# Declaration of Charles Stewart III on Excess Undervotes Cast in Sarasota County, Florida for the 13th Congressional District Race

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I, Charles Stewart III, hereby attest to the following:

## Introduction

I have been retained as an expert to analyze the excessive number of undervotes that were cast in Sarasota County, Florida in the 2006 general election for the 13th congressional district. I received a PhD in political science at Stanford University in 1985. I am a tenured professor of political science at the Massachusetts Institute of Technology (MIT), where I am also the head of the Department of Political Science. At MIT I have taught classes on American politics, elections, congressional politics, and statistical methods, at both the undergraduate and graduate levels. Since early 2001 I have been a participant in the Caltech/MIT Voting Technology Project (VTP), which is an interdisciplinary project to study various aspects of election reform, particularly the role of voting machines in the administration of elections. (From mid-2002 to mid-2003 I was the MIT director of the project.) As part of my involvement with the VTP, I have written about the performance of voting machines, in particular studying the rates of undervotes and overvotes (sometimes called "the residual vote") as a measure of voting machine performance. This research has appeared in peer reviewed journals and reports issued by the VTP. I have helped to organize and have participated in conferences about setting standards for voting machines, voting machine security, election reform, and the detection of fraud in election administration.

Detailed information about my professional background and scholarly activity may be found in my *curriculum vitae,* which I attach to this declaration.

## Summary of Key Conclusions

1. **Sarasota County undervote rates for the 13th congressional district race were substantially higher than the undervote rates observed in the other counties that comprise the district.** Various comparisons of the undervote rates that were produced in different counties, on different machines, and under different modes of voting (i.e., absentee voting, early voting, and Election Day voting) lead clearly to the conclusion that these differences were caused by the use of the iVotronic electronic voting machine in Sarasota County. The fact that undervote rates in Sarasota County were so much higher than in the rest of the district allows us to rule out the possibility that Sarasota County's undervote rates were caused by factors such as voter revulsion to a negative campaign or dissatisfaction with both candidates.
2. **The undervote rate in the 13th district was anomalous when compared to other countywide races that were contested in Sarasota County.** The undervote rate for *early voting* in the 13th district race was greater than for any other item on the countywide ballot. The undervote rate for *Election Day voting* exceeded that for most of the items on the countywide ballot. In stark contrast, the undervote rate for *absentee voting* was among the lowest for all countywide races.
3. **The number of excess undervotes caused by the use of the iVotronic machines in Sarasota County was between 13,209 and 14,739 votes.** This estimate was based on a study of the patterns among the undervotes cast on other countywide races in Sarasota County.
4. **The size of the excess undervote in Sarasota County, coupled with the amount of support received by Jennings among ballots actually counted in Sarasota County, make**

**it likely that had the electronic machines not malfunctioned, Jennings would have won the election by at least 739 votes, and possibly by as many as 825 votes.** This analysis is based on two methods, one that takes Sarasota County as a single unit, and another that simulates the allocation of the excess undervote to Jennings and Buchanan on a precinct-by-precinct basis.

5. **The level of undervoting experienced using electronic voting machines in Sarasota County for the 13th congressional district greatly exceeds the undervote rates that were estimated to have occurred in other well-established cases of voter confusion.** This suggests a substantial possibility that the exaggerated undervote rates in Sarasota County were not solely due to voter confusion, but also caused by factors related to machine malfunction.

## Background Information

The 13th U.S. House District of Florida (henceforth "the 13th district") consists of all of DeSoto, Hardee, and Sarasota counties, along with portions of Charlotte and Manatee counties. After a manual recount of the race, Vern Buchanan has been declared the winner over Christine Jennings by a margin of 369 votes.[1] The election returns by county are reported in Table 1. Sarasota County, where the undervote anomalies occurred, gave Jennings a 5.6% point margin over Buchanan (52.8% *vs.* 47.2%) among all ballots that were counted.

[1] Stephen Majors, "Manual recount ends, leaving Buchanan leading Jennings," Associated Press State and Local Wire, November 18, 2006, accessed via LexisNexis; Jeremy Wallace, "Buchanan wins district 13 recount; legal action looms," heraltribune.com, November 18, 2006.

Table 1. Election returns in the 13th congressional district, by county.

| County | Jennings | Buchanan |
|---|---|---|
| Charlotte | 4,270 | 4,459 |
| | (48.9%) | (51.1%) |
| DeSoto | 3,056 | 3,467 |
| | (46.8%) | (53.2%) |
| Hardee | 1,684 | 2,628 |
| | (39.1%) | (60.9%) |
| Manatee | 44,365 | 50,053 |
| | (47.0%) | (53.0%) |
| Sarasota | 65,366 | 58,535 |
| | (52.8%) | (47.2%) |
| Total | 118,741 | 119,142 |
| | (49.9%) | (50.1%) |

Source: Florida Secretary of State, Division of Elections, http://election.dos.state.fl.us/elections/resultsarchive/enight.asp, last accessed 11/19/2006, 9:14am.

The counties cast their ballots using a variety of methods. These methods are summarized in Table 2. Sarasota County used the ES&S Model 650 optical scanner to count paper absentee ballots and the ES&S iVotronic direct recording electronic device to record votes cast during early voting and on Election Day.

Table 2. Voting technologies used in the counties comprising the 13th congressional district.

| County | Absentee tabulation equipment | Precinct tabulation equipment | Precinct accessible equipment |
|---|---|---|---|
| Charlotte | ES&S Model 650 | ES&S iVotronic | ES&S iVotronic |
| DeSoto | Diebold AccuVote OS | Diebold AccuVote OS | Diebold AccuVote TSx |
| Hardee | Diebold AccuVote OS | Diebold AccuVote OS | Diebold AccuVote TSx |
| Manatee | Diebold AccuVote OS | Diebold AccuVote OS | Diebold AccuVote TSx |
| Sarasota | ES&S Model 650 | ES&S iVotronic | ES&S iVotronic |

Source: Florida Department of State, Division of Elections, http://election.dos.state.fl.us/votemeth/systems/countysys.asp, last accessed 11/19/2006, 9:47am.

**Definitions:**
Diebold AccuVote OS: optical scanner of paper ballots
Diebold AccuVote TSx: direct recording electronic voting machine
ES&S iVotronic: direct recording electronic voting machine
ES&S Model 650: optical scanner of paper ballots

The closeness of the original tally triggered, first, the provisions of Florida's automatic machine recount law and then, second, the manual recount of overvotes and undervotes. These two recounts together have led to only trivial changes over the original unofficial counts that were released immediately after Election Day.[2] This fact is important for the analysis contained in this declaration because some of the evidence that suggests serious voting machine problems in Sarasota County relies on reviewing detailed election returns, such as election returns that are reported at the precinct level and that separate out voting that happened in three separate phases — early voting, absentee voting, and Election Day voting.

Only Charlotte County has yet released on the Web precinct-level election returns that reflect the two rounds of recounts. However, there is every indication that the detailed unofficial precinct reports that were released immediately after Election Day match almost precisely the

[2] Phil Long, Marc Caputo, and Jack Dolan, "Florida begins 'meaningless ritual' of vote recount," *Miami Herald,* Nov. 16, 2006, via LexisNexis; "FL13: Judge delays audit of undervotes, *The Frontrunner,* via LexisNexis; Nicholas Azzasa, "Jennings picks up six votes, but still trails Buchanan," *Bradenton Herald,* Nov. 17, 2006, via LexisNexis.

detailed information at the precinct level following the two rounds of recounts. Therefore, for the remainder of this declaration, I make use of the details provided in the unofficial returns that were released immediately after Election Day, unless I indicate otherwise.

## Comparisons within the 13th Congressional District

Summary: Sarasota County undervote rates for the 13th district race were substantially higher than the undervote rates cast in the other counties that comprise the district.

The unofficial returns reported a very high undervote rate among ballots cast in Sarasota County for the 13th congressional district. (An “undervote rate” is defined as the percentage of all ballots cast that did not record a vote for either 13th congressional district candidate. It is calculated by dividing the number of undervotes by the total number of votes cast.) Table 3 reports these undervote rates in tabular form. The total undervote rate in the district was 8.2% of the 259,171 ballots that were cast.

