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STATISTICAL ISSUES IN THE 2000 U.S. PRESIDENTIAL ELECTION IN FLORIDA

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I. INTRODUCTION

The State of Florida played a key role in determining the 2000 Presidential Election. Although Al Gore won the nationwide popular vote by over 500,000 votes, he lost the election, with Florida's Electoral College votes deciding for George W. Bush.

Several interesting statistical issues arose in the post-election discussion about the counted and uncounted votes in Florida. Crucial issues included the high Buchanan vote, the high overvote in Palm Beach County and the undervote in counties using the punchcard ballot. This Article discusses these issues.

This Article first presents a simple statistical analysis that shows clear evidence that the Buchanan vote in Palm Beach County was extremely unusual based on patterns using vote totals in other Florida counties. The Article also mentions several other studies that came to similar conclusions. Next, the Article summarizes studies about the overvote in Palm Beach County that suggests the butterfly ballot may have cost Gore the election. The Article then discusses the evidence that the undervote was higher in counties using the punchcard ballot, a critical issue in the legal cases following the election. The Article ends with comments on one particular attempt in the media to ascribe voter intent to the uncounted ballots.

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II. THE BUCHANAN VOTE IN PALM BEACH COUNTY

In Palm Beach County, initial election returns reported 3407 votes for the Reform Party candidate, Pat Buchanan.[1] In the days following the election, many claimed these votes were largely intended for Al Gore but wrongly cast for Buchanan because of the confusing design of the butterfly ballot.

When the controversy over the Buchanan vote in Palm Beach County arose, many researchers, including the authors, performed statistical analyses to study whether the Buchanan vote was higher than expected, given other information from this election and the presidential election four years earlier. A statistical tool called a regression model[2] was used to describe the trend in the countywide percentage vote for Buchanan in Florida, relative to measures such as the percentage vote for Ross Perot (the Reform Party candidate) in 1996, the Buchanan vote in the 1996 Republican primary, the Bush and the Gore vote in 2000, and the Reform Party registration totals.[3] The various analyses predicted fewer than 900 votes for Buchanan in Palm Beach County, compared to the 3407 votes he actually received.

For instance, in 1996, the Reform Party candidate for President was Ross Perot. Figure 1 plots the countywide vote for Buchanan in 2000 against the countywide vote for Perot in 1996. Each point in this figure represents a county. The value on the vertical axis for that point is the vote for Buchanan in 2000. The value on the horizontal axis for that point is the vote for Perot four years earlier. This figure shows the strong positive correlation statewide between the Perot vote in 1996 and the Buchanan vote four years later: counties with a relatively high Perot vote in 1996 tended to have a high Buchanan vote in 2000, and counties with a relatively low Perot vote in 1996 tended to have a low Buchanan vote in 2000. The Buchanan vote in 2000 was roughly three percent of the Perot vote in 1996.[4] In Figure 1, Palm Beach County is the point falling well above the others, with the Perot 1996 vote total equal to 30,739[5] and the Buchanan

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1. General Election Palm Beach County, Fla., Nov. 7, 2000, *available at* http://www.pbcelections.org/ElectionResults/2000/GEN/cum_PRE.htm#1 (last visited Nov. 14, 2001).

2. A regression model is a statistical tool that uses data to develop a mathematical formula providing predictions of one outcome (such as vote for Buchanan in 2000) based on another outcome (such as vote for Perot in 1996). *See, for instance*, STATISTICAL METHODS FOR THE SOCIAL SCIENCES, Ch. 9 (3d ed., Alan Agresti & Barbara Finlay, Prentice Hall, 1997) [hereinafter STATISTICAL METHODS].

3. Data from 1996 obtained from Fla. Dep't of State, *available at* http://election.dos.state.fl.us/.

4. *See infra* p. 120.

5. Data from 1996 election obtained from archives at Fla. Dep't of State, *available at* http://election.dos.state.fl.us/.

2000 vote total equal to 3407.[6] This point is what statisticians refer to as an "outlier." This means it is far removed from the overall trend in the data points, which roughly follows a straight line.

Without the data point for Palm Beach County, the correlation between the Buchanan vote in 2000 and the Perot vote in 1996 is 0.92.[7] The existence of a positive correlation between the countywide totals of votes for any two candidates is expected, since counties with greater numbers voting tend to have greater numbers of votes for all candidates. More informative is a model that describes the relationship between the percentage of the county's vote that Buchanan received in 2000 and the percentage of the county's vote that Perot received in 1996.

A statistical regression model is a way of describing how the vote for Buchanan in 2000 relates to the vote for Perot in 1996. For the purpose of this statistical analysis, each voter's observation in a county in 2000 is "binary"; he or she either voted for Buchanan or did not. The standard distribution in statistics for handling binary data is the binomial.[8] The authors assumed the binomial distribution in fitting a straight-line regression model to describe the relationship between the percentage vote in a county for Buchanan in 2000 and the percentage vote for Perot in that county in 1996.[9]

Since the Palm Beach County observation seems like an extreme outlier, the straight line model was fitted using data from all the counties except Palm Beach.[10] This analysis yielded a prediction equation that provided a predicted percentage vote for Buchanan in each county based on the percentage of the vote that Perot received in that county four years earlier. This prediction equation is:

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6. ABC News website for initial returns, *available at* http://www.abcnews.go.com/sections.politics/2000vote.general/FL_country.html. Vote count later certified by Fla. Dep't of State, *available at* http://election.dos.state.fl.us/ (vote count was 3441).

