# Report on Voting and Ballot Form in Palm Beach County

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**Summary** -- I believe with a very high degree of scientific certainty that defects in the butterfly ballot form used in Palm Beach County caused substantial bias in the recording of people's votes.  At least 2000 people who intended to vote for Al Gore ended up having their votes recorded for Pat Buchanan, but virtually no one who intended to vote for George Bush had their vote recorded for another candidate. As a result, the butterfly ballot in Palm Beach County had the net effect of being significantly biased against Al Gore.

The evidence for this conclusion comes from my own analysis of data from Florida counties using standard statistical methods for the analysis of electoral data, from my knowledge of designing forms and questionnaires to elicit information from people, and from my review and replication of research by others.

I believe that my testimony will assist the court in understanding the issues presented. Furthermore, my conclusions are based upon scientific principles which have been established for many years and which are universally recognized and accepted in the field of political methodology.

**Design of the Ballot Form** -- When voters confront a ballot form, they must quickly figure out how to respond in order to convey their preferences.  This task requires reading instructions and information about the candidates on the ballot, determining how to produce an effective response, and detecting and correcting any errors in the entire process.  The butterfly ballot form in Palm Beach County was designed in such a way that it provides highly contradictory cues to voters as they undertake these tasks.  As a result, it produced an unusual number of errors that created substantial biases in the Palm Beach County voting results.

My conclusions about this ballot are based upon my experience as Director of the University of California Survey Research Center and as a scientific survey researcher who has designed and undertaken surveys in Canada, Estonia, Russia, and the United States. I am knowledgeable about the design of survey questionnaires and the factors that affect response quality.  Questionnaires for scientific surveys involve either responses filled in by survey interviewers or by the respondent.  In either case, survey researchers are very concerned with limiting the number of errors and reducing the bias in responses.  From this perspective, I can say with a very high degree of scientific certainty that the ballot form in Palm Beach County violated standard and well-known principles of form design.

The Palm Beach County butterfly ballot is designed with candidates listed in two columns

with punch-holes between the two columns.  The left hand column lists the Republican ticket, then the Democratic ticket, and then other tickets.  The right-hand column lists the Reform ticket, the Socialist ticket, and then other tickets.

The punch-holes are for the Republican, Reform, Democratic, Socialist, and other tickets in that order.  The parties are numbered (3) Republican, (4) Reform, (5) Democratic, (6) Socialist, etc.  The punch-holes are in the same order.  The physical layout places Republicans highest on the ballot, Reform second highest, Democrats third highest, Socialist fourth highest, and so forth.

Thus, three features of the ballot -- its numbering, the order of the punch-holes, and the physical position of the party and candidate labels, suggest the following order of the candidates:  Republican, Reform, Democratic, Socialist, etc.  But detecting these features and determining this order requires that voters move their eyes back and forth across the page to read labels in both columns and to ascertain the position of punch-holes.

Deciphering and marking this ballot is difficult because its format violates several common conventions that allow people to understand complex forms.  One convention is that people read down columns and then to the top of the next column.  According to this convention, the parties are in the order Republican, Democrat, etc., but this ordering is different than the order of the punch-holes.  The second convention, that the major parties are listed first on the ballot in Florida, leads to the same problem because the punch-holes include the Reform Party in-between the two major parties.  A third convention, that punch-holes or "answer" boxes are typically to the right of the candidate names, is also violated.

To properly cast their votes, Palm Beach County residents had to ignore these conventions.  They had to go back and forth from one column to another as they deciphered and marked their ballot, and they had to look for punch-holes on the left or the right depending upon the column they were in.  Consequently, voters were confronted with a very difficult cognitive task given the short time that they have to complete their ballot.  Because the ballot violated conventions, there was no clear relationship between the stimulus and the response.  Voters who read down the column could easily infer that the first punch-hole was for George Bush and the second punch-hole was for Al Gore.  As a result, Gore supporters could inadvertently punch the hole for Pat Buchanan.  Other errors are also possible, although I will not explore them here.

**Impact of Ballot Design** -- The ballot design itself led me to the conclusion that errors in Palm Beach County balloting would be biased against Al Gore and in favor of Patrick Buchanan.  But it did not indicate the magnitude of these errors, and I did not want to rely simply upon my assessment of the ballot form to conclude that the ballot was biased against Al Gore.  In order to show that this bias existed and in order to determine its size if it existed, I engaged in my own research using data from the State of Florida, Palm Beach County, and other Florida Counties.  My analysis proceeded in the following steps.

**Was the Buchanan vote much larger than expected in Palm Beach County?** --

I began my own analysis of the impacts of the Palm Beach ballot as an intellectual exercise on the evening of Wednesday, November 8th, and I completed it by Thursday afternoon, November 9th. I then posted it on the web at "http://socrates.berkeley.edu/~ucdtpums/"). Many others also posted their analysis in the next few days. Among the numerous excellent pieces of research, I rely upon the paper by Jonathan Wand, Kenneth Shotts, Jasjeet Sekhon, Walter Mebane, and Michael Herron which is available on the web at "http://elections.fas.harvard.edu/". My analysis relies upon standard and widely used statistical techniques. It also relies upon my experience as a Ph.D. in Political Science and Economics, as a teacher of courses in statistical methods at the University of California, Berkeley, and as a widely published author in statistical methods and electoral research.