Table 3. Undervote rates, by county, in the 13th congressional district.

| | Ballots cast absentee | | Ballots cast early | | Ballots cast on Election Day | | All ballots cast | |
|---|---|---|---|---|---|---|---|---|
| County | Number cast | Percent undervote | Number cast | Percent undervote | Number cast | Percent undervote | Number cast | Percent undervote |
| Charlotte[a] | 1,636 | 3.1% | 3,040 | 2.3% | 4,280 | 2.4% | 8,962[a] | 2.5% |
| DeSoto | | | | | | | 6,665 | 2.1% |
| Hardee | | | | | | | 4,555 | 5.3% |
| Manatee | | | | | | | 96,705 | 2.4% |
| Sarasota | 22,525 | 2.5% | 30,832 | 17.6% | 88,927 | 13.9% | 142,284 | 12.9% |
| Total | | | | | | | 259,171 | 8.2% |
| Total, without Sarasota | | | | | | | 116,887 | 2.5% |

Note: Election returns posted on the Internet from DeSoto, Hardee, and Manatee counties do not break down the returns into the different voting modes (absentee, early voting, and Election Day).

**Sources**
Charlotte County: Charlotte County Supervisor of Elections, Precinct Report, Official Results, http://www.charlottevotes.com/Elections/Reports/Gen06summary.HTM, last accessed 11/19/06, 9:58am.

DeSoto County: Florida Secretary of State, Division of Elections, http://election.dos.state.fl.us/elections/resultsarchive/enight.asp, last accessed 11/19/06, 9:46am.

Hardee County: Hardee County Supervisor of Elections, Election Summary Report, http://www.hardeecountyelections.com/Results/GEMS%20ELECTION%20SUMMARY%20REPORT%20GENERAL%2006.pdf, last accessed 11/19/06, 10:07am.

Manatee County: Manatee County Supervisor of Elections, Election Results, http://www.votemanatee.com/results.asp?dateid=55&ocode=30&office=Rep%20Congress%20Dist%2013, last accessed 11/19/06, 10:09am.

Sarasota County: Sarasota county Supervisor of Elections, Summary Report, Unofficial Results, http://www.srqelections.com/results/gen2006sum.htm, last accessed 11/19/06, 10:12am.

[a]Charlotte County reported 6 provisional ballots in the official results. None of these contained an undervote.

The Sarasota County undervote rate in the 13th district was 12.9%. This was considerably higher than the undervote rates for the four other counties that comprise the district. The undervote rates in the other counties were as follows: Charlotte, 2.5%; DeSoto, 2.1%; Hardee, 5.3%; and Manatee, 2.4%. The combined undervote rate of these four counties (adding all the undervotes together and dividing by the total number of votes cast) was 2.5%.

The difference in the undervote rate between Sarasota County and all the other counties in the district was 10.4%.

The undervote rates *within Sarasota* County for early voting (17.6%) and Election Day voting (13.9%) were substantially higher than for absentee ballots (2.5%). Both early voting and Election Day voting were conducted using the iVotronic touch screen voting system; absentee ballots were cast using optically scanned paper ballots.

Absentee ballots and the early votes were cast during the same approximate time span. The only difference is the voting technology used to record and count these two types of ballots — absentee votes were cast on paper ballots and early votes were cast on electronic voting machines. Therefore, it is reasonable to conclude that the difference in the undervote rates between these two voting modes was caused by the use of different voting machines.

Because the undervote rates in Sarasota County among early votes and Election Day votes are similar, standing in stark contract with the absentee undervote rates, it is also reasonable to conclude that the higher undervote rates among the early votes and the Election Day votes were caused by the use of the iVotronic electronic voting machines.

Another telling contrast contained in Table 3 is between Charlotte County and Sarasota County. Both counties used the same iVotronic machine for early voting and Election Day voting. Within Charlotte County itself, the undervote rates across the three modes of voting ---

absentee, early and Election Day --- were much more consistent with each other, compared to Sarasota County. In Charlotte County the undervote rates were as follows: absentee, 3.1%; early voting, 2.3%; and Election Day voting, 2.4%. The comparable Sarasota county undervote rates were as follows: absentee, 2.5%, early voting, 17.6%, and Election Day voting, 13.9%

Furthermore, the difference in the absentee undervote rates between Charlotte and Sarasota counties is small (0.6% higher in Charlotte) and is statistically insignificant at conventional levels.[3] On the other hand, the undervote rates in Sarasota County were substantially higher than in Charlotte for both early voting (by 15.3% points) and Election Day voting (by 11.5% points). These differences are substantial, both in a substantive sense and a statistical sense.[4]

These differences are so large that there is 1 chance in 100 million that a difference this large in undervote rates among the *early votes* could have happened by chance; there is 1 chance in 5 million that a difference this large in undervote rates among *Election Day votes* could have happened by chance.

Taken as a whole, there can be no doubt that the use of iVotronic machines in Sarasota County caused an excess number of undervotes to appear in that county. The iVotronic machines caused the higher rates in both the early voting setting and on Election Day.

The fact that undervote rates in Sarasota County were so much higher than in the rest of the district allows us to rule out the possibility that Sarasota County's undervote rates were caused by other factors that influenced voter behavior throughout the district --- such as voter

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[3] The standard statistical test to judge the probability that two means are equal is the *t*-test. The *t*-statistic in this case is 0.65, which is associated with a *p*-value of .6513. (The comparison being made here is between the average undervote rates in each precinct in Charlotte County compared to each precinct in Sarasota County.) A common interpretation of this *p*-value is that there is a 65.13% chance that if the absentee undervote rates *were* equal in the two counties, a difference of this magnitude would be produced by pure chance.

[4] The *t*-statistics that evaluate the probability that these differences are due to chance are 6.02, for early voting, and 5.41, for Election Day voting. The *p*-values associated with these statistics are .00000001 and .0000002, respectively.

revulsion to a negative campaign or dissatisfaction with both candidates. Evidence that such alternative explanations were causing high undervote rates would have shown up throughout the district, not just in a single county, and not just in one type of voting machine in one county.

There is no doubt that the use of the iVotronic machines caused the extraordinarily high rate of undervotes in Sarasota County.

## Comparisons within Sarasota County

Summary: The undervote rate in the 13th district was anomalous when compared to other countywide races that were contested in the county.

The overall pattern of election returns *within Sarasota County* provides further compelling evidence that the pattern of excess undervotes was confined to voting on the 13th congressional district race. This is illustrated in Table 4, which reports the undervote rates for all races that appeared on all ballots in the county. (Races that were excluded are those that were only on some ballots within the county, such as the Venice city elections.)

Table 4. Undervote rates in Sarasota County among all county-wide races on the ballot.

| | Undervote rate | | | |
|---|---|---|---|---|
| | Absentee | Early voting | Election Day | Total |
| **Federal and stateside offices** | | | | |
| U.S. senator | 1.0% | 0.8% | 1.3% | 1.1% |
| 13th congressional district | 2.5% | 17.6% | 13.9% | 12.9% |
| Governor & lt. governor | 0.7% | 1.3% | 1.4% | 1.3% |
| Attorney general | 2.6% | 4.4% | 4.8% | 4.4% |
| Chief financial officer | 4.0% | 4.0% | 4.7% | 4.4% |
| Commissioner of Agriculture | 4.9% | 4.9% | 5.4% | 5.2% |
| **Charter Review Board members** | | | | |
| District 1 | 10.2% | 8.1% | 9.2% | 9.1% |
| District 2 | 16.2% | 17.0% | 16.6% | 16.6% |
| District 3 | 11.8% | 8.8% | 9.9% | 10.0% |
| District 4 | 12.1% | 8.8% | 10.1% | 10.1% |
| District 5 | 11.7% | 8.5% | 9.9% | 9.8% |
| **Hospital Board member** | | | | |
| Southern District Seat 1 | 10.6% | 8.9% | 10.1% | 9.9% |
| **Judicial retention votes** | | | | |
| Justice Lewis | 21.3% | 15.3% | 16.4% | 16.9% |
| Justice Pariente | 21.1% | 14.9% | 16.1% | 16.7% |
| Justice Quince | 21.3% | 15.9% | 17.3% | 17.7% |
| Judge Casanueva | 23.2% | 17.0% | 18.6% | 19.0% |
| Judge Davis, Jr. | 23.1% | 16.7% | 18.2% | 18.6% |
| Judge Larose | 23.2% | 17.0% | 18.6% | 18.9% |
| Judge Salcines | 24.2% | 17.5% | 19.1% | 19.6% |
| Judge Stringer, Sr. | 24.6% | 17.3% | 18.9% | 19.5% |
| **Circuit Judge election** | | | | |
| 12th circuit, group 21 | 20.2% | 15.2% | 15.4% | 16.1% |
| **Constitutional amendments** | | | | |
| Amendment 1 | 14.0% | 8.5% | 10.2% | 10.4% |
| Amendment 3 | 7.4% | 5.0% | 5.8% | 5.9% |
| Amendment 4 | 6.8% | 3.9% | 4.5% | 4.7% |
| Amendment 6 | 5.5% | 2.5% | 3.1% | 3.4% |
| Amendment 7 | 7.0% | 3.9% | 4.9% | 5.0% |
| Amendment 8 | 9.8% | 6.1% | 8.0% | 7.9% |
| **County charter amendment** | | | | |
| County charter amendment | 7.7% | 4.8% | 6.4% | 6.2% |

Presented in the order in which they appeared on the ballot.