7. The correlation is a statistical measure used to describe strength of association. A value of zero represents a lack of association and a value of one is the strongest possible positive association.

8. When each observation is binary, the binomial distribution provides probabilities for the possible total number of outcomes of each type. *See* STATISTICAL METHODS, *supra* note 2, § 6.6.

9. For a discussion of regression models for binary data, see ALAN AGRESTI, AN INTRODUCTION TO CATEGORICAL DATA ANALYSIS (Wiley 1996).

10. In technical terms, this is a binary regression model assuming the binomial distribution and using the identity link. It is called a linear probability model. The model was fitted with the method of maximum likelihood using the statistical software package SAS, with its procedure GENMOD. This method differs from the usual least squares method for a normally distributed response for straight-line models. Ordinary least squares is inappropriate, since the tremendous variability in the numbers of votes among the counties implies great variability in the variance of the countywide percentages.

Predicted Buchanan percentage =

-0.03 + 0.0304 × (Perot percentage).

This equation means that the predicted Buchanan percentage in 2000 was roughly 3% of the Perot percentage in 1996 (or more precisely, 0.03 percentage points less than 3.04% of the Perot percentage).

The Perot percentage of the vote in Palm Beach County in 1996 was 7.74.[11] This regression model predicts a percentage for Buchanan in 2000 of -0.03 + 0.0304(7.74) = 0.205, about 1/5 of 1%. This result translates to 884 votes for the 430,762 people reported voting in Palm Beach County on election day. By contrast, the actual vote in Palm Beach County for Buchanan was 3407 (0.79%).[12]

Similar results occur using other predictors, such as the Buchanan vote in the 1996 Presidential Election.[13] More refined models can use several predictors in one model. For instance, using the Bush vote in 2000 as well as the Perot vote in 1996 to predict the Buchanan vote in 2000, the prediction equation is

Predicted Buchanan percentage

= -.22 + .0274 × (Perot %) + .0045 × (Bush %).

This model gives a predicted Buchanan percentage of 0.14%, which translates to 652 votes.

On the butterfly ballot, Bush appeared first in the left column, followed by Buchanan in the right column, Gore in the left column, and then the Socialist Party candidate (David McReynolds) in the right column. Thus, if many who intended to vote for Gore had difficulty with this ballot, one would also expect an abnormally high vote for the Socialist Party candidate. In fact, the Socialist Party vote was also an extreme outlier for Palm Beach County. That candidate received 302 votes in Palm Beach County, nearly half his statewide total of 622.[14] Regression models predict a vote for McReynolds that is only about ten percent of this actual vote. The next candidate on the ballot after the Socialist Party candidate was the Libertarian candidate, Harry Brown. The rest of Florida had fifty times as

11. 30,739 of the 397,231 votes. Results obtained from Fla. Dep't of State, *available at* http://election.dos.state.fl.us/.

12. ABC News, *supra* note 6.

13. Fla. Dep't of State, *supra* note 3.

14. Election archives at Fla. Dep't of State, *available at* http://election.dos.state.fl.us/.

many Libertarian votes as Socialist votes, but in Palm Beach County there were only twice as many Libertarian votes.[15]

These regression models assume, somewhat unrealistically, that all counties having the same fixed levels of the predictor values have the same percentage vote for Buchanan. Models that allow this percentage to vary[16] give similar results about the predicted vote for Buchanan. Similar results also occur using other mathematical forms than the linear one for the prediction equation.[17]

In the weeks after the election, many statisticians fit similar regression models using larger databases containing other predictors, including votes for other candidates, the vote for Buchanan in the 1996 Republican presidential primary, registration totals for various parties, and demographic variables such as population size, race, age distribution, education, and income. All these analyses showed the Buchanan vote in Palm Beach County in 2000 to be unusually high.[18]

A group of political scientists performed a variety of analyses to rule out the alternative explanations than the butterfly ballot for the high Buchanan vote.[19] They noted that in Palm Beach County, Buchanan's proportion of the vote on election-day ballots was four times his proportion on absentee(non-butterfly) ballots, yet the Buchanan proportion did not differ significantly between election-day and absentee ballots in any other Florida county. They also noted that among 3053 U.S. counties where Buchanan was on the ballot, Palm Beach had the most anomalous excess of votes for Buchanan.[20]

Statistical analyses should preferably be done using ballot-level or precinct-level data, rather than county-level data. This helps to reduce bias due to aggregation (overly broad grouping of voters). Precincts in Palm Beach County with a relatively high Gore vote or relatively high vote for the Democratic senatorial candidate, Bill Nelson, also tended to have a relatively high Buchanan vote.[21] An analysis of the ballot-level data showed

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15. Greg Adams, *Voting Irregularities in Palm Beach, Florida*, 14 CHANCE 22, 22-24 (2001).

16. An example is the beta-binomial model, which lets percentages vary according to a beta distribution.

17. For instance, logistic regression is the most common way of modeling binary data. However, it is more difficult to interpret the prediction equation. For these data, that model gives prediction equations quite close to the linear equation, as the sample percentages of vote for Buchanan in the 67 counties varied only between 0.1 and 1.7. Thus, it is not discussed here.

18. For a survey of the various analyses, see links provided by Prof. Greg Adams at Carnegie Melon Univ., *available at* http://madison.hss.cmu.edu.

19. J.N. Wand, K.W. Shotts, J.S. Sekhon, W.R. Mebane, Jr., M.C. Herron, and H.E. Brady.

20. *Id.*

21. J.N. Wand et al., *The Butterfly Did It: The Aberrant Vote for Buchanan in Palm Beach County, Florida*, 95 AM. POL. SCI. REV. 793-810 (2001).

that Palm Beach voters who supported Nelson were six times more likely to vote for Buchanan for president on the butterfly ballot than on the absentee ballot.[22]

The website of Professor Greg Adams at Carnegie Mellon University provides links to several studies using various data bases.[23] A study by Professor Richard Smith at the University of North Carolina used a variety of sophisticated statistical methods.[24] Based on the vote in other counties, his model gives a point prediction of 326 votes for Buchanan in Palm Beach County.[25] He also developed a probabilistic assessment of what Buchanan's vote should have been. He reported a 95% chance that the Buchanan vote should be between 181 and 534, based on the vote in other counties.[26] Professor Adams published a recent article on the voting irregularities in Palm Beach county.[27]

No statistical analysis can prove that Buchanan's Palm Beach County vote was mostly unintended. Other factors not accounted here might explain this discrepancy. However, the analyses cast suspicion on the Buchanan total in that county.

III. THE OVERVOTE IN PALM BEACH COUNTY

Also noteworthy in Palm Beach County was a relatively high number of ballots (19,235 or 4.2%) disqualified as "overvotes" — voting for more than one presidential candidate in the election.[28] Although one can never discern for sure whether Buchanan's 3407 votes were all truly intended for him, it is possible to get some further information about the overvotes by visually inspecting them. In fact, the *Palm Beach Post* did this and reported the following:

- 5330 voted for Gore and Buchanan, 2908 voted for Gore and McReynolds (the Socialist Party candidate whose name appeared below Gore's in the right column), and 1631 voted for Bush and Buchanan.

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22. *Id.*

23. Greg D. Adams & Chris Fastnow, *A Note on the Voting Irregularities in Palm Beach, FL, available at* http://madison.hss.cmu.edu/ (last visited Nov. 9, 2001).

24. Richard L. Smith, *A Statistical Assessment of Buchanan's Vote in Palm Beach County, available at* http://www.unc.edu/depts/statistics/faculty/rs/palmbeach.html (last modified Nov. 20, 2000).

25. *Id.*

26. *Id; see also* Adams, *supra* note 15.

27. *See* Adams, *supra* note 15.

28. Joel Engelhardt & Scott McCabe, *Over-Votes Cost Gore the Election in Florida: A Palm Beach Analysis of 19,125 Ballots That Were Punched More Than Once*, PALM BEACH POST, Mar. 11, 2001, at A1.

- Gore appeared on 15,371 (80%) of the overvote ballots. Buchanan appeared on 8689, McReynolds on 4567, Browne (the Libertarian candidate) on 4218, and Bush on 3751.
- Although Browne appeared two names below Gore, there were 1305 Gore-Browne punches. Speculation is that some voters misread "Libertarian" as "Lieberman."
- In 1996, with a standard ballot having only four names, there were only 3,073 overvotes, compared to 19,235 in 2000. Likewise, there were relatively few overvotes in other races on the 2000 ballot that did not have the butterfly structure for listing names.[29]

The most common overvote pattern was for Gore and Buchanan.[30] Of course, there is no assurance that most of these voters intended to vote solely for Gore. However, some information is provided by correlations with other votes on the ballot. The *Palm Beach Post* story mentioned that eighty-three percent of the Gore-Buchanan overvote ballots had votes for Democrat Bill Nelson for U.S. Senator; Nelson received sixty-two percent of the countywide vote.[31]

This evidence about the overvotes, in conjunction with the statistical regression analyses of the Buchanan vote presented above, suggests that the butterfly ballot design is likely to have cost Gore a substantial number of votes in Palm Beach County.

For instance, suppose ninety-nine percent of the Gore-Buchanan and Gore-McReynolds votes were truly intended for Gore (Buchanan and McReynolds together received less than one percent of the countywide vote). Likewise, suppose ninety-nine percent of the Bush-Buchanan vote was intended for Bush. Of the 3407 votes cast solely for Buchanan, suppose 1000 were truly intended for Buchanan, 1843 were actually intended for Gore, and 564 were intended for Bush. (Here, the remaining 2407 votes are allocated to Gore and Bush in the same percentages as the Gore-Buchanan and Bush-Buchanan overvotes.) This corresponds to an additional 9,999 votes for Gore and 2,179 votes for Bush. That is, this illustrative analysis predicts an advantage of 7820 for Gore.

Such calculations are speculative and based on unverifiable assumptions. However, given the small margin of victory statewide for Bush, it is certainly quite plausible that the butterfly ballot design cost Gore the election.

Incidentally, although the overvote in Palm Beach County received considerable media attention, Palm Beach was not the only county where

29. *Id.*
30. *Id.*
31. *Id.*

this was a serious problem. For instance, the overvote in Duval County was 7.5%, a total of 21,942 ballots.[32] The Duval County ballot had candidates for President on two pages. According to a *N.Y. Times* story, more than twenty percent of the ballots in predominantly African-American precincts were tossed out, with nearly a third tossed out in two of those precincts.[33]

An analysis of the overvote in eight of Florida's largest counties showed Gore on forty-six thousand overvote ballots and Bush on seventeen thousand.[34] Those who overvoted for President in these counties, but cast a valid vote in the U.S. Senate race favored the Democrat (Bill Nelson) over the Republican candidate by seventy to twenty-four percent.[35] That study showed that even counties where Bush won had more overvotes for Gore than for Bush.[36] Such results suggest that racial and socioeconomic factors positively associated with the overvote were also positively associated with voting Democratic.

IV. HIGHER UNDERVOTE FOR PUNCHCARD BALLOTS

Professor Nicholas Hengartner of the Statistics Department at Yale University testified as an expert witness for the Gore legal team in the Leon County Circuit Court (under Judge N. Sanders Sauls) in Tallahassee. In contesting the state-certified count, the Gore team provided evidence to support its contention that a hand recount could change the result of the election. It claimed that the punchcard ballots caused a relatively high undervote (ballots reported as not showing a preference for President) in the counties for which it requested recounts. The undervote rate was 0.3% in counties using ballots with optical scanning, but 1.5% (five times higher) in counties using the punchcard ballot; in the key county of Palm Beach, it was 2.2% (Figure 2 replicates a graphic presented in their testimony.).[37]

The authors did some related work based on data that Dr. Hengartner had obtained from county election supervisors prior to November 30, 2000. The discrepancy between optical scanning counties and punchcard counties remained after adjusting for racial demographics. This is partially illustrated by Figure 3, which shows a strong tendency for higher undervote rates in punchcard counties, regardless of the percentage of African-Americans in the county. Of the counties using punchcard ballots, the three with the

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32. Raymond Boner & Josh Barbanel, *Counting the Vote: Duval County; Democrats Rue Ballot Foul-Up in 2nd County*, N.Y. TIMES, Nov. 17, 2000, at A1.

33. *Id.*

34. Dan Keating, *Fla. 'Overvotes' Hit Democrats the Hardest; Gore 3 Times as Likely as Bush to be Listed on Tossed Ballots*, WASH. POST, Jan. 27, 2001, at A1.

35. *Id.*

36. *Id.*

37. CNN story, *available at* http://www.cnn.com/2000/ALLPOLITICS/stories/11/30/jackson.undervote/.

highest undervote totals were the three for which the counted votes had the highest percentages in favor of Gore: Broward, Palm Beach, and Miami-Dade (see Figure 4). However, many smaller counties that had majorities for Bush used punchcard ballots. To avoid charges of bias, the authors believe Gore should have asked for a recount (under a common standard) of the undervote in all Florida counties.

In these analyses and in ones for the Buchanan vote in Palm Beach County,[38] it would be more effective to have less aggregated data. For instance, because of socioeconomic factors correlated with the undervote and overvote, it seems plausible that Gore could have picked up more votes than Bush even in some counties that had a majority of counted votes for Bush (such as Duval). Unfortunately, the readily available demographic data have geographical units that do not match with precincts.

Incidentally, the recount in Palm Beach County (which was not completed on time to be included in state-certified totals) used strict standards and counted less than ten percent of the undervotes.[39] Even after the recount, the percent of undervotes in Palm Beach County remained relatively high, about six times the average for counties using optical scanning.[40]

V. WHAT IF THE VOTE HAD BEEN FLAWLESS?

Soon after the election, the *Miami Herald* presented a statistical analysis that attempted to answer the question, "If no one had ever heard of hanging chads, if the butterfly ballot had never flown, if no voter had bungled in the booth, who would have won Florida and the presidency of the United States?"[41] Although an answer to this question carries no legal weight, it may be of interest to anyone whose ideal is a counted vote that accurately reflects what voters intended. The *Miami Herald* article described an analysis that allocated the undervote and overvote in each precinct to the candidates in the same proportions as received (in that precinct) in the officially counted vote.[42] Of the 185,000 discarded ballots, about 42% went to Bush and 56% to Gore according to this mechanism, resulting in a predicted Gore win by more than 23,000 votes.[43] This assumes

38. See analyses discussed in Section II of this Article.

39. Based on the data at Palm Beach County election archive, *available at* http://pbcelections.org/ElectionResults/2000/GEN/00genhc.htm, (10,310 manual handcount of overvote).

40. *Id.*

41. Anabelle de Gale et al., *History in Session: Gore Team States Case Includes 'Legal Votes,' Lawyers Urge a Flawless Vote Would Have Shown a Winner; Analysis Finds an Edge for Gore*, MIAMI HERALD, Dec. 3, 2000, at A1.

42. *Id.*

43. *Id.*

unrealistically that every voter intended to vote for President;[44] however, if as few as 10% truly did, Gore remained ahead with a margin of 1443 votes.[45]

One of the writers of the *Miami Herald* article, Curtis Morgan, contacted one of the authors before it was published to discuss the strengths and weaknesses of this study. The authors noted that the analysis had the advantage of being done at the precinct level,[46] which made it much more plausible than if it used results at the county level. However, it is not possible to know how accurate such a prediction is. The *Miami Herald* projection essentially assumes that the discarded ballots were a random sample of all the ballots cast in a precinct,[47] which is highly unlikely.

Some factors would seem to bias the results of such an analysis against Gore. For example, if overvoting was correlated with being African-American, and if African-Americans tended to vote more heavily for Gore, then the prediction would be too low for Gore because of racial heterogeneity within precincts. In other words, even a precinct-level analysis does not completely control for demographic and socioeconomic factors that vary within precincts. Similarly, a precinct-level analysis does not consider non-random factors associated with the nonvote; e.g., the design of the butterfly ballot that seems to have resulted in a large overvote in Palm Beach County apparently worked overwhelmingly against Gore.[48]

The prediction of voter intent might be improved, for example, by considering properly recorded votes in other races on the ballot. However, any such method of assigning discarded ballots to candidates is open to criticisms such as those above. Better answers to these questions may become available after detailed examination of the ballots by various researchers.

One analysis, by the *Miami Herald*, the *N.Y. Times*, and several other newspapers, was reported while this Article was in the editorial process.[49] They reviewed almost 61,000 undervotes and 111,000 overvotes in Florida.[50] Of the overvotes, Gore was marked on 84,197 ballots and Bush

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44. *Id.*

45. *Id.*

46. *Id.*

47. *Id.*

48. *See infra* § III.

49. Dennis Caughon, *USA Today, Other Newspapers Examine Overvote: More Than 110,000 Ballots Were Disqualified Because They Registered More Than One Presidential Vote*, USA TODAY, May 11, 2001, A2; Ford Fessenden & John M. Broder, *Study of Disputed Florida Ballots Finds Justices Did Not Cast the Deciding Vote*, N.Y. TIMES, Nov. 12, 2001, at A1; Andres Viglucci, *New Study Shows Bush-Gore Still a Tough Call*, MIAMI HERALD, Nov. 12, 2001, at 9A.

50. Viglucci, *supra* note 49.

on 37,731.[51] Voter intent was clear on three percent of these ballots.[52] For instance, on some ballots, voters had both voted for Gore and written his name on the write-in line. These overvotes would have yielded a net of 682 more votes for Gore than Bush if counted.[53] The undervote from the optical scan machine ballot showed a net of 384 more votes for Gore than Bush if counted.[54] The undervote from the punchcard ballot varied between a net of 464 more for Gore to a net of 275 more for Bush depending on the standard used.[55] The study concluded that a statewide inspection of votes could have resulted in either Bush or Gore being declared the winner, depending on the standard imposed for counting punchcard ballots.[56]

A major study sponsored by a consortium of newspapers has been carried out by the National Opinion Research Center (NORC) at the University of Chicago. Their "Florida Ballots Project" has developed computer databases based on detailed inspections of the 175,010 rejected ballots from all six thousand Florida precincts. Results of the NORC study were reported in the *N.Y. Times* and elsewhere as this Article was in press. Most widely reported was the determination that the statewide manual recount ordered by the Florida Supreme Court, if carried out under the standards that county election officials said they would have used, would have resulted in a 493 vote win for Bush. The *N.Y. Times* also reported that the winner of the recounted election varied according to the standard used to determine vote intent, but that in every scenario, the margin was narrower than the final 537 vote lead awarded to Bush in the actual election.[57]

The NORC study found that the widely reported problems with punchcard ballots disproportionately affected voters in precincts having relatively greater numbers of elderly voters, where undervotes were apparently caused by punching the cards too gently, resulting in a "dimpled chad."[58] The NORC study also found that ballot design was critically important, regardless of the type of ballot used. With more than 113,000 Florida voters casting ballots for two or more presidential candidates, there were nearly twice as many overvotes as undervotes, and the overvote rate was five times higher in the eighteen counties that used a two-column ballot than elsewhere. This is illustrated in Figure 5 which shows the overvote

51. *Id.*
52. *Id.*
53. *Id.*
54. *Id.*
55. *Id.*
56. *Id.*
57. Fessenden & Broder, *supra* note 49.
58. Ford Fessenden, *Ballots Cast by Blacks and Older Voters Were Tossed in Far Greater Numbers*, N.Y. TIMES, Nov. 12, 2001.

percentages for sixty-two Florida counties broken down according to number of columns on the ballot and the ballot type — Optical scanning, Votomatic (where voters manually punch out chads), and Datavote (the voter presses a lever that punches out the chad mechanically.[59] It is clear from Figure 5 that the effect of poor ballot design on the overvote rate was as strong in counties using an optically scanned ballot as in those using a punch card ballot, indicating that this problem will not be solved by recent legislative action to eliminate punchcard ballots.

Finally, after controlling at the precinct level for ballot design, education, and other socioeconomic factors, the NORC study found that a significantly higher proportion of ballots were rejected in majority black precincts than elsewhere.

VI. SUMMARY

This election in Florida appeared to be a "statistical tie." The difference between the state-certified vote for Gore and Bush was likely to be much smaller than the potential number of additional votes if all truly legal votes could have been accurately counted. Evidence provided so far by the inspection of ballots by news organizations supports this conclusion. Because of the magnitude of potential error in counting, which is partly due to the uncertainty about the many ballots with various types of chads in counties that used punchcard, it is doubtful that the nation can know who won among the votes cast that were truly legal.

Sadly, there was a very large number of illegal votes, as well as votes apparently cast for other than the intended candidate, due to such factors as the butterfly ballot, the two-column and two-page ballots, voter confusion, and voter carelessness. Statistical analyses performed so far suggest that these factors worked primarily against Al Gore, perhaps in the magnitude of tens of thousands of votes. This situation will be increasingly studied, and future studies should provide better statistical analyses about the vote and the problems affecting it.

59. These data were obtained from the N.Y. TIMES website, *available at* http://www.nytimes.com/. Data for the remaining five counties were not available there.

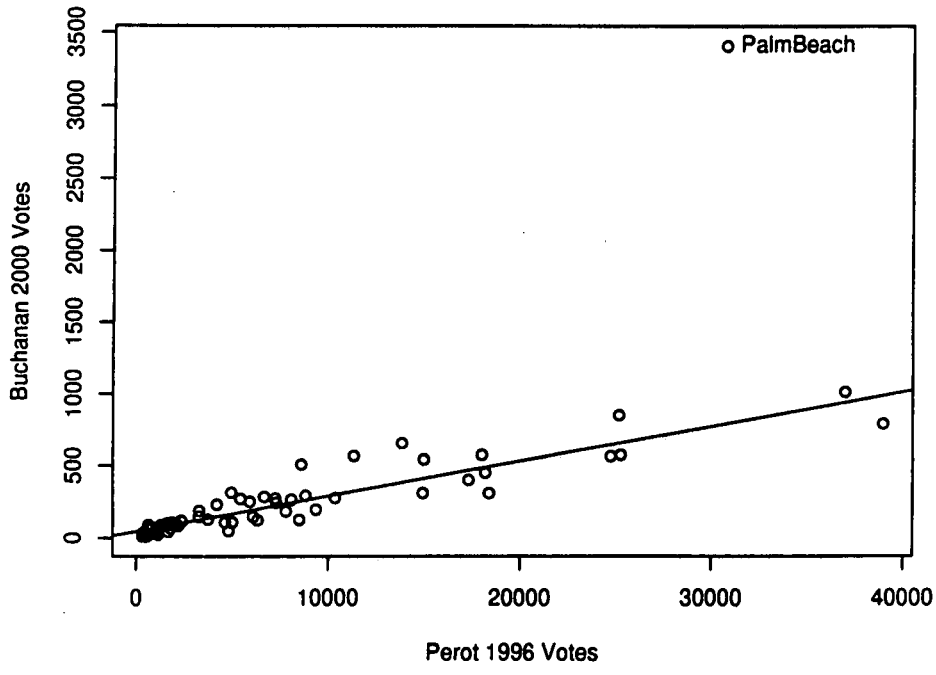

Figure 1: Total vote, by county, for Reform Party candidates Buchanan in 2000 and Perot in 1996.

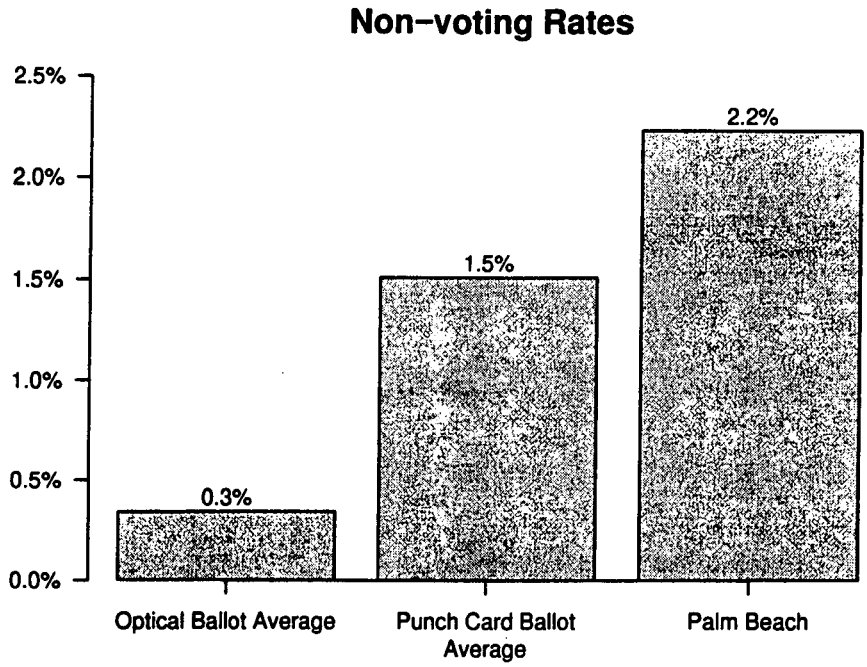

Figure 2: Statewide undervote rates for optical and punch card ballots. A replica of a plot presented by Prof. Nicholas Hengartner in the Leon County Circuit Court on Dec. 2, 2000.

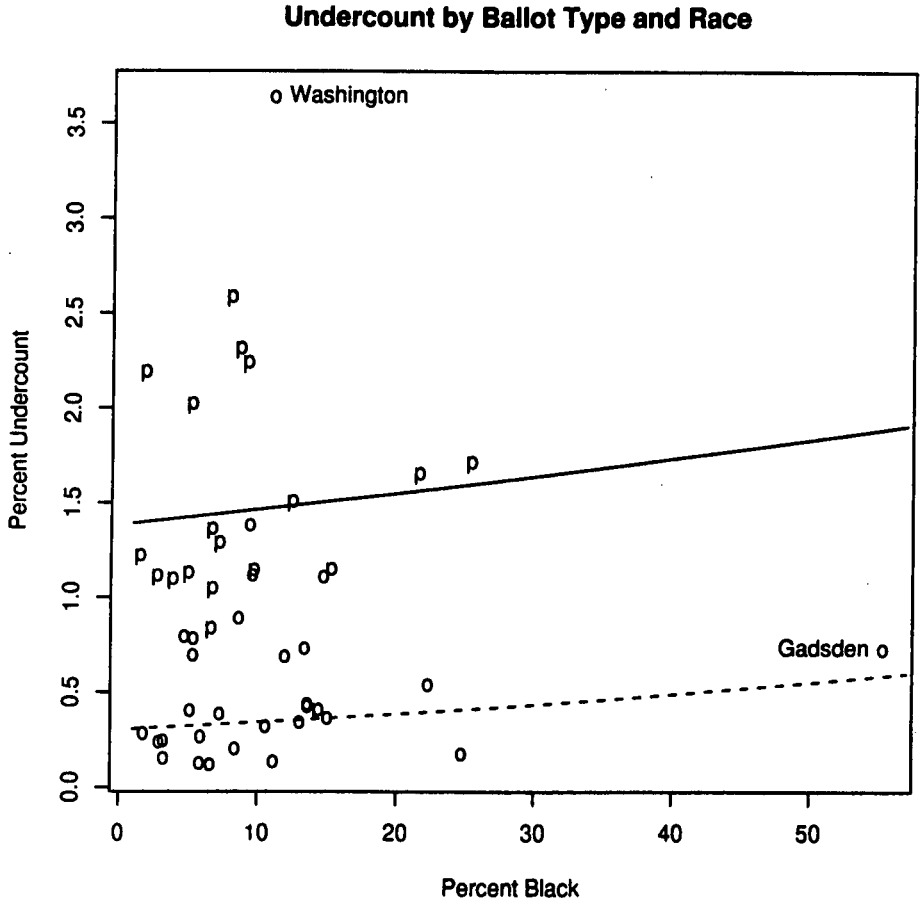

Figure 3: County undervote rates for optical and punch card ballots versus the population percentage black. The plotting symbol p indicates a county using a punch card ballot and o a county that used optical scanning. Data obtained by Nicholas Hengartner from county election supervisors prior to November 30, 2000.

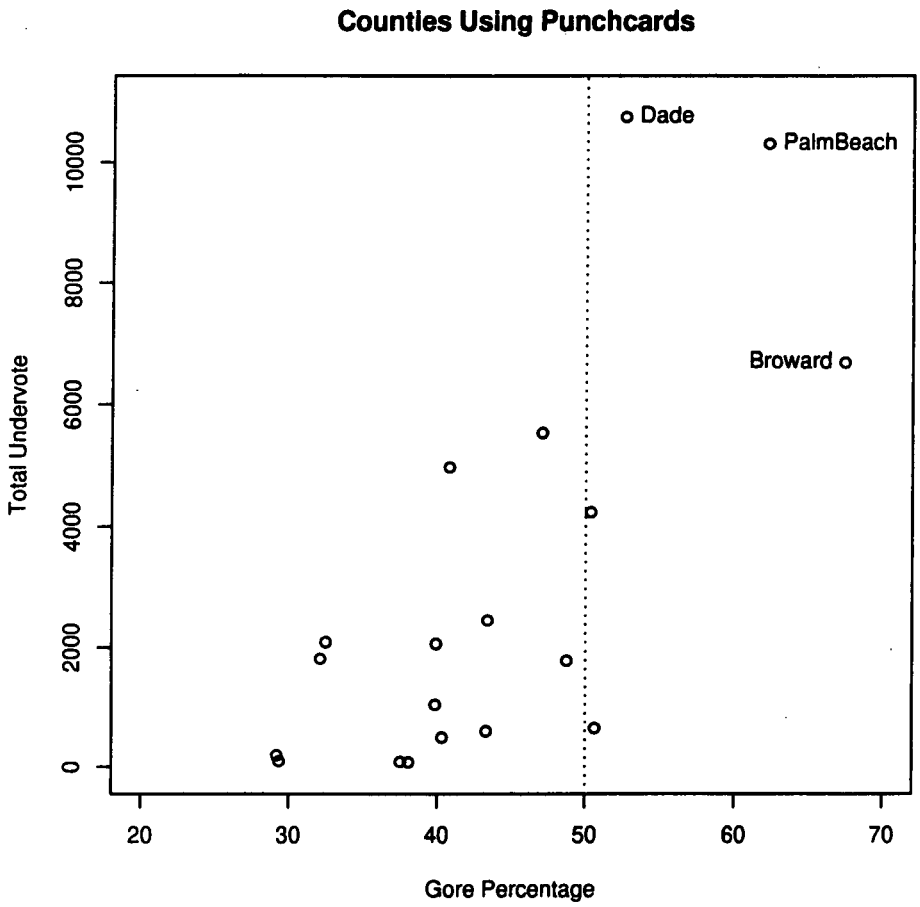

Figure 4: Number of ballots not showing a vote for President, and the percentage vote in that county for Gore for counties using the punchcard ballot. Three counties labeled having the highest percent vote for Gore were counties having the greatest undervote. Data obtained by Nicholas Hengartner from county election supervisors prior to November 30, 2000.

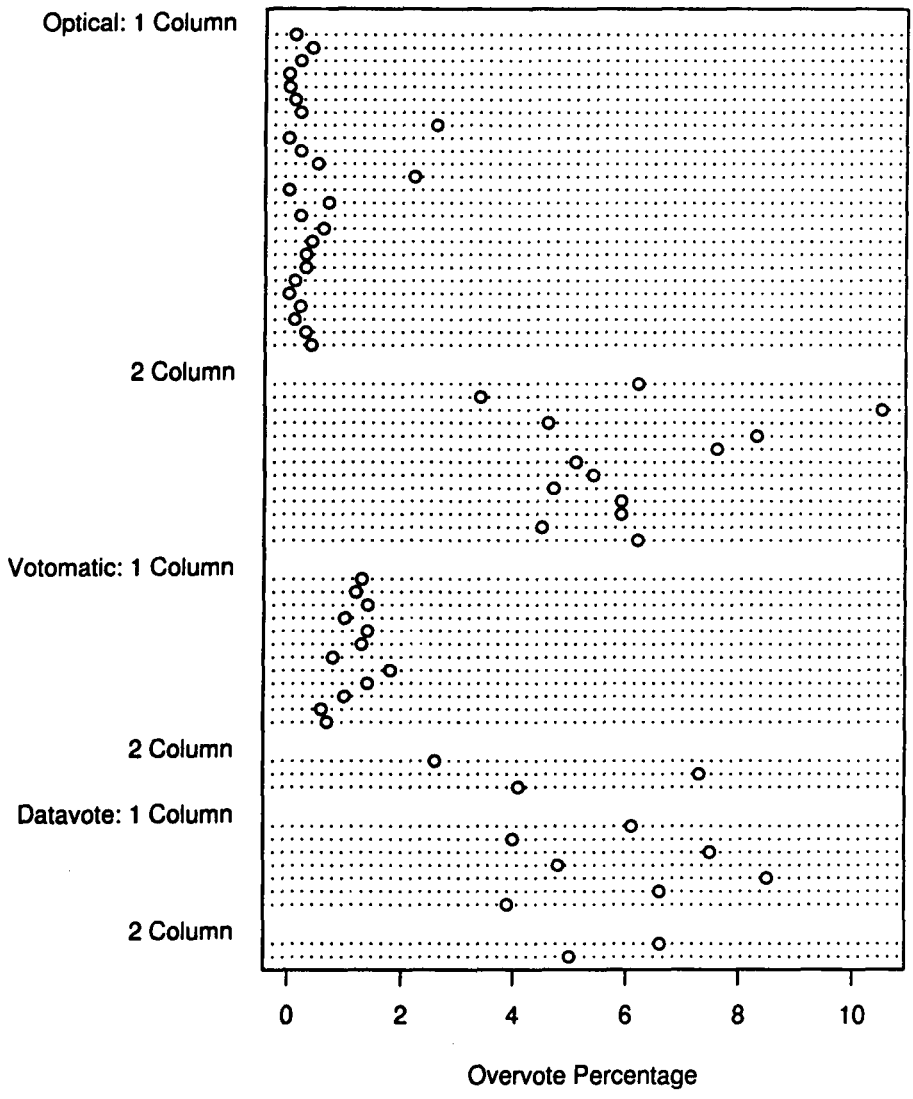

Figure 5: Overvote percentages for 62 Florida counties.