The papers mentioned above and many others present overwhelming evidence that the percentage of the vote for Patrick Buchanan in Palm Beach County is extraordinarily atypical compared to all other Florida Counties and compared to other reporting districts around the country once we control for state variations in Buchanan support and for the different sizes of reporting units. These analyses prove with a very high degree of scientific certainty that the Palm Beach County Buchanan vote of about .8% was exceptionally large -- between 2.6 to six standard deviations away from the expected value of around .19%. Thus, the likelihood that the observed Buchanan vote is produced by the same factors that were at work in the rest of Florida's counties is certainly no greater than one out of 200 and possibly as small as one in a billion.

**Why are there so many Buchanan Voters in Palm Beach County? -**- There are two obvious explanations for the large Buchanan vote. One is that for some reason, Palm Beach County has an unusually large number of Buchanan supporters who voted for him. The second is that some feature of the ballot caused large numbers of non-Buchanan supporters to inadvertently cast their votes for Patrick Buchanan.

Several pieces of evidence have been offered to suggest that Palm Beach County has an exceptional number of Buchanan supporters. One is that Buchanan obtained 8,788 votes in Palm Beach County in the 1996 Republican primary in Florida. This number is larger than the 3,407 he received in the 2000 Presidential race. However, in 1996, Buchanan's support from Palm Beach County was 5.4% of his statewide total, whereas in 2000 it was 19.6% of his statewide total. These figures can only be explained by believing that forces that were reducing Buchanan support elsewhere in 2000 were not working in the same fashion in Palm Beach County. Furthermore, in 1996, Buchanan's support in Palm Beach County was not statistically significantly different from what could be predicted from simply looking at the relationship between Buchanan support and Dole support in all other Florida counties. Yet, as pointed out above, in 2000, Buchanan's support was much, much greater than expected.

Another argument is that there is an unusually high registration of Reform Party members in Palm Beach County. In fact, in 2000, there were only 336 registered Reform Party members in Palm Beach County. Clearly, these are not enough people to account for the 3,407 votes recorded for Patrick Buchanan. In addition, there were only 1,282 voters in

Palm Beach County for Joel Deckard, the Reform Party candidate for the Senate.

Moreover, statistical analysis shows that there is no relationship between the number of voters who voted for Buchanan in Palm Beach County precincts and the number of voters who voted for Deckard -- even though there is a statistically significant relationship between the two votes in the adjoining Broward County. This very strongly suggests that there is something different about Buchanan's vote in Palm Beach County.

The support for the proposition that Buchanan votes resulted from something other than ballots cast by Buchanan supporters is increased beyond any reasonable doubt by the following analysis. In two nearby counties for which I have obtained data (Broward and Miami-Dade), the Buchanan vote among absentee and election day voters is very similar. In Broward County Buchanan support is .13% among election day voters and .17% among absentee voters. In Miami-Dade County it is .09% among election day voters and .11% among absentee voters. In both cases, the absentee voters are somewhat more likely to vote for Buchanan, but the increase in Buchanan support between the election day voters and the absentee voters is no more than about 31%. (Thus, in Broward County we calculate [.17 - .13]/.13 = .307 or 31%).

The comparable figures for Palm Beach County are astonishing. Three things stand out on Figure 1 which presents the data for all three counties:

(1) The Buchanan vote among absentee voters is .23% and this is well within the error bounds of what almost all models have predicted for the level of Buchanan support among Palm Beach County voters. That is, the Buchanan vote among absentee voters looks like what researchers around the country would expect from Palm Beach County as a whole.

(2) The Buchanan vote among election day voters of .85% is, unlike that in the other two counties, larger than the Buchanan vote among absentee voters of .23%.

(3) Most incredibly, the Buchanan vote of .85% among election day voters is almost _four times_ bigger than the Buchanan vote of .23% of absentee voters.

In short, while the absentee vote for Buchanan in Palm Beach County is what we expected based upon our models, the election day votes in Palm Beach County are extraordinarily anomalous.

A look at the absentee ballot (Figure 2) makes it clear why this is so. The absentee ballot in Palm Beach County was designed much differently than the election day ballot. It lists candidates in columns with controls to the right. As a result, there is virtually no chance that a voter will inadvertently circle one candidate when intending to vote for another.

In short, I believe far beyond a reasonable doubt that it was the election day ballot that created the anomalous Buchanan vote percentage in Palm Beach County.

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In addition, a comparison of the Buchanan vote among those who cast absentee ballots with the vote of those who cast election day ballots provides an excellent measure of the number of mistakes caused by the butterfly ballot. In the other two counties, the percent Buchanan vote among absentee voters is higher than that among the election day voters. Thus, a very conservative estimate of the proportion Buchanan voters in Palm Beach County is the percent Buchanan among the absentee voters which is .23%. The difference between the vote share for election day voters of .85% and this figure of .23% for absentee voters is an excellent and very conservative measure of the mistakes caused by the Butterfly ballot. This approach yields an error rate percent of .62% (calculated from 85% - .23%) on the 386,731 votes that were initially reported as cast on election day. This amounts to about 2,400 Buchanan votes that were cast in error and only about 1,000 votes from true Buchanan supporters.

**Who Made the Errors? --** Ballot errors are regrettable, and they should be minimized. But ballot errors are much less worrisome when they affect all candidates roughly in proportion to their support in the voting population. If this happens, the relative positions of the candidates in the voting are unchanged. Clearly this was not true for Buchanan who benefitted from these mistakes, but Buchanan was not a contender in Florida, so the additional vote he received did not change his circumstances. Al Gore and George Bush, however, are both contenders for Florida's electoral votes and relatively small numbers of voters could affect their final status. Thus, it is very important to establish whether those voters who mistakenly voted for Buchanan were Bush or Gore supporters.

Whether the mistakes were made by Bush or Gore supporters can be answered by considering county data from all Florida counties other than Palm Beach County and precinct level data from Palm Beach, Broward, and Miami-Dade counties. The basic argument is that if the "extra" Buchanan voters are Bush supporters who made a mistake, then we would expect a quite different pattern in the data than what we would get if the "extra" Buchanan voters are Gore supporters. This argument was first elaborated in my paper "What Happened in Palm Beach County?" which was posted on the web on Thursday, November 9, 2000. This paper makes some simple assumptions and uses standard statistical methods to conclude that at least 2000 of the Buchanan votes in Palm Beach County were cast by Gore supporters who mistakenly punched Buchanan's name.

The logic of the analysis that concludes it was Gore and not Bush voters who made mistakes can be explained through a hypothetical example. We begin with Figure 3 which depicts what happened in the rest of the state of Florida outside of Palm Beach County by considering 10,000 voters. For simplicity, the example puts aside all third party candidates except Buchanan. In the hypothetical example, Bush and Gore obtain the same number of votes, 4,990. Buchanan obtains 20 votes or .2% of the total.

Assume that we can split this hypothetical state into three equal-sized precincts -- one with 33% Bush support, another with 50% Bush support, and a third with 67% Bush support. Because Buchanan was once a Republican and because he still appeals to Republicans, we find that he does better in precincts with more Bush voters. In our example, he gets

about four votes in the precinct with only 33% Bush supporters, 7 in the precinct with 50% Bush supporters, and 9 in the precinct with 67% Bush supporters. Thus, Buchanan's support goes up as the percentage of Bush supporters goes up.

This is exactly the pattern we observe in scatterplots of Buchanan vote percentage versus Bush vote percentage for each precinct in Broward (Figure 4) and Miami-Dade (Figure 5) counties. Scatterplots like these are used by all statisticians because of their utility and simplicity. Indeed, plotting scatterplots like this is now a standard grade school exercise.

In Figures 4 and 5, Buchanan support in Broward and Miami-Dade counties increases as we go from precincts with lower to higher Bush support. The same relationship also exists across the counties in the state of Florida. Statistical tests decisively confirm that the lines in Figure 4 and 5 slope upwards.

The lines that are drawn are Ordinary Least Squares's (OLS) fits to the data. OLS is, perhaps, the most commonly used statistical method, and it is the workhorse of statistical analysis. It was invented almost 200 years ago for solving problems in astronomy and physics where scientists wanted to describe the line that best described a scatterplot of points. This method is now widely used in all of the sciences. OLS determines a straight line through a set of points by finding that line which minimizes the sum of the square of the "residuals" which are defined as the difference between the line and the observed data.

Figure 6 shows what would happen if all of the mistakes came from people who would otherwise be Bush supporters. That is, it shows what would happen if the ballot form had caused Bush supporters to mistakenly vote for Buchanan. In this example, I assume that the chance for Bush supporters to make mistakes is the same across all Bush supporters. This assumption seems valid because the mistake is due to the ballot form. Therefore, it is the characteristics of the form and not the characteristics of Bush supporters that lead to errors. As shown in Figure 6, if it is Bush supporters making mistakes, then a scatterplot of Buchanan voters in each precinct against the level of Bush support would still be upwardly sloped.

Figure 7 shows what would happen if all the mistakes came from people who would otherwise be Gore supporters. That is, it shows what would happen if the ballot form had caused Gore supporters to mistakenly vote for Buchanan. In this case, precincts with more Bush supporters obviously have fewer Gore supporters who are available to make mistakes. Now, if the rate at which Gore supporters make mistakes is high enough, then the "true" Buchanan supporters who vote for Buchanan (shown in Figure 3) are swamped by "mistaken" Buchanan voters who come from the ranks of Gore supporters. The result is a line that slopes downwards.

In effect, each precinct is made up of some true Buchanan supporters and some mistaken Buchanan voters who come from among Gore supporters. The first group gets bigger with Bush support. The second group gets smaller. If there are enough Gore supporters who make mistakes, then they cause the slope of the line to go down. Thus, Figure 6 which

assumes that Bush supporters have made errors and Figure 7 which assumes that Gore supporters have made errors are strikingly different.  In Figure 6 the slope of the line is positive -- it goes up.  In Figure 7, the slope of the line is negative -- it goes down.  These results provide a clear-cut way to distinguish between a situation where it is all Bush or all Gore voters making mistakes.

Figure 8 shows what happens when we look at the relationship of Buchanan vote to Bush vote in Palm Beach County.  Whereas these lines slope upwards in scatterplots for Broward and Miami-Dade counties, the line for Palm Beach County slopes downwards.  Moreover, the slope is highly significantly different from zero.

These graphs show, with a very high degree of scientific certainty, that there are significant numbers of Gore voters who mistakenly voted for Buchanan.  Using the method in my paper cited above along with multiple sets of data, it is possible to get highly refined estimates of the fraction of Gore supporters who mistakenly voted for Buchanan and the fraction of Bush supporters who mistakenly voted for Buchanan.

My estimates of these models leads me to say with a very high degree of scientific certainty that essentially none (at most perhaps a handful) of the Bush supporters mistakenly supported Buchanan while at least 2000 Gore supporters mistakenly supported Buchanan.

**Conclusions** -- In my career as a social scientist that now spans almost thirty years, I have never seen non-experimental data that told such an unequivocal story.  And I have never seen so many analyses that converged on the same conclusion.  As a result, I feel certain far beyond any reasonable doubt that at least 2000 Gore supporters mistakenly voted for Buchanan because of the design of the Palm Beach County butterfly ballot.

This result is very worrisome.  Speaking as a political scientist, I believe that the legitimacy of our institutions is sorely taxed every time they fail to perform as advertised.  One of the promises of democracy is that votes will be effective.  In Palm Beach County, however, the votes of at least 2,000 voters were ineffective because of a poorly designed ballot.  Moreover, these votes handicapped one candidate (Gore) and helped another (Buchanan), thus leading to questions about the fairness of the election.

**Figure 1**

**Buchanan Vote by Ballot Type and County**

Buchanan Vote Percent (y-axis, 0.00 to 0.90)

County Name (x-axis)

Broward: Election Day Ballot 0.13, Absentee Ballot 0.17
Miami-Dade: Election Day Ballot 0.09, Absentee Ballot 0.11
Palm Beach: Election Day Ballot 0.85, Absentee Ballot 0.23

☐ Election Day Ballot  ■ Absentee Ballot

Figure 2

Palm Beach County Absentee Ballot

OFFICIAL ABSENTEE BALLOT
GENERAL ELECTION
PALM BEACH COUNTY, FLORIDA
NOVEMBER 7, 2000

ELECTORS
FOR PRESIDENT
AND
VICE PRESIDENT

(REPUBLICAN)
GEORGE W. BUSH - PRESIDENT
DICK CHENEY - VICE PRESIDENT ... 3

(DEMOCRATIC)
AL GORE - PRESIDENT
JOE LIEBERMAN - VICE PRESIDENT ... 5

(LIBERTARIAN)
HARRY BROWNE - PRESIDENT
ART OLIVIER - VICE PRESIDENT ... 7

(GREEN)
RALPH NADER - PRESIDENT
WINONA LaDUKE - VICE PRESIDENT ... 9

(SOCIALIST WORKERS)
JAMES HARRIS - PRESIDENT
MARGARET TROWE - VICE PRESIDENT ... 11

(NATURAL LAW)
JOHN HAGELIN - PRESIDENT
NAT GOLDHABER - VICE PRESIDENT ... 13

PRESIDENTIAL CANDIDATES
CONTINUED IN NEXT COLUMN

PRESIDENTIAL CANDIDATES
CONTINUED FROM
PREVIOUS COLUMN

(REFORM)
PAT BUCHANAN - PRESIDENT
EZOLA FOSTER - VICE PRESIDENT ... 4

(SOCIALIST)
DAVID McREYNOLDS - PRESIDENT
MARY CAL HOLLIS - VICE PRESIDENT ... 6

(CONSTITUTION)
HOWARD PHILLIPS - PRESIDENT
J. CURTIS FRAZIER - VICE PRESIDENT ... 8

(WORKERS WORLD)
MONICA MOOREHEAD - PRESIDENT
GLORIA La RIVA - VICE PRESIDENT ... 10

WRITE-IN CANDIDATE
To vote for a write-in candidate, follow the directions on the long stub of your ballot card.

UNITED STATES
SENATOR
(Vote for One)

BILL McCOLLUM ... 21
BILL NELSON ... 22
JOE SIMONETTA ... 23
JOEL DECKARD ... 24
WILLIE LOGAN ... 25
ANDY MARTIN ... 26
DARRELL L. McCORMICK ... 27

To vote for a write-in candidate, follow the directions on the long stub of your ballot card.

REPRESENTATIVE
IN CONGRESS
CONGRESSIONAL DISTRICT 16
(Vote for One)

MARK FOLEY ... 30
JEAN ELLIOTT BROWN ... 31
JOHN McGUIRE ... 32

To vote for a write-in candidate, follow the directions on the long stub of your ballot card.

STATE TREASURER
TREASURER
(Vote for One)

TOM GALLAGHER ... 49
JOHN COSGROVE ... 50

COMMISSIONER
OF
EDUCATION
(Vote for One)

CHARLIE CRIST
GEORGE H. SHELDON
VASSILIA GAZETAS

PUBLIC DEFENDER
15TH JUDICIAL
CIRCUIT
(Vote for One)

RICHARD JORANDBY
CASEY NAUGHTON

STATE SENATOR
DISTRICT 35
(Vote for One)

DAVID "DAVE" VAUGHAN
TOM ROSSIN
SHERRE LOVE

STATE REPRESENTATIVE
HOUSE DISTRICT 85
(Vote for One)
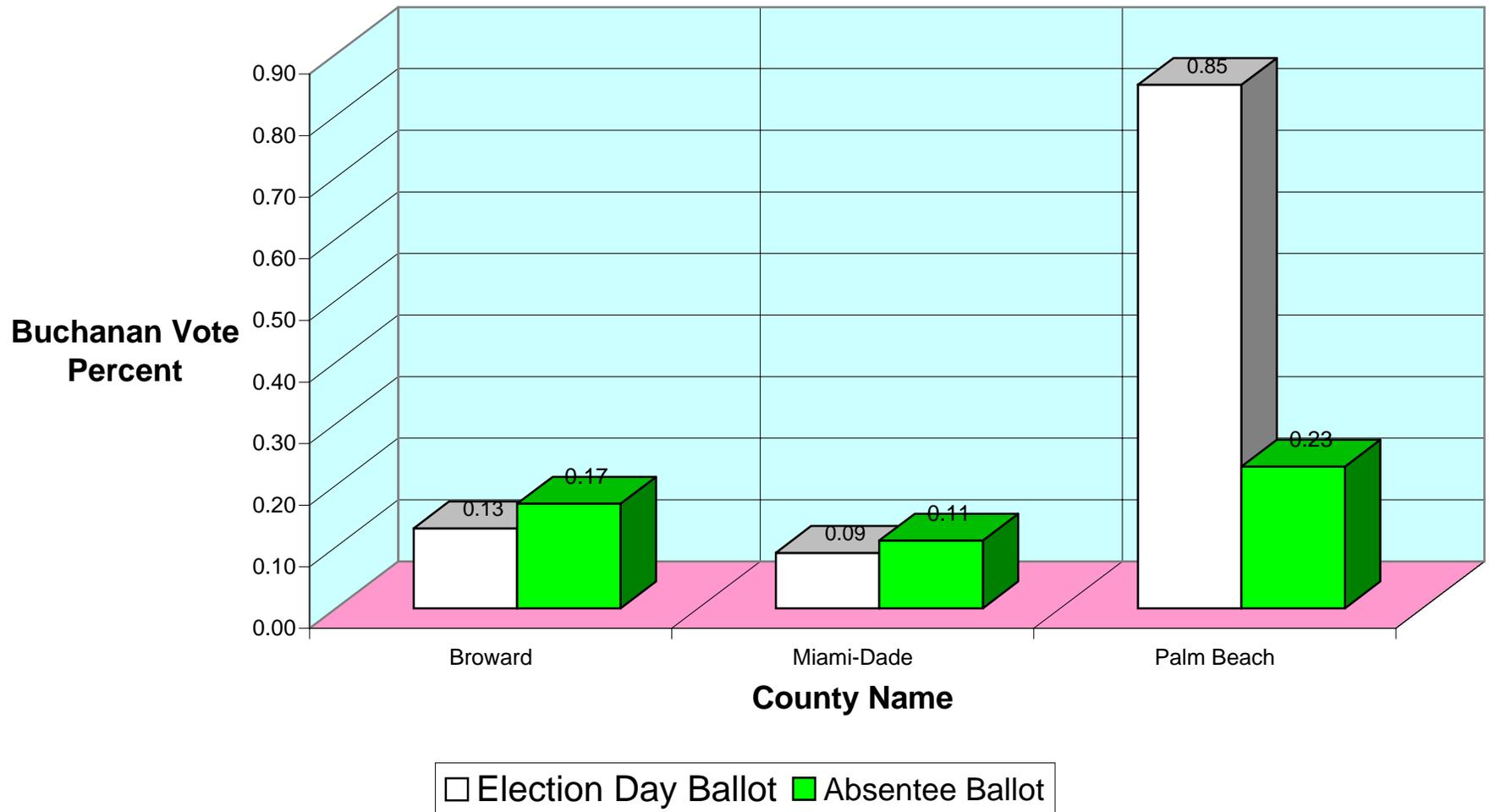
CHERYL A. CARPENTER
LOIS J. FRANKEL

**Figure 3**
**Florida Other than Palm Beach County:**
**Buchanan Voters by Bush Support in Precincts**
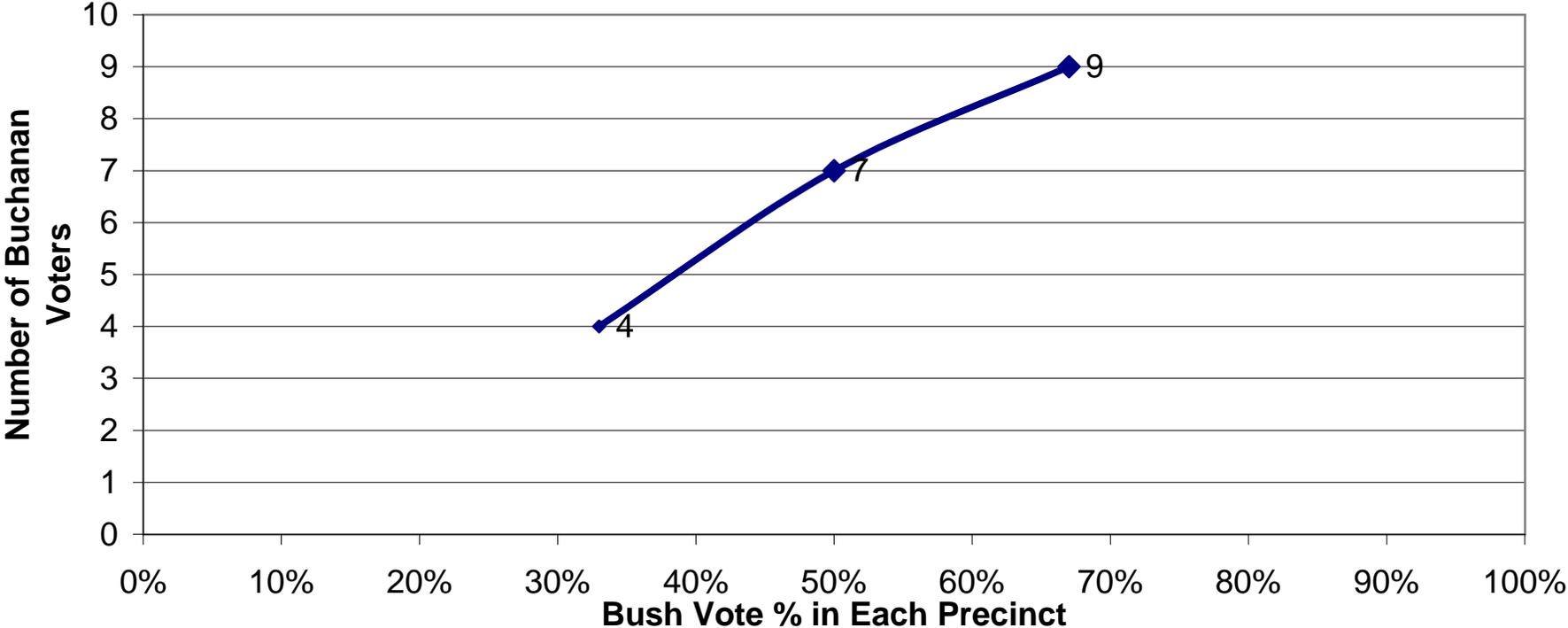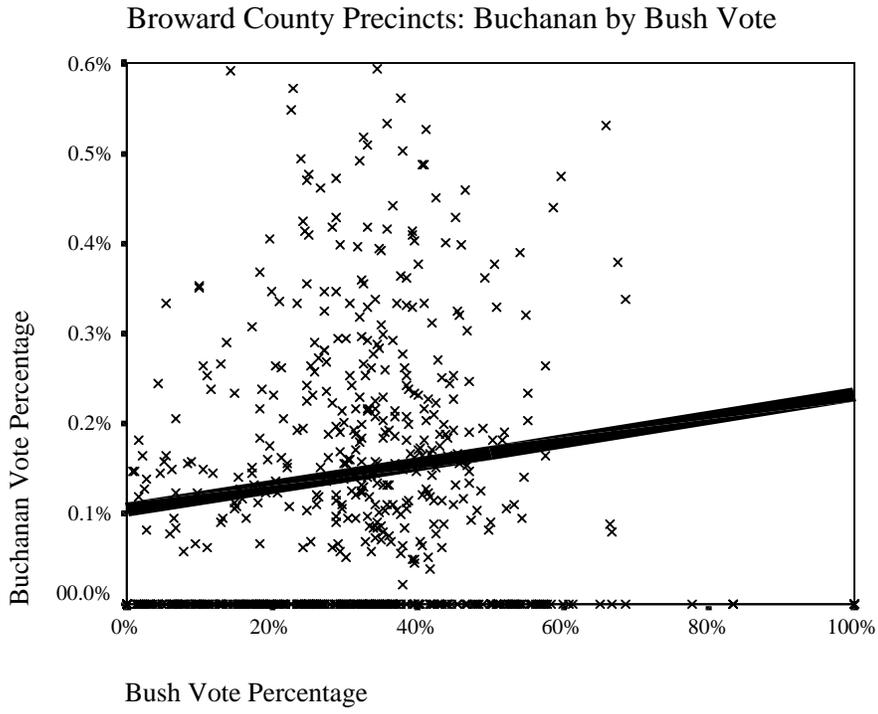
10,000 Voters
4,990 Bush
4,990 Gore
20 Buchanan

Figure 4

Broward County Precincts: Buchanan by Bush Vote

Figure 5



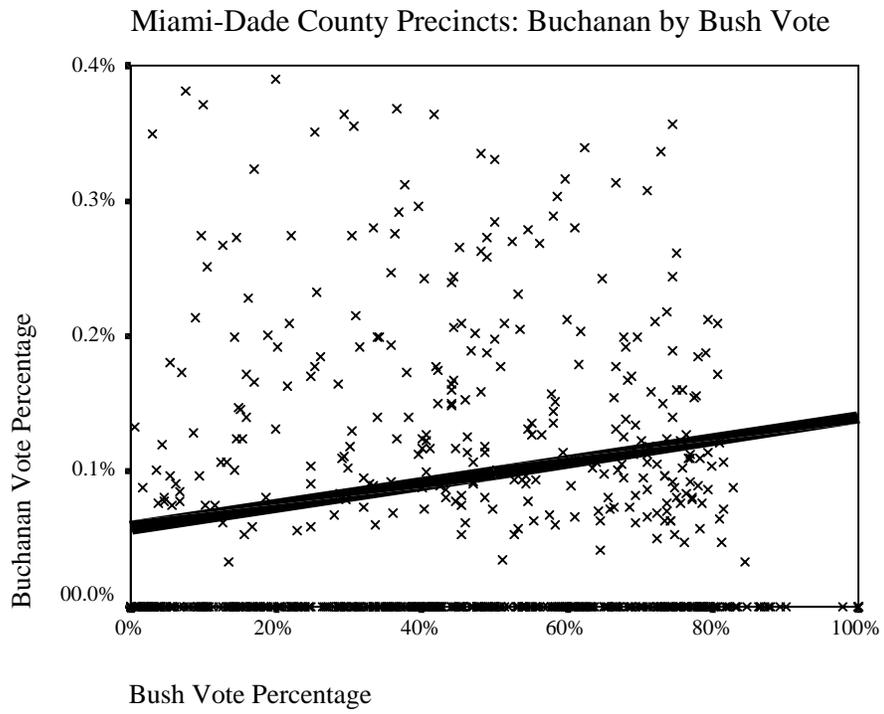Miami-Dade County Precincts: Buchanan by Bush Vote

**Figure 6**
**Bush Supporters Mistakenly Vote for Buchanan in**
**Palm Beach County:  Buchanan Voters by Bush Support in Precincts**
10,000 Voters:  4,930 Bush; 4,990 Gore; 80 Buchanan
(20 True Buchanan Supporters
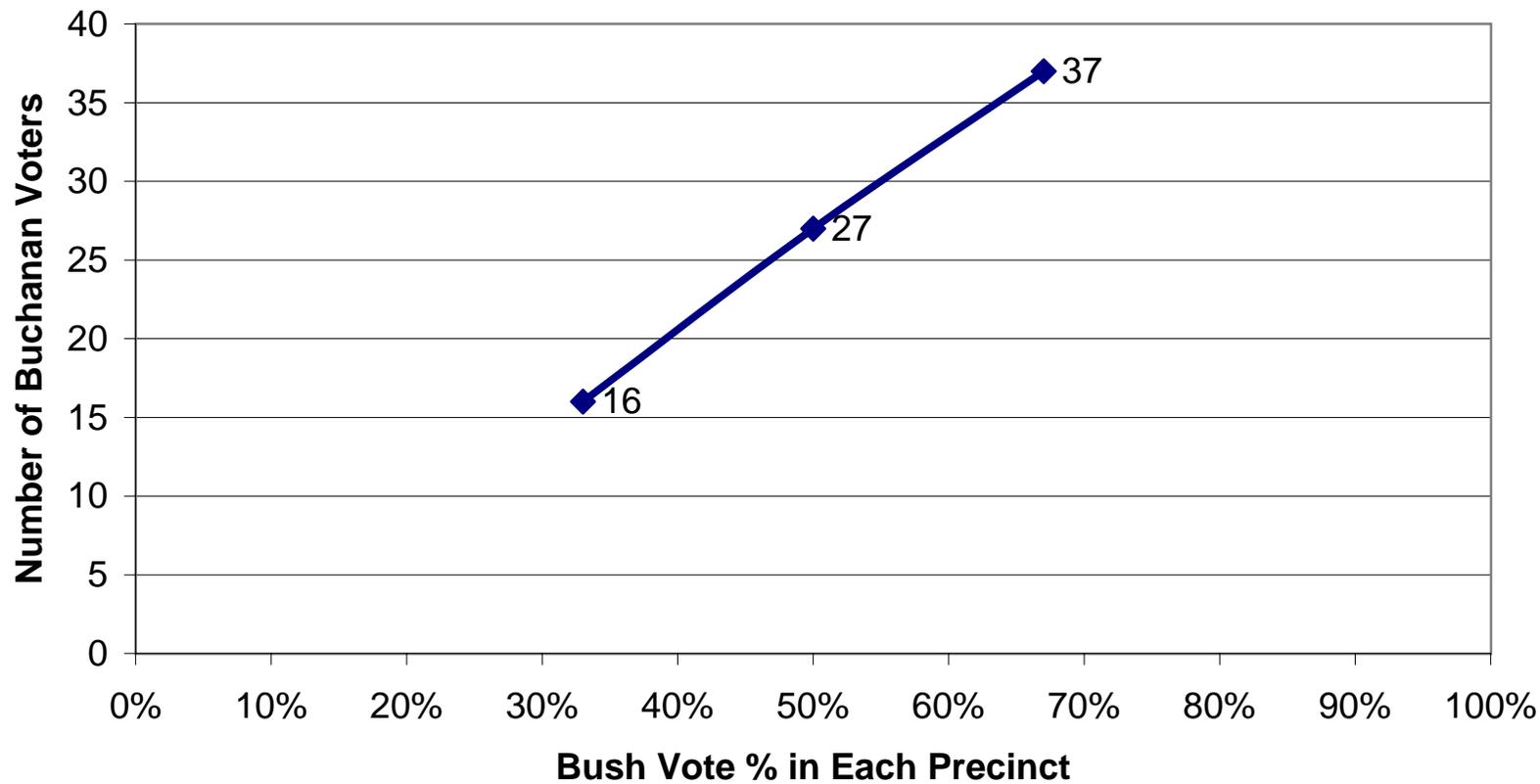60 Bush Supporters who Mistakenly Vote for Buchanan)

**Figure 7**
**Gore Supporters Mistakenly Vote for Buchanan**
**in Palm Beach County: Buchanan Voters by Bush Support in Precincts**
10,000 Voters: 4,990 Bush; 4,930 Gore
80 Buchanan
(20 True Buchanan Supporters
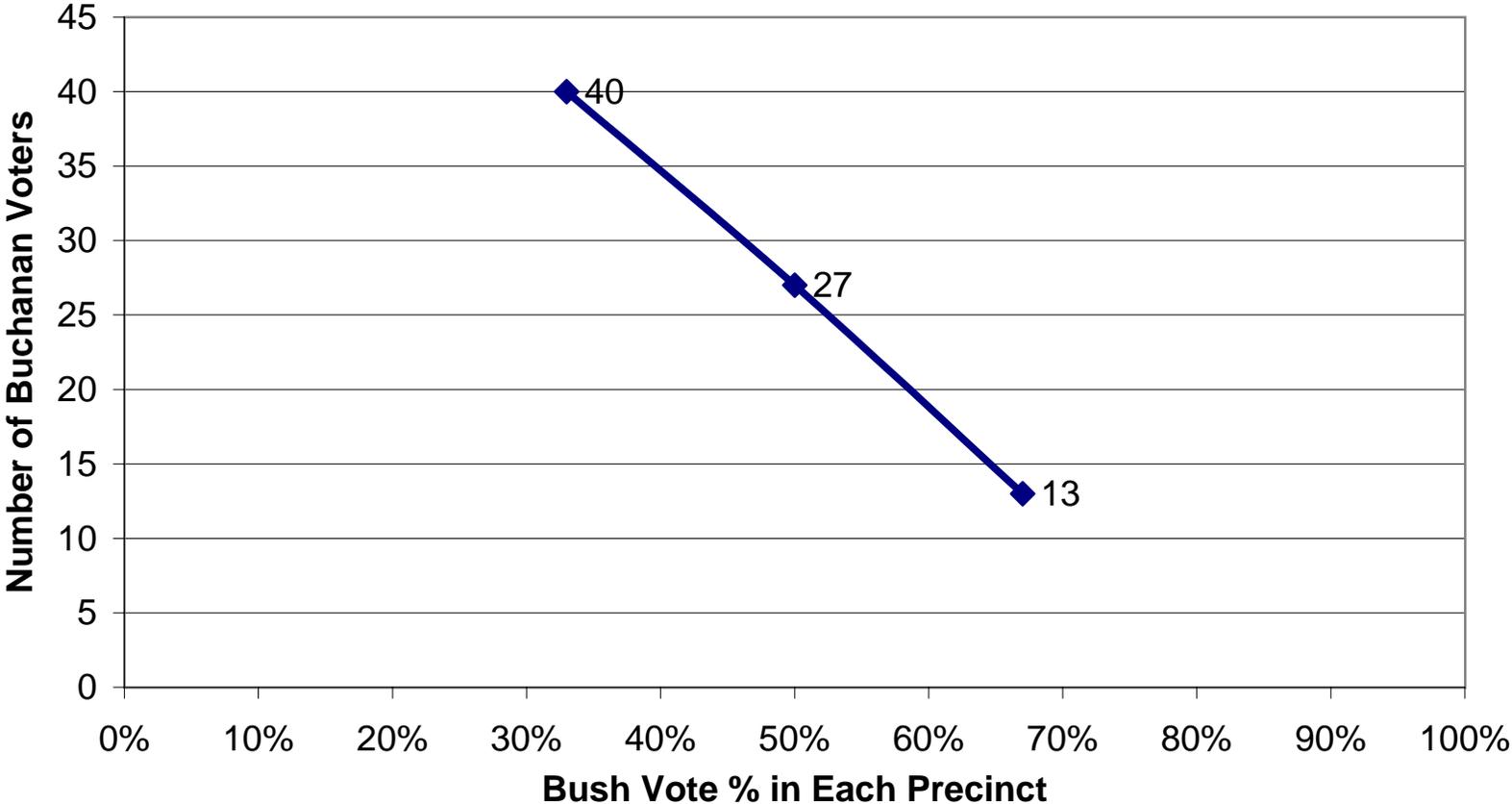60 Gore Supporters who Mistakenly Vote for Buchanan)

Figure 8



Palm Beach County Precincts: Buchanan by Bush Vote