Source: Sarasota county Supervisor of Elections, Summary Report, Unofficial Results, http://www.srqelections.com/results/gen2006sum.htm, last accessed 11/19/06, 10:20am.

The undervote rate for the 13th congressional district in Sarasota County is vastly out of proportion to the undervote rates for the other prominent federal and state offices that were at the "top of the ballot" in 2006. The undervote rate for the 13th congressional district was 12.9%, compared to the following undervote rates for the other statewide offices: U.S. senator, 1.1%; governor, 1.3%; attorney general, 4.4%; chief financial office, 4.4%; and commissioner of agriculture, 5.2%.

Examining the undervote rates of the three different modes of voting --- absentee, early, and Election Day --- we see that the anomalous number of undervotes in the 13th congressional district only appears in voting modes that used the iVotronic machines. The absentee undervote rate for the 13th congressional district, 2.5%, is entirely consistent with the absentee undervote rates for all of these other prominent races. These other undervote rates were as follows: U.S. senator, 1.0%; governor, 0.7%; attorney general, 2.6%; chief financial officer, 4.0%; and commissioner of agriculture, 4.9%.

On the other hand, the early voting undervote rate for the 13th congressional district was 17.6%. This contrasts significantly with the race for U.S. senator (0.8%), governor (1.3%), attorney general (4.4%), chief financial officer (4.0%), and commissioner of agriculture (4.9%). A very similar pattern emerges when we compare the 13th congressional district to these other races on Election Day.

Only one other race on the whole countywide ballot appears, at first look, to be as anomalous as the 13th district congressional race. This is the Charter Review Board (CRB) District Seat 2, which had an overall undervote rate that was 6.5% points higher than CRB Seat 4, which had the second-highest undervote rate among Charter Review Board seats. A review of the sample countywide ballot reveals that Seat 2 was the only one without two major-party candidates running.[5] Seats 1, 3, 4, and 5 were contested by two candidates, a Republican and Democrat. Seat 2 was contested by a Republican and a nonpartisan candidate. Because political party is a strong voting cue for many voters who cast ballots in low-profile races, it is safe to assume that the undervote rate for the CRB Seat 2 was due to the lack of two major-party candidates, not the electronic voting machines. This assumption is confirmed by observing that the undervote rate among *paper absentee ballots* for CRB Seat 2 (16.2%) was also much higher than the other CRB seats. In other words, the undervote rate for the CRB Seat 2 was high regardless of the mode of voting, which is quite different from the 13th congressional district race.

The overall pattern of the undervote rates presented in Table 4 underscores just how anomalous the pattern of undervotes in the 13th district race was as follow:

1. The undervote rate for *early voting* in the 13th district race was greater than for *any other item* on the countywide ballot.
2. The undervote rate on *Election Day* for the 13th district race exceeded that of all the Charter Review Board seats that had two major-party candidates, exceeded the undervote rates for all the state constitutional amendments and the county charter amendment, and was nearly as high as the undervote rates of the judicial retentions.
3. In stark contract, the undervote rate among *absentee ballots* for the 13th district race was among the *lowest* of all races on the countywide ballot. Only the undervote rates for U.S. senator and governor were lower; the absentee undervote rate for *every other countywide race* was higher.

[5] Sarasota County Supervisor of Elections, "Official Sample Ballot General Election, November 7, 2006." http://www.srqelections.com/SampleBallots/sample%20ballot%20general%202006.pdf, last accessed 11/19/06, 3:34pm.

**Calculating the Number of Excess Undervotes in Sarasota County**

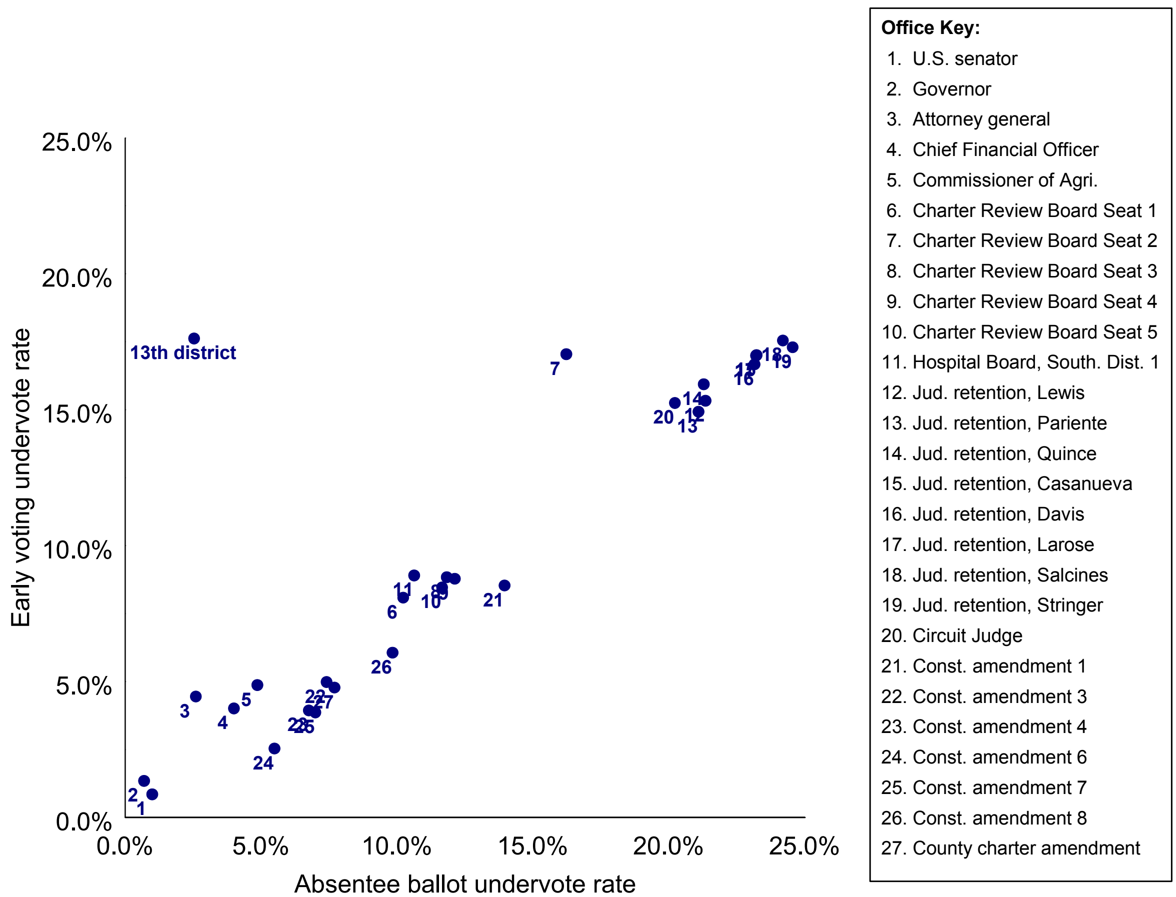
Summary: Taking into account the undervote rate among the absentee ballots cast in the 13th district, we can estimate that the number of *excess undervotes* that were created in the 13th congressional district race because of problems associated with the use of the electronic voting machines ranged between 13,209 and 14,739 votes.

Careful study of the undervote rates for all countywide races reported in Table 4 reveals that the range of undervote rates across offices can be quite high. For instance, the overall undervote rate varied in Sarasota County from 1.1% (U.S. senator) to 19.6% (retaining Judge Salcines). There is similar variability when we focus in on the different types of voting. Undervote rates among absentee ballots ranged from 0.7% (governor) to 24.6% (retaining Judge Stringer); among early votes they ranged from 0.8% (U.S senator) to 17.6% (13th congressional district); and on Election Day they ranged from 1.3% (U.S. senator) to 19.1% (retaining Judge Salcines).

As a general matter, offices that produce a low undervote rate among absentee ballots will also produce low undervote rates in early voting and Election Day voting. The converse is usually also true --- offices that produce a high undervote rate in one form of voting (absentee, early, or Election Day) will tend to produce high undervote rates in all the other forms of voting. Using a statistical term, we can say that the undervote rates cast among absentee ballots are usually highly *correlated* with the undervote rates cast among early votes and Election Day votes.

In Figure 1 I have illustrated the high degree of correlation in the undervote rates among different modes of voting in Sarasota by graphing the data that appear in Table 4. The horizontal axis measures the undervote rate among absentee ballots for all the countywide races. The vertical axis measures the undervote rate during early voting among all countywide races. The data points represent all of the countywide races that are reported in Table 4. The data points are labeled with a number that corresponds with the key to the right of the graph. The data point for the 13th congressional district is labeled directly.

Figure 1. Comparison of undervote rates among absentee ballots and early voting, Sarasota County, among all races on the countywide ballot.




The data points in the Figure 1 graph line up almost perfectly along a straight line. There are only two exceptions: (1) the 13th congressional district race and (2) the Charter Review Board Seat 2. With the exception of these two races, it is possible to predict with a high degree of accuracy the undervote rate for a countywide race *in the early voting* if one knows the undervote rate among *the absentee ballots*. In other words, there is a high degree of correlation between these two undervote rates, when viewed on a race-by-race basis.

The most common method used to make this sort of prediction is a statistical technique called linear regression. Using linear regression, we can draw a unique line through all of the data points in Figure 1 that "best" fits through all the data.[6] I have reported the results of such a regression procedure, for the Figure 1 data, in Table 5. Because the 13th congressional district race and the CRB Seat 2 race are known to be anomalous, it is possible to conduct this procedure by excluding these two races. I have also reported the results after excluding these two races, in the second column of Table 5.

[6] The criterion for determining what constitutes the "best fit" of a line through a series of data points is a basic topic in statistics textbooks used in the social and natural science. The criterion is to find the line that minimizes the sum of the squared distance between the estimated line and all of the data points.

Table 5. Regression predicting the early vote undervote rate in Sarasota County, using the absentee ballot undervote rate. (Data are displayed in Figure 1; standard errors are in parentheses)

| Variable | Including all countywide races | Excluding 13th district and CRB Seat 2 |
|---|---|---|
| Absentee ballot undervote rate | 0.627<br>(0.077)<br>*t*=8.11<br>*p*=1.37x10$^{-8}$ | 0.706<br>(0.024)<br>*t*=29.65<br>*p*=2.02x10$^{-20}$ |
| Intercept | 0.020<br>(0.011)<br>*t*=1.77<br>*p*=.089 | 0.0028<br>(0.0035)<br>*t*=0.80<br>*p*=.431 |
| N | 28 | 26 |
| R2 | .72 | .97 |
| Standard error of the regression | .032 | 0.0095 |

The coefficients reported in Table 5 tell us how to predict the undervote rate for early voting in a race if we know the undervote rate among absentee ballots in that race. Using all of the data, the predicted undervote rate for early voting is equal to

$$0.020 + 0.627 \times \text{Absentee undervote rate} \qquad \text{(Equation 1)}$$

The numbers in parentheses in Table 5, which are called standard errors, measure how precisely we have estimated the coefficients. The ratio of the coefficient to the standard error produces a test statistic called the *t-statistic*, which can be used to quantify how likely it is that we would have gotten this coefficient if, *in fact,* there was *no* relationship between the undervote rates cast among the absentee ballots and the early vote. Sometimes this is interpreted as quantifying how likely it is that the observed relationship happened due to chance alone.

Using all the data together, the chance that there is really no relationship between these two undervote measures is less than 1-in-100 million.

The $R^2$ in Table 5 statistic is a summary measure of the degree to which the observed data actually array themselves along a straight line. A perfect line would produce an $R^2$ value of exactly 1. Perfectly random data would produce an $R^2$ value of exactly 0. The $R^2$ value of .72 in the first column of Table 5, which describes the degree to which all of the data in Figure 1 fit along a straight line, is generally regarded as a "high" correlation in the social sciences.

The regression described in the second column of Table 5 excludes the two anomalous cases in the county, estimating this relationship using races that are more typical. Because this analysis excludes two clear outlines, all of the measures of "goodness of fit," such as $R^2$, are even higher. The *t*-statistic for the slope coefficient is higher in Column 2 (29.3 *vs.*7.88) and the $R^2$ is approaching 1 (.97). Excluding the two atypical cases, the predicted undervote rate for early voting is equal to

$$0.0028 + 0.706 \times \text{Absentee undervote rate} \qquad \text{(Equation 2)}$$

We can use *either* of these two prediction lines to quantify the degree to which the undervotes in the early voting were excessive. The procedure can be described as follows:

- Using either Equation 1 or Equation 2, substitute in the *known* absentee undervote rate for the 13th congressional district, and calculate the predicted undervote rate for early voting.
- Subtract this predicted undervote rate for early voting from the actual, observed undervote rate for early voting. This is the estimate of the *excess undervote rate* for early voting. (In statistics, this value is generally known as the *residual.*)

Using Equation 1, the expected undervote rate for the early voting was approximately 3.6%[7] and the estimated *excess undervote rate* for early voting was 14.0%.[8] Using Equation 2, the expected undervote rate for early voting was approximately 2.1%[9] and the estimated excess undervote rate for early voting was 15.5%.[10]

Taking into account the undervote rate among the absentee ballots, the excess undervote rate in the 13th district among the early votes was in the range of between 14.0% and 15.5%.

There were a total of 30,832 early votes cast in Sarasota County. If we multiply either of these two estimates of the excess undervote rate by the total number of early votes, we can calculate the *total number of excess undervotes among the early votes* in Sarasota County. Those numbers are 4,316 if we use the 14.0% figure and 4,779 if we use the 15.5% figure.

In other words, *the number of votes lost during early voting because of problems associated with the electronic voting machines was between 4,316 and 4,779.*

The same procedure can be used to predict the number of excess undervotes on *Election Day*, based on the undervote rate among the absentee ballots. The procedure is identical to the one I have just described, so I will not repeat the details again of how the estimates are calculated.

Figure 2 shows the data. The horizontal axis records the undervote rate among absentee ballots for all countywide races in Sarasota County; the vertical axis records the undervote rate on Election Day in Sarasota County. The key to the graph is the same as in Figure 1.

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[7] The calculation is as follows: Substituting the observed undervote rate among absentee ballots in the 13th congressional district into Equation 1, we have

$$0.020 + 0.627 \times .025 = 0.0357, \text{ or } 3.57\%$$

[8] This is calculated as follows: The observed undervote rate for early voting in the 13th congressional district was 17.6%. 17.6% - 3.6% = 14.0%.

[9] The calculation is as follows: Substituting the observed undervote rate among absentee ballots in the 13th congressional district into Equation 2, we have

$$0.0028 + 0.706 \times .025 = 0.0205, \text{ or } 2.05\%$$

[10] This is calculated as follows: The observed undervote rate for early voting in the 13th congressional district was 17.6%. 17.6% - 2.1% = 15.5%

Figure 2. Comparison of undervote rates among absentee ballots and Election Day voting, Sarasota County, among all races on the countywide ballot.

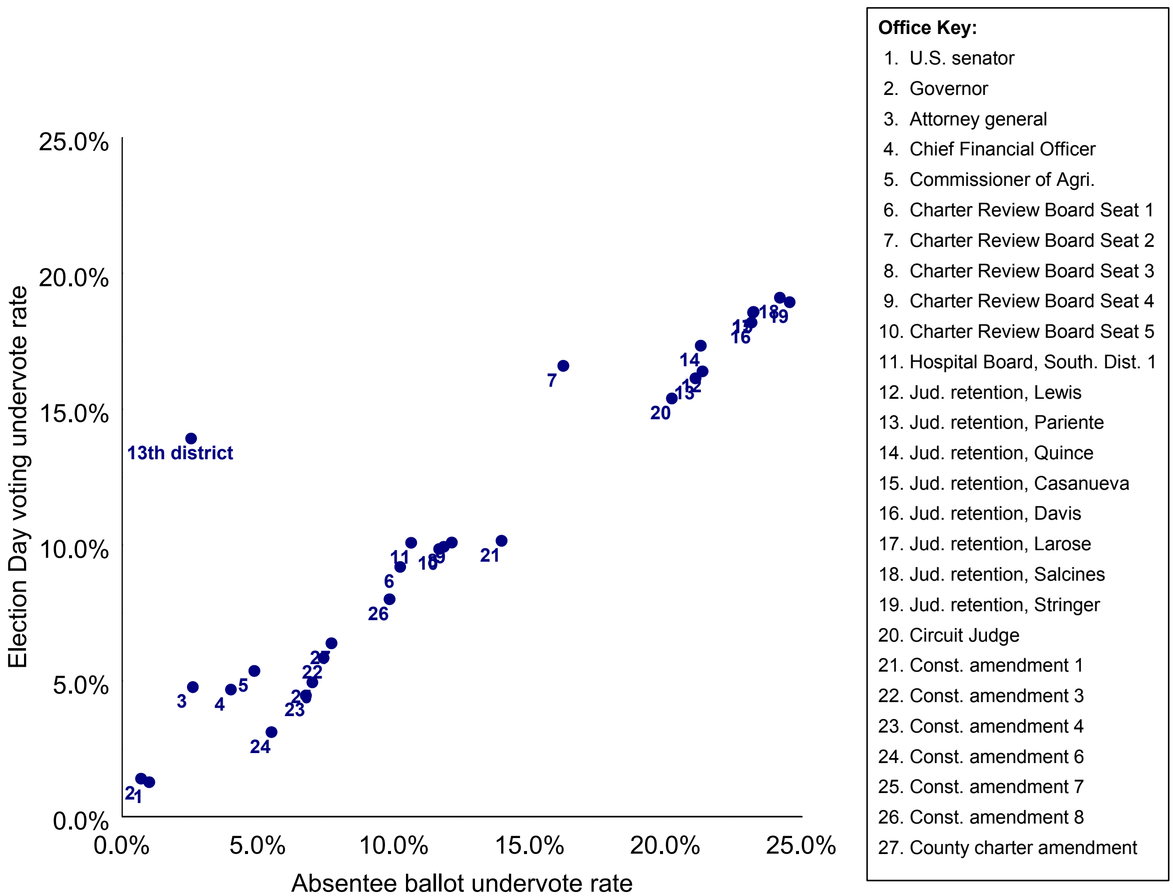


Table 6 reports the results of regressions to predict the undervote rate on Election Day, using the undervote rate among the absentee ballots. The first column reports the results using all the countywide races; the second column reports the results excluding the two anomalous races (the 13th congressional district and CRB Seat 2).

Table 6. Regression predicting the Election Day undervote rate in Sarasota County, using the absentee ballot undervote rate. (Data are displayed in Figure 2; standard errors are in parentheses)

| Variable | Including all countywide races | Excluding 13th district and CRB seat 2 |
|---|---|---|
| Absentee ballot undervote rate | 0.688<br>(0.057)<br>*t*=12.15<br>*p*=5.50x10$^{-12}$ | 0.744<br>(0.021)<br>*t*=34.68<br>*p*=5.12x10$^{-22}$ |
| Intercept | 0.021<br>(0.0083)<br>*t*=2.52<br>*p*<.018 | 0.0086<br>(0.0032)<br>*t=2.68*<br>*p*<.013 |
| N | 28 | 26 |
| R2 | .85 | .98 |
| Standard error of the regression | .0234 | .0086 |

Column 1 of Table 6 provides the coefficients we need to calculate our prediction of the percentage of undervotes on Election Day, as a function of the absentee vote undervote rate. These coefficients produce the following equation for the predicted value of the Election Day undervote rate:

$$0.021 + 0.688 \times \text{Absentee undervote rate} \qquad \text{(Equation 3)}$$

Equation 3 yields a prediction for the undervote rate in the 13th congressional district of 3.9%.[11]

Column 2 of Table 6 provides the coefficients we need to calculate our prediction of the percentage of undervotes on Election Day, as a function of the absentee vote undervote rate, this

[11] The calculation is as follows: Substituting the observed undervote rate among absentee ballots in the 13th congressional district into Equation 1, we have

$$0.0021 + 0.688 \times .025 = 0.0392, \text{ or } 3.92\%$$

time excluding the two anomalous races. These coefficients produce the following equation for the predicted value of the Election Day undervote rate:

$$0.0086 + 0.744 \times \text{Absentee undervote rate} \qquad \text{(Equation 4)}$$

Equation 4 yields a prediction for the undervote rate in the 13th congressional district of 2.7%.[12]

Using Equation 3, the expected undervote rate for Election Day is approximately 3.9% and the estimated *excess undervote rate* for early voting is 10.0%.[13] Using Equation 4, the expected undervote rate for Election Day was approximately 2.7% and the estimated excess undervote rate for early voting was 11.2%.[14]

Taking into account the undervote rate among the absentee ballots, the excess undervote rate in the 13th district among on Election Day was in the range of between 10.0% and 11.2%.

There were a total of 88,927 Election Day votes cast in Sarasota County. If we multiply either of these two estimates of the excess undervote rate on Election Day by the total number of Election Day votes, we can calculate the *total number of excess undervotes among the Election Day votes* in Sarasota County. Those numbers are 8,893 if we use the 10.0% figure and 9,960 if we use the 11.2% figure.

In other words, *the number of votes lost on Election Day because of problems associated with the electronic voting machines was between 8,893 and 9,960.*

Combining the two sets of estimations together ---- the estimation of the excess undervote rate during early voting and on Election Day --- *I estimate that the excess undervotes*

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[12] The calculation is as follows: Substituting the observed undervote rate among absentee ballots in the 13th congressional district into Equation 1, we have

$$0.0086 + 0.744 \times .025 = 0.0272, \text{ or } 2.72\%$$

[13] This is calculated as follows: The observed undervote rate for Election Day in the 13th congressional district was 13.9%. 13.9% - 3.9% = 10.0%.

[14] This is calculated as follows: The observed undervote rate for Election Day in the 13th congressional district was 13.9%. 13.9% - 2.7% = 11.2%

*that were cast in the 13th congressional district race because of problems associated with the use of the electronic voting machines ranged between 13,209 and 14,739 votes.* In other words, between 73% and 82% of the 18,000 undervotes cast in Sarasota County in the 13th congressional district race were cast by voters who intended to vote in the congressional race.

A large number of votes were lost in Sarasota County because of problems associated with electronic voting machines used in the early voting phase and on Election Day. That number may be as high as 14,739 votes. We can rule out alternative explanations as major causes of these extraordinary numbers through the comparisons we can make --- comparisons *between* Sarasota County and other counties in the congressional district *plus* comparisons we can make *within* Sarasota County.

- No other county had the same undervote levels as Sarasota County, which rules out the counter-argument that the undervotes were due to district-wide disgust with the tenor of the race.
- Votes cast at the same time using different methods --- i.e., absentee voting using paper *vs.* early voting using electronic machines --- yielded substantially different undervote rates. This, too, rules out the alternative explanation that the undervotes were caused by voter disgust.
- Because early voting and Election Day voting happened at different times, using identical voting equipment, and because these electronic forms of voting produced extraordinarily high undervote rates compared to paper ballot absentee, there is strong evidence that the excess undervote problems were caused by the use of these electronic machines in Sarasota County.

**Calculating the Number of Votes Lost to Jennings and Buchanan Due to Problems with Electronic Voting Machines**

Summary: The size of the excess undervote in Sarasota County, coupled with the size of support received by Jennings among ballots counted in Sarasota County, makes it likely that had the electronic machines not malfunctioned, Jennings would have won the election.

The following question naturally arises: if the excessive number of undervotes *had not occurred* in Sarasota County, how would those votes have been divided between the two candidates in the 13th district congressional race? Systematic methods can be used answer this question. Some are simple, others are more involved. They all produce the same results: Had the excessive number of undervotes not occurred in Sarasota County, Jennings would have won the election. Her margin of victory would have ranged between 157 and 746 votes.

This section reviews two methods we can use to address the consequences of the excessive undervotes. The first method treats Sarasota County as a single unit. The second method uses the information that was reported at the precinct level.

*Method 1: Taking Sarasota County as a single unit*

One way to approach this question directly is to treat the voters who unintentionally undervoted because of voting machine-related errors as a random sample of everyone who voted in the 2006 general election in Sarasota County. If we do that, then the best estimate of how these voters would have divided their votes between Jennings and Buchanan, in the absence of other information about the characteristics of the voters who left the 13th district race blank, is the actual observed vote share of the candidates in Sarasota County. This was 52.8% for Jennings and 47.2% for Buchanan.

In the previous section of this report I estimated that the *excess undervotes* in Sarasota County for the 13th congressional district was between 13,209 and 14,739 votes. If we allocate these votes to Jennings and Buchanan in proportion to the overall Sarasota County vote, then we can estimate the following:

1. If the excess number of undervotes was 13,209 and if these votes had been divided just as the counted vote in Sarasota County had been divided, then Jennings would have received 6,974 additional votes, Buchanan would have received 6,235 votes, and Jennings would have gained a net of 739 votes. *This exceeds the official margin given to Buchanan (369) by 370 votes.*
2. If the excess number of undervotes was 14,739 and if these votes had been divided just as the counted vote in Sarasota County had been divided, then Jennings would have received 7,782 additional votes, Buchanan would have received 6,957 votes, and Jennings would have gained a net of 825 votes. *This exceeds the official margin given to Buchanan (369) by 456 votes.*

These are what are known as "point estimates." It is possible to use basic ideas from statistical sampling to see how firm these estimates are, in the face of known sampling uncertainty.

It is well known that whenever we draw a random sample from a population, the characteristics of the *sample* will always vary somewhat from that of the *population*. The size of this variation is very well understood in statistics and is used to construct measures such as the "margin of error" that is commonly reported in public opinion surveys.

Take, as an example, the simple case of a very large urn filled with exactly 50% red balls and 50% blue balls. In this example, let us draw out 100 balls, completely at random. The first time we draw out 100 balls, we are unlikely to get exactly 50 red balls and 50 blue balls --- for instance, we may get 53 red balls and 47 blue balls. The next time we might get 45 red balls and 55 blue balls.

We know that if we repeat this exercise a large number of times, the *average* number of red balls will be 50 and the *average* number of blue balls will be 50. But we also know that most samples will yield some other mix of red and blue balls. In theory, at least, that mix might cover some samples that are only red balls, only blue balls, and every other mix in between.

We also know that the distribution of the number of red and blue balls will follow a very predictable pattern. The variability of the samples that emerge can be described by a measure called the *standard error,* which tells us how wide or narrow the distribution will be. Whenever we are analyzing a proportion (such as the red ball/blue ball example, or election returns), the standard error of the distribution can be calculated as follows:

$$\text{standard error} = \sqrt{\frac{p(1-p)}{n}},$$

where $p$ is the proportion (50% in the red ball/blue ball example) and $n$ is the size of the sample (100 in the example). Using this formula, we can calculate in the red ball/blue ball example that the standard error is 5.0%. Using this standard error, we can then consult a normal distribution table to describe how often we will get mixes of balls within a certain range. For instance, in this example, we know after consulting the normal distribution table that 95% of the time we should expect to draw a sample of balls that has at least 40 and no fewer than 60 red balls; we should expect 99% of all samples to have at least 35 and no fewer than 65 red balls.[15]

Returning to the 13th congressional district race: if we were to take a random sample of general election voters in Sarasota County of size 14,000 --- roughly half-way in the middle of the estimate of how many excess undervotes there were --- the standard error of that sample would be:

$$\sqrt{\frac{0.528(1-0.528)}{14{,}000}} = 0.0042\,,$$

or 0.42%. Consulting a normal distribution table, we can calculate that 95% of all random samples of 2006 general election voters in Sarasota County that contained 14,000 voters would produce vote rates for Jennings of between 52.0% and 53.6% of the vote.[16]

We are now in a position to estimate the number of votes that would have been added to the Jennings and Buchanan tallies in Sarasota County had there not been an excess of undervotes among the electronic voting machines. For this calculation, we need to specify the *size of the excess undervote* we will use and the *fraction of support for Jennings* that would be revealed among these voters.

For starters, I begin with mid-point estimates of these two numbers. That is, I assume that the size of the excess undervote was 13,884 (half-way between 13,148 and 14,619) and that the fraction of support for Jennings was 52.8% (i.e., the actual general election results for Sarasota County).

[15] This calculation is based on the fact that 95% of the normal curve lies within ±2 standard errors; 99% of the normal curve lies within ±3 standard errors.

[16] Recalling that 95% of all samples will fall within ±2 standard errors, then the lower bound is calculated as follows: $0.528 - 2 \times 0.004 = 0.520$, or 52.0%. The upper bound is calculated as follows: $0.528 + 2 \times 0.004 = 0.536$, or 53.6%.

- The number of votes received by Jennings among the excess undervotes would be 0.528 $\times$ 13,884 = 7,331.
- The number of votes received by Buchanan would be 13,884 – 7,331 = 6,552.
- The net gain in votes for Jennings would be 7,331 – 6,552 = 779.

*Under this middle-of-the-road scenario, Jennings would win the election by 410 votes,* that is, 779 - 369.

I have done a series of calculations for nine different scenarios and reported the results in Table 7. The scenarios vary the fraction of the assumed Jennings vote from a low of 52.0% to a high of 53.6% and vary the excess undervotes from 13,148 to 14,619.[17]

Table 7. Different scenarios estimating the Jennings/Buchanan vote among the excess undervotes in Sarasota County.

| | Jennings share of the vote | | |
|---|---|---|---|
| | 52.0% | 52.8% | 53.6% |
| Estimated number of undervotes | 13,148 | 13,148 | 13,148 |
| Jennings votes | 6,837 | 6,942 | 7,047 |
| Buchanan votes | 6,311 | 6,206 | 6,101 |
| Net gain for Jennings | 526 | 736 | 947 |
| Victory margin for Jennings | 157 | 367 | 578 |
| | | | |
| Estimated number of undervotes | 13,883 | 13,883 | 13,883 |
| Jennings votes | 7,220 | 7,331 | 7,442 |
| Buchanan votes | 6,664 | 6,553 | 6,442 |
| Net gain for Jennings | 555 | 778 | 1,000 |
| Victory margin for Jennings | 186 | 409 | 631 |
| | | | |
| Estimated number of undervotes | 14,619 | 14,619 | 14,619 |
| Jennings votes | 7,602 | 7,719 | 7,836 |
| Buchanan votes | 7,017 | 6,900 | 6,783 |
| Net gain for Jennings | 585 | 819 | 1,053 |
| Victory margin for Jennings | 216 | 450 | 684 |

[17] The fraction of the Jennings vote is varied to range between a minimum that is 2 standard errors below the actual Jennings vote to a maximum that is 2 standard errors above the actual Jennings vote. The excess undervotes are varied between the lower and upper bound estimates previously developed for the number of excess undervotes in the county.

Under the least favorable scenario to the Jennings position, she still comes out ahead in the race by 157 votes. In the most favorable scenario, she wins by 684 votes. The middle-of-the-road scenario estimates a 409-vote Jennings victory.

Therefore, if we treat the voters caught up in the excess undervote as a random sample of all Sarasota County general election voters, Christine Jennings would have picked up a sufficient number of additional votes *in all scenarios* to change the outcome of the election.

*Method 2: Conducting simulations using precinct-level voting returns*

We can reproduce this analysis by moving this set of calculations down to a precinct-by-precinct basis. That is, it is possible to use the precinct election returns to calculate the excess undervote *in each precinct* and then to treat the voters caught up in the excess undervote as a random sample *of the precinct.* We can then multiply the estimated number of excess undervotes *in the precinct* by the vote for Jennings *in the precinct* to calculate the additional votes that she would have received, had the excess undervote not occurred. We can then subtract this number from the total excess undervote in the precinct to calculate the additional votes that Buchanan would have received in the precinct.

Subtracting the additional Buchanan vote from the additional Jennings vote produces an estimate of the net change in the Jennings margin *in that precinct.* Because some precincts gave a majority of their votes to Jennings while others gave a majority of their votes to Buchanan, it is possible that some precincts will show a net shift of support in favor of Jennings while others will shift in favor of Buchanan. To calculate the net shift in support for Jennings in the entire county, we simply add together all the corresponding precinct shifts.

To further add realism to this simulation, we can separate out votes cast early from those cast on Election Day and treat the undervotes as coming from a random sample of all voters *in that precinct* who cast a ballot using the same mode of voting --- early or Election Day. It is reasonable to treat early voting and Election Day voting as separate populations since the level of support garnered by Jennings in each of these voting modes was different --- Jennings received 57.1% of the Sarasota County early vote and 52.2% of the Election Day vote.

Therefore, for each precinct in Sarasota County, I must estimate the following:

- the number of excess undervotes among the early votes;
- the number of excess undervotes among the Election Day votes;
- the percentage of the early voters who supported Jennings; and
- the percentage of the Election Day voters who supported Jennings.

I used three different methods to calculate the number of excess undervotes among the early vote and Election Day vote:

1. Assume that if the excess undervote had not occurred, then the undervote rate for early voting would have been 82% of the absentee undervote rate, and the undervote rate of Election Day voting would have been 92% of the absentee undervote rate. These two figures, 82% and 92%, were chosen because they are the actual average relationship (among all countywide offices) between the early vote undervote rate and the absentee undervote rate, on the one hand, and the Election Day undervote rate and the absentee undervote rate, on the other.
2. Assume that the correct undervote rate for early and Election Day voting is *equal to* that of the absentee ballot undervote rate. This is a more conservative assumption than Assumption # 1, with respect to the Jennings position.

3. Assume that the correct undervote rate for early and Election Day voting is equal to *twice* that of the absentee ballot undervote rate. This assumption is even more conservative than the previous two assumptions.

For the estimated fraction of support for Jennings among early voters and Election Day voters, I used the actual observed vote for Jennings among voters who cast their ballots early and on Election Day, respectively. As discussed above, the observed vote for the candidates is the best estimate of the underlying support for Jennings and Buchanan among voters who used a particular mode of voting within a precinct, absent any other information about the characteristics of individuals who undervoted.

Here is an example to illustrate how this simulation was implemented. In Precinct 1, 64.4% of the early vote went to Jennings; 63.9% of the Election Day vote went to Jennings. There were 361 early votes in Precinct 1. There were 72 undervotes among the early votes. The percentage of undervotes among the absentee ballots was 3.5%. Under the assumption that the correct undervote rate for early voting was 82% the absentee ballot rate, the undervote rate for early voting is set to 2.9% (0.82 × 3.5%).

Therefore:

- The predicted number of undervotes among the early votes is estimated to be 2.9% × 361 = 10.
- The excess number of undervotes among the early votes is estimated to be 72 – 10 = 62.
- The number of votes recovered for Jennings among the early vote undervotes is 62 × 0.644 = 40.
- The number of votes recovered for Buchanan among the early vote undervotes is 62 – 40 = 22.

- The net gain in votes for Jennings among the early voters in this precinct is 40 – 22 = 18.

A similar set of calculations can be performed to estimate the net gain in votes for Jennings among the *Election Day* votes. There were 383 Election Day votes in Precinct 1. There were 34 actual undervotes on Election Day. The percentage of undervotes among the absentee ballots was 3.5%. Under the assumption that the correct undervote rate for the Election Day voting was 92% of the absentee ballot rate, the undervote rate for Election Day voting is set to 3.2% (0.92 × 3.5%). Therefore:

- The predicted number of undervotes among the Election Day votes is estimated to be 3.2% × 383 = 12.
- The excess number of undervotes among the Election Day votes is estimated to be 34 – 12 = 22.
- The number of votes recovered for Jennings among the Election Days undervote is 22 × 63.9% = 14.
- The number of votes recovered for Buchanan among the early vote undervotes is 22 – 14 = 8.
- The net gain in votes for Jennings among the Election Day undervotes is 14 – 8 = 6.
- Overall, the net gain in votes among the excess undervotes in this precinct, combining the early voting and Election Day vote, is 18 + 6 = 24.

Table 8 illustrates how the calculation would be done, using Precincts 1 to 5 as examples.

Table 8. Illustration of precinct-by-precinct estimate of recovering excess undervotes. (Calculations were done using a Microsoft Excel worksheet. Some calculations are affected by rounding error, which are identified in the footnotes.)

a. Early vote calculation

| Precinct | Actual number of early votes cast | Actual number of early vote undervotes | Undervote rate among absentee ballots in the precinct | 82% of absentee undervote rate | Expected number of early vote undervotes[a] | Excess of undervotes among early votes[b] | Percentage of the early vote received by Jennings in the precinct | Excess undervotes allocated to Jennings[c] | Excess undervotes allocated to Buchanan[d] | Net gain in votes to Jennings by allocating excess undervotes[e] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 361 | 72 | 3.5% | 2.9% | 10 | 62 | 64.4% | 40 | 22 | 18 |
| 2 | 107 | 19 | 1.8% | 1.5% | 2 | 17 | 68.2% | 12 | 6 | 6 |
| 3 | 98 | 17 | 4.3% | 3.5% | 3 | 14 | 75.3% | 10 | 3 | 7 |
| 4 | 260 | 35 | 2.5% | 2.1% | 5 | 30 | 60.0% | 18 | 12 | 6 |
| 5 | 107 | 18 | 2.3% | 1.9% | 2 | 16 | 85.4% | 14 | 2 | 11 |

b. Election Day vote calculation

| Precinct | Actual number of Election Day votes cast | Actual number of Election Day undervotes | Undervote rate among absentee ballots in the precinct | 92% of absentee undervote rate | Expected number of Election Day undervotes[f] | Excess of undervotes among Election Day votes[g] | Percentage of the Election Day vote received by Jennings in the precinct | Excess undervotes allocated to Jennings[h] | Excess undervotes allocated to Buchanan[i] | Net gain in votes to Jennings by allocating excess undervotes[j] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 383 | 34 | 3.5% | 3.2% | 12 | 22 | 63.9% | 14 | 8 | 6 |
| 2 | 612 | 61 | 1.8% | 1.6% | 10 | 51 | 59.5% | 30 | 21 | 10 |
| 3 | 417 | 51 | 4.3% | 3.9% | 16 | 35 | 61.8% | 21 | 13 | 8 |
| 4 | 630 | 58 | 2.5% | 2.3% | 15 | 43 | 48.3% | 21 | 22 | -2 |
| 5 | 380 | 33 | 2.3% | 2.1% | 8 | 25 | 67.7% | 17 | 8 | 9 |

Table 8, continued.

c. Consolidation of previous calculations

| Precinct | Net gain in votes to Jennings by allocating excess early voting undervotes | Net gain in votes to Jennings by allocating excess Election Day undervotes | Net gain in votes to Jennings by allocating all excess undervotes[k] |
|---|---|---|---|
| 1 | 18 | 6 | 24 |
| 2 | 6 | 10 | 16 |
| 3 | 7 | 8 | 15 |
| 4 | 6 | -2 | 4 |
| 5 | 11 | 9 | 20 |

[a]Calculated by multiplying the total number of early votes cast by the undervote rate of the absentee ballots
[b]Calculated by subtracting the expected number of early vote undervotes from the actual number of early vote undervotes.
[c]Calculated by multiplying the excess of undervotes among early votes by the percentage of the early vote received by Jennings among the early vote in the precinct.
[d]Calculated by subtracting the excess undervotes allocated to Jennings from the excess of undervotes among early votes. Rouding error appears in Precinct 3.
[e]Calculated by subtracting the excess undervotes allocated to Buchanan from the excess undervotes allocated to Jennings. Rounding error appears in Precinct 5.

[f]Calculated by multiplying the total number of Election Day votes cast by the undervote rate of the absentee ballots
[g]Calculated by subtracting the expected number of Election Day undervotes from the actual number of Election Day undervotes.
[h]Calculated by multiplying the excess of undervotes among Election Day votes by the percentage of the Election Day vote received by Jennings on Election Day in the precinct.
[i]Calculated by subtracting the excess undervotes allocated to Jennings from the excess of undervotes among Election Day votes. Rounding error appears in Precinct 3.
[j]Calculated by subtracting the excess undervotes allocated to Buchanan from the excess undervotes allocated to Jennings.

[k]Calculated by adding the two columns immediately to the left.

Table 9 reports the results of using different assumptions to estimate the effects of recovering the excess undervotes. Under any of these scenarios, Jennings emerges the victor in the race, by margins ranging from 478 to 746 votes.

Table 9. Results from the precinct-by-precinct simulations.

| Assumed ratio of undervotes | Votes recovered by Jennings | Votes recovered by Buchanan | Net gain by Jennings | Victory margin for Jennings |
|---|---|---|---|---|
| 82%, early voting<br>92%, Election Day voting | 8,156 | 7,041 | 1,115 | 746 |
| 100% | 7,975 | 6,891 | 1,084 | 715 |
| 200% | 6,292 | 5,445 | 847 | 478 |

**Comparisons to Other Situations When Ballot Design Caused “Voter Confusion” and/or a Loss of Votes.**

Summary: The level of undervoting experienced using electronic voting machines in Sarasota County for the 13th congressional district greatly exceeds the undervote rates that were estimated to have occurred in other well-established cases of voter confusion. This suggests a substantial possibility that the exaggerated undervote rates in this case were not solely due to voter confusion, but also caused by factors related to machine malfunction.

Based on the analysis in this report, I conclude that it was very likely that the excessively high undervote rates in the 13th congressional district among votes cast in Sarasota County were caused by the use of iVotronic electronic voting machines. It is important to understand the precise mechanism that led these voting machines to perform so poorly in this instance.

In studies of the influence of voting technologies on the outcomes of elections, two classes of explanations are generally explored to explain why voting technology sometimes fail. First, the equipment may physically fail. Second, voters may be confused by features of the equipment that distract them from taking their intended actions.

Examples of actual failures include worn gears on mechanical lever machines, poor maintenance of punch card machines that lead to “pregnant chad,” and malfunctioning diodes that cause optical scanners to fail. Examples of voter confusion include the "butterfly ballot" used in Palm Beach County during the 2000 presidential election, inadequate instructions that cause voters to invalidate their ballots by writing-in candidates they have already voted for by filling-in an oval on an optically scanned ballot, or the placement of ballot questions in mechanical lever machines outside the visual field of some voters.

In the particular case of the vote in Sarasota County, there are two major potential explanations for why there were so many excess undervotes. One possible explanation is voter confusion. In particular, it has been argued that the ballot layout in Sarasota County naturally drew the eye *away from* the 13th congressional district race, through the use of colors and banners that were intended to draw the eye *toward* the beginning of the state contests.

A second potential explanation is machine malfunction. Numerous voters reported difficulties casting a vote in the 13th congressional district race or with using the "review screen," which should have allowed them to correct an undervote that happened by accident.[18] These difficulties include pressing the name of one candidate and seeing the other candidate highlighted, or pressing the screen repeatedly with no effect.

Aggregated election returns are usually poor tools to use in gauging the physical failure of election machines. But, aggregate election returns have been used to estimate the effects of *voter confusion* caused by the design of ballots. The studies that have been published on this subject have tended to document "confusion rates" or "lost vote rates" that are very small in size. These studies have typically found the lost vote rate due to poor ballot design to be around 1% to 2%. Sometimes they climb as high as 5%.

If the excess undervote rate I have calculated for Sarasota County was entirely caused by voter confusion, then the "confusion rate" would be in the range of 11.0% to 12.2% of all

[18] For example, see Frank Gluck, Heather Allen, and Mike Saewitz, "Most callers report voting problems," heraldtribune.com, last accessed 11/19/06, 5:37pm.

electronic ballots cast in Sarasota County.[19] These percentages are vastly out of proportion to other documented instances of voter confusion, which I will review below.

Because of the tradition of the secret ballot in the United States, it is usually difficult to know precisely why votes have been lost when voters have difficulty with voting machines. Some scholarly research has appeared that attempts to estimate how many votes have been lost outright, or cast for an unintended candidate, because of poor ballot design.

The best-known case of ballot design leading to voter confusion is the so-called "Butterfly Ballot" used in Palm Beach County, Florida during the 2000 presidential election. Research published in the *American Political Science Review* by Wand, et al estimate that roughly 2,300 votes that were intended for Al Gore were mistakenly cast for Pat Buchanan as a consequence of the confusing ballot design in that county. This amounts to a ballot design "mistake rate" of 0.9% among all votes that were intended to be cast for Al Gore.[20]

Another case in which the details of ballot design were shown to influence the ability of voters to complete their voting intentions was the October 7, 2003 gubernatorial recall election in California. This election featured only two items on the ballot: (1) a question about whether Governor Gray Davis should be recalled and (2) a candidate list allowing the voter to choose a gubernatorial candidate, in the event that Davis was recalled. The list included 135 candidates who were running to replace Davis. Among these were a handful of well-known candidates who had vigorously campaigned across the state (such as Arnold Schwarzenegger, who eventually won) interspersed among a sea of mostly unknown candidates who were on the ballot solely because of California's liberal ballot access laws.

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[19] These rates are calculated as follows. The number of ballots cast electronically in Sarasota County totaled 119,759 (30,832 early votes plus 88,927 Election Day votes). The lower bound on the estimate of the number of excess undervotes was 13,209; 13,209/119,759 = 11.0%. The upper bound estimate of the number of excess undervotes was 14,739; 14,739/119,759 = 12.3%.

[20] Jonathan N. Wand, et al, "The butterfly did it: The aberrant vote for Buchanan in Palm Beach County, Florida," *American Political Science Review,* vol. 95, 2001, pp. 793-810.

Relying on the randomization rules that govern the candidate ballot order in California elections, Alvarez, et al published research in *PS: Political Science and Politics* that showed that unknown candidates who were lucky enough to be placed next to the high-profile candidates received a small boost in their vote total.[21] It is reasonable to assume that the excess of votes received by these lucky obscure candidates were intended for the better-known neighboring candidates. While the pattern was very regular, the magnitude of the effects was very small. For instance, Alvarez, et al estimate that approximately 0.35% of the votes that were intended for Schwarzenegger were cast for his "ballot neighbors" instead. In other words, voter confusion in this case amounted to much less than 1% of the votes intended for Schwarzenegger being given to other candidates.

The most commonly-studied effect that ballot design has on voter behavior concerns ballot order effects in general. In other words, the studies concern the excess votes that candidates receive purely from being listed first on the ballot. The most frequently cited scholarly article on the subject is by Miller and Krosnick, published in *Public Opinion Quarterly.*[22] Studying elections in Ohio, in which there were different methods used to randomly list candidate names on the ballot, Miller and Krosnick discovered a regular pattern of advantage given to candidates who were listed first. They found that, on average, being placed at the top of the ballot garnered the candidate 2.5% more of the vote. This advantage varied according to the race being considered. It was as high as 5% for some judicial races. As a general matter, ballot order influenced the behavior of voters most on nonpartisan races and on races for obscure offices.

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[21] R. Michael Alvarez, et al, "The complexity of the California recall election," *PS: Political Science and Politics,* Jan. 2004, pp. 23-26.

[22] Joanne M. Miller and Jon A. Krosnick, "The impact of candidate name order on election outcomes," *Public Opinion Quarterly,* vol. 62, no. 3, pp. 291-330.

Voters can be misled by ballots that are challenging --- or by subtle design features that draw their attention away from the task at hand --- but the excess in undervotes cast in Sarasota County in the 13th congressional district race is vastly greater than what has been documented in carefully studied instances where ballot design has been shown to influence voter behavior. It is reasonable to assume, therefore, that this excess in undervotes in Sarasota County was not purely the consequence of a poorly designed ballot.

Dated: November 20, 2006 ________________________________________

Charles Stewart III

# CURRICULUM VITAE

## CHARLES HAINES STEWART III

DEPARTMENT: Political Science DATE: September 8, 2006
DATE OF BIRTH: March 31, 1958
CITIZENSHIP: United States

## EDUCATION

| INSTITUTION | Degree | Date |
|---|---|---|
| Stanford University | Ph.D. | 1985 |
| Stanford University | A.M. | 1982 |
| Emory University | B.A. | 1979 |

TITLE OF DOCTORAL THESIS: The Politics of Structural Reform: Reforming the Budgetary Process in the House, 1865-1921 (Dissertation committee: John E. Chubb [chair], Terry M. Moe, and John A. Ferejohn)

## PROFESSIONAL EