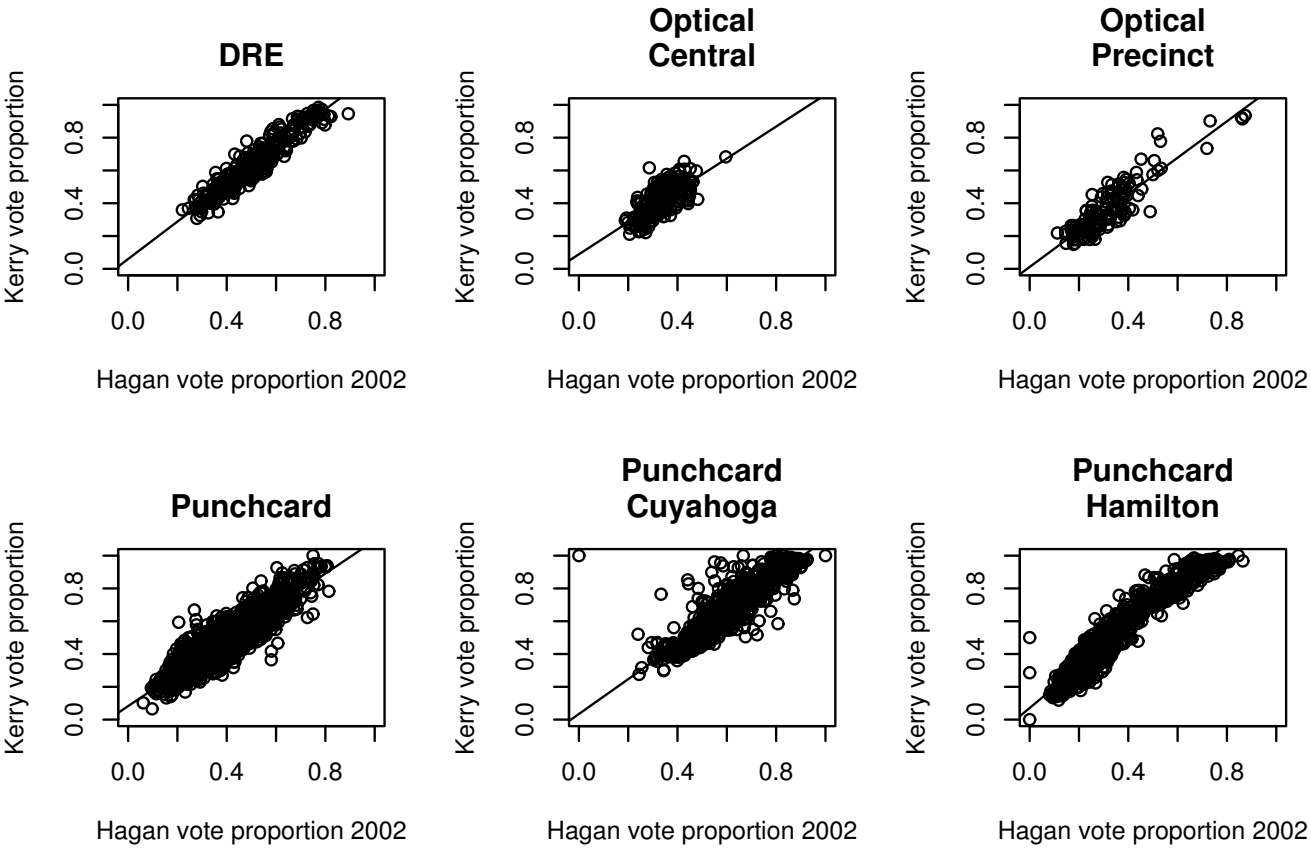


Figure 30: Democratic President Proportion by 2002 Democratic Governor Proportion in Precincts with Constant Boundaries Since 2002, by Machine Type

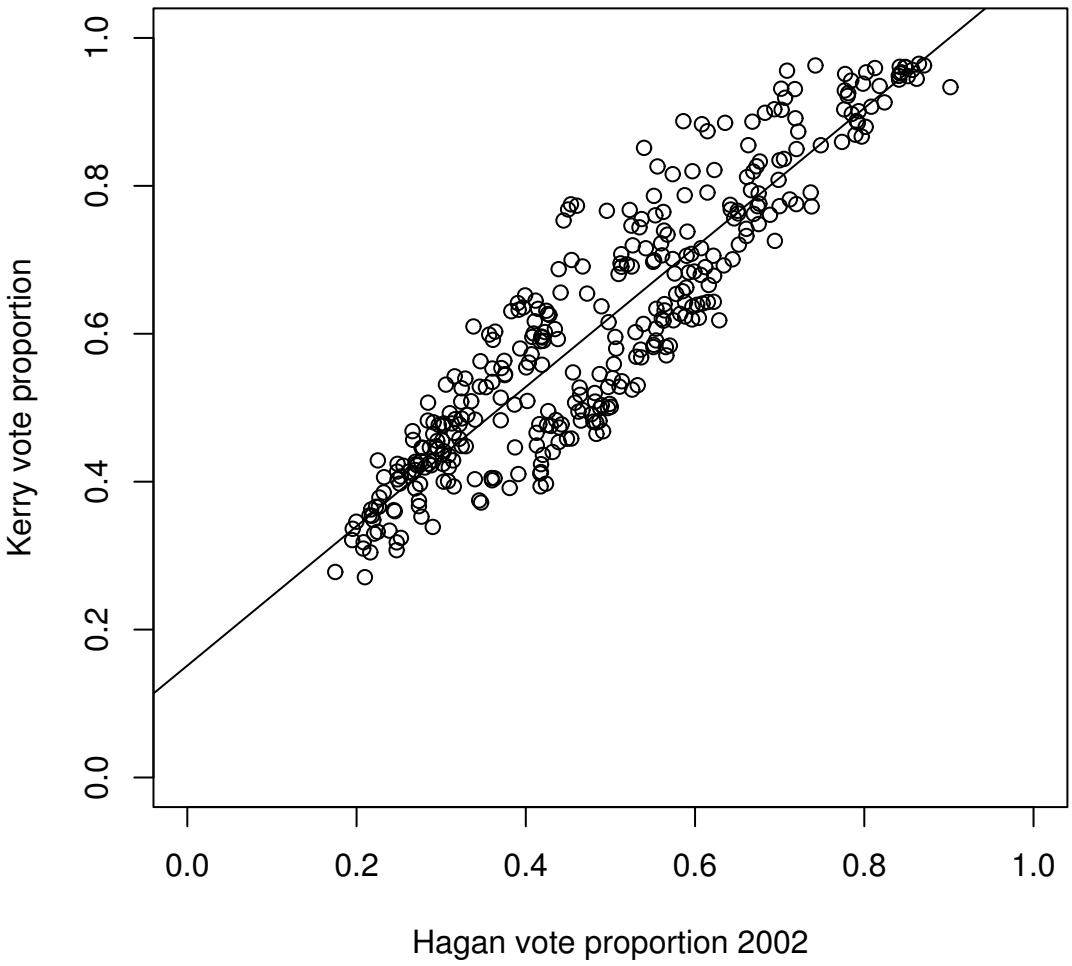


Figure 31: Democratic President Proportion by 2002 Democratic Governor Proportion in Wards with Constant Boundaries Since 2002

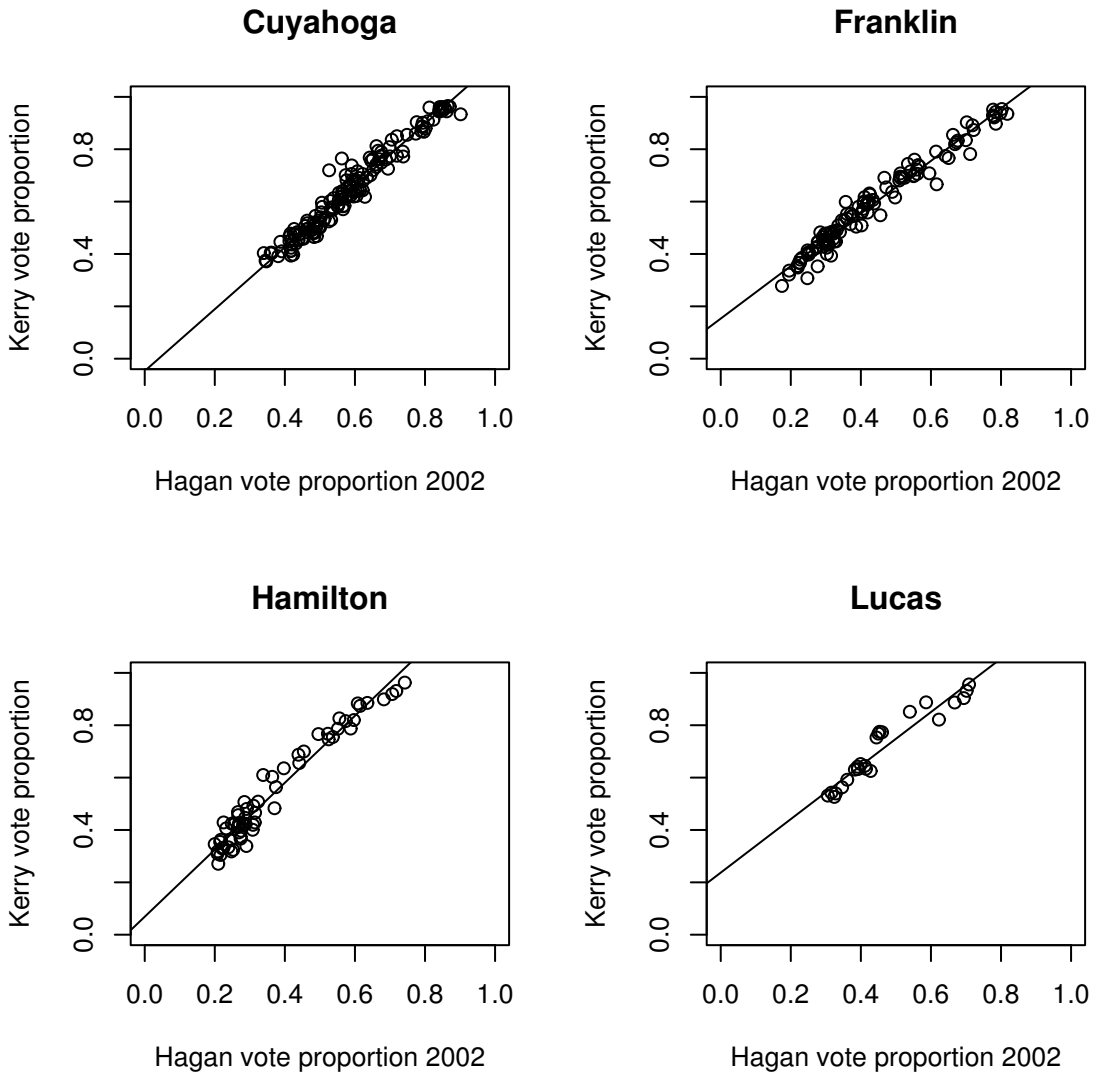


Figure 32: Democratic President Proportion by 2002 Democratic Governor Proportion in Wards with Constant Boundaries Since 2002, by County

Table 30: Vote for Kerry versus Bush: 2002 Gubernatorial Vote Regressor

	Precincts			Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.456	0.00589	77.5	0.64	0.0224	28.6
Logit(Democratic Vote in 2002)	1.040	0.00627	166.0	1.04	0.0266	39.1

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of votes for Kerry versus the number of votes for Bush. Precincts: LQD $\sigma = 2.98$; $\tanh$ $\sigma = 2.87$; $n =$ 5,384; 17 outliers. Wards: LQD $\sigma = 9.09$; $\tanh$ $\sigma = 8.91$; $n =$ 357; no outliers.

The precinct estimation includes precincts with constant boundaries from the following counties: Adams, Allen, Ashland, Athens, Belmont, Butler, Carroll, Clermont, Clinton, Columbiana, Coshocton, Cuyahoga, Darke, Geauga, Greene, Hamilton, Hardin, Harrison, Hocking, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Meigs, Miami, Monroe, Morgan, Morrow, Noble, Ottawa, Paulding, Perry, Pike, Portage, Preble, Shelby, Trumbull, Tuscarawas, Van Wert, Vinton, Wayne, Williams.

The ward estimation includes wards with constant boundaries from the following counties: Cuyahoga, Franklin, Hamilton and Lucas.

Table 31: Outliers: Vote for Kerry versus Bush: 2002 Gubernatorial Vote Regressor

County	Code	SRes	County	Code	SRes
Butler	AFD	−4.55	Hamilton	AQM	4.18
Cuyahoga	ABE	−5.12	Hamilton	BDN	810.96
Cuyahoga	AZY	512.89	Hamilton	BDQ	691.59
Cuyahoga	CQY	−4.79	Licking	ACV	4.75
Cuyahoga	CRG	−6.56	Licking	ACY	6.55
Cuyahoga	CRY	4.28	Lorain	AKV	−4.07
Cuyahoga	CWY	−4.22	Miami	AAN	−8.28
Greene	AHJ	4.52	Tuscarawas	AAX	−4.82
Hamilton	APT	4.37			

Table 32: Vote for Kerry versus Bush: 2002 Gubernatorial Vote and Issue 1 Vote Regressor

	Precincts			Wards		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	0.524	0.00653	80.2	0.605	0.0239	25.40
Logit(Democratic Vote in 2002)	0.946	0.00684	138.0	1.000	0.0285	35.20
Logit(Yes on Issue 1)	−0.283	0.01030	−27.3	−0.225	0.0540	−4.16

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct or ward, the dependent variable counts the number of votes for Kerry versus the number of votes for Bush. Precincts: LQD $\sigma = 2.78$; $\tanh$ $\sigma = 2.68$; $n = 5{,}384$; 22 outliers. Wards: LQD $\sigma = 8.33$; $\tanh$ $\sigma = 8.49$; $n = 357$; no outliers.

The precinct estimation includes precincts with constant boundaries from the following counties: Adams, Allen, Ashland, Athens, Belmont, Butler, Carroll, Clermont, Clinton, Columbiana, Coshocton, Cuyahoga, Darke, Geauga, Greene, Hamilton, Hardin, Harrison, Hocking, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Meigs, Miami, Monroe, Morgan, Morrow, Noble, Ottawa, Paulding, Perry, Pike, Portage, Preble, Shelby, Trumbull, Tuscarawas, Van Wert, Vinton, Wayne, Williams.

The ward estimation includes wards with constant boundaries from the following counties: Cuyahoga, Franklin, Hamilton and Lucas.

Table 33: Outliers: Vote for Kerry versus Bush: 2002 Gubernatorial Vote and Issue 1 Vote Regressor

County	Code	SRes	County	Code	SRes
Athens	AAF	-4.33	Cuyahoga	CRY	4.52
Athens	AAG	-4.49	Cuyahoga	CSB	-5.19
Athens	AAK	-5.03	Cuyahoga	CWY	-4.92
Butler	AFD	-6.01	Hamilton	APT	4.14
Cuyahoga	ABE	-5.91	Hamilton	AQM	4.27
Cuyahoga	AZY	271.42	Hamilton	BDN	372.23
Cuyahoga	CQH	-4.10	Hamilton	BDQ	364.10
Cuyahoga	CQM	-4.16	Licking	ACZ	-4.17
Cuyahoga	CQY	-5.70	Lorain	AKV	-4.10
Cuyahoga	CRG	-7.97	Miami	AAN	-8.11
Cuyahoga	CRM	-4.00	Tuscarawas	AAX	-4.76

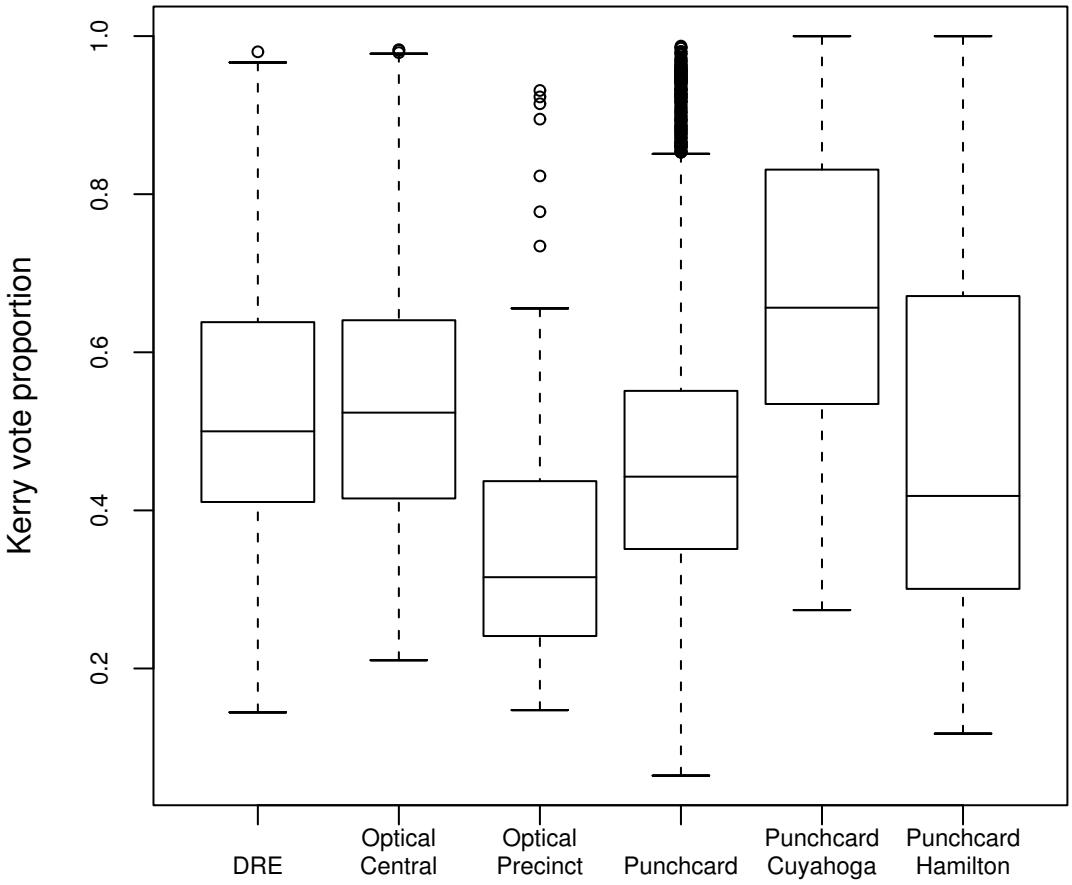


Figure 33: Democratic President Proportion in Ohio 2004 Precincts by Machine Type

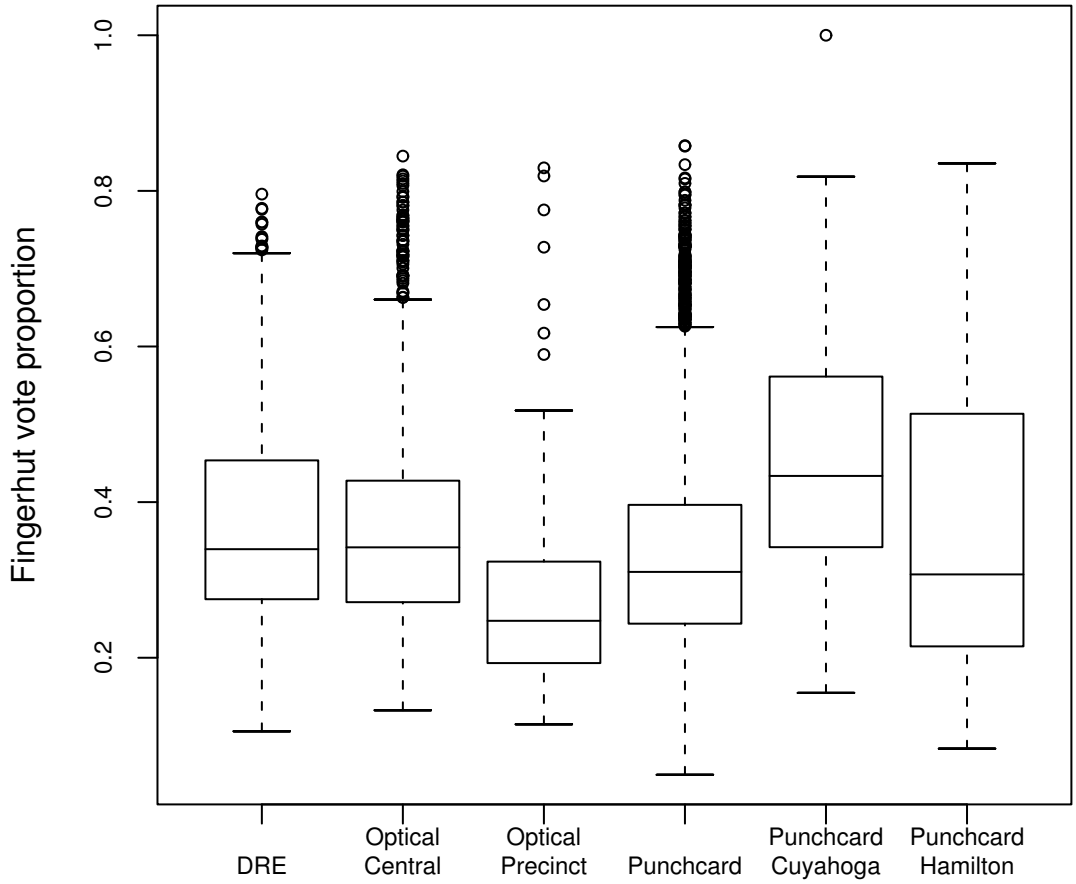


Figure 34: Democratic Senator Proportion in Ohio 2004 Precincts by Machine Type

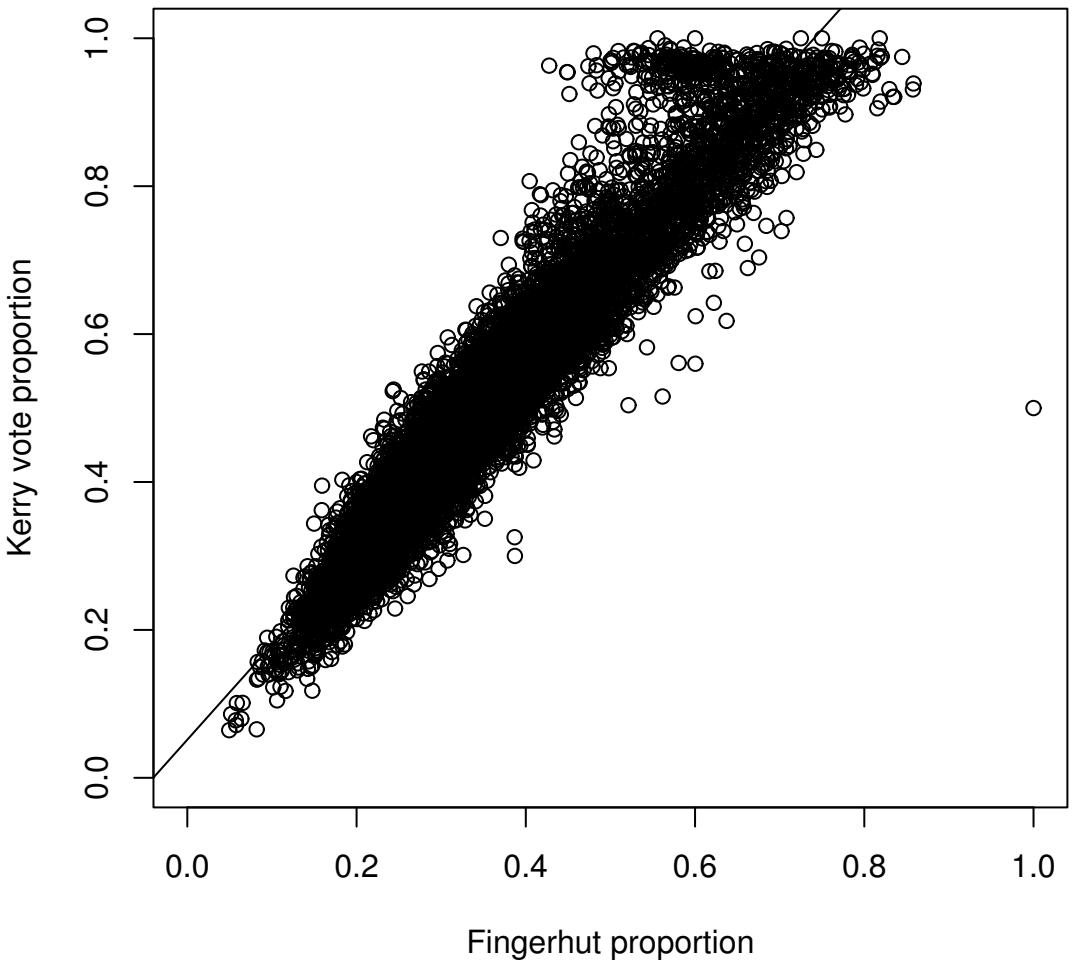


Figure 35: Democratic President Proportion by Democratic Senator Proportion in Ohio 2004 Precincts

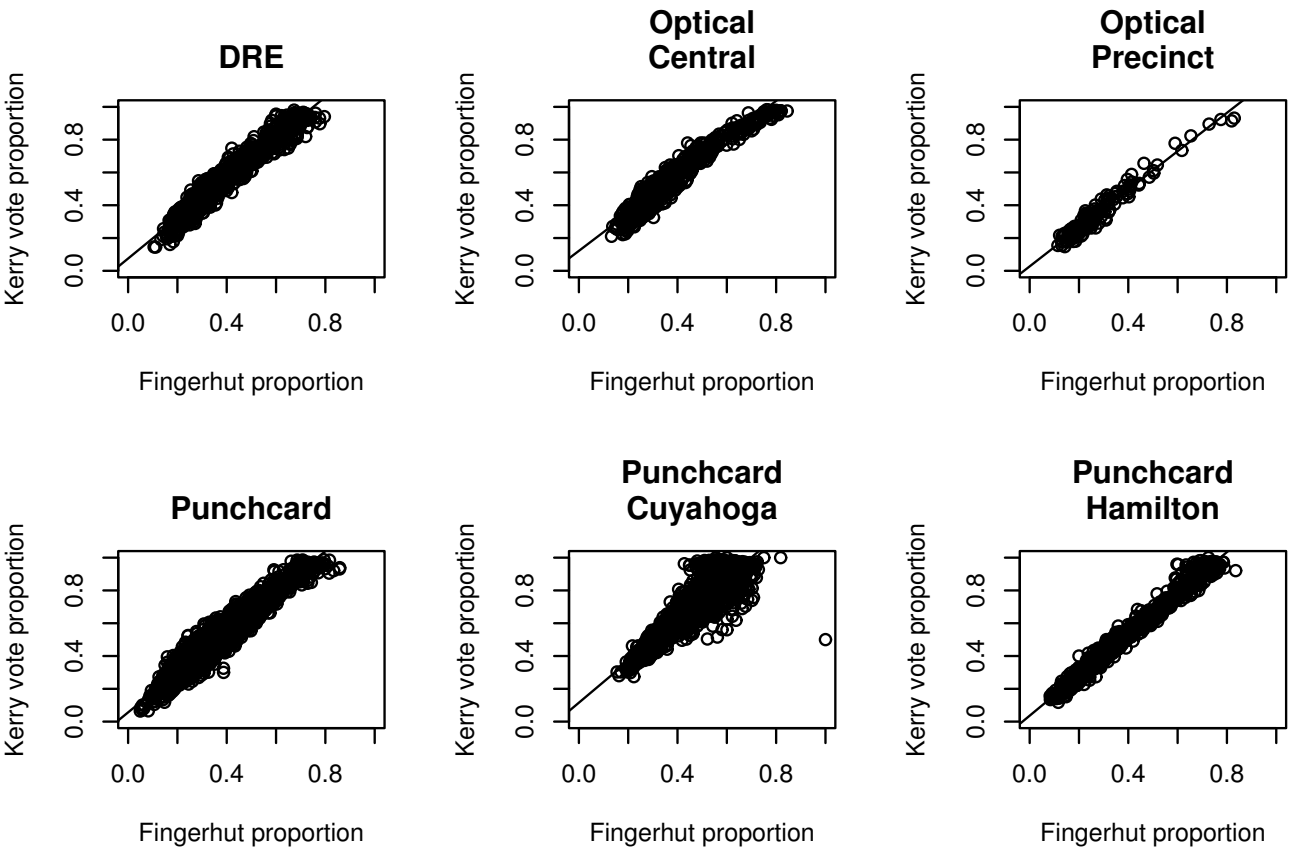


Figure 36: Democratic President Proportion by Democratic Senator Proportion in Ohio 2004 Precincts by Machine Type

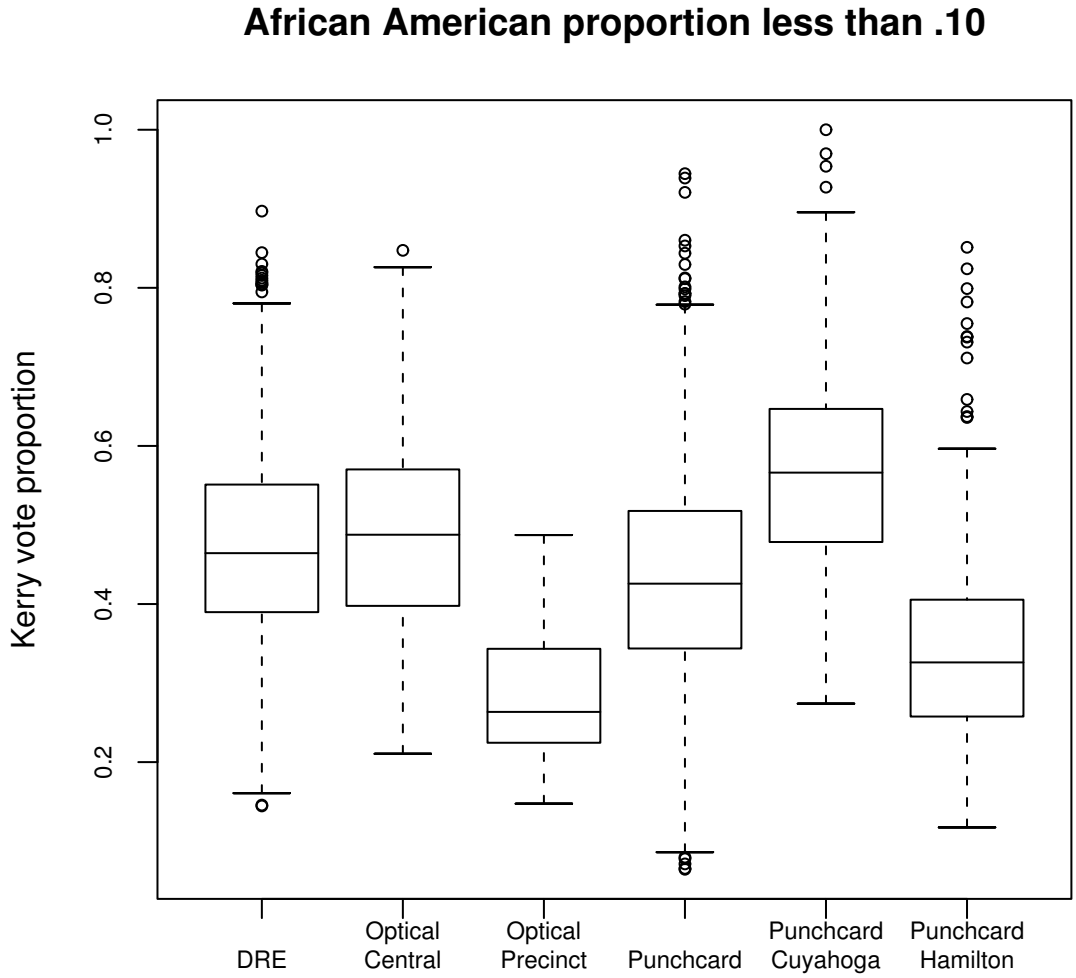


Figure 37: Democratic President Proportion in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Less Than 10 Percent

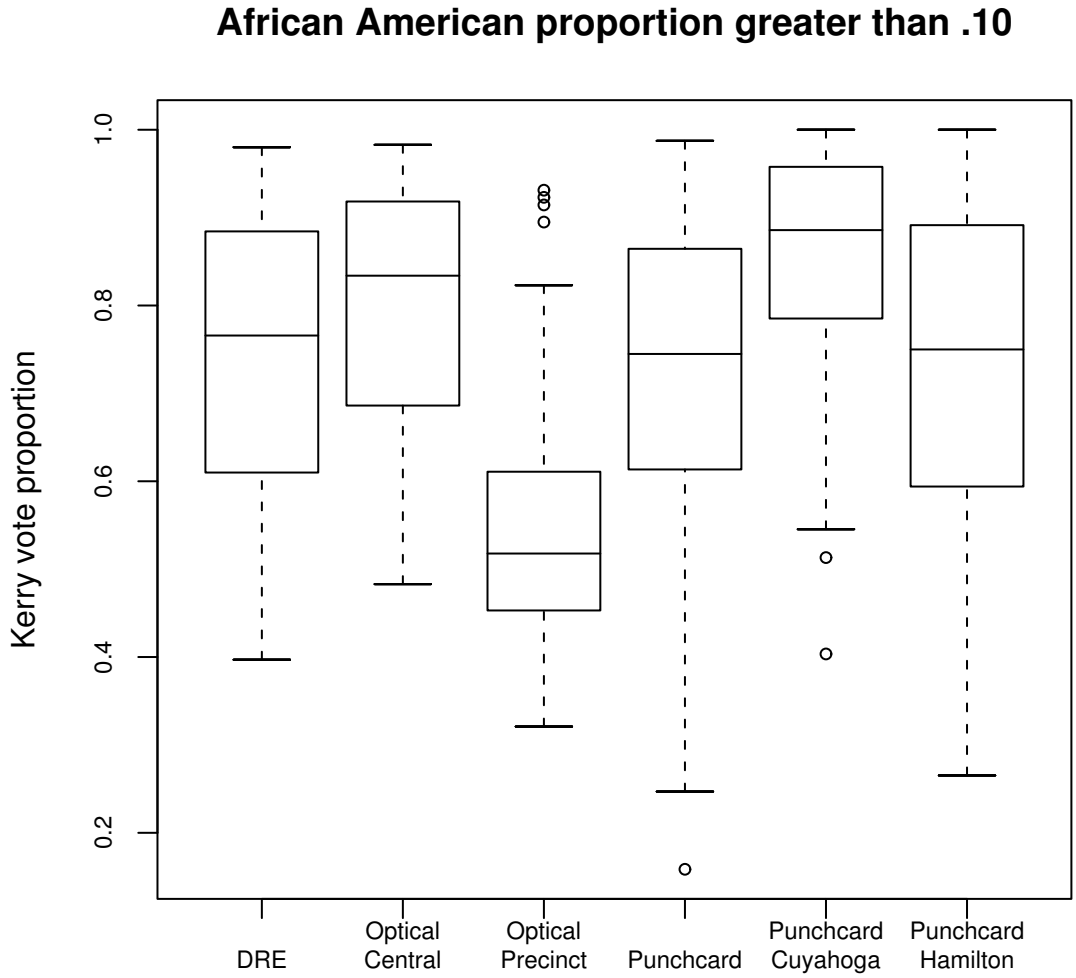


Figure 38: Democratic President Proportion in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Greater Than 10 Percent

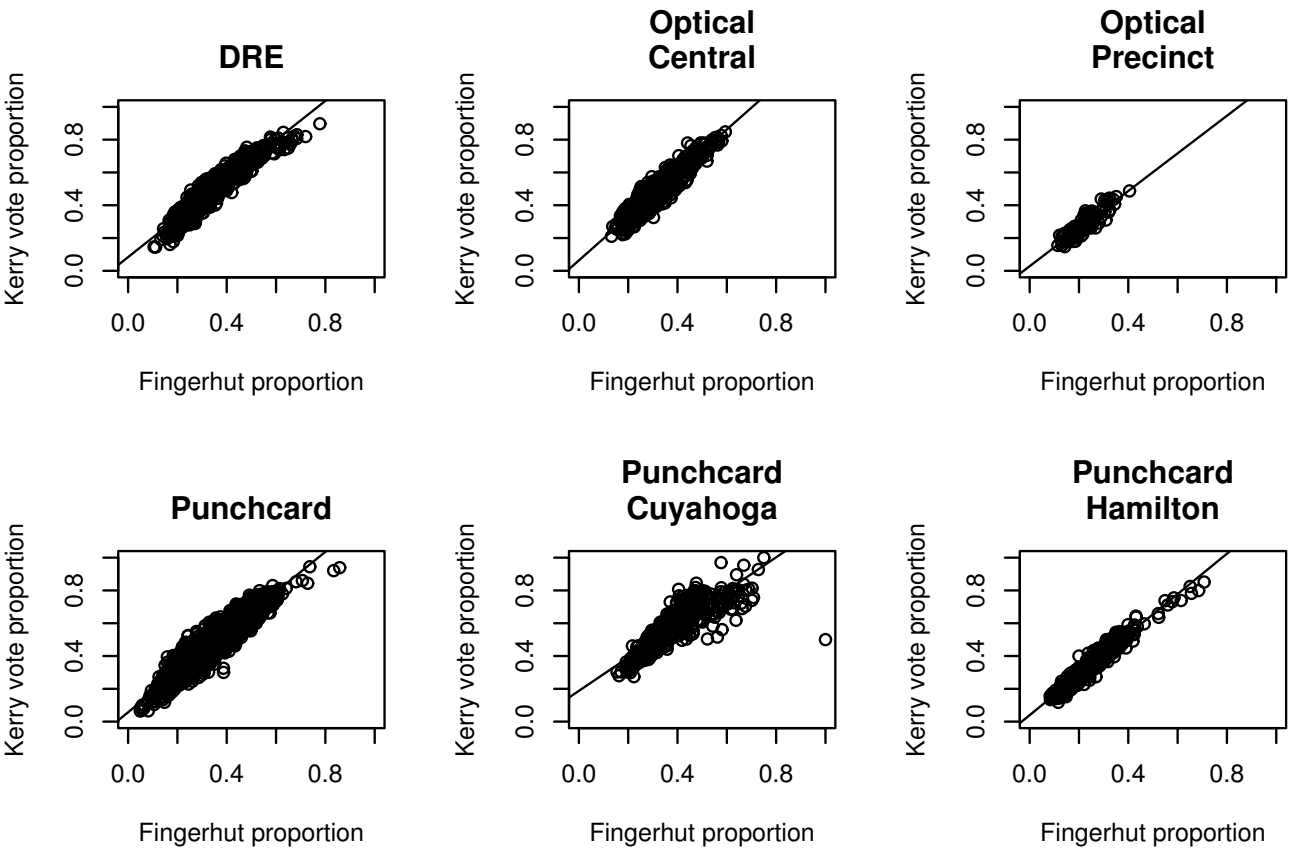


Figure 39: Democratic President Proportion by Democratic Senator Proportion in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Less Than 10 Percent

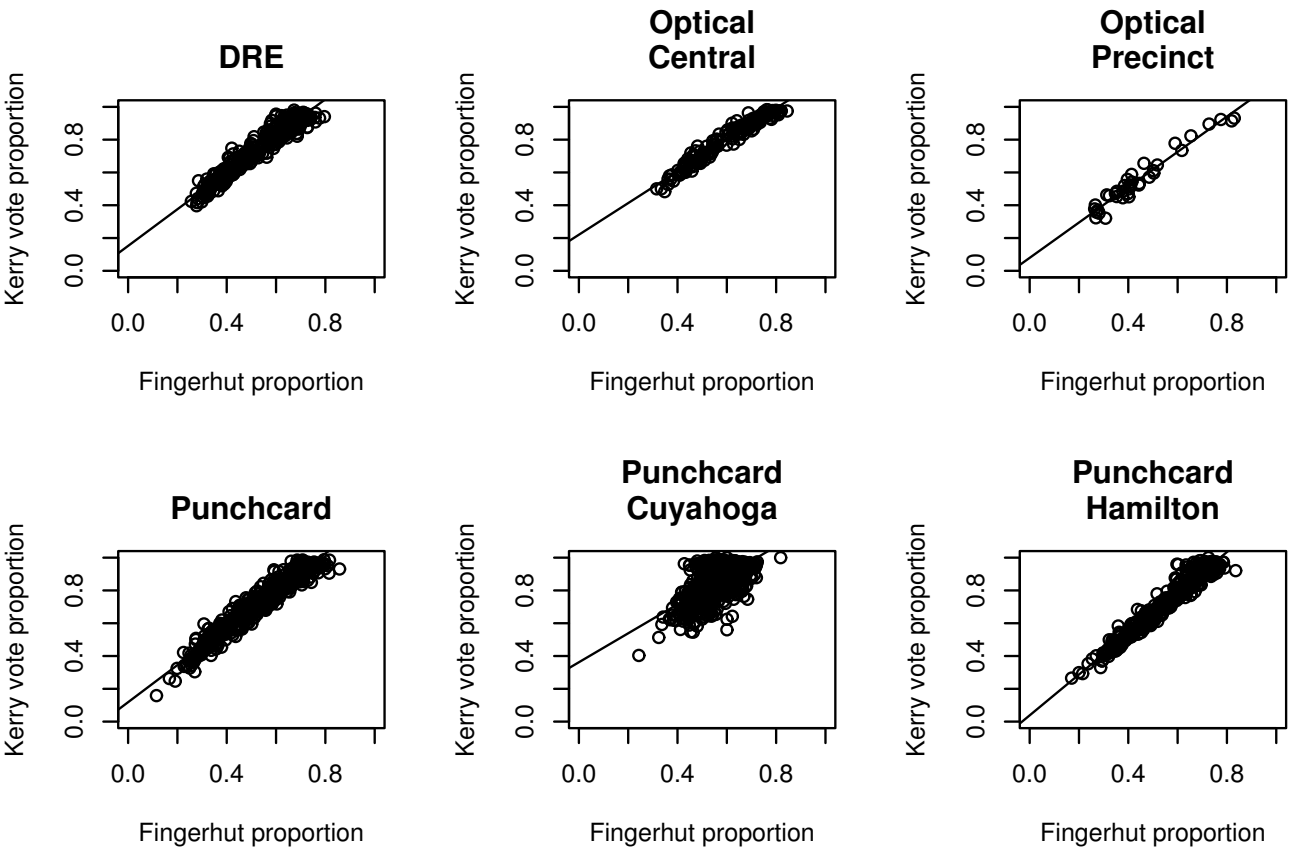


Figure 40: Democratic President Proportion by Democratic Senator Proportion in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Greater Than 10 Percent

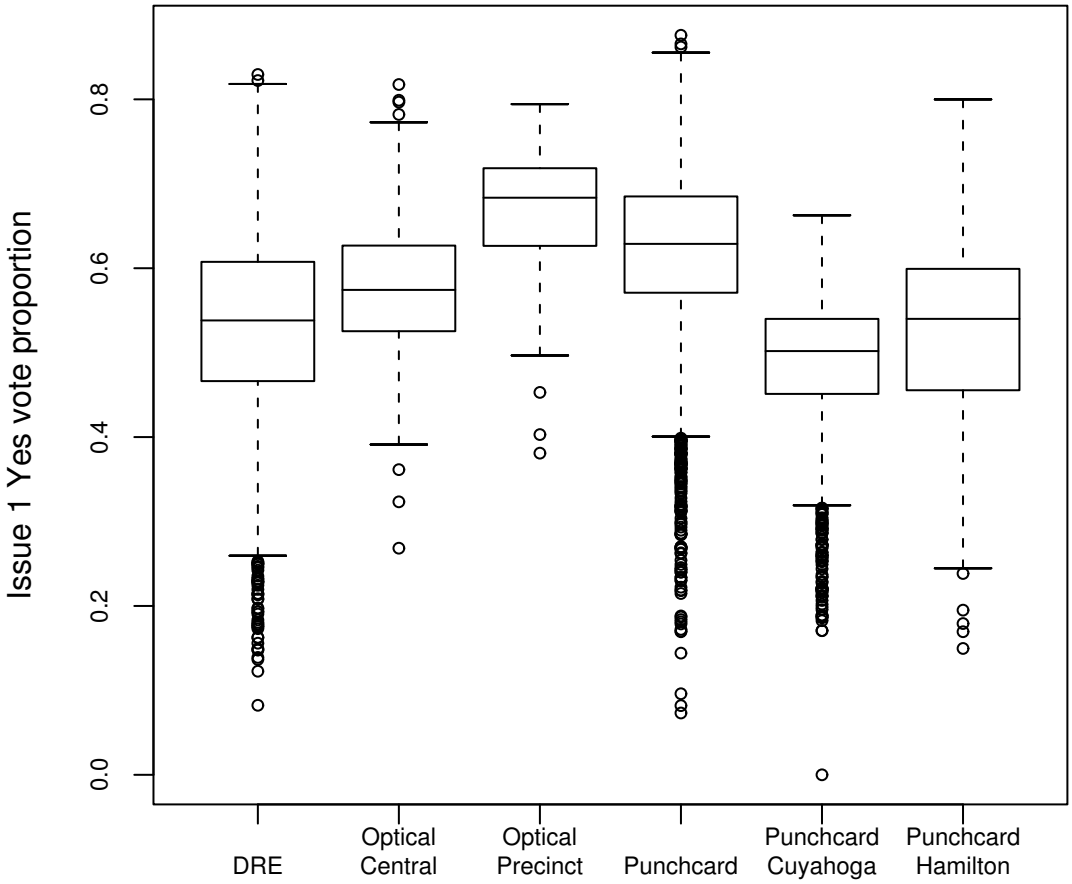


Figure 41: Issue 1 Proportion Yes in Ohio 2004 Precincts by Machine Type

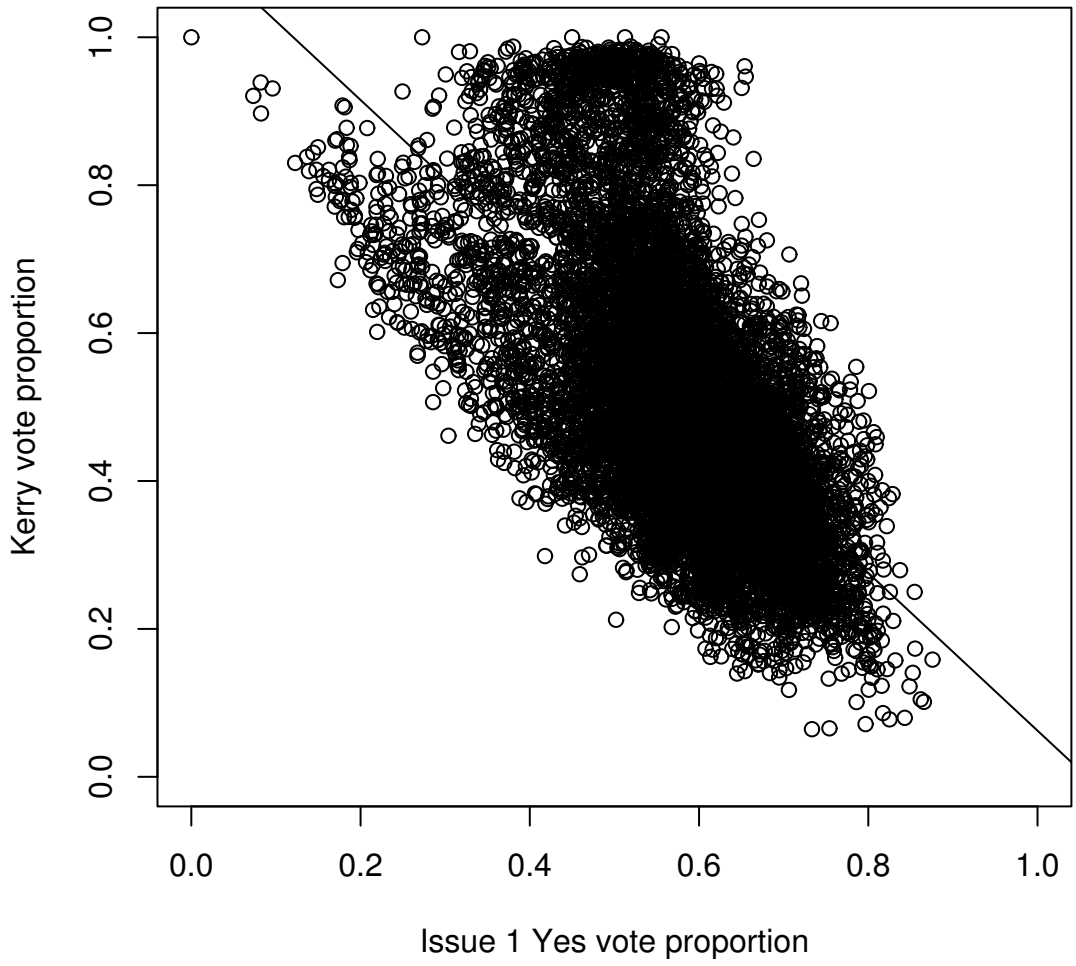


Figure 42: Democratic President Proportion by Issue 1 Yes Proportion in Ohio 2004 Precincts

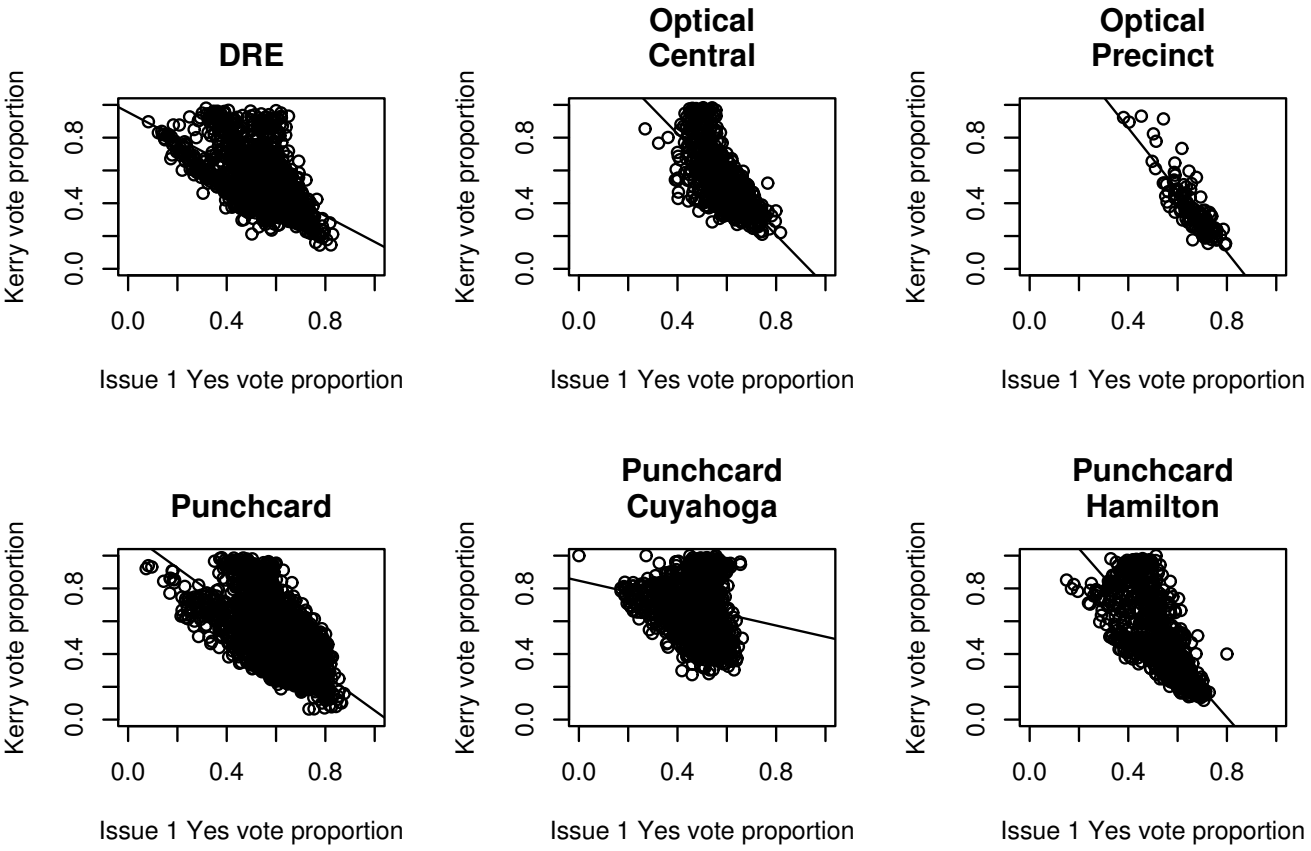


Figure 43: Democratic President Proportion by Issue 1 Yes Proportion in Ohio 2004 Precincts by Machine Type

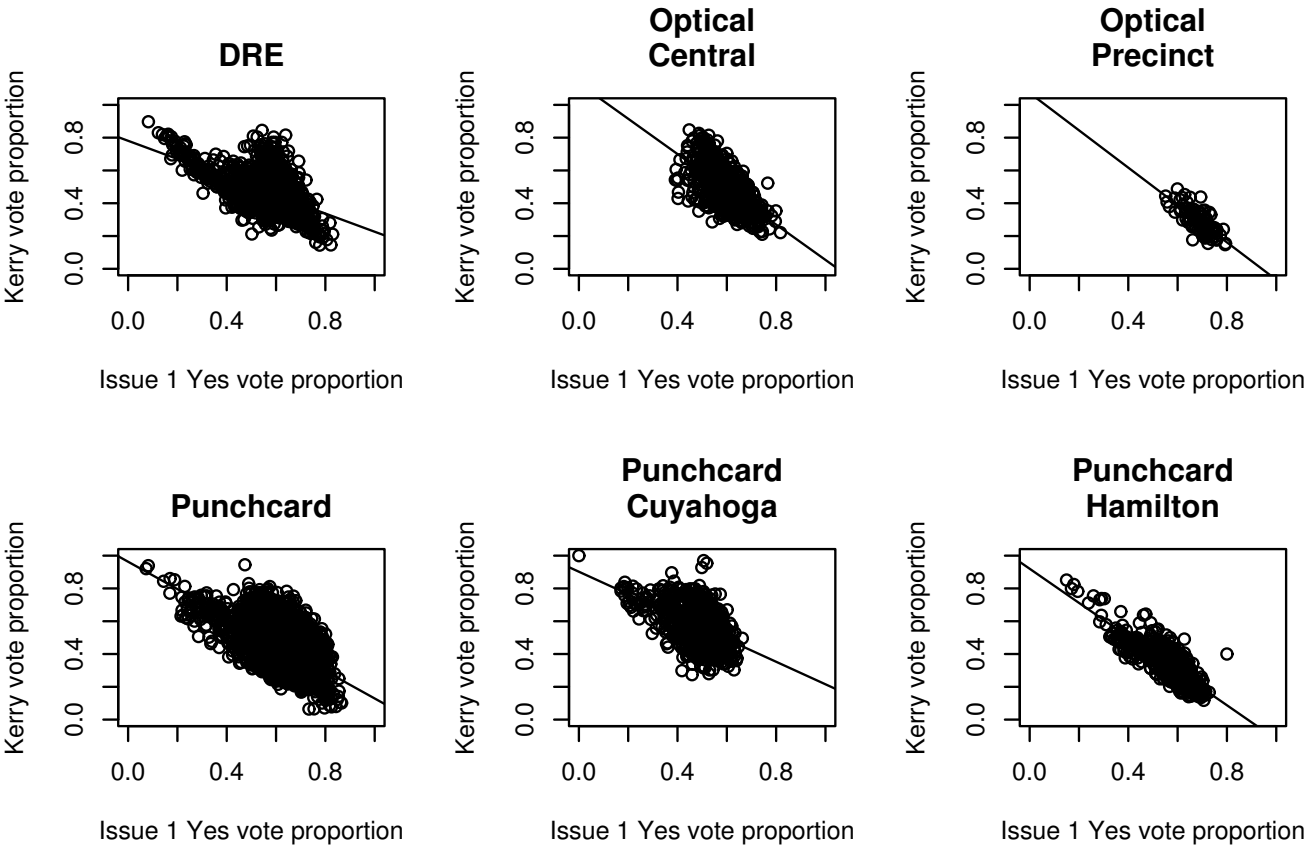


Figure 44: Democratic President Proportion by Issue 1 Yes Proportion in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Less Than 10 Percent

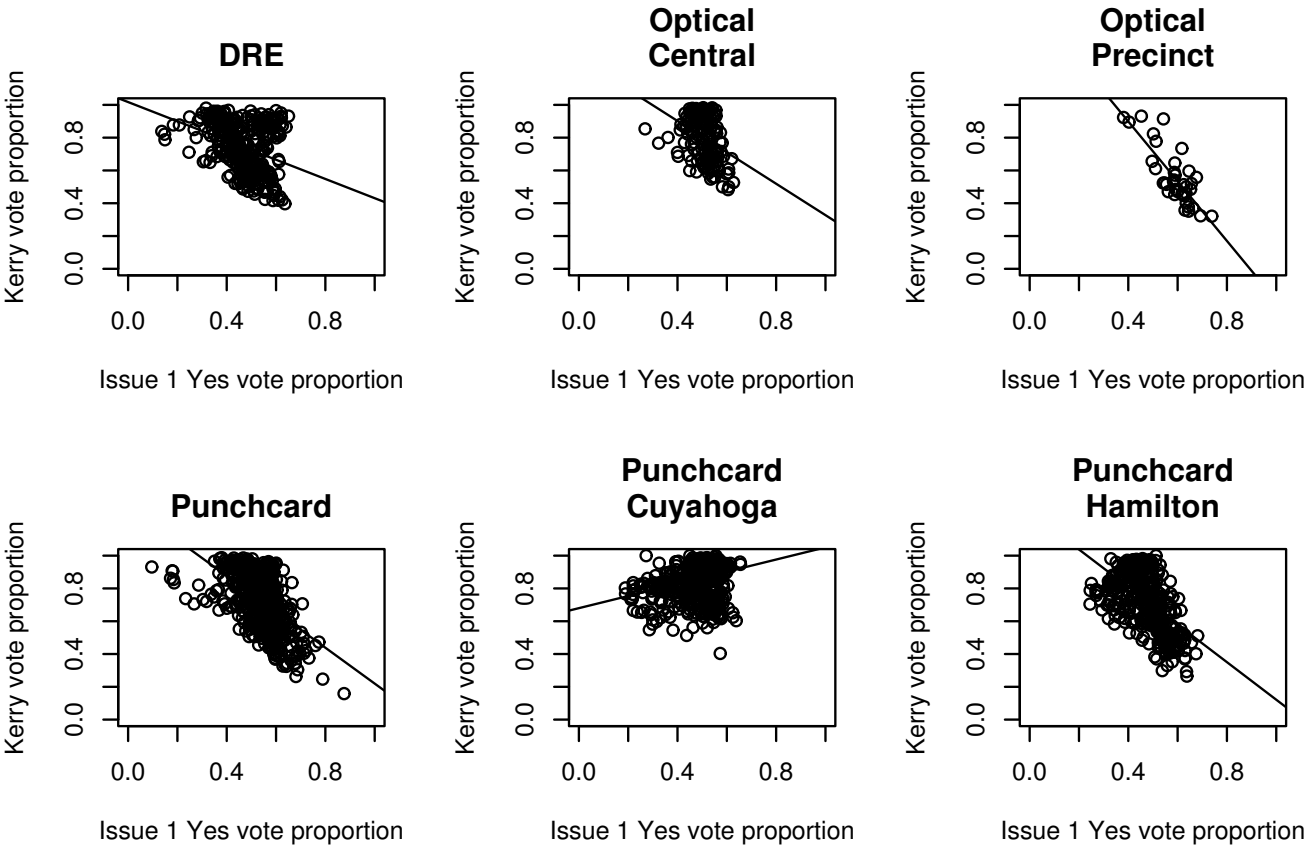


Figure 45: Democratic President Proportion by Issue 1 Yes Proportion in Ohio 2004 Precincts by Machine Type for African American Proportion in Precinct Greater Than 10 Percent

Table 34: Vote for Kerry versus Bush: 2004 Senatorial Vote, Issue 1 Vote and Precinct Racial Composition Regressors (Selected Counties)

	Hamilton County		
Variable	Coef.	SE	t-ratio
(Intercept)	0.272	0.0186	14.6
Logit(Democratic Vote for Senate)	0.796	0.0172	46.3
Logit(Yes on Issue 1)	−0.312	0.0193	−16.1
Proportion African American	1.440	0.0534	26.9
	Cuyahoga County		
	Coef.	SE	t-ratio
(Intercept)	0.7840	0.0145	54.10
Logit(Democratic Vote for Senate)	0.9970	0.0203	49.20
Logit(Yes on Issue 1)	0.0538	0.0222	2.42
Proportion African American	1.9800	0.0408	48.50
	Crawford County		
	Coef.	SE	t-ratio
(Intercept)	0.696	0.0435	16.00
Logit(Democratic Vote for Senate)	0.992	0.0576	17.20
Logit(Yes on Issue 1)	−0.335	0.0697	−4.81
Proportion African American	−4.560	1.5900	−2.87

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of votes for Kerry versus the number of votes for Bush. Hamilton: LQD $\sigma = 1.33$; $\tanh$ $\sigma = 1.27$; $n = 979$; no outliers. Cuyahoga: LQD $\sigma = 2.09$; $\tanh$ $\sigma = 1.99$; $n = 1{,}411$; 16 outliers. Crawford: LQD $\sigma = 0.94$; $\tanh$ $\sigma = 0.84$; $n = 46$; 1 outlier.

Table 35: Outliers: Vote for Kerry versus Bush: 2004 Senatorial Vote, Issue 1 Vote and Precinct Racial Composition Regressors

County	Code	SRes	County	Code	SRes
Carroll	AAJ	-0.67	Cuyahoga	CRK	-7.89
Columbiana	ACK	-4.58	Cuyahoga	CRM	-6.82
Crawford	ABG	4.68	Cuyahoga	CRO	-4.09
Cuyahoga	ABE	-4.80	Cuyahoga	CWY	-4.96
Cuyahoga	ABJ	-4.32	Darke	AAO	8.26
Cuyahoga	ABQ	-4.07	Darke	ABL	10.63
Cuyahoga	APX	-5.27	Darke	ABP	13.38
Cuyahoga	AYV	-6.99	Franklin	ACN	4.79
Cuyahoga	AYZ	-4.63	Franklin	AMC	-8.18
Cuyahoga	BLH	-7.99	Greene	AIN	3.25
Cuyahoga	BLI	-6.03	Madison	ABN	-5.11
Cuyahoga	BLK	-7.36	Medina	AAG	4.78
Cuyahoga	CQY	-7.63	Montgomery	AQU	-4.13
Cuyahoga	CRC	-5.05	Trumbull	AJU	-5.36
Cuyahoga	CRG	-9.63			

Appendix: Notes Regarding the Data

By precinct we mean an election day location for casting votes. Some precincts share locations but we do not aggregate by location. Furthermore, some precincts are split, i.e., serve voters in different legislative districts for the Ohio lower house, but splitting is not relevant to our analysis since all Ohio voters had the chance to vote for presidential electors.

We ignore absentee precincts and federal-only precincts. In addition, we ignore all precincts that reported zero registered voters.

For the most part we take as given the accuracy of data supplied to us by the Ohio Secretary of State and by various county BoEs. In some cases we have verified data with multiple sources, and where discrepancies were found we have resolved them to the extent that we have been able. All of our election data is public.

Data regarding precinct racial composition are proprietary data prepared under contract for the DNC.

The condition of Ohio election data has both contributed to and been an impediment to our work. With respect to the former, we appreciate and have benefited greatly from the efforts that the Ohio Secretary of State makes in assembling precinct-level election returns for the entire state. The availability of these returns has obviated the need for us to collect and process a large number of different precinct canvasses. We have caught only a few errors in Secretary of State data, and the Secretary of State has resolved these problems immediately upon being informed of them. Data collected by the Ohio Secretary of State ignore presidential write-in candidates; we do the same.

On the other hand, the lack of uniformity in data formats and availability across Ohio's 88 counties has complicated our task considerably. For instance, some counties do not have records on the number of voting machines at each precinct; others sent us hand-written information with machine counts; and still others were able to send us electronic spreadsheets with machine counts. Similarly, some counties have consistent precinct naming conventions that correspond to codes used by the Ohio Secretary of State; others employ two or three naming conventions across their own records and do not link their data to Secretary of State codes.

The most severe data problems have been caused by a lack of standards in precinct names. We are puzzled as to why some Ohio counties use Secretary of State codes for their precincts while others do not. If this situation were addressed, so that each county identified its precincts with a three letter code, then compiling election data from Ohio would be immeasurably easier.

Another key data issue concerns the stability of precinct boundaries across time. Many precincts moved between the general elections of 2002 and 2004, and one of our tasks was trying to identify those that did not move. In some cases, counties informed us that none of their precincts had changed since November, 2002. We attempted to verify the accuracy of all such claims, and in many cases found them to be wanting. In such cases we attempted to determine which of a county's precincts did not move.

Electronic maps, often called shapefiles, would make the task of identifying temporal precinct changes simple. In general, however, it appears that Ohio counties do not produce maps of their precincts, particularly in non-census years.

Appendix: Brief Explanation of Statistical Tools Used in this Report

Boxplots For example see Figure 1. The middle line in each boxplot shows the median of the plotted data and the boundaries of the box below and above the median show the first and third quartiles. The whiskers at the ends of the dashed lines each spans a range 1.5 times the interquartile range (IQR) or extends to the most extreme point if that point is closer than 1.5 IQR to the median. Points further than 1.5 IQR from the median are shown individually. These points represent points that are unusually far from the bulk of the data.

Robust (tanh) overdispersed binomial regression estimates For example see Table 3. The binomial regression model is used to assess the relationship between a set of counts for the number of occurrences and nonoccurrences of an event and a set of conditioning variables (so-called "regressors"). For instance, in Table 3 the event is voting by a registered voter and the nonevent is nonvoting by a registered voter. The model analyzes the number of votes and nonvotes by registered voters in each precinct.

The conditioning variables are assumed to affect the probability that events occur in a way that can be represented by a linear function. For instance, to model turnout as depending only on the type of voting technology, for each technology we may create a variable that takes the value one if a precinct used the technology and zero otherwise (a so-called "dummy variable"). We pick one technology to be the reference category. The model estimates a baseline for this category and the differences between that category and the others. For instance, if DRE is the reference category and OC, OP and P denote dummy variables for the other technologies, then a linear predictor for precinct i may be written as follows

$$Z_i = b_0 + b_1 \mathrm{OC}_i + b_2 \mathrm{OP}_i + b_3 \mathrm{P}_i \ .$$

The value Z_i is a score that depends on the coefficients b_0, b_1, b_2 and b_3. Alternately, we may estimate a separate model for each type of voting technology, using a linear predictor of the following form for each set of precincts:

$$Z_i = b_0 \ .$$

In this case the differences between the values estimated for b_0 for each type of technology tell us about the performance differences of interest. One goal of the statistical estimation is to determine values for those coefficients, which otherwise are unknown. Given the score, we can compute the probability that an event occurs in precinct i by using the following function (the "logistic" function):

$$p_i = 1/(1 + \exp(-Z_i)) \ .$$

This value p_i, which is greater than zero and less than one, represents the probability that an event occurs at every occasion where the event is possible in precinct i.

In the voter turnout case, for example, p_i is the probability that each registered voter in precinct i votes, i.e., p_i is the voter turnout rate. Notice that this rate is assumed to be the same for every voter in precinct i. In fact, the true probability varies from person to person. This variability is measured by a dispersion parameter that is estimated for each model.

The estimation is "robust" in the sense that the stipulated model is not assumed to be a good approximation for all of the observed data. Observations that have counts that differ greatly from the values the model predicts receive less weight in the estimation procedure. If an observed count is sufficiently far from the predicted value, its weight is reduced to zero. In this case the observation is declared to be an "outlier." An observed count may differ greatly from the predicted value for many reasons. With election data,it is always possible that there are otherwise innocuous reporting errors, either in the counts of events and nonevents or in the measurements of the conditioning variables. Or the data may accurately reflect the fact that unusual processes occurred in the place that has the discrepant count. In either case, further investigation is warranted.

The estimation method is derived in Mebane and Sekhon (2004a). Software implementing the method is available in the `MultinomRob` package for the statistical programming environment **R** (Mebane and Sekhon 2004b).

studentized residual For example see Table 4. This statistic takes the difference between the observed count of events and the count predicted by a model and rescales it to take into account the total number of events and nonevents in the precinct, the expected relative rarity of events in the precinct, the configuration of the regressors and the estimated dispersion. With these adjustments, different studentized residuals may be compared to one another. A negative residual means the observed number of events is smaller than the predicted number, and a positive residual means the observed number is larger than the predicted number. A studentized residual greater than 2.0 or smaller than -2.0 represents a count that is relatively unusual given the specified model. An outlier has a studentized residual greater than 4.0 or smaller than -4.0.

logit function The logit or log-odds function is $\text{logit}(p) = \log(p/(1-p))$. It is the inverse of the logistic function, i.e.,

$$\frac{1}{1+\exp(-\text{logit}(p))} = \frac{1}{1+\exp(-\log(p/(1-p)))} = \frac{1}{1+(1-p)/p} = p \ .$$

To understand the rationale for the model of Table 30 (Kerry tends to have "uniformly" more support than Hagen), let $d_0 > 0$ and $d_1 = 1$, and for $p = \text{D2002}$ consider

$$q_K = \frac{1}{1+\exp(-(d_0 + \text{logit}(p)))} = \frac{1}{1+e^{-d_0}(1-p)/p} \ .$$

Because $d_0 > 0$ implies $0 < e^{-d_0} < 1$, for $0 < p < 1$ we have that $0 < e^{-d_0}(1-p)/p < (1-p)/p$ and hence $q_K > p$. For instance, suppose $p = 1/2$:

$$q_K = \frac{1}{1+e^{-d_0}(1-(1/2))/(1/2)} = \frac{1}{1+e^{-d_0}} > 1/2 \ .$$

References

Herron, Michael C. and Jasjeet S. Sekhon. 2005. "Black Candidates and Black Voters: Assessing the Impact of Candidate Race on Uncounted Vote Rates." *Journal of Politics* 67 (1): .

Knack, Stephen and Martha Kropf. 2003. "Roll Off at the Top of the Ballot: Intentional Undervoting in American Presidential Elections." *Politics and Policy* 31 (4): 575–594.

Mebane, Walter R., Jr., and Jasjeet S. Sekhon. 2004a. "Robust Estimation and Outlier Detection for Overdispersed Multinomial Models of Count Data.". *American Journal of Political Science* 48 (April): 392–411.

Mebane, Walter R., Jr., and Jasjeet Sekhon. 2004b. "Multinomial Robust Regression (MultinomRob)." Package for **R**. Source code along with LINUX and Windows binaries are available from the Comprehensive R Archive Network (CRAN, http://cran.r-project.org/).

Ohio 2004 Election: New Registrants, Provisional Ballots, Voting Machines, Turnout and Polls Open Elapsed Times in Franklin County Precincts

Walter R. Mebane, Jr.

June 18, 2005

The survey of those who cast provisional ballots in Cuyahoga County (Feldman and Belcher 2005; Mebane 2005) strongly suggests that provisional ballots are cast in Ohio in large part because election officials fail to process voter registrations and changes in registration occurring shortly before the election. The Franklin County precinct data analyzed in this memo confirm that provisional ballots also occur for that reason in another county.

The analysis reported in the Ohio precincts report (Mebane and Herron 2005) measures the ratio of voting machines per registered voter for precincts in many Ohio counties. A key result from that analysis is that voter turnout increases as that ratio increases. The mechanism conjectured in that report is that more machines per registered voter meant there were shorter lines, and that shorter lines meant that more people could take the time to vote. As discussed in this memo, precinct data from Franklin County verifies that mechanism. The analysis presented here also suggests that inadequate provision of voting machines in Franklin County reduced voter turnout much more than the estimates presented in Mebane and Herron (2005) would imply.

For discussion of the statistical methods used in this memo see Mebane and Herron (2005) and Mebane and Sekhon (2004a; 2004b).

Figure 1 shows the relationship between the proportion of ballots cast as provisional ballots and the change in voter registration between April and November during 2004. The curved line is the ordinary least squares regression line including a quadratic term. *A higher proportion of ballots were cast as provisional ballots where there was a greater increase in voter registration during 2004.* The relationship flattens out for increases in registration above about 500.

Figure 2 shows the relationship between the proportion of ballots cast as provisional ballots and the number of voting machines per voter registered to vote in November 2004. The line is the ordinary least squares regression line. *A lower proportion of ballots were cast as provisional ballots where the number of voting machines per registered vote was higher.*

Table 1 shows that *a higher proportion of ballots were cast as provisional ballots where there was a greater increase in voter registration during 2004 and where there were fewer voting machines per voter registered to voter in November.* The Proportional Change in Voter Registration (April to November) referred to in the table is the difference between the number registered to vote as of 11/4/04 and the number registered to vote as of 4/1/04, divided by the number registered to vote as of 4/1/04. The overdispersed binomial regression results reported in Table 1 shows that the proportion of provisional ballots increased as that change in registration during 2004 was greater. The significant coefficient estimated for the square of the change proportion indicates that the rate of increase in the proportion of provisional ballots was slightly smaller for higher levels of the change. *The negative estimated coefficient for the machines per registered voter ratio shows that crowding in polling places also increased the proportion of provisional ballots.*

Table 2 shows provisional vote outliers. The precinct codes and precinct names are not the codes used by the Secretary of State but rather the codes included in the source data file.

Figure 3 illustrates how providing an inadequate number of voting machines in precincts in Franklin County, Ohio, in 2004 produced long lines and caused voter turnout to decrease. The

figure shows three scatterplots. The first plot shows the relationship between the voting machines per registered voter ratio and voter turnout across precincts. The line in the plot is the ordinary least squares regression line. Turnout is higher where the number of voting machines per registered voter is higher. The second plot shows the relationship between the voting machines per registered voter ratio and the elapsed time each precinct's polls were open. A longer elapsed time implies that there were more voters still waiting to vote at the end of election day. Many voters waited in long lines during the day, so this duration measure is not a perfect indicator for the long lines phenomenon. But it is practically speaking the only such measure available throughout the entire state of Ohio for 2004. The durations are shorter (meaning lines were shorter) where the number of voting machines per registered voter is higher. The third plot shows the relationship between the elapsed time each precinct's polls were open and voter turnout. Turnout is lower where the durations are greater (meaning lines were longer).

Table 3 further clarifies the relationships among voting machine provision, polling place crowding and voter turnout. The first and third plots in Figure 3 have a clear outlier with very low turnout, so there is already a question of how much that point distorts the overall pattern. A little thought also raises a question of what effect having a polling place be open longer should produce on voter turnout. Other things equal, keeping the polls open longer should increase voter turnout (the counterfactual is obvious: imagine closing the polls while people are still standing in line waiting to vote). So if not having enough voting machines is the root cause of reduced voter turnout, we might expect that the relationship between polls open elapsed time and turnout is positive, not negative, when longer elapsed times are considered for the same number of machines per registered voter. The overdispersed binomial regression results reported in Table 3 show exactly the expected pattern. In a regression where voter turnout is the dependent variable and the polls open elapsed time is the only regressor, the estimated coefficient is negative: turnout is lower where the elapsed time is greater. But when the polls open elapsed time and the machines per registered voter ratio are both included as regressors, both estimated coefficients are positive: having more voting machines per registered voter is associated with higher voter turnout, but so is keeping the polls open longer, given the number of voting machines per registered voter. The display at the bottom of Table 3 illustrates the magnitude of the machine effects by computing expected turnout rates for precincts at the first quartile, the median and the third quartile of the machines per registered voter ratio values, taking into account that in many precincts the machine effect was compensated for (and hence reduced) by keeping the polls open longer in response to the long lines of voters still waiting to vote at the end of election day. *With the polls open elapsed time held at the median time observed among Franklin County precincts, moving from the first to the third quartile of the voting machines per registered voter ratio is associated with an increase of about 7.5 percent in voter turnout.*

Table 4 shows the outliers from the regression models reported in Table 3. The precinct codes and precinct names are not the codes used by the Secretary of State but rather the codes included in the source data file.

Data source: spreadsheet file franklinMchWrkProPollClose.xls (downloaded from https://wiki.dnc.org/bin/view/OhioVRI/WebHome on Apr 13 19:12).

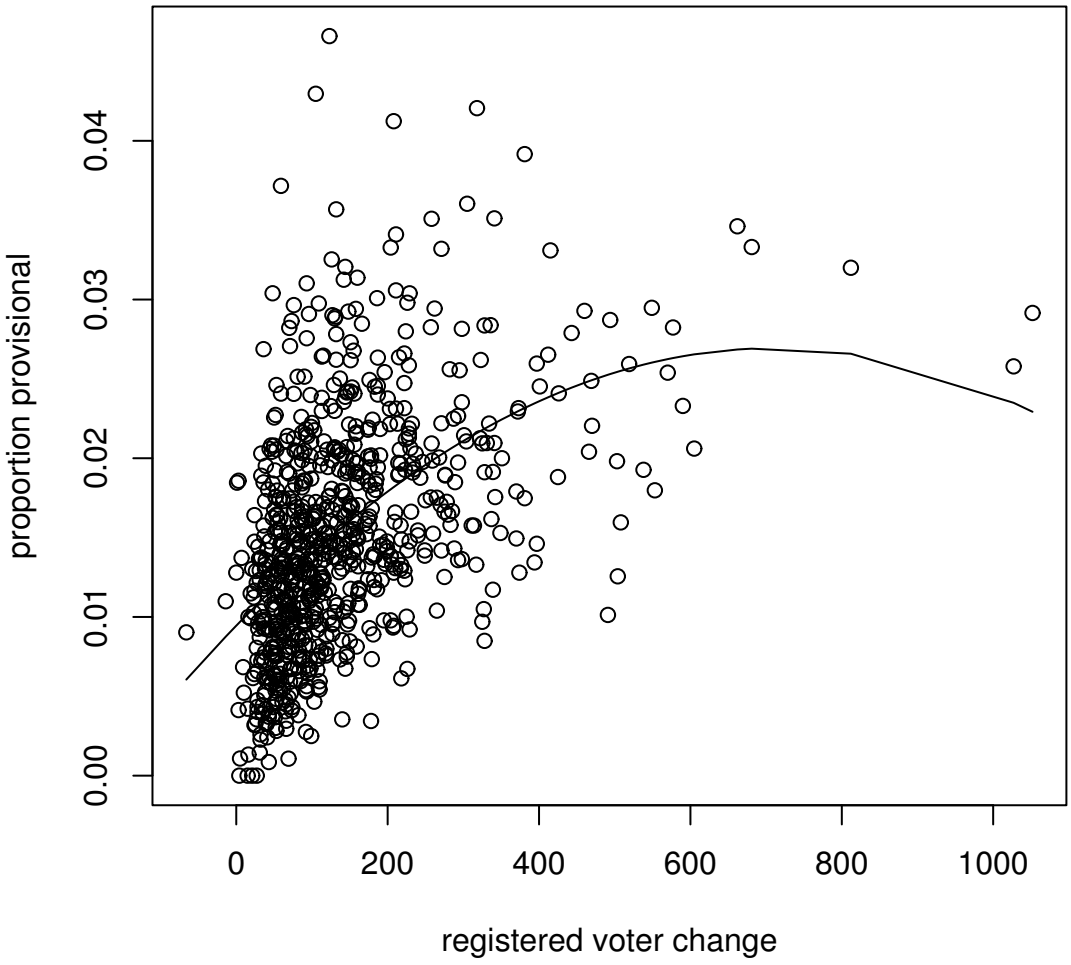


Figure 1: Provisional Ballots and Registration Changes in Franklin County

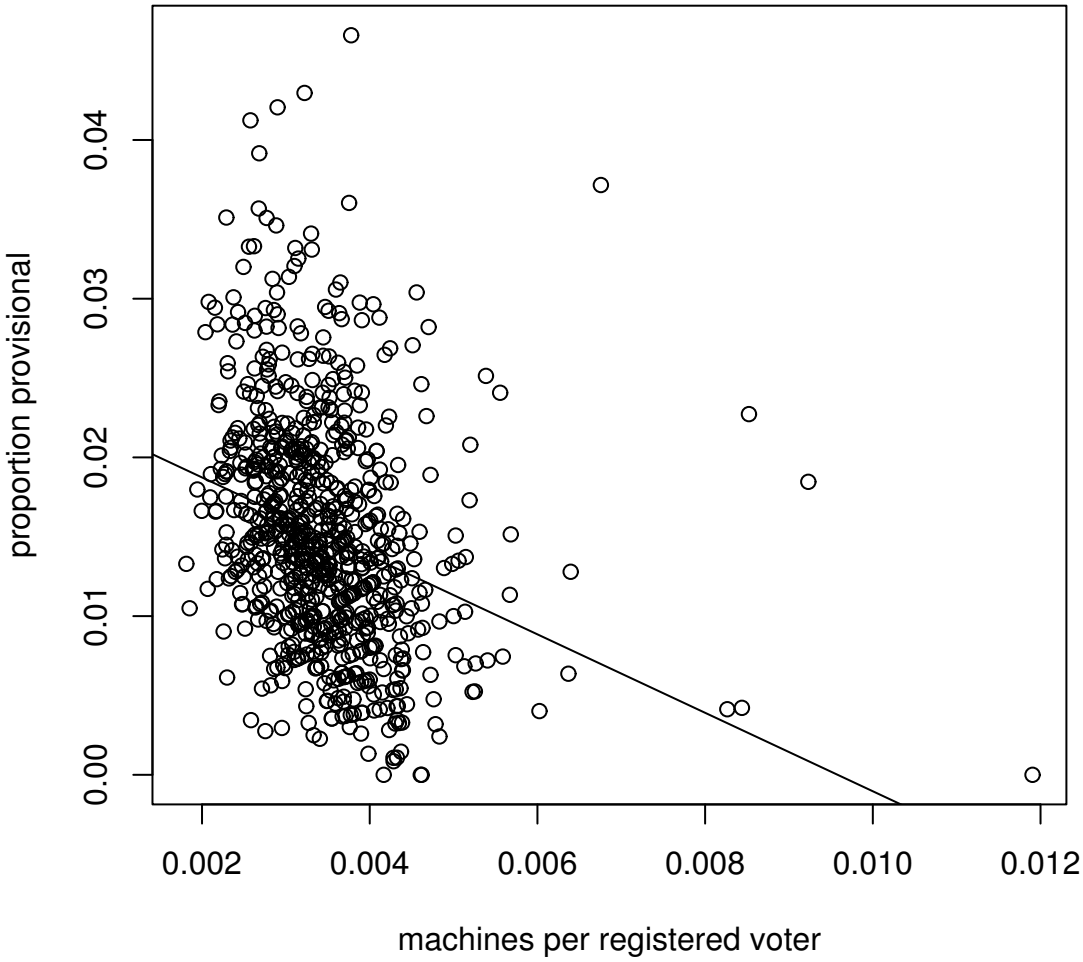


Figure 2: Provisional Ballots and Machines per Registered Voter in Franklin County

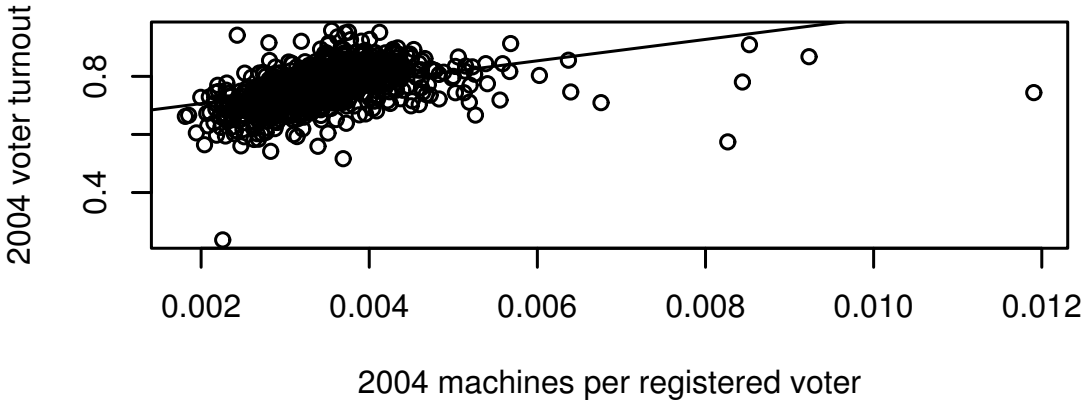
Table 1: Provisional Ballots: Registration Changes and Machines per Voter Regressors

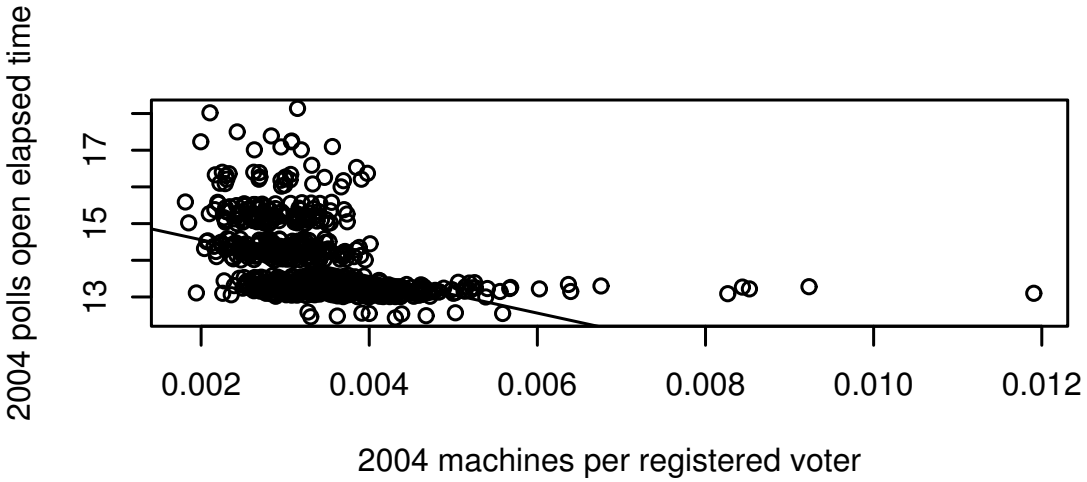
Variable	Coef.	SE	t-ratio
(Intercept)	-3.74	0.0899	-41.60
Proportional Change in Voter Registration (April to November)	3.17	0.2200	14.40
Proportional Change in Voter Registration (A to N) Squared	-2.44	0.2330	-10.40
Machines per Registered Voter	-180.00	22.5000	-7.99

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of provisional ballots versus the number of nonprovisional ballots. LQD $\sigma = 1.24$; $\tanh\, \sigma = 1.36$; $n = 788$; 13 outliers.

Table 2: Outliers: Provisional Ballots: Registration Changes and Machines per Voter Regressors

Code	Precinct	Precinct Name	SRes
01016D	COLS 16-D	Columbus City Ward 16 - Precinct D	5.31
01040B	COLS 40-B	Columbus City Ward 40 - Precinct B	6.46
01046K	COLS 46-K	Columbus City Ward 46 - Precinct K	3.91
01048A	COLS 48-A	Columbus City Ward 48 - Precinct A	6.81
01062A	COLS 62-A	Columbus City Ward 62 - Precinct A	5.88
01062E	COLS 62-E	Columbus City Ward 62 - Precinct E	4.27
01062I	COLS 62-I	Columbus City Ward 62 - Precinct I	4.93
01065D	COLS 65-D	Columbus City Ward 65 - Precinct D	4.08
01065G	COLS 65-G	Columbus City Ward 65 - Precinct G	4.03
01065H	COLS 65-H	Columbus City Ward 65 - Precinct H	4.00
01066A	COLS 66-A	Columbus City Ward 66 - Precinct A	4.93
01066B	COLS 66-B	Columbus City Ward 66 - Precinct B	4.27
19104A	REYNS 4-A	Reynoldsburg City - Fourth Ward - Precinct A	4.22





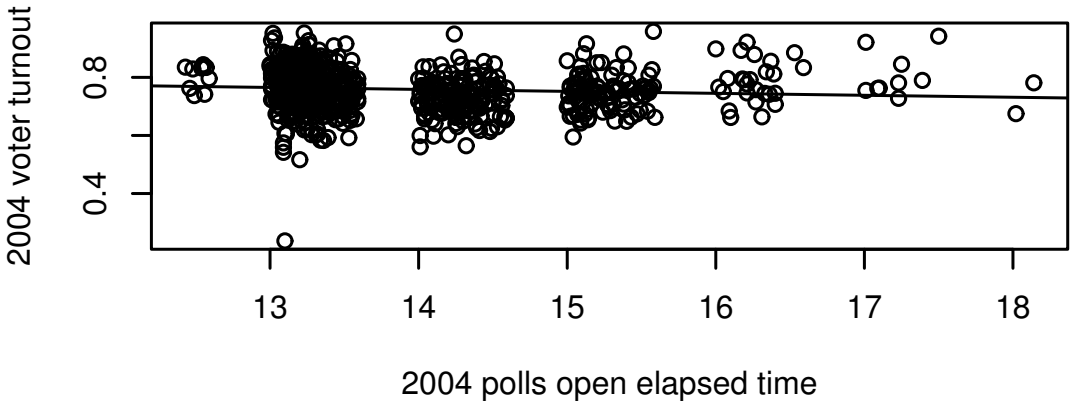


Figure 3: Number of Voting Machines, Turnout and Long Lines in Franklin County

Table 3: Voter Turnout: Polls Open Elapsed Time and Machines per Voter Regressors

	Franklin Precincts			Franklin Precincts		
Variable	Coef.	SE	t-ratio	Coef.	SE	t-ratio
(Intercept)	1.9600	0.167	11.70	−1.7100	0.2050	−8.34
Polls Open Elapsed Time	−0.0584	0.012	−4.88	0.0997	0.0117	8.53
Machines per Registered Voter	—	—	—	445.0000	19.6000	22.70

Notes: Robust ($\tanh$) overdispersed binomial regression estimates. For each precinct, the dependent variable counts the number of registered voters voting versus the number of registered voters not voting. Polls open time only: LQD $\sigma = 4.53$; $\tanh\ \sigma = 4.45$; $n = 788$; 4 outliers. Both regressors: LQD $\sigma = 3.93$; $\tanh\ \sigma = 3.67$; $n = 788$; 7 outliers.

Expected Voter Turnout at
Machine Ratio Quartiles
with Median Polls Open Time

	Quartile		
	25%	50%	75%
Franklin County Precincts	0.715	0.753	0.79

Table 4: Outliers: Voter Turnout: Polls Open Elapsed Time and Machines per Voter Regressors

One Regressor

Code	Precinct	Precinct Name	SRes
01040B	COLS 40-B	Columbus City Ward 40 - Precinct B	-4.05
01073I	COLS 73-I	Columbus City Ward 73 - Precinct I	4.20
01073J	COLS 73-J	Columbus City Ward 73 - Precinct J	4.95
06000F	FRANKLIN-F	Franklin Township Franklin-F	-8.22

Two Regressors

Code	Precinct	Precinct Name	SRes
01073J	COLS 73-J	Columbus City Ward 73 - Precinct J	5.02
06000F	FRANKLIN-F	Franklin Township Franklin-F	-6.46
08100A	LOCKBOURNE	Hamilton Township - Lockbourne	-8.08
16200A	HARRISBURG	Pleasant Township - Harrisburg	-4.00
17000J	PRAIRIE-J	Prairie Township - Prairie J	-4.53
19000A	TRURO-A	Truro Township - Truro A	-8.60
21102G	DUB 2-G	Dublin City - Second Ward - Precinct G	4.11

References

Feldman, Diane, and Cornell Belcher. 2005. "DNC Provisional Ballot Survey." April 28, 2005. Included in the Democratic National Committee report, *Democracy at Risk: The 2004 Election in Ohio*.

Mebane, Walter R., Jr.. 2005. "Inferences from the DNC Provisional Ballot Voter Survey." April 27, 2005. Included in the Democratic National Committee report, *Democracy at Risk: The 2004 Election in Ohio*.

Mebane, Walter R., Jr., and Michael C. Herron. 2005. "Ohio 2004 Election: Turnout, Residual Votes and Votes in Precincts and Wards." June 9, 2005. Included in the Democratic National Committee report, *Democracy at Risk: The 2004 Election in Ohio*.

Mebane, Walter R., Jr., and Jasjeet S. Sekhon. 2004a. "Robust Estimation and Outlier Detection for Overdispersed Multinomial Models of Count Data.". *American Journal of Political Science* 48 (April): 392–411.

Mebane, Walter R., Jr., and Jasjeet Sekhon. 2004b. "Multinomial Robust Regression (MultinomRob)." Package for **R**. Source code along with LINUX and Windows binaries are available from the Comprehensive R Archive Network (CRAN, http://cran.r-project.org/).

Democracy at Risk: The 2004 Election in Ohio

Section VII
Electronic Voting: Accuracy, Accessibility and Fraud

Electronic Voting: Accuracy, Accessibility, and Fraud

Dan S. Wallach
Associate Professor
Department of Computer Science
Rice University

We have seen a number of studies of electronic voting systems over the past several years, roughly broken into two camps: computer scientists and statisticians. Among computer scientists, we have studies performed by academics and by a number of different testing organizations, many of which found significant flaws in the design and implementation of electronic voting systems. Among statisticians, we have studies of voting residual rates, turnout, and other important issues, many of which have concluded that new DRE voting systems are less accurate than more traditional optical scan ballots. This report considers many of the issues raised by these studies and some of our observations from the presidential election in Ohio in November 2004.

Incident reports and machine accuracy

A common feature can be observed in many "problem reports" from DRE voters. They will claim that they selected one candidate and then observed a "switch" of some kind to a different candidate. Inevitably, these problems are difficult or impossible to reproduce, and could be caused by problems with the engineering of voting systems, or could be exacerbated by a perception of machine inaccuracy. Unfortunately, *we have no baseline data* on how accurate DRE systems (or, really, any voting systems) are at capturing voter intent. Proper scientific studies would bring would-be voters into a controlled environment on a non-election day; they were asked to vote for their candidates and were videotaped while voting (no privacy being necessary for such an experiment because there would not be an actual election). The voters' input to the machine could be compared with a spoken survey after the fact, or otherwise corroborated with other factors. Such a study would determine a true, baseline *human error rate*. Most interestingly, such a study would help determine how many errors result from *calibration* errors[1], a common source of anxiety with current DRE systems. Today, the best we can measure are *residual vote rates*, that is, we can count how many ballots are cast with some races left blank ("undervotes") or with multiple selections on a given race ("overvotes"). Many studies of residual voting rates compared to voting technologies, including the DNC's study of Ohio, have shown that the lowest residual vote rates occur with *precinct-based optical scan systems*. In such systems, voters mark a plain paper ballot with a pen. A computerized scanner, mounted above the ballot box, will reject

[1] In typical commercial touch-screen systems, a layer of glass or plastic is placed above the actual screen to detect finger contact. Because some voters are taller and others shorter, every voter will have a different angle from their eye to the finger to the screen below. "Calibration" can be done for a "typical" voter height, but can never be perfect for all possible voters. Typically, buttons are drawn onscreen much larger than a human finger to minimize such errors.

overvoted ballots, eliminating a common mode of human error and giving voters a chance to restate their intent.

Figure 1: A Precinct-based optical scan system (the ES&S Optech Eagle)

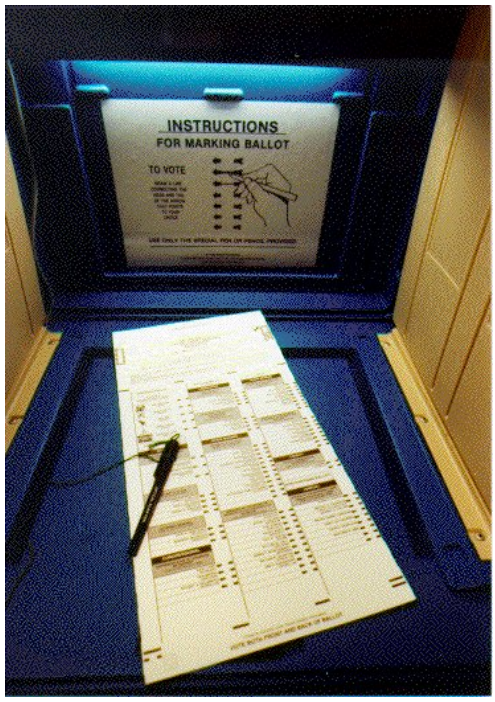


Figure 2: An optical scan ballot for the ES&S Eagle

In all of these studies, DRE systems are consistently shown to have higher residual vote rates than optical scan systems, even though all commercial DRE systems are engineered to simply prevent overvoting (when you select a second candidate for a race, the DRE will de-select the first candidate). This suggests that many voters are more capable of expressing their preferences accurately traditional optical scan systems than to newer DRE systems.

Accessibility

Based on findings like this, an obvious recommendation would be to eliminate DRE systems and go strictly with precinct-based optical scan systems. They're more accurate, significantly cheaper, and offer significant benefits in terms of election transparency and resistance to wholesale election fraud (more on that later). Unfortunately, they're not accessible to several different populations of voters. Voters with low vision may be unable to read the small type that is often necessary to list all of the candidates on a relatively small piece of paper. Voters with zero vision (i.e., blind voters) cannot use optical scan systems whatsoever without assistance, either from an electronic system or a human assistant. Voters with low motor control might have difficulty using the pen to mark the paper ballot and to deposit their marked ballots into the ballot box. And, voters may be illiterate or may not be fluent in English.

DRE systems are often touted as the solution to accessibility needs in the polling place. HAVA requires all U.S. voting precincts offer "accessible" for elections subsequent to January 2006. Today's DRE systems satisfy these accessibility concerns with a variety of add-on devices, including touch-pads and headphones as well as "sip and puff" input devices.

Election Fraud

A primary concern of any election system, whether done by hand, via computer, or any other mechanism is that *it must provide sufficient evidence to convince the losing candidate that he or she actually lost.* Naming the winner is the easy part. When we talk about *evidence*, however, we bring up all the same issues that might occur in a criminal investigation, including tampering (either by insiders or outsiders) and maintenance of a proper chain of custody over the evidence.

Vote by Mail

A simple system to first consider is voting by mail. Virtually all ballots in Oregon are cast by mail, and a significant number are cast in many other states. Mail-in votes are trivially subject to *bribery* or *coercion* (either "I'll pay you $10 for your vote" or "I'll break your kneecaps if you don't give me your vote") at the level of individual voters. This would become expensive to perform at a large scale, particularly without knowledge of the fraud becoming public. To perform such fraud at a *wholesale* level, where a small number of people might attempt to damage the system is far more difficult. A corrupt mail courier could only tamper with the ballots that he or she personally handled, and tamper-resistant features on the ballot or envelope might make such tampering hard to disguise. Once the ballots arrive at the central tabulation facility, fewer people would need to be involved, but hopefully stronger security measures are in place to prevent such fraud. If, for example, ballot envelopes are counted before even being opened, then those counts could be compared, in batches, to the tallies after the batches are scanned and processed. Such measures are comparable to *separation of duty* techniques common in the banking industry, where no one employee can ever embezzle funds without another employee discovering the missing funds as part of their job.

Precinct-based optical scan

Precinct-based optical scan systems compare favorably to vote-by-mail systems. Because the voter must vote privately in a (hopefully) well-controlled polling place, coercion and bribery don't work. The precinct ballot scanner catches overvoting and allows the voter to try again, a feature not possible with mail ballots. The scanner also keeps its own tally of the votes, which can be rapidly transmitted over a modem or spoken over a telephone. Printouts can be physically signed by precinct-level voting officials, and independently tabulated by interest groups that are willing to send representatives to each precinct. This provides an important hedge against the risk of ballot box tampering, particularly while the ballot boxes are in transit from the local precinct to some form of central storage (probably the single greatest vulnerability in any paper-based election system). However, a significant risk remains. What if the *software* inside the scanner incorrectly tabulated the ballots? No election observer would be able

to independently count the ballots themselves. Likewise, precinct-level election officials generally do not (and certainly should not) handle ballots after they are cast. The risk of software error might result from software bugs, or could possible be the result of *fraudulent programming* (sometimes referred to as a *Trojan horse*). Today's certification and "logic and accuracy testing" are completely insufficient to detect such problems[2]. However, so long as the paper ballots are handled properly, they will remain, after the election, allowing for a meaningful recount. *The ability to perform such a recount provides a critical hedge against the risk of scanner failures.*

DRE voting systems

Direct Recording Electronic (DRE) voting systems offer a number of benefits relative to precinct-based optical scan systems. They also introduce significant new complexity, new risks, and new costs. A DRE terminal may cost thousands of dollars, and many must be purchased to allow busy precincts to limit voter waiting times to avoid the problems observed, for example, in Franklin County, Ohio.

Modern DREs are, at their core, general-purpose programmable computers. Some even run Microsoft's Windows CE operating system. This gives DREs the flexibility to support a variety of attractive features including large text, speech synthesizers, and multiple languages, all of which help making voting accessible to a wider demographic of voters. This same flexibility, unfortunately, significantly increases the ease with which someone might tamper with the software. Such tampering could occur where the machine was manufactured or anywhere else from the moment the machine leaves its manufacturer to the day of the election. Anyone who has uninterrupted physical access to a DRE voting system for any length of time could potentially tamper with its software. Consider software updates. As with normal consumer software vendors, DRE vendors are constantly improving and modifying their software to satisfy the needs of their customers. They then submit this software for "certification" by an Independent Testing Authority. There are three U.S. companies currently serving as Independent Testing Authorities. However, in cases where outside computer security firms or academics have had the opportunity to independently examine DRE software, they have found significant and wide-ranging flaws. As such, it appears that the ITAs do not have the skills to properly audit voting system software. We also observe that ITAs make no warrant that voting systems are actually suitable for use in an election. Rather, much more weakly, they claim that voting systems "satisfy FEC standards", which unfortunately require almost nothing with regard to software quality or security, or even about usability or accuracy. More elaborate standards are in development, but are nowhere near adoption.

A fundamental attribute of all modern DRE systems is their elimination of the paper trail we have with optical scan systems. While these systems will allow voting totals, or even individual votes in some cases, to be printed at the end of the election, this does not

[2] Logic and accuracy testing for an optical scanner generally involves running a "test deck" through the machine. After scanning the deck, the tally is read from the machine. The scanner's tally can be compared to the known totals. Unfortunately, a well-designed Trojan horse can tell when it's being tested, either by identifying that, in fact, it's seeing the same test deck it always sees, or even by observing that the test ballots are arriving much faster than "normal" voters might cast their ballots.

provide a hedge against software failures in the DRE. It's entirely possible that a DRE voter could vote for one candidate, which would be displayed on screen, while an entirely different candidate could be recorded internally as having received that vote. If such an error occurred, neither the voter nor any election official would be able to undo the damage after the fact. If such an error occurred systematically, it could swing the outcome of an election. And, if the faulty software was deliberately placed in the machine, it could even be programmed to modify itself to eliminate any traces of its having been present. *If such fraud were occurring, it would not be visible to poll workers or election observers.*

As with any other voting system, DRE votes must ultimately be centrally tabulated. This information may be communicated over a modem or carried by hand in a computer memory card. As with traditional ballot boxes, such data may be subject to tampering while in transit. However, while ballot boxes are large objects that can be easily observed and tracked, computer memory cards are small and sleight-of-hand can allow for quick substitutions. Likewise, telephone lines are not terribly secure against attackers who can climb telephone poles. While appropriate cryptographic techniques can mitigate against all of these risks, many DRE vendors either use no cryptography at all or do it improperly, leaving the data effectively unprotected while in transit. Once the data arrives at the central tabulation facility, it is typically stored in off-the-shelf personal computers running a Microsoft operating system and some form of database. These computers, themselves, may be subject to attack by election insiders. Anyone with physical access to these computers and the appropriate tools could execute a database script to directly modify the database records, overwriting any original data without leaving any evidence of such tampering. Furthermore, in the case that these machines are *ever* connected to the Internet, perhaps to deliver results to an election web server or to the press, these machines could be attacked over the Internet. Even if all the latest security patches have been applied, attackers may well keep other security attacks in reserve, specifically to attack such election computers.

Internet voting systems

The Department of Defense commissioned a voting system to allow overseas soldiers to cast their votes on the Internet, using web browsers and other off-the-shelf components available, even in remote locations. A report, written by several experts asked to study this system, concluded that both the end-user computers and the central tabulation machines were fundamentally at risk of security attack. Present software technology is not good enough that we can make any guarantees about such systems' robustness against attack. And, if such a system were deployed, adversaries ranging from disaffected local voters to foreign intelligence services would have incentives and opportunities to go after the system. The Department of Defense scrapped the project.

While many other attempts to introduce non-traditional voting schemes may increase voter turnout by making it easier to vote, they introduce significant risks along these lines. Any opportunity for an attacker to electronically communicate with either a voter or the tabulation facility makes it easier than ever before to perform election fraud.

Likewise, such systems have all of the same bribery and coercion issues present in vote-by-mail systems.

Voter-verifiable paper trails and other DRE improvements

A number of proposals have emerged from the computer science community to improve the security and robustness of DRE-like voting systems. The simplest proposal is to attach some form of printer to a DRE system. Voters would use the same computerized user interface as before. However, when voters indicate that they are done, a printer would generate a printed representation of their ballot. Voters could read this ballot and, if they agree, it would become the official ballot, the primary record of their voting intent. The DRE system could keep its own internal tally, but as with precinct-based optical scanners, the paper records would take precedence in a recount. There are many variants on voter-verifiable schemes. One variant, the "Mercuri method," holds the ballot under glass. Voters can read it but cannot touch it. This defeats a vote-buying scheme called chain voting[3], and also prevents voters from accidentally removing ballots from the polling place. Another variant simply uses a computer to mark a traditional optical scan paper ballot which is then deposited into a standard ballot box (see Figure 3). An intriguing benefit of such systems is that only one per precinct needs to be purchased to satisfy HAVA requirements. Voters who need the accessibility features of DRE systems can use them, and voters who do not can use standard pens. With limited budgets, this becomes an attractive option for many counties, particularly those already using optical scan voting systems.

Figure 3: ES&S / Vogue Automark (computer-assisted optical scan ballot marking device)

[3] A typical chain voting attack on a paper ballot system has the attacker standing outside the polling place, offering to buy votes. A voter who wishes to sell a vote is given a ballot, already marked by the attacker and is told to pocket this ballot, go get a fresh one, and swap them. The previously-marked ballot is deposited in the box, and the fresh, unmarked ballot is returned to the attacker for the payment.

Computer scientists and cryptographers have also developed a variety of intriguing cryptographic schemes using advanced mathematical techniques to allow voters to go home with just enough numerical evidence that they can verify their vote is part of the final tally without being able to prove to a third party what their vote actually was. Such schemes generally allow independent third parties to perform their own tallies of the election, based again on cryptographic evidence. To date, such schemes have not been used in any elections and questions remain about both whether the cryptographic schemes can be broken and whether these systems would be usable by the broad voting population.

Recommendations

- Precinct-based optical scan systems are the most "accurate" voting systems available today. They are also reasonably priced and can satisfy HAVA requirements in a cost-effective manner with devices such as the ES&S AutoMark (see Figure 3).
- Current DRE systems are not engineered to meet the needs of elections. They are extremely expensive to procure and maintain. They are not sufficiently robust against fraud. They are less usable to the broad population of voters than earlier, simpler technologies.
- Existing standards and practices for the certification of voting systems are insufficient to the security requirements of DRE systems. Significant effort will be needed to create the next generation of standards.
- Few quantitative studies have been performed on the usability of different voting technologies. Vendor claims of improved usability should not be considered meaningful until they perform significant user studies under controlled conditions. Existing anecdotal evidence, including event reports, are at best mixed in their opinions of different voting systems' usability. Election official should perform controlled, scientific studies of their own populations using their own voting machines to truly understand where they might be experiencing usability problems.
- Most voting system vendors consider their software to be proprietary trade secrets and generally resist any attempts to disclose and discuss their designs in public. *Private, vendor trade secrets have no place in public elections.* Vendors are welcome to protect their intellectual property with copyrights and patents, but their full designs must be subject to public scrutiny. As elections become increasingly electronic, such scrutiny is critical to maintaining transparency and public confidence in elections.
- Computer software, at every stage in the process, might be buggy and could well be malicious. Different strategies are necessary to mitigate against this threat, depending on what voting system is used.
    - Paperless DRE voting systems generally print precinct-level tallies at the end of the election. These printouts are generally signed by the election officials working in the precinct. Those signed printouts should be treated

as important evidence as to the result of the election and should be preserved for recounts and post-election auditing.
    - Precinct-level optical scanners might incorrectly tally votes as well. The original marked ballots should be independently counted, or at least randomly sampled and compared to the electronic results, before an election result is certified.
    - Paperless DRE systems should be upgraded to voter-verified paper trail systems. The printouts should be treated in exactly the same fashion as optical scan ballots: they should be carefully preserved as evidence of voter intent and should be randomly sampled and compared to the electronic results.
    - "Parallel testing," where some DRE voting systems are pulled out of general use and are tested, on election day but under controlled conditions, is an pragmatic and valuable test that should be performed whenever such voting machines are being used.
    - The computers used to tabulate election results are a tempting target for election fraud, and as such, require more significant controls, including well-chosen passwords and physical access restrictions. They should never, in their entire lifetime, be connected to the Internet or to any modem or communication device. Instead, an "air gap" style of security should be used. Data can be released to the public through simple measures such as burning a CD with election results and hand-carrying such a CD to a separate, network-enabled computer.
- Election officials need to hire "penetration testing" (also called "tiger team") consultants to examine the security of their election systems. Where such teams have been hired in the past, significant vulnerabilities have been discovered. Such teams should be hired on a recurring basis to audit voting machines as well as the entire voting process, from registration through tabulation.
- The timely publication of detailed precinct-level election statistics is critical to the public confidence in an election result, and such data is often not available in its entirety for every county. Such statistics can be easily derived from local voting tabulation systems and should be quickly and electronically reported in a standardized fashion.

Democracy at Risk: The 2004 Election in Ohio

Section VIII
Transparent Aggregation of Voting Results Using the Internet

TRANSPARENT AGGREGATION OF VOTING RESULTS USING THE INTERNET

Juan M. Jover, Ph.D.
White Paper
May 31, 2005

SUMMARY

A method is proposed to transparently compile and aggregate the voting results from all voting stations and accurately determine who won an election using the internet.

THREE PHASES OF VOTING

Voting can be divided into three phases:

1. **Eligibility**
   This phase refers to all the procedures and equipment needed to determine who is eligible to vote including, among others, voter registration and voting location assignment.

2. **Casting the vote**
   This phase refers to recording confidentially and accurately the intentions of each voter. This can be done in person or by mail. Recording the votes is accomplished through a set of procedures and voting equipment such as optical scanners, punchcards, etc.

3. **Aggregation**
   After the votes have been counted on each voting station, an aggregation phase begins in which the votes from the different voting stations are aggregated into precincts and used to determine who won an election.

THE ISSUES IN AGGREGATING THE VOTES

Lots of attention has been paid to the first two phases. Eligibility is well covered in State and Federal laws and new laws are being proposed to cover registration of voters by third parties, voter identification, and provisional ballots.

The second phase, casting the vote, has received also lots of attention since 2000, especially in determining the intention of the voter and allowing Voter Verified Paper Ballots.

In contrast, little attention has been placed in Aggregation, a critical phase of the voting process. Aggregation refers to adding the results from the different voting stations to determine the winner for each race. The two main issues in aggregation are:

- Ensuring that the results from each voting station are accurately input into a tabulating computer.
- Ensuring that the tabulating computer properly adds the results from the appropriate voting stations for each race.

While the software required to perform these calculations is relatively simple, it is very possible to commit errors that will affect the results of a race because:

- Many tabulating computers are not used exclusively for this task and therefore are subject to viruses being introduced in them while performing other tasks (like browsing the internet).
- Many tabulating computers are connected to the internet to transmit their results and therefore hackers could change the results of the tabulation.

Problems with tabulating computers in the last presidential election have been reported (e.g., Conyers Report 1/5/05).

Only one piece of legislation (S450 and companion HR939) has been proposed in the 109th Congress to resolve some of the issues with aggregation. This law proposes:

- Certain data to be compiled on each Federal election
- This data to be disclosed no later than six months after the election.

This proposal would not solve the issues with Aggregation, and leaves vulnerable one of the three phases of voting.

A new method is proposed to aggregate results in an election. Because it is done transparently it provides a high degree of accuracy in the tabulation of the results and because of its design it can bring an additional level of scrutiny to the whole election results.

PROPOSED METHOD OF AGGREGATING RESULTS IN ELECTIONS

- At the closing of voting, observers shall preliminarily certify the results for each voting machine. The data collected shall include, among others, the number of votes per candidate, spoiled votes, number and type of voting machine, as well as demographics of the precinct. Each observer keeps a copy of the preliminary certification for each machine.

- A selected person (usually the presiding officer of the precinct) transmits this information to a central headquarters (this can be done via computer or automated telephone input system). A password protects that only authorized people enter the data.
- The information is automatically displayed in an official election website, listing all data per machine (indicating the name of the person submitting the data and time/date stamp).
- The observers of the election check on the official election website that the information displayed matches the counts that they preliminarily certified. This allows detection of any errors that may have occurred during transmission and posting of the information.
- The central computer displaying the website aggregates the results to show who won the election.
- The information in the website is downloadable by anyone, including the press and academic institutions. By downloading the information, third parties can verify that the information is aggregated accurately. The information should be in a standard format and should be available for download as soon as entered. Each download should have a time stamp in plain text and encrypted per the most advanced security methods available.

Therefore, this system solved the two problems with Aggregation:

- Accurate transmission of the election data, and
- Accurate tabulation of the results

IMPLICATIONS OF THIS PROPOSED METHOD

To ensure a fair and accurate election, the three phases of voting need to be examined. The proposed method allows for detection and correction of any errors that may occur in the Aggregation phase of voting and therefore it needs to be implemented to protect our elections.

Implication #1: This method provides an additional advantage: the downloaded data can be analyzed with powerful statistical methods to understand the profiles of the electorate and determine whether there is any anomaly with the election results.

Implication #2: A mandatory manual recount should occur before certification of the results if anomalies are uncovered by the statistical analysis.

Implication #3: A consistent data format and which data to report must be determined by a commission of experts.

Implication #4: The website program used in federal elections could be distributed to all states to ensure uniformity in reporting, which is very important for performing statistical analysis.

QUESTIONS & ANSWERS

How can you be certain that the aggregation is done correctly?
The basis of this system is that observers can check that the data counts introduced per machine are accurately reported on the official election website. Then anybody who downloads the data can ensure that the aggregation (tabulation) of the results is done correctly.

Is it secure to use the internet for this?
Yes. In this proposal the internet is used to post results and do the aggregation. Observers can check that the data on the website is the same that they certified for each voting station; if this is not the case, they can file an incident report online in the same website.

What if somebody hacks the system?
If a hacker changes the results reported per machine, the observers of the election would catch it.
Hackers could also modify the totals to change the winner of a race, but the third parties who download the data and review the reporting of the final results independently would catch this.

What if somebody enters the wrong data for a voting station?
The observers would catch the error and the data would be reentered, flagging the fact that it has been reentered with information of the person authorized to do so and the date/time stamp.

Can the internet handle all these requests for downloads?
It is well understood by internet experts, how to design a system that will allow all the downloads expected on election night.

Are there any additional advantages of using this system?
Yes. This system will allow third parties to perform statistical analysis of the data immediately after results per voting station are reported. This will allow a wealth of information to understand how the electorate voted and would allow a method to determine anomalies that would require a manual recount of the results in certain voting stations.

Is the system proposed here necessary to ensure accurate elections?
Absolutely. Many systems are needed to ensure accurate elections, but without the system proposed here we can never be certain of an accurate tabulation of the results of an election and therefore be certain about who won the election.

Democracy at Risk: The 2004 Election in Ohio

Section IX
Experience on the Ground in Ohio

ON THE GROUND IN OHIO:
A SUMMARY OF PROBLEMS AND CHALLENGES WITH THE CONDUCT OF THE 2004 OHIO GENERAL ELECTION AND WITH THE AGGREGATION OF ELECTION DATA IN OHIO

I. Pre-Election Day

Voter Registration Processing

- Dramatic surge in voter registration left many county boards scrambling
- Delays in processing new voter registrations kept many from being added to the rolls (and undoubtedly led to an increase in the number of provisional ballots cast)
- Incoherent guidance from Secretary of State sowed a great deal of confusion and led to the improper rejection of many applicants

Absentee Ballot Processing

- Delays in processing absentee ballot applications meant that many applicants did not receive ballots by election day
- Many voters who did not receive ballots were listed on the rolls as having voted absentee – many were turned away without being given the opportunity to vote provisionally

Volatile Legal Landscape

- Court decisions in the 48 hours prior to election day left even legal experts confused as to the state of election law on November 2, 2004

Recommendations for the Future

- Exercise tighter monitoring of pre-election voter registration and absentee ballot processing on county level
- Demand that the Secretary of State allocate additional resources to those counties falling behind in processing applications
- Undertake a thorough examination of election law and need for litigation well in advance of election

II. Election Day

Insufficient Resources

- Too few (working) voting machines (especially in Knox & Franklin counties)
- Inadequate staffing of poll workers
- Insufficient supplies of provisional ballots

Poor Training of Poll Workers

- Serious confusion over provisional ballot rules
- Many poll workers required voters to produce identification
- These and other points of confusion contributed to the long lines on election day

Equipment Problems

- DREs in Mahoning County changing votes from Kerry to Bush
- Punch card machines in Cuyahoga County improperly aligned

Voter Intimidation

- Isolated instances of overt intimidation at polling locations
- Scattered reports of fliers threatening arrest of people with outstanding parking tickets or with child support owing

Recommendations for the Future

- Demand that the Secretary of State push the county boards to improve poll worker training
- Establish an even more extensive voter protection effort – if the operation stands up earlier, it may be able to find problems before it is too late to solve them
- Establish a more organized system (within the voter protection effort) for data collection and resolution of incidents reported

III. Collecting and Aggregating Data

Very Little Centralization/Standardization of Record Keeping

- In nearly all cases, data must be collected individually from the 88 county boards of elections
    - The Ohio Secretary of State maintains very little of this information centrally
    - Therefore there are very few standards imposed on the collection or retention of data
    - Where the Secretary of State did collect data centrally, the process was far easier (though not without errors)

- The level of discipline in the record keeping practices of these boards varies significantly
    - Many simply did not keep records on the information we sought, while others only tracked the data county wide rather than precinct by precinct
    - The majority of county boards do not maintain their records electronically
    - The level of cooperation in producing the information sought varied considerably from one board to the next

Recommendations for the Future

- Pre-Emptive Public Records Requests – where county boards are aware of impending requests, they may be obligated to take reasonable efforts to collect the data
- Pressure the Secretary of State for tighter record-keeping standards – this may simply require working with the few vendors operating in Ohio to develop a slightly different product for their clients – the county boards

Democracy at Risk: The 2004 Election in Ohio

Section X
Ohio Election Protection Summary

OHIO ELECTION PROTECTION SUMMARY

Julie Andreeff Jensen, Esq.

Introduction

This memo is a summary of the Election Day reports in the state of Ohio from November 2, 2004. As part of the Kerry – Edwards's team in Ohio, I was sent to Cleveland to help run the GOTV efforts in Cuyahoga County. Approximately a week before Election Day, we established a voter protection team throughout the state of Ohio, with particular emphasis in the largest counties. Cuyahoga County was the first priority because it had the largest vote goal in the state and had the most targeted precincts where we anticipated problems outside of the poll locations which could prevent people from voting.

The purpose of the election protection team was to protect people's right to vote, to answer any questions about the voting process, and to coordinate with the democratic challengers inside the polling locations. Each county structured their team slightly differently based on their resources and targeted polling locations.

In Cuyahoga County, we had approximately 301 targeted precincts. We recruited and trained 1,500 people the weekend before the election to serve as poll monitors outside these targeted precincts to protect people's right to vote. Most of the targeted precincts were located in predominantly African American communities and poorer neighborhoods. At most locations we paired up a local person and an out of town person so that at least one of the two poll watchers would have local knowledge of the area and neighborhood. We held five separate trainings where we educated the poll monitors on election law, provisional ballots in Ohio, and anticipated problems or questions that could come up on Election Day.

We scheduled two shifts on Election Day; however the poll monitors could also work an entire day if they were available. We also created a supervisory structure based on the Ward structure of Cuyahoga County. Each Ward had two roaming supervisors who were responsible for an average of ten polling locations. They checked in with each location hourly, brought them food or additional supplies and reported back problems to Kerry-Edwards headquarters. We established a communications structure where the poll monitors reported directly to their supervisor, the supervisor reported up to one of six of our election protection staffers at Kerry- Edwards's headquarters, and they then reported to me in the Boiler Room. Essentially, from 5:30 am until midnight on Election Day poll monitors reported problems and concerns at the polls. We were then able to respond quickly and remedy the problem.

Unfortunately, because each county created their own structure, there was no uniform procedure as to how to preserve reports after Election Day. Most of the Election Day reports were not saved or were not kept in a manner that would make them useful in

any way. The most complete set of reports thus far is from Cuyahoga County because I personally kept the poll watchers reports and the designated challengers kept their reports on what occurred inside the polls. After many attempts to find reports and pull together information, it became apparent to me that there was no way to recreate the reports from Election Day across Ohio. However, from the bits and pieces of information I have received from emails from county counsels, conversations with people who were in other parts of Ohio, and my personal experience - I have written a summary of the types of incidents that occurred on Election Day. In Cuyahoga County we created a mid-day report based on the number of reports we had received by 4:00 pm. Although this report is far from complete, I have attached that report for your review as a snapshot of what was happening on Election Day. I believe that report shows trends in the types of incidents that occurred and which areas were most affected. I briefly summarize it later in this memo.

Another very useful tool was the statewide data base of complaints and questions received on Election Day. We established a statewide toll-free number where people could call on Election Day to report problems. This report from the data base is lengthy but useful to show the types of incidents and the counties which experienced the most problems. Unfortunately, the information is not complete or perfect; but it does give us a glimpse of what was happening statewide on Election Day.

As my part of the DNC Ohio project I have summarized both Cuyahoga and the state-wide information for your review. I hope this information will be helpful for future campaigns in the state of Ohio or nationally. Some of the information contained in this report is anecdotal from my personal experience in Cuyahoga County on Election Day. Other parts of this report are based on paper copies of voter protection reports and the statewide data base.

Cuyahoga County – Cleveland and surrounding suburbs

There was a significant amount of voter protection activity occurring throughout Election Day in Cuyahoga County. While the national news continued to report "no problems at the polls" what was actually happening on the ground was a different story.

I began to receive calls as early as 6:00 am from poll watchers worried that no one was yet at their polling location and they weren't sure if they would open up on time. The stream of calls didn't stop until approximately 10:00 pm. Even though the polls closed at 7:30 p.m., we still had long lines waiting to vote (especially in the African American precincts) and we were receiving calls about problems at these locations. We had a rapid response team on call to go to poll locations that had problems as well as local elected officials on call to be deployed to problem locations. At 7:30 p.m., I deployed all staff and rapid response teams into the field to the top five polling locations with long lines. Their goals were to make sure people stayed in line and they voted. I received calls from each of the five locations once our staff arrived, reporting that people were not leaving and that they would stay in line as long as necessary. Many of the staff handed their phone to people in line so I could speak with them directly and thank them

for staying to vote. They continued to reassure me they weren't leaving until their vote was counted.

Attached you will find an incidents report, which was completed around 4:00 pm on Election Day. This report gives an accurate but incomplete look at what was occurring in Cuyahoga County. As you will see, most of the problems were focused around either slow lines at the polls due to poor preparation and training of poll workers or by broken voting machines. However, there clearly were other major concerns worth noting, including the unwarranted requirement of identification. In addition, there were some very significant intimidation and harassment techniques reported, but they were generally not widespread.

In the incident report there is a list of Wards. These were the Wards which contained the 301 targeted polling locations in predominantly African American and other minority communities. If you look at the incident reports broken down by Wards, it is interesting to note that Ward 5 and Cleveland Heights have double the number of incident reports than any of the other Wards. In both Ward 5 and Cleveland Heights, African Americans make up 95% of the voting population. It is no surprise that the incident reports are significantly higher in those two Wards even with such a small sample size. We had a significant voter protection presence in both of these locations reporting back problems, and I believe they can be attributed to the high voter turn out in these areas despite the high volume of reported problems.

There was an ebb and flow to the kind of reports we received throughout Election Day. From approximately 6:00 am until 12:00 noon most of the reports we received concerned malfunctioning machines and not enough booths open. Over the next two hours, the incidents reports slowed a bit, but by 3:00 pm we were again flooded with reports from the field. The calls after 3:00 pm concerned different types of incidents. We started to hear much more about potential voter intimidation tactics and very long lines within the African American community. At exactly 4:00 p.m., two separate black outs occurred at two different African American churches in Cuyahoga County. Once we were informed of the blackout, we supplied flashlights and voting continued. A staff member from the city was carefully coordinating with our reports. She was able to have the power back on in less than 15 minutes.

We also received reports of confusion whether people were at the right polling location. In downtown Cleveland, African American voters were told to go to one church, then when arrived there told to go to another church. The voters were bounced between the two churches until they finally got frustrated and were planning to go home. They complained to our poll monitor who reported the incident. We were then able to get the Mayor to go to the location to straighten out the situation. In addition, media arrived at the location; things settled down and there were no further problems reported from that polling location.

Long lines were the most reported problem in Cuyahoga County on Election Day. At some of the Black churches in Cleveland, there was up to a three hour wait to vote. There were many reasons for the long lines – the most common reason was that there were not enough machines at the polling locations. Machine malfunction was also a contributing factor. At some of the large African American churches, only half of the voting machines used previously were functioning on Election Day.

Anecdotally, there are plenty of examples from Cleveland which might be relevant to this report. I have selected the following incident to illustrate how the election protection team functioned and the effectiveness of the communications structure. At approximately 4:00 p.m., we received in the boiler room complaints that Willow Elementary precinct had lower than expected turn out. We began to receive calls from people who lived in this precinct reporting that the reason people were not coming out to vote was because someone had been in the neighborhood telling them that if they had outstanding parking tickets, warrants, or child support payments, they would be arrested if they tried to vote. Our poll monitors confirmed that some of the people arriving at the polls had told them about the rumors as well. As this was reported from the poll monitors through the structure up to me, I was able to respond. This area is a predominantly African American precinct, and I felt it would take a person recognizable in the black community to get these people back out of their houses to go vote despite the rumors. I spoke with our boiler room in Columbus and told them I needed the best African American surrogate they could get to come to Cleveland and go door-to-door in the precinct where Willow Elementary was located. Within an hour, the Reverend Al Sharpton was flown into Cleveland and went directly to this polling location and the surrounding neighborhood to encourage people to come out and vote. Within an hour of his arrival, there was an hour long line at Willow Elementary. Reverend Sharpton was very effective in getting the turn out in that community up to our expectations and we all appreciated the help on the ground.

State-Wide Reporting

The Ohio voter protection statewide hotline was established to answer questions and report problems especially in the counties which did not have such an extensive voter protection team as Cuyahoga County. The hotline received complaints from 60 of the 99 counties in Ohio. Approximately 860 reports were called into the hotline according to the data base provided to me by Eric Greenwald.

Franklin County received the most reports with 187, followed by Cuyahoga with 122, Hamilton with 100, Montgomery with 77, and Summit with 66 reports. The following is a break down of the types of reports received by the hotline and how many total complaints were reported throughout the day from all of the counties. I have also attached an excel spreadsheet which I created listing all of the counties, how many reports were received, and then broken down by how many of each type of report were received. Please refer to the spreadsheet for more complete data.

Provisional Ballot Issues	149
Long Lines/delays	123
Poll worker problems	120
Mechanical problems	112
Intimidation	95
Identification required	41
Absentee ballot issues	28
Nader on ballot	11
Other	181

Below is a brief explanation and summary of each category to lend a better understanding of what these numbers represent.

Provisional ballot issues

This category includes all reports of voters who were in the wrong location and were denied their right to vote by provisional ballot; reports that entitled voters were not offered provisional ballots; reports of locations that ran out of provisional ballots; reports that stickers to seal the provisional ballots were missing; and reports of concerns that the integrity of provisional ballots had been compromised because they were not handled as legally required. What was apparent from the reports was that many of the poll workers for the BOE did not understand the provisional ballot rules, and therefore, many mistakes were made when offering or failing to offer voters provisional ballots.

Long Lines/Delays

This category basically covers calls from voters reporting that the lines were longer than an hour. At some locations in Cuyahoga County and Franklin County, the lines were up to three hours long and people were leaving their polling locations. When we received reports that people were leaving their polling locations, we canvassed those precincts again to encourage people to come back out to vote. Most of the reasons for long lines dealt with broken voting machines – whether punch card machines or optical scanners. Also, incompetent poll workers for the BOE were largely to blame for slowing down the lines.

Poll Worker Problems

This category, as just mentioned, includes reports about poll workers not understanding the rules, slowing down the lines, sleeping on the job, or behaving unprofessionally and belligerently towards voters. One of the biggest improvements that could be made for the next election would be systematic training for poll workers to be organized by an outside unbiased organization rather than by the BOE.

Voting Machine Problems

This category includes a wide variety of problems reported throughout the day. There were several different types of voting machines depending on the particular county in which one votes. However, there were wide spread problems throughout the state with mechanical failure – whether it was an optical scanner malfunctioning in Toledo or a punch card not lining up properly, as was the case in Cuyahoga County.

In addition, reports were received that touch screen voting machines were malfunctioning at certain locations. For instance, voters reported in Franklin County that if you touched the screen to vote for John Kerry, the vote would automatically jump to the other party.

In the counties which used punch card machines, like Cuyahoga – we received reports that the cards were not lining up properly, so that it was difficult to tell if they had voted for the person for whom they intended to vote. In addition, the chads were not punching all the way through, leaving some hanging. Another problem involved the chads that did detach from the cards, if the trays were not emptied regularly, the chads would pile up in the tray beneath the machines causing the machines to jam. To help reduce these problems - each targeted polling location in Cuyahoga County had a sample punch card machine outside of the poll as a tutorial on how to properly punch a card all the way through however problems still occurred. .

Voting machine problems caused slow downs at the polls, which contributed to long lines.

Intimidation

This category includes a wide range of reports from pro-life groups standing outside the polling locations screaming "baby killers" at Kerry supporters, to voters being told if they have outstanding parking tickets or child custody payments, they will be arrested at the polling location. Approximately 50% of all the reports of intimidation were in the largest three counties – Cuyahoga, Franklin and Hamilton. While it is difficult to tell from the data base in which precincts these incidents occurred because there is a lot of incomplete information – it is fair to say that most of these incidents occurred in the minority precincts of the three largest cities.

Another example of intimidation involves a report from in Lima, Ohio that police were towing cars that had Kerry signs or stickers in the window. Lima is a heavily republican area, and leading up to the campaign, we had several incidents of intimidation including the vandalizing of a car belonging to a young woman who had introduced Elizabeth Edwards at an event in Lima. Bush won Lima with 67% of the vote.

Identification

Ohio's election law is very clear that it rarely requires identification for voting on Election Day. Only a tiny fraction of new voters are required to provide their id. However, on Election Day there were many voters who were improperly required to provide their i.d. at the polls. The 41 reports received on the hotline do not accurately represent how wide spread the problem was of unlawfully requiring voter i.d. on Election Day. Not only did it slow down the lines, but it also confused voters and made them wearier of the process.

Absentee ballot problems

This category includes reports from voters who said they requested an absentee ballot but never received one in the mail. On Election Day, many of them attempted to vote at their polling location because they did not receive their absentee ballot. Many of these people were told to vote by provisional ballot instead or were not allowed to vote at all. When we received reports that voters were turned away, we attempted to guide these individuals to the BOE and have them vote there, in hopes that their vote would more likely be counted.

Nader on ballot

There were several calls from a handful of counties who reported that Ralph Nader's name was still on the ballot. A month or two before the election, the Ohio courts ruled that Nader's name was to be removed from the ballot within a reasonable amount of time. In a few select counties where ballots had already gone to print, Nader's name was allowed to remain on the ballot, but they were required to put a conspicuous sign up in the poll informing voters that Nader was not to be considered a candidate running for president.

Other

This category contains a hodge-podge of reports filed throughout the day which do not fit into any of the above categories. Some of the examples include reports that the polls were not open on time or were closed at 7:30 p.m. and the voters in line were not allowed to vote; power outages; electioneering activities which occurred within 100 feet of the door of the polling location; polling locations running out of ballots; Bush signs found inside the polling location; pencils found inside the polling booth; and poll workers for BOE failing to post the list of persons who had already voted at the three pre-set times throughout the day.

Conclusions

It was apparent while preparing for Election Day during our GOTV efforts, that the differences from county to county, whether administrative incompetence or the type of voting machine in use, made it inherently more difficult for people to vote. The wide variety of rules and procedures caused a lot of confusion. The voting rights and protection team was intended to quell some of the confusion and provide a source of information which voters could trust and feel confident they were getting accurate information. I believe we accomplished that goal and, in turn, saved many potentially lost votes during the last election. But we can do better.

I passionately believe that a consistent voting rights and protection team should be in each battleground state, and the program should be started even earlier than it was during the last election cycle. However, a strict system of recording reports on Election Day and a follow up system for reporting the results needs to be in place. This past cycle was the first time such an elaborate system was put into place to protect people's right to vote. Now we must build off of that foundation and capture the information we learn on a national level so that we may have better and more complete data to analyze following the next election.

We had extensive resources available to us in Cuyahoga County – hundreds of volunteers, sample punch card machines, umbrellas, ponchos for rain, and even identifiable voting rights jackets and credentials. This investment allowed the voting rights team to be the most organized, credible, and effective team in presidential history. I strongly encourage the same commitment be made for future election cycles.

In addition, I believe there should be a systematic method of recruiting and training competent poll workers to work on Election Day. Better trained workers would speed up the voting process, eliminate long lines, and give people a level of confidence when they vote that their vote will be counted.

INCIDENT CATEGORIES	**NUMBER OF INCIDENTS**	
TOTALS AS OF 3:42 PM		
Slow Lines due to poor training, understaffing, misinfo	19	25.00%
Down voting machine	18	23.70%
Require ID	10	13.20%
Misc*	7	9.20%
No dem challenger	5	6.60%
Damaged cards/ diff punch	4	5.30%
Late Opening	3	3.90%
Unjust requirement of provisional ballot	3	3.90%
No materials inside polling place	2	2.60%
Back and forth between polling locations	2	2.60%
No provisional ballot	1	1.30%
No new registered voter list	1	1.30%
Voter machine not being used	1	1.30%
*Examples: insufficient signage, not handicap accessible, street traffic,		
TOTAL	76	100.00%
WARD INCIDENT COUNTS		
Ward 1	5	8.60%
Ward 2	3	5.20%
Ward 3	1	1.70%
Ward 4	5	8.60%
Ward 5	9	15.50%
Ward 6	1	1.70%
Ward 7	0	0.00%
Ward 8	3	5.20%
Ward 9	2	3.40%
Ward 10	1	1.70%
Ward 11	2	3.40%
Ward 12	0	0.00%
Ward 13	3	5.20%
Ward 14	0	0.00%
Ward 15	4	6.90%
Ward 16	0	0.00%
Ward 17	0	0.00%
Ward 18	1	1.70%
Ward 19	0	0.00%

Ward 20	0	0.00%
Ward 21	0	0.00%
Ward H (Cleveland Heights)	10	17.20%
Ward I (East Cleveland)	2	3.40%
Ward J (Euclid)	2	3.40%
Ward P (Maple Heights)	1	1.70%
Ward A (Beechwood)	1	1.70%
Ward S (Shaker Heights)	1	1.70%
Ward 0 (Lyndhurst)	1	1.70%
TOTAL as of 3:45pm	**58**	**100.00%**

Democracy at Risk: The 2004 Election in Ohio

Section XI
Statewide Data Collection

STATEWIDE DATA COLLECTION

Eric Greenwald, Esq.

We were asked to gather data from all 88 Ohio county boards of elections on a wide variety of subjects relating to the 2004 general election: (1) voter registration, voter turnout, and election results, (2) absentee ballots cast, (3) provisional ballots cast and provisional ballots counted, (4) the number of voting machines/booths in each precinct, (5) the number of poll workers in each precinct, (6) sample ballots from each county, (7) reports of problems with voting machines, (8) problems with long lines at polling locations, (9) the number of official challengers present at polling locations and the number of challenges filed against voters, and (10) the changes that had taken place in precinct boundaries since 2002.

A. Summary

In most cases, the process of collecting this data was a challenge. Although I have included below a discussion of each data set, there were four principal reasons for the general difficulty: (1) in nearly all cases, the data had to be collected from each county board of elections individually (the Ohio Secretary of State maintains very little of this information centrally), (2) there is great variation in the record-keeping practices from one county board to the next – many simply did not keep records on the information we sought, while others only tracked the data county wide rather than precinct by precinct, (3) of the records that the county boards do keep, the vast majority are not maintained in a form that can be distributed electronically, requiring labor-intensive data entry by hand, and (4) the level of cooperation from the boards of elections in producing the data varied significantly.

Although we can offer some suggestions to the Secretary of State and the boards of elections for improving the collection and retention of election data, the level of autonomy granted the boards, combined with a significant variation in the staffing and resources available at the county level, suggest that the challenges presented in this study will persist into the future.

B. Challenges to Data Collection

1. Registration, Turnout, and Election Results

This is one of the few data sets that the Secretary of State's office collects centrally. Although it took them until the end of March 2005 to compile the data from the November 2, 2004 election, the Secretary of State provided a single Excel file with registration, turnout and election results from all 11,572 Ohio precincts. Although there were a few errors in the data from the Secretary of State, having a single spreadsheet with

data from all 88 counties dramatically simplified the process of data collection and assimilation. This spreadsheet was uploaded to the collaborative website.

We did receive from most county boards an abstract of this data, but most were only able to provide the information in hard copy. The documents received prior to the arrival of the data from the Secretary of State were also uploaded to the collaborative website. Those received after were superfluous and, therefore, not uploaded. Note: had we been required to rely upon these hard copy forms, the work would have been onerous.

2. Absentee Ballots

Although most county boards maintained absentee voter information in some form, only 20 counties collected the data on a precinct-by-precinct basis (having the data broken out by precinct was critical to its utility in the analysis of the quant team). Eleven counties provided data broken out by race (showing the number of absentee ballots cast for each candidate or issue), but, of these, only four also provided this information by precinct – the others were only county-wide results. Fifteen counties provided no information whatsoever (as they did not record absentee ballots separately from regular ballots). Where available, the data received was uploaded to the collaborative website.

3. Provisional Ballots

Although the county boards demonstrated a somewhat better track record in collecting data on provisional ballots than on absentees, fewer than half tracked the total number of valid provisional ballots on a precinct-by-precinct basis. Only 20 counties tracked the number of invalid provisional ballots precinct by precinct. Where available, the data received was uploaded to the collaborative website.

The Secretary of State's office did ask each county to provide county-wide totals for both provisional ballots cast and provisional ballots counted, so we do have this data; however, it does not provide the level of granularity sought in this study. A spreadsheet with the countywide provisional totals was uploaded to the collaborative website.

4. Voting Machines/Booths

We were able to collect information on the number of voting machines/booths allocated to each precinct from all but 10 counties. Where counties provided a precinct-by-precinct spreadsheet showing machine/booth allocation, these documents were uploaded to the collaborative website. Where counties provided only formulas, the information was included in a spreadsheet cataloging all documents (entitled "Document Matrix"). This matrix was uploaded to the collaborative website.

There is, however, an important caveat to make with respect to this data. In some counties, the board of elections responded to concerns over long lines in certain precincts by distributing additional machines during the course of Election Day. Virtually none of the counties that distributed additional machines kept track of the precise number of machines distributed, the polling locations they went to, or the time the machines were distributed.

Although it appears that the number of additional machines distributed was relatively small, we do not have data to show precisely how many machines were present in each precinct at all times during the election.

5. Poll Workers

Ohio law requires that the county boards of elections provide at least four poll workers for each polling location (two from each major political party). As a result, there was not a great deal of variation among the counties in this practice.

Some counties assigned additional poll workers to precincts with larger numbers of registered voters, and some assigned an additional worker to help direct voters in polling locations where more than one precinct was voting in the same physical location.

In a few instances, counties provided spreadsheets showing the precinct-by-precinct assignments of poll workers. These documents were uploaded to the collaborative website. In most cases, however, county boards provided formulas and/or total numbers of workers assigned. This information was incorporated into the Document Matrix.

6. Sample Ballots

All but 17 counties provided sample copies of the ballots used in the 2004 general election. Where possible, these documents were scanned and uploaded to the collaborative website. Some sample ballots could not be uploaded because of their size, but we do have hard copies on file.

7. Problems with Voting Machines

With only a few minor exceptions, county boards of election did not track information concerning problems with voting machines. Most counties responded to our inquiries by indicating that they had no reports of major problems and/or that they had only reports of minor problems (e.g., a burnt light bulb on a punch card machine). This information was incorporated into the Document Matrix.

In nearly all of these cases, it was clear that the response was based not upon formal reporting but upon the anecdotal recollection of the director or deputy director of the board of elections.

For those counties that use direct recording electronic voting machines (DREs), we did ask permission to have access to DREs used in the 2004 general election and to the computer source code used in therein. The county boards declined these requests, citing security concerns.

We also initiated discussions with the vendors that provide DREs to Ohio counties in an effort to obtain source code and access to sample machines. In each case, the vendors expressed serious concerns about the need to protect the security of the code. In some cases, vendors pointed out their extreme discomfort with providing this sort of access to a partisan organization and suggested we try to form a bi-partisan coalition through which to submit the request.

8. Problems with Long Lines at Polling Locations

Again, with only a few minor exceptions, county boards did not track information concerning the length of time voters spent waiting in line to vote on Election Day. Most counties responded to our inquiries by indicating that there were no reports of significant delays at the polls (or that there had been only scattered reporting of delays). This information was incorporated into the Document Matrix.

In these cases, it was fairly clear that the response was based not upon formal reporting but upon anecdotal recollection of the director or deputy director of the board of elections.

9. Challengers and Challenges

Here as well, most counties did not keep records of challengers present at the polls or the number of voters challenged. Although poll workers are supposed to collect credentials from challengers and keep records on challenged voters, it appears that this was done only in rare cases.

(It is worth noting that the political parties seeking to assign challengers to polling locations were required to register the names and voter registration information of those challengers with each board of elections prior to Election Day. This information is generally available, but by no means does this definitively show where challengers were actually present. In many cases, duplicate names were submitted as challengers for multiple polling locations, and there were surely many challengers registered who did not actually work on Election Day.)

As to the number of voters challenged, the vast majority of counties reported that no challenges were filed. Only a few counties reported actual challenges filed (some of those were pre-election day). Only eight counties reported having no records on the question of challenged voters, but it is reasonable to assume that many of the counties reporting no challenges did not actually have a mechanism for retaining records when challenges do take place.

10. Changes in Precinct Boundaries

More than half of the counties in Ohio undertook at least some change in the way their precinct boundaries were drawn between 2002 and 2004. These changes presented some problems to the process of collecting and analyzing data, as the demographic data to be used in our study predates these changes.

In the majority of counties that had made such changes, the modifications were only precinct mergers and/or splits. These changes were not nearly so problematic as those instances where the precise boundary lines between two or more counties were re-drawn street by street to accommodate population changes.

It is worth noting that, among the boards of elections reporting no changes in precinct boundaries, there were several counties that later reported (in response to follow-up questions) that they did, in fact, change some precinct boundaries between 2002 and 2004. In some cases, the changes were quite substantial. This discovery only came about as the quantitative team began to notice problems with the data that indicated a change in boundaries. Some of those responding only realized that these changes had taken place when asked about the creation or disappearance of specific precincts in their county.

A very small number of counties maintain geographic shape files that make it possible to re-orient the demographic data according to current precinct boundaries. Where counties do not maintain such files, it is virtually impossible to reconcile the data.

There is a document on the collaborative website that summarizes the precinct boundary activity in each county since 2002.

C. **Recommendations for the Future**

There are a few means through which the process of collecting and analyzing the data used in this study might be made easier in the future. It is important to note, however, that these recommendations are either speculative and/or require the cooperation and investment of resources on the part of the Ohio Secretary of State and county boards of elections.

1. Pre-Emptive Public Records Requests

In some cases, county boards of elections were unable to provide some of the data sought in this study because they simply did not have any expectation that people might be asking for this information. To the extent it is possible to anticipate the need for specific data sets, it may make sense to submit requests for the information *before* the election actually takes place.

Public records statutes in Ohio require officials to put forth "reasonable" efforts to comply with records requests. Thus, although we could not expect the county boards to implement complicated data collection systems in response to such pre-emptive requests, making the expectation for record retention clear would, at minimum, alert the boards to the need and obligate them to exert at least reasonable efforts to that end.

With respect to provisional and absentee ballot data, reasonable efforts are likely all that would be required to make accurate record retention possible. The same may well be true with respect to reporting of problems with voting machines, delays due to long lines, and challenges to voters.

2. Improvement in Statewide Standards for Record Retention

In those limited cases where the Secretary of State required the county boards to produce data (voter registration, voter turnout, election results, and county-wide provisional totals), our process of collecting data was dramatically simplified, and the data was very easy to use (entirely in electronic format).

It is worth noting that, in so doing, the Secretary of State frequently had to work directly with the vendors to gather this information, as many of the county boards do not actually control the electronic records created during the tallying process.

In virtually all other areas of record retention, the county boards were left to their own devices and methods. As a result, the quality and format of data varied significantly from county to county.

This was generally a function of the county's size and the resources the board of elections had available. In the smaller counties, the board of elections staff consisted only of the director and deputy director. In such cases, it is often difficult to find a staff member with the technical expertise necessary to generate data reports in electronic form.

To the extent that there was consistency from one county to the next in the manner of record keeping, it was generally related to the fact that the counties in question shared the same vendor. As a result, they tended to use the same forms and reports.

Should the Secretary of State implement stronger (or at least more thorough) standards for record retention, it should only be a matter of working with the very small number of

vendors who provide election services to Ohio county boards of elections to establish a higher degree of consistency and usability of data. Even a matter as basic as requiring that each county board of elections post election data on their website would dramatically simplify the process of collecting, analyzing and verifying critical information in the democratic process.

Obviously, such changes in record retention practice are entirely up to the Secretary of State (or the Ohio legislature). It may, however, be worth submitting recommendations in the hope that they would be taken seriously.

As a final thought, in lieu of changes implemented from the Secretary of State's office, it may be possible in the future to work more directly with the vendors. Based upon conversations with some county board staff members and with some vendor representatives, it may be possible to submit requests for records directly to the vendor. It is important to note, however, that this would require the permission of the board of elections in question and may well require payment of a non-trivial fee (based upon what the vendor would bill to the board of elections).

Democracy at Risk: The 2004 Election in Ohio

Section XII
Recommendations for Future Action

RECOMMENDATIONS FOR FUTURE ACTIONS
By Donna Brazile, Chair
Voting Rights Institute

The right to vote and to have that vote accurately counted is the bedrock on which our democracy stands. Nothing is more fundamental to our freedom than our confidence in the integrity of our democratic institutions.

The Democratic Party will continue to work with Members of Congress, state lawmakers, local election officials, and community leaders to make sure that all voters maintain confidence in our system of elections.

"Democracy at Risk: The Ohio Election" report will be broadly distributed to members of Congress and other elected leaders, Democratic National Committee (DNC) officials, state party leaders and activists. We will also post our results on the official Voting Rights Institute (VRI) website to help educate citizens about what is at stake in the next election.

In addition, the Party will work with the appropriate officials and the grassroots community to update and reform our election laws. Some of the recommendations are as follows:

1. The Democratic Party must continue its efforts to monitor election law reform in all fifty states, the District of Columbia and territories.

2. States should be encouraged to codify into law all required election practices, including requirements for the adequate training of official poll workers.

3. States should adopt uniform and clear published standards for the distribution of voting equipment and the assignment of official pollworkers among precincts, to ensure adequate and nondiscriminatory access. These standards should be based on set ratios of numbers of machines and pollworkers per number of voters expected to turn out, and should be made available for public comment before being adopting.

4. States should adopt legislation to make clear and uniform the rules on voter registration.

5. The Democratic Party should monitor the processing of voter registrations by local election authorities on an ongoing basis to ensure the timely processing of registrations and changes, including both newly registered voters and voters who move within a jurisdiction or the state, and the Party should ask state Attorneys General to take action where necessary to force the timely updating of voter lists.

6. States should be urged to implement statewide voter lists in accordance with the Help America Vote Act ("HAVA"), the election reform law enacted by Congress in 2002 following the Florida debacle.

7. State and local jurisdictions should adopt clear and uniform rules on the use of, and the counting of, provisional ballots, and distribute them for public comment well in advance of each election day.

8. The Democratic Party should monitor the purging and updating of registered voter lists by local officials, and the Party should challenge, and ask state Attorneys General to challenge, unlawful purges and other improper list maintenance practices.

9. States should not adopt requirements that voters show identification at the polls, beyond those already required by federal law (requiring that identification be shown only by first time voters who did not show identification when registering.)

10. State Attorneys General and local authorities should vigorously enforce, to the full extent permitted by state law, a voter's right to vote without showing identification.

11. Jurisdictions should be encouraged to use precinct-tabulated optical scan systems with a computer assisted device at each precinct, in preference to touchscreen ("direct recording equipment" or "DRE") machines.

12. Touchscreen (DRE) machines should not be used until a reliable voter verifiable audit feature can be uniformly incorporated into these systems. In the event of a recount, the paper or other auditable record should be considered the official record.

13. Remaining punchcard systems should be discontinued.

14. States should ask state Attorneys General to challenge unfair or discriminatory distribution of equipment and resources where necessary, and the Democratic Party should bring litigation as necessary.

15. Voting equipment vendors should be required to disclose their source code so that it can be examined by third parties. No voting machine should have wireless connections or be able to connect to the Internet.

16. Any equipment used by voters to vote or by officials to tabulate the votes should be used exclusively for that purpose. That is particularly important for tabulating/aggregating computers.

17. States should adopt "no excuse required" standards for absentee voting.

18. States should make it easier for college students to vote in the jurisdiction in which their school is located.

19. States should develop procedures to ensure that voting is facilitated, without compromising security or privacy, for all eligible voters living overseas.

20. States should make voter suppression a criminal offense at the state level, in all states.

21. States should improve the training of pollworkers.

22. States should expend significantly more resources in educating voters on where, when and how to vote.

23. Partisan officials who volunteer to work for a candidate should not oversee or administer any elections.

The right to vote, the right to participate in the electoral system must never be compromised. Every American voter must have full confidence that all registered voters will be able to cast their votes without any impediments and that every valid vote will be counted.

Finally, this summer, America will mark the 40th anniversary of the passage of the 1965 Voting Rights Act. Before August 1965, poll taxes and literacy tests effectively muted the voices of so many and denied generations of African Americans a voice in the governance of their country. Three important provisions of the landmark civil rights act are set to expire in 2007. As Democrats we will work for their renewal and robust enforcement.

For more information on the Democratic National Committee and the Voting Rights Institute, please visit us at http://www.democrats.org/vri/

You may also write or call us at Voting Rights Institute, Democratic National Committee, 430 S Capitol Street, SE Wash DC 20003, (202) 863-8000.

Democracy at Risk: The 2004 Election in Ohio

Section XIII
Appendix

From the DNC Press Office
Democratic News

For Immediate Release
December 6, 2004

DNC Chair McAuliffe and Voting Rights Institute Chair Donna Brazile Announce Comprehensive Investigative Study on Election Practices in Ohio

Washington, D.C. – Democratic National Committee (DNC) Chairman Terry McAuliffe and Voting Rights Institute Chair Donna Brazile announced today that the DNC will conduct a comprehensive investigative study of key election practices and issues surrounding the 2004 general election in Ohio. The purpose of this study is not to contest the results of the election but to fulfill the Democratic Party's commitment to ensuring that every eligible voter can vote and that every vote cast, is counted.

"A record number of Americans participated in the 2004 election, especially in Ohio. We owe it to the people who waited hours to vote, who voted for the first time or have voted in every election to understand what happened and what can be done in the future to ensure every voter's rights are protected," DNC Chairman Terry McAuliffe said. "We've come a long way since Florida in 2000, but we still have work to do. We must do more as a nation and as a political party to keep voting rights and election reform on the front burner. To that end, I am announcing that the Democratic National Committee - after consulting with our Voting Rights Institute leadership and staff, party activists, supporters, elected officials and others - will conduct a thorough investigation into various election administration issues that arose in the state of Ohio in the 2004 election."

"The Voting Rights Institute and the Democratic Party stand on the principle that, regardless of whether we win or they win, every vote should be counted and every voter should have a voting experience free of hassles and intimidation regardless of where they live," VRI Chair Donna Brazile said. "This investigation will not only examine the issue of counting every vote, but seek to answer such questions as why so many people had to wait in line in certain Ohio precincts and not others? Why weren't there enough machines in some counties and not others? Why were so many Ohioans forced to cast provisional ballots? The goal of this investigative study is to get answers that we can use to help implement and advocate reforms in the future."

The DNC investigative study will examine the legitimate questions and concerns that have been raised in Ohio and will develop factual information which will be critically important in crafting further necessary election reforms. Specifically, the investigation will seek to address questions surrounding the issues of adequate voting resources (machines, pollworkers, etc), the high number of provisional ballots – valid and invalid – as compared with other states, anomalies in the reported results as compared with exit

polls, historical data, and reported anomalies within counties and precincts and whether the touch-screen machines and tabulating systems functioned properly.

To address these questions and more, the DNC, at its own expense, will assemble a top-flight team of recognized experts to be named at a later date including:

- a political scientist expert in quantitative analysis;
- an expert or experts in the design of computer hardware and software systems;
- an expert in voting systems and machines;
- an investigator with forensic expertise; and
- a pollster to survey voters who cast provisional ballots and to conduct other original survey research as needed.

This team will be supported by DNC and state party staff, consultants who were deeply involved in the election effort in Ohio, Ohio attorneys and the DNC legal team. McAuliffe announced that he had reached out to local Democratic elected officials in Ohio and they expressed strong support for the project and promised to cooperate in anyway that they could.

"We are launching this comprehensive investigative study not to contest the results of the 2004 election, but again to help ensure that every eligible vote cast is truly counted. This study will address the legitimate questions and concerns that have been raised in Ohio. Our goal is to understand and report back on what happened and why," said Chairman McAuliffe.

As soon as the team is named, it is anticipated the investigation will begin immediately and a full report will be issued in the spring.

###

For Immediate Release
March 4, 2005

Democratic National Committee Announces Ohio Election Review Team

Washington, D.C. – The Democratic National Committee (DNC) announced the members of its Ohio Election Task Force. This group of seasoned professionals in the electoral and technology fields are taking an in-depth look into the issues of voter registration problems, long lines at the polls, the issuance and counting of provisional ballots and voting equipment irregularities that voters faced during the 2004 presidential election in Ohio. The team has been hard at work since January, conducting surveys and reviewing election data from all across the state. The task force will submit its report to the DNC with suggestions for moving forward.

"I am confident that Voting Rights Institute (VRI) Chair Donna Brazile and her team of experts will properly investigate what went wrong in the Ohio election process," said DNC Chairman Governor Howard Dean. "This investigation will ensure that every vote will be counted and everyone who is eligible to vote will be able to secure that right."

"This team is hard at work, analyzing voting irregularities," said VRI Chair Brazile. "We are putting the efforts and resources into this project because it is vital that we find out what went wrong, how we can fix it, and restore the faith of the American people in our voting system."

###

OHIO REVIEW TEAM MEMBERS

Julie Andreeff - Julie Andreeff, a graduate of American University's Washington College of Law, is a practicing attorney and lobbyist. Andreeff was an associate at Powell Goldstein Frazer & Murphy where she specialized in election law. Andreeff left Powell Goldstein to become part of the team during the Iowa caucuses which helped John Kerry win a come from behind victory. She then traveled to three other primary states and served as political director in those states until Kerry secured the nomination. During the General election, Andreeff returned to Iowa to serve as political director and left mid-cycle to go to the battle ground state of Ohio where she was a regional field director for the campaign. As part of her role in Ohio, she built and managed the largest voter protection and education team in presidential history in Cuyahoga County. Andreeff recruited and trained 1500 poll watchers to serve as a front line for voters to answer any questions and ensure their right to vote. She helped direct the largest Get-out-the-Vote effort in Cuyahoga County contributing to a record turn out of voters for Democrats in Ohio presidential history.

Cornell Belcher – Cornell Belcher is the founder and President of Brilliant Corners Research and Strategies and functions as the principal strategist on all of the firm's projects. Belcher is experienced at campaign politics and has over a decade of expertise in quantitative and qualitative research, message development and product and behavioral insight. Belcher has built Brilliant Corners into an established brand that organizations and companies seek out for its unique perspective and creative approach.

Diane Feldman - Diane Feldman is President of The Feldman Group, a highly regarded national political research firm. Established in 1989, The Feldman Group has worked with Democratic candidates from President of the United States to local school board president, and with unions, issue campaigns, initiatives and referenda across the country. The Feldman Group has helped win elections nationally and in 40 states. In 2004, Feldman was a part of the Kerry - Edwards 04 polling team. Before founding The Feldman Group, Feldman was a partner at Feldman, Lester & Associates, and Senior Associate with Greenberg Research. Feldman is a research as well as political professional. She holds a PhD in experimental psychology and quantitative methods from the State University of New York at Binghamton and has held research fellowships at Yale University and Duke University.

Eric Greenwald - Eric Greenwald is a lawyer and consultant in Washington, DC with extensive experience in both the public and private sector. He has served as an Attorney Advisor with the Central Intelligence Agency's Office of General Counsel and in the National Security Law Unit of the Federal Bureau of Investigation where he focused on counterterrorism and international computer crime. In the private sector, Mr. Greenwald has worked as a litigator and an international trade lawyer with the law firms Steptoe & Johnson and Shearman & Sterling respectively. More recently, he has been involved in production and editing of television and radio news with 60 Minutes and National Public Radio. During the 2004 presidential campaign, Greenwald worked with the Voting Rights Institute as the Deputy Director for Voter Protection in Ohio where he coordinated

very closely with election officials and collaborated on litigation concerning provisional ballots and voter registration.

Michael C. Herron, PhD - Michael Herron is Associate Professor of Government at Dartmouth College. He previously was on the faculty of Northwestern University and was a Post - Doctoral Research Fellow at Harvard University. Herron has published in the top political science journals, and his current research interests consist of the study of election irregularities, legislative districting, and the use of quantitative methods in political research.

Daniel J. Hoffheimer – Daniel J. Hoffheimer, former President of the Cincinnati Bar Association and of the Federal Bar Association, Cincinnati Chapter, is a partner with Taft, Stettinuis & Hollister LLP, Cincinnati, OH, where his law practice is concentrated in nonprofit, charitable, and political organizations; wealth management, succession and estate planning, trust and probate law, family business, elder law and guardianships estate and gift taxation and probate court litigation. In 2004, Hoffheimer served as State Counsel in Ohio for the Kerry-Edwards campaign. He earned his bachelor's degree, cum laude, from Harvard College and his law degree in 1976 from the University of Virginia Law School.

Juan M. Jover, PhD – Dr. Juan Jover, a high - technology entrepreneur, received his Doctorate in Electrical Engineering and Masters in Engineering Management both from Stanford University. He has been involved in the investigation of false claims related to technology devices. His membership in the Institute of Electrical and Electronic Engineers and its Standards Association provides insights to standardization of electronic equipment. Jover received a Fulbright Fellowship in 1980 and co-authored a book on computers in Spanish at age 24.

Walter R. Mebane, Jr., PhD - Walter R. Mebane Jr. is Professor of Government at Cornell University. He has published numerous research articles concerning topics in American politics, especially elections, and political methodology, including statistics and mathematical modeling. He wrote a series of articles that examined the discrepancies between voters' intentions and the outcome of the 2000 presidential election, focusing on Florida. He has developed statistical methods useful for identifying anomalies in election results. Currently he is continuing work on a project that examines how information, partisan messages and rational voter choices all relate to the dynamics of election campaigns and the institutional structure of American government. He is a member of the Council of the Midwest Political Science Association and served on the Social Science Research Council's National Research Commission on Elections and Voting.

Jasjeet S. Sekhon, PhD – Sekhon is an Associate Professor of Government at Harvard University and an Associate of Harvard's Center for Basic Research in the Social Sciences. He's done extensive research on elections, voting behavior and voting irregularities. Sekhon has developed numerous statistical methods including techniques to detect election irregularities and methods to make causal inferences. He is the author of

numerous scientific articles and software programs. For more information please see http://jsekhon.fas.harvard.edu/.

Dan Wallach, PhD - Dan Wallach is an Assistant Professor in the Department of Computer Science at Rice University in Houston, Texas. He earned his bachelor's at the University of California, Berkeley and his PhD at Princeton University. His research involves computer security and the issues of building secure and robust software systems for the Internet. Wallach began his security career in 1995 when he and his colleagues found serious flaws in the security of Java applets; an attacker could use your web browser to hijack your entire computer. Wallach has also studied security issues that occur in distributed and peer-to-peer systems. Wallach, along with colleagues at Johns Hopkins, co-authored a groundbreaking study that reported significant flaws in Diebold's AccuVote-TS electronic voting system. He has testified about voting security issues before government bodies in the U.S., Mexico, and the European Union.

OHIO ADVISORY TEAM MEMBERS

Timothy M. Burke - Timothy M. Burke is an attorney with the Cincinnati firm of Manley Burke. His practice is concentrated in local government law. He is in his 12th year as the Chair of the Hamilton County Board of Elections. Prior to joining the Board he handled many election law matters including successfully defending a rare contest of election case. He also served as an International Election Supervisor for the first post war municipal elections in Bosnia and did election training in Slovakia.

Susan Gwinn – Susan Gwinn has served as the Athens County Democratic Party Chairwoman and as a member of the Ohio Democratic Party Executive Committee since 1996. She has served on the Athens County Board of Elections since 1998 and in 2000 became the Chairwoman of the Board and continues to serve today. Professionally, she is an attorney in private practice in Athens County. She also served as regional counsel for the Kerry Campaign in 2004 coordinating 21 county counsels and helped shape the legal strategy for Ohio. She has been a leader in Ohio in promoting provisional balloting and secured the first provisional voting location on an Ohio campus in 2000. The Ohio University campus remains the only Ohio campus with a provisional voting location which has led to Athens County having one of the highest percentages of provisional voting in the State. Over 7,000 Ohio University students voted in Athens County during the 2004 election.

Greg Haas - A 25-year veteran political consultant, Haas is currently Senior Political Director for Mayor Michael B. Coleman of Columbus, Ohio. Haas has worked on numerous campaigns, including serving as Ohio coordinator for then Governor Bill Clinton in 1992 and was the first person hired to work the Clinton reelection. He served as campaign and media consultant for Mary Ellen Withrow, the only person to serve as County Treasurer, State Treasurer, and U.S. Treasurer. Haas has also served as Executive Director of the Ohio Democratic Party and Deputy Political Director of the Democratic National Committee.

Brooke Hill - Brooke Hill began working in the world of political campaigns and elections as a volunteer in the Cincinnati campaign office for Presidential candidate Michael Dukakis in 1988. Having since served in a variety of campaign capacities for members of Cincinnati City Council and the Mayor, Ohio Attorney General, US Senate and President, Ms. Hill's consultation is now often sought by elected officials and candidates. She was a member of the Ohio Democratic Party Executive Committee and currently serves as Special Assistant to the Mayor of Cincinnati.

Dennis Lieberman - Dennis Lieberman is a partner with the law firm Flanagan, Lieberman, Hoffman & Swaim. He has served as Chair of the Montgomery County Democratic Party since 1994 and currently serves on the Montgomery County Board of Elections. He has also been active with the Ohio Democratic Party and Chairs Association.

Senator Mark Mallory – Senator Mark Mallory is the Assistant Minority Leader of the Ohio Senate, representing the 9th Senate District, which spans most of Cincinnati and some surrounding municipalities. He is the second highest ranking African American Democrat in state government. During his ten years of service in the legislature, Mallory has been a champion of voting rights and election reform, having served on both the Election System Study Commission and the Help America Vote Act State Planning Committee. Mallory has been a long time proponent of eliminating punch card voting machines, hosting a demonstration of alternative voting machines in the summer of 2003. Mallory has also been a tireless advocate to protect the voting rights of ex-offenders. Co-Chairman of the Hamilton County Democratic Party from 1999 to 2004, Mallory has helped lead a resurgence of the Democratic Party in the traditionally conservative Hamilton County. He has also been a member of the Democratic National Committee since 2000 and a member of the State Central Committee since 1998.

Alan Melamed - Alan Melamed is the President of Melamed Communications, a public relations firm specializing in governmental affairs, media relations, issue and candidate campaigns and crisis management. Melamed has served in a broad range of positions in political campaigns at the national, state and local levels. He currently manages the Mayoral Campaign for Cleveland City Council President, Frank G. Jackson. In 2004, Melamed served as Campaign Manager for Ohioans Protecting the Constitution leading the statewide campaign against the so-called Gay Marriage Amendment to the Ohio Constitution. In 1998, he chaired Lee Fisher's Gubernatorial Campaign in Ohio and served as the campaign's spokesperson. He has also worked as a staff member in the U.S. Senate, as an aide to former Governor Jack Gilligan and as a city councilman in Shaker Heights for 12 years. He is a member of the executive committees' of the Ohio Democratic Party and the Cuyahoga County Democratic Party.

Ron Malone - Ron Malone is the Ohio Director of AFSCME United, representing more than 90,000 working men and woman in Ohio. Malone has held that position since 1994. He also was the Assistant Secretary of State in Ohio, and was responsible for the election process of Ohio's elections. Malone was the Mayor of Marion, Ohio from 1980–1988.

Russ Pry - Russ Pry is an attorney with the law firm of Cassetty, Muse & Pry and has been chair of the Democratic Party of Summit County since 1998. He served as the past Secretary and Treasurer of the Democratic Party of Summit County. Pry has been on the Summit County Board of Elections since 2000, and prior to that served as a local elected official for approximately ten years. From 1980-1984, Pry served as the Field Representative to former Congressman John Seiberling (14 Cong. Dist. OH).

Jim Ruvolo - Jim Ruvolo is principal of Ruvolo and Associates, a public affairs and political consulting firm in Toledo, Ohio. The firm specializes in providing strategic counsel to clients in the areas of government affairs, political campaigns, and crisis management. Prior to starting the firm, Ruvolo served as Executive Director and Chairman of the Ohio Democratic Party from June, 1982 through January, 1991. He also was formerly the President of the Association of State Democratic Chairs and Vice Chair of the Democratic National Committee. In 1992, Ruvolo chaired the Rules Committee at the Democratic National Convention. Ruvolo served on the Lucas County Board of Elections from 1976 until 1983. These county boards are comprised of two Democrats and two Republicans and oversee the conduct of the election in the county. In national campaigns, Ruvolo was the delegate selection coordinator for President Clinton in 1996 and Vice President Al Gore in 2000. In 2004, Ruvolo was the Chair of the Ohio John Kerry campaign.

Fred Strahorn – Fred Strahorn is serving his third term in the Ohio State Legislature. He is a member of the Montgomery County Democrats and serves on the Economic Development and Environment, Finance and Appropriations, Primary and Secondary Education Subcommittee, Public Utilities and Energy, and Ways and Means committees. In 2003 he received the Charles Wesley Peckham Award for Humanitarian Leadership.

Nan Whaley - Nan Whaley is former Executive Director of the Montgomery County Democratic Party, a former Board Member of the Montgomery County Board of Elections and was the co-Chair of the County Kerry Campaign. A grassroots activist, Whaley has been involved in elections in Southwest Ohio for over 10 years. Whaley currently serves as an assistant to the Auditor in the Montgomery County Auditors Office.

Dennis White - Dennis White has over 18 years of public service in the Democratic Party. He is the Chair of the Ohio Democratic Party and a Madison Township Trustee, overseeing a $9 million budget that includes fire, police and public services. He is the former Franklin County Democratic Party Chair and during his chairmanship he oversaw a massive revitalization of that organization which resulted in over 130 Democrats being elected to office, including the first Democrat mayor in over thirty years.

For More Information Contact:
DNC Voting Rights Institute
430 South Capitol Street, SE
Washington, DC 20003
(202) 863-8000
www.democrats.org/vri/