



CALTECH/MIT VOTING TECHNOLOGY PROJECT

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RESIDUAL VOTE IN THE 2004 ELECTION

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Executive Summary

- Seventeen million more people voted in 2004 than voted in 2000, a 14% increase. Approximately one million of these “new votes” can be attributed to reforms in voting machines and administrative practices over the past four years.
- Of the thirty-seven states (including DC) that have reported total turnout in the 2004 presidential election, the aggregate residual vote rate was 1.1% in 2004. Among these same states, the residual vote rate was 1.9% in 2000.
- Florida and Georgia saw the biggest decreases in the residual vote rate across the past four years, by 2.5% and 3.1%, respectively.
- Only four states --- Connecticut, Indiana, Iowa, and Nebraska --- saw increases in their residual vote rates from 2000 and 2004.
- The greatest improvements in residual vote rates occurred in counties that shared the following characteristics:
 - The whole state engaged in comprehensive election reform
 - The county changed its voting machines, especially those that abandoned punch cards.
- Changing voting machines and changing election administration practices often went hand-in-hand. One-half to two-thirds of the reduction in residual vote rate over the past four years appears can be attributed to non-machine factors, including increased electoral competition in “battleground states” and statewide reform efforts.
- The residual vote rate declined more between 2000 and 2004 in counties that gave Albert Gore a large percentage of the vote in 2000.

Residual Vote in the 2004 Election

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In 2000 Americans learned that their elections are not always run according to the highest standards. This revelation led to two major developments. The first was a flurry of election reform activity at the state and national levels. The second was a degree of scrutiny over the conduct of the 2004 election that is probably unprecedented in American history.

The high degree of scrutiny over how the 2004 election was run, particularly in the “battleground states,” has in turn led to a steady stream of election horror stories. A casual reading of American newspapers might lead a typical reader to conclude that state and local governments had learned nothing from 2000 --- that the billion dollars spent on upgrading election equipment and practices under the Help America Vote Act (HAVA) had been wasted.

A careful consideration of reports from around the country about the conduct of elections in some jurisdictions reveals that election reform is still a work in progress. At the same time, a full consideration of all the evidence from the 2004 election will likely highlight the most important point of all: four years of election reform made a difference on several fronts. Taking the American electoral system as a whole, the emerging evidence is that the election of 2004 was run much better than the election of 2000. Seventeen million more people voted in 2004 than voted in 2000, a 14% increase in the size of the presidential electorate. Some of this increased turnout --- perhaps over a million new voters --- can be attributed to new equipment and changes in administrative practices.

This report documents the improvement in one measure of election system performance that the Caltech/MIT Voting Technology Project championed following the 2000 election --- the “residual vote rate.” Utilizing the official election returns that have been published by the date of this report, the residual vote rate fell from 1.91% in 2000 to 1.07% in 2004.¹ Assuming this comparison holds firm once the last few states have reported their official turnout numbers, and assuming that the states that do not report turnout at all had similar improvements in ballot accuracy across the quadrennium, this works out to a recovery of one million “lost votes” between 2000 and 2004.²

Of course, this simple comparison ignores many complications in the use of the residual vote rate to assess the performance of voting machines. Part of the residual vote rate is composed of voters who intentionally abstain; what looks like a recovery of lost votes may simply be due to a drop in intentional abstentions in 2004. Most states that changed voting machines also undertook significant voter- and election worker education efforts. What looks like the recovery of lost votes due to improved machines may be due instead to better-informed workers and voters in states that also happened to change machines. Finally, election officials knew that their actions would be scrutinized in 2004 to an unprecedented degree. If this knowledge led them to more scrupulously round up stray votes that may have gone uncounted in

¹ The data in this paper were derived from the following sources. All election data was taken from the official election returns as reported by state divisions of elections and gathered directly by the author. In a few cases, anomalies were corrected by contacting local election officials directly. This data is available from the author upon request. (Those seeking county-level election returns for states that do not report turnout are directed to www.uselectionatlas.org.) Data concerning voting technologies was purchased from Election Data Services (EDS). Requests for this data should be directed to EDS.

² The calculation performed here is simple. The difference in the residual vote rate between 2000 and 2004 was 0.84%. Aggregate presidential turnout for 2004 is estimated to have been 122.2 million; 0.84% of 122.2 million is 1.03 million.

years past, then the actual recovery of lost votes would be due to tighter election administrative efforts, not better machines.

Over the next month and years, researchers will accumulate the evidence necessary to parcel credit for the drop in the residual vote rate among its various components. The purpose of this report is to make an initial estimate that parcels out credit to machine changes, as opposed to other changes.

The remainder of this report takes a deeper look at the initial patterns concerning the change in the presidential residual vote rate from 2000 to 2004. It shows that states (or more precisely, counties) that changed their voting machines showed the greatest improvement in the residual vote rate. However, it also shows that more than half of the improvement in the residual vote rate is likely due to factors that go beyond having new voting machines *per se*. These factors include improved administrative practices (such as greater care given to election returns and better voter education) and fewer abstentions due to the closeness of the presidential race. Nonetheless, buying new machines made a substantial positive difference in 2004.

Background: Calculation of the Residual Vote Rate

The Caltech/MIT Voting Technology Project has championed the use of the “residual vote rate” as a measure of voting machine accuracy ever since it began examining voting machine performance in the wake of the 2000 presidential election. The residual vote rate in a county is the percentage of all ballots cast that did not record a vote for president. In a mechanical sense, a vote can fail to be counted either because there was no vote for president on an individual’s ballot (an “undervote”) or multiple marks (an “overvote”).

To calculate the residual vote rate of a political jurisdiction, it must report two things, (1) the number of votes cast for all presidential candidates, including write-ins and (2) the total number of voters who appeared at the polls and were given a ballot. We call this latter statistic “turnout.” All counties report the number of votes received by candidates who were printed on the ballot. Most, but not all, report the number of write-ins, if the state allows them. It is important to keep in mind that the residual vote rate can be inflated if a county does not report the number of write-in votes, since uncounted write-ins will appear to be undervotes.

Not all states require their counties to report turnout.³ In 2004, it appears that eleven states will not report actual turnout. These states are Alabama, Kansas, Louisiana, Maine, Minnesota, Mississippi, Missouri, Oklahoma, Pennsylvania, Texas, and Wisconsin, which together accounted for approximately 24% of all presidential votes cast in the United States. This is a slightly smaller number of states not reporting turnout than in previous years. In addition, as of the writing of this report, three other states have yet to report turnout for 2004. These are Delaware, Rhode Island, and South Carolina, and account for about 3% of all presidential votes cast. When they release their turnout figures, they will be included in updates to this analysis.

The residual vote rate is a convenient measure, but it must be used with care. Because of the secret ballot, it is impossible to know, for instance, how many ballots that contained a legal vote for president were cast in error. The residual vote rate must be used alongside other

³ Some counties will report turnout even when the state does not require it. The election reporting software that now comes bundled with many of the newer machines facilitates these reports. However, when the state does not require its counties to report turnout, counties will adopt their own standards for what to include in their turnout report --- for instance, many of these counties only report total turnout from Election Day, omitting absentees or failing to update turnout reports to reflect the final, official, canvass. Our experience with working with turnout data from such counties is that their turnout reports are extremely variable and often unreliable. Therefore, this report only examines turnout from counties in which the state requires a turnout report, and the turnout figures are given officially by the state.

measures of voting technology accuracy to gain a complete understanding of how well voting machines perform.

The primary criticism levied against the residual vote rate is that it is impossible to distinguish between a ballot that contains no marks for president because of a technology-induced error and a ballot that contains no marks for president because the voter consciously abstained. If blank ballots primarily occur because of conscious abstentions and if blank ballots dominate residual votes, then the residual vote rate loses its utility.

For the thirty-seven states (including the District of Columbia) that have thus far reported total turnout, the aggregate residual vote rate was 1.1% in 2004. Among these same states, the residual vote rate was 1.9% in 2000. Table 1 reports the residual vote rate among all the states from 2000 and 2004. Confining ourselves to the thirty-five states for which we can calculate residual vote rates in both 2000 and 2004, seven had residual vote rates above 2% in 2000, compared to only two in 2004. Of these thirty-five states, five had residual vote rates below 1% in 2000, compared to fifteen in 2004. Florida and Georgia saw the biggest decreases in the residual vote rate, by 2.5% and 3.1%, respectively. They were also among the states that engaged in the most significant election reform efforts across the past four years. Only four states --- Connecticut, Indiana, Iowa, and Nebraska --- saw increases in their residual vote rates from 2000 and 2004. In three of these states (Connecticut, Iowa, and Nebraska), there was little, if any, change in the voting machines used, whereas the fourth state (Indiana) experienced significant voting machine upgrades statewide.

Factors Influencing Residual Vote Rate Improvement

Our emphasis in this report is on the role that voting machine improvements played in reducing residual vote rates. In order to estimate those effects precisely, we also need to account for other factors that may have reduced residual vote rates. In addition to changes in voting machines, we explore two other factors here, electoral competition and general statewide reform efforts. We address these latter two factors before examining changes in voting machines.

Electoral competition

A component of residual votes is intentional abstentions. Compared to other races, voters rarely left their ballots blank for president. Nonetheless, public opinion surveys have identified a small number of voters (always less than 1%) every four years who admit to not voting for president. We know that the residual vote rates vary from year-to-year and from county-to-county, even when voting machines stay unchanged. For instance, the 1988 residual vote rate was 2.4%, compared to 1.9% in 1992, even though there was very little nationwide change in voting machines.

One explanation for this variation must be differences in how voters evaluate the presidential candidates --- compared to each other and compared to other races on the ballot. The more energized the electorate, the lower the residual vote rate, as fewer voters consciously abstain.

By all accounts 2004 was an energized election. It was widely predicted, by campaign professions and the public at large, that 2004 was going to be a close election. Both campaigns worked hard to turn out their most devoted voters, stoking the fires of political passion with “red state/blue state” rhetoric. Such dynamics might explain the general reduction in the residual vote

rate from 2000 to 2004. In addition, the political battles were especially passionate in the “battleground states,” where the outcome was perceived to be especially uncertain, and where the Electoral College would be determined. Such a dynamic might also explain a greater reduction in the residual vote rate in battleground states.

In fact, the residual vote rate fell more in the battleground states than in the others. Of the thirty-five states in our sample, seven were battleground states --- Florida, Iowa, Nevada, New Hampshire, New Mexico, Ohio, and Oregon. The overall reduction in residual vote rate among these states was 1.2%, compared to 0.7% among the remainder.

General reform efforts

After the 2000 general election, a nationwide election reform effort was unleashed. However, the effort was not uniformly distributed across the states. Some states, like Florida, had highly visible statewide election reform commissions that met immediately on the heels of the election and recommended sweeping reforms of elections. Other states, like Massachusetts and New York, did virtually nothing. Some states had worse problems than others, and naturally they were the ones that were typically the most active. A major theme of many of these reform efforts --- a theme reinforced when the federal Help America Vote Act (HAVA) was passed --- was the replacement of antiquated punch card equipment with more modern equipment. These efforts went beyond the machines, however, into the realm of registration practices, provisional ballots, voter education, and precinct worker training.

Unfortunately, there is no comprehensive set of measures to indicate which states were the most and least comprehensive in their approaches to reform, beyond buying new machines. Here, we take a crude attempt, measuring reform with indicators of statewide reform. First,

states with unusually high residual vote rates in 2000 may have worked harder to improve in 2004, and therefore may have had bigger reductions. (We can think about this as measuring the “demand side” for reform.) Second, states that saw more of its voters using a new voting machine (thus highlighting the importance of training voters and precinct workers how to use the voting equipment) may have had greater improvements.

It is in fact the case that states with especially high residual vote rates in 2000 showed the biggest improvements in 2004. Among the states with residual vote rates over 2% in 2000, the overall residual vote rate reduction was 2.3%, compared to an average *increase* of 0.1% among the states that had a residual vote rate below 1%. States in the intermediate range --- a residual vote rate between 1% and 2% in 2000 --- experienced an intermediate reduction in residual vote rate of 0.4%.

It is also the case that the states that replaced more of its voting machines (regardless of type) experienced the greatest residual vote rate reductions. Roughly half of all votes were cast in states where 30% or fewer of the voters were using new voting machines. These states experienced an aggregate 0.6% reduction in the residual vote rate. The other half of all votes were cast in states where 30% or more of the voters used new voting machines. These states experienced an aggregate 1.1% reduction in the residual vote rate. Within this group, voters in the three states that experienced a complete changeover in voting machines (D.C., Georgia, and Nevada) saw their residual vote rates fall by 2.4%

Voting machines

We now turn our attention to changes in voting equipment. Overall, counties that changed their voting technology between 2000 and 2004 experienced an aggregate 1.2%

reduction in the residual vote rate, compared to an aggregate 0.6% reduction in the counties that did not. At the most basic level of analysis, changes in voting technologies appear to be associated with a substantial portion of the drop in the residual vote rate in 2004, but not all.

Within our sample of states, 607 counties changed their voting technologies between 2000 and 2004. These counties accounted for 37% of the votes cast in these states. Among these 607 counties, we see virtually every type of technology change, except that no counties abandoned their existing technology to adopt punch cards or lever machines. Still, some upgrade paths were much more common than others. For instance, 167 counties abandoned punch cards to adopt optical scanners and 150 abandoned lever machines to adopt DREs; at the same time, only three counties abandoned hand-counted paper for DREs and 2 abandoned DREs for optical scanning.

If we want a precise measure of which upgrade paths produced the greatest reductions in the residual vote rate, we need to confine ourselves to the most common paths. There were four upgrade paths that involved more than 50 counties: from punch cards to optical scanners (154 counties), from punch cards to DREs (76), from lever machines to DREs (158), and from optical scanners to DREs (97). All other voting technology changes involved a total of 105 counties.

Table 2 reports the average improvement in the residual vote rate, according to the type of voting technology change from 2000 to 2004. The upgrade choices are ranked by their improvement in the residual vote rate. With the exception of the upgrade path from lever machines to DREs, making a change in voting technology resulted in residual vote rates improving at twice the rate as occurred in counties that kept their voting technology unchanged in 2000. In other words, making any change in voting machines improved the residual vote rate.

A Multivariate Perspective

The previous section reviewed three different explanations for why the residual vote rate fell so substantially from 2000 to 2004 --- electoral competition, general reform efforts, and voting machine upgrades. What that analysis did not do was consider how these factors were interrelated. For instance, 41% of counties with residual vote rates of greater than 3% in 2000 changed their voting equipment in time for 2004, compared to only 29% of counties with residual vote rates of less than 1%. So, when we observe that counties that changed their voting technologies in 2004 had greater residual vote rate gains, is this because the machines were better, or because counties that changed tended to have higher residual vote rates in 2000, and it was these counties that saw the biggest gains in 2004, regardless of whether they changed voting machines or not. Or consider the fact that the average 2000 residual vote rate for counties that later adopted DREs was 3.0%, compared to 2.5% for the counties that switched over to optical scanners, which compares to 2.2% for counties that made no changes. When we discover that counties that switched to DREs in 2004 experienced larger residual vote rate improvements, is it because of the machines, or is it because the counties that performed the poorest in 2000 also tended to choose DREs, and the greater overall effort in 2004 explained the reduction in the residual vote rate, not the new machines?

To answer questions like these, we need to simultaneously control for all the factors were previously considered. This is easily done using a simple linear regression model. Each observation is a county for which we have residual vote rate data in both 2000 and 2004. The dependent variable is the change in the residual vote rate for each county from 2000 to 2004. We start with independent variables that measure electoral competition and reform effort in 2004. Those variables are the following:

Electoral competition is measured by the (logarithm of the) percentage margin of victory enjoyed by either Gore or Bush in the county's state.⁴

Statewide change in voting machines is measured by the percentage of a state's voters who used a "new" voting machine in 2004, compared to 2000. In constructing this measure, the county that is the observation is omitted, so that this is a measure of the degree to which voting machines changed *in the rest of the state*.

Statewide change in residual vote rate is measured by the change in the residual vote rate of a county's state when we *exclude* the county in question.⁵ Therefore, this is the measure of the degree to which the residual vote rate declined *in the rest of the state*.

Previous residual vote rate is measured by the residual vote rate of the county in 2000.

Table 3 reports the regression of change in residual vote on these four independent variables. Column 1 reports the regression results with simply these four control variables. Each performs as expected --- counties from the least electorally competitive states and from state that overall did not improve much in 2004 had worse gains compared to 2000. Counties in states that had undergone an extensive overhaul of voting machines statewide and counties that had exceptionally high residual vote rates in 2000 showed the greatest improvement in 2004.

Column 2 reports results of a regression in which the only independent variable is a dummy variable indicating whether the county changed voting machines in 2004. The -0.0062

⁴ Formally, if B_s = the votes received by Bush in state s in 2000 and G_s = the votes received by Gore in state s in 2000, then the Electoral Competition measure is equal to the logarithm of $\text{abs}((B_s - G_s) / (B_s + G_s))$.

⁵ Formally, call $S_{c,2004}$ the statewide residual vote rate for county c in 2004 that excludes county c from the calculation, and define $S_{c,2000}$ similarly for 2000. Then this variable, $S_c = S_{c,2004} - S_{c,2000}$.

coefficient means that the average county that adopted new machines enjoyed a 0.62% *additional* reduction in residual vote rate in 2000, compared to counties that did not change voting technologies. (Counties that did not change voting technologies nonetheless enjoyed an average 0.61% residual vote rate improvement, as is indicated by the Constant coefficient.) Thus, before adding statistical controls, we see that changing voting machines doubled the residual vote rate improvement in the average county.

Column 3 combines the analyses of the previous two regressions. The most important coefficient to observe is associated with change in voting equipment. It is cut by almost two-thirds --- from a reduction of 0.62% to a reduction of 0.22%. The reason for this reduction is the moderate correlation between changing voting equipment and all of the other control variables, not just the correlation individual counties changing voting equipment and the rest of the state making changes. In other words, roughly 2/3 of the reduction in the residual vote rate associated with changing voting machines can be attributed to “indirect” and “spurious” effects that are due to factors that are highly correlated with (and perhaps even cause) counties changing voting technologies.

The regressions reported in Columns 4 and 5 reproduce the analyses in Columns 2 and 3, this time using a battery of dummy variables to indicate the different types of voting machine upgrades that counties undertook between 2000 and 2004. Column 4 enters the dummy variables without controls. These coefficients correspond directly with the percentages reported in Table 2, with the only difference that the coefficients in Table 3 have to be added to the Constant term to produce the percentages in Table 2.

Like the analysis in Columns 2 and 3, the coefficients from Column 4 are reduced substantially when the controls are added in Column 5. There is one exception, however. The

coefficient associated with moving from optical scanning to DREs is only affected slightly when the other controls are added. This finding is intriguing because in previous research (VTP 2001; Ansolabehere and Stewart 2005), we discovered that optical scanners tended to have the lowest residual vote rates and that DREs tended to have higher residual vote rates. Here we discover that there may be particular gains to be had when a jurisdiction that already uses optical scanners chooses to use the newest generation of DREs.

Conclusion

As Election Day 2004 came and went, much of the controversy that surrounded the election's conduct concerned the reliability and security of new electronic voting machines and the access that voters had to ballots themselves. It has become easy to forget that the urgency of election reform became evident in 2000 because of the manifestly poor performance of older voting machines, which led some to "loose" votes more easily than others. A major portion of the energy expended since 2000 in reforming elections has come in buying new voting machines and training new voters and poll workers how to use them.

The analysis in this report shows that this effort produced results. One million votes were "recovered" in 2000 because of the dramatic drop in the residual vote rate. Yet this report also suggests a cautionary tale about placing too much faith in buying new machines alone. The greatest residual vote rate gains were not made in the states where voting machines were upgraded in a piecemeal fashion. Rather, voting machine upgrades were the most effective when the entire state was involved. The best example was Georgia, which switched over entirely to one type of voting machine (Diebold Accuvote-TS's) *and* engaged in an unprecedented voter

education effort. It is likely that the combined effects of these two actions, not either one alone, that led to Georgia's stunning improvements over time.

A Political Postscript

There has been much post-election speculation about whether the actions of voting administrators helped or hurt the fortunes of the two major party presidential candidates. In the case of the residual vote rate, the biggest gains occurred in counties that leaned Democratic.

The 2000 residual vote rate in counties that were carried by the Democrat Albert Gore was 1.99%; in 2004 that rate fell to 1.05%. The 2000 residual vote rate in counties that were carried by the Republican George W. Bush was 1.82%; in 2004 that rate fell to 1.09%. While the effects are small, by any measure the residual vote rate fell more in pro-Kerry counties than in pro-Bush counties.

We can gain greater precision in this estimate by placing this analysis in a regression framework. Column 1 of Table A1 reports the results of a regression in which the dependent variable is the change in residual vote rate from 2000 to 2004, and the independent variable is the percentage of the two-party vote for Gore in 2000. Column 2 adds the controls that were used in Table 3, including the dummy variable that indicates that a county had changed voting machines.

Adding the controls cuts the magnitude of the “Gore effect” in half, but it is still statistically and substantially robust. Because we have controlled for mostly non-political factors, it is likely that this reduction in the residual vote rate in counties that were friendly toward Democratic candidates was due to efforts by Kerry campaign workers and supporters to make sure that all their votes were counted.

Table 1. Residual vote rates in the states, 2000 and 2004.

| State | Residual vote rate | | | Residual vote rate | |
|---------------|--------------------|------|----------------|--------------------|------|
| | 2004 | 2000 | | 2004 | 2000 |
| Alabama | * | * | Montana | 1.2% | 1.7% |
| Alaska | 0.6% | 0.8% | Nebraska | 1.8% | 1.4% |
| Arizona | 1.3% | 1.6% | Nevada | 0.3% | 0.6% |
| Arkansas | 1.4% | * | New Hampshire | 1.2% | 1.7% |
| California | 1.5% | 1.6% | New Jersey | 0.8% | 1.0% |
| Colorado | 0.9% | * | New Mexico | 2.5% | 2.8% |
| Connecticut | 1.8% | 1.0% | New York | 0.8% | 2.0% |
| Delaware | H | 1.7% | North Carolina | 1.4% | 3.3% |
| D.C. | 1.1% | 1.9% | North Dakota | 1.0% | 1.4% |
| Florida | 0.4% | 2.9% | Ohio | 1.7% | 1.9% |
| Georgia | 0.4% | 3.5% | Oklahoma | * | * |
| Hawaii | 0.6% | 1.2% | Oregon | 0.8% | 1.6% |
| Idaho | 2.4% | 2.9% | Pennsylvania | * | * |
| Illinois | 1.4% | 3.9% | Rhode Island | H | 0.8% |
| Indiana | 1.7% | 1.5% | South Carolina | H | 3.4% |
| Iowa | 1.0% | 0.9% | South Dakota | 1.7% | 1.8% |
| Kansas | * | * | Tennessee | 1.1% | 1.1% |
| Kentucky | 0.9% | 1.5% | Texas | * | * |
| Louisiana | * | * | Utah | 1.5% | 1.7% |
| Maine | * | * | Vermont | 0.6% | 1.0% |
| Maryland | 0.3% | 0.5% | Virginia | 0.8% | 1.8% |
| Massachusetts | 0.5% | 1.1% | Washington | 0.8% | 1.1% |
| Michigan | 0.7% | 1.1% | West Virginia | 1.7% | 1.9% |
| Minnesota | * | * | Wisconsin | * | * |
| Mississippi | * | * | Wyoming | 1.0% | 1.5% |
| Missouri | * | * | | | |

* No turnout figures reported.

H Has not yet reported turnout for 2004.

Table 2. Aggregate change in residual vote rates, by type of voting technology change from 2000 to 2004.

| Equipment used in 2000 | Equipment used in 2004 | Change in residual vote rate | Number of counties / voters (2004) |
|---------------------------------|---------------------------|---------------------------------|---------------------------------------|
| Punch card | DRE | -1.46% | 76 / 9.9m |
| All other equipment changes | | -1.32% | 105 / 3.4m |
| Optical scan | DRE | -1.26% | 96 / 4.1m |
| Punch card | Optical scan | -1.12% | 154 / 13.5m |
| Lever | DRE | -0.79% | 148 / 2.7m |
| Same equipment in 2000 and 2004 | | -0.61% | 1335 / 57.2m |

Table 3. Effect of political competition, state reform effort, statewide residual vote change, and voting technology change on residual vote rate change, 2004 (linear regression). (Standard errors in parentheses.)

| | (1) | (2) | (3) | (4) | (5) |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Electoral competition | 0.00031 (0.0008) | --- | 0.00030 (0.0008) | --- | 0.00032 (0.0008) |
| Statewide change in voting machines | -0.0020 (0.0006) | --- | -0.0002 (0.0007) | --- | 0.0003 (0.0007) |
| Change in statewide residual vote rate | 0.31 (0.02) | --- | 0.31 (0.02) | --- | 0.30 (0.02) |
| Residual vote rate in 2000 | -0.80 (0.01) | --- | -0.79 (0.01) | --- | -0.80 (0.01) |
| Change in voting equipment | --- | -0.0062 (0.0008) | -0.0022 (0.0005) | --- | --- |
| Specific changes: (Compared to no change) | | | | | |
| Punch to opscan | --- | | --- | -0.0051 (0.0011) | -0.0016 (0.0005) |
| Punch to DRE | --- | | --- | -0.0084 (0.0012) | -0.0026 (0.0007) |
| Lever to DRE | --- | | --- | -0.0018 (0.0023) | 0.0005 (0.0011) |
| Opscan to DRE | --- | | --- | -0.0065 (0.0018) | -0.0058 (0.0010) |
| All other changes | --- | | --- | -0.0071 (0.0020) | -0.0029 (0.0010) |
| Constant | 0.011 (0.0003) | -0.0061 (0.0005) | 0.011 (0.0004) | -0.0061 (0.0005) | 0.011 (0.0004) |
| N | 1849 | 1850 | 1849 | 1850 | 1849 |
| R ² | .76 | .04 | .77 | .04 | .77 |

Table A1. Analysis of political effects of reduced residual vote rate. (Dependent variable = change in residual vote rate; standard errors in parentheses)

| | (1) | (2) |
|--|--------------------|----------------------|
| Gore percentage, 2000 | -0.019 (0.003) | -0.0080 (0.0015) |
| Electoral competition | --- | 0.00031 (0.00008) |
| Statewide change in voting machines | --- | 0.00008 (0.00071) |
| Change in statewide residual vote rate | --- | 0.33 (0.02) |
| Residual vote rate in 2000 | --- | -0.78 (0.01) |
| Change in voting equipment | --- | -0.0022 (0.0005) |
| Constant | 0.0013 (0.0015) | 0.015 (0.0008) |
| N | 1850 | 1849 |
| R ² | .02 | .77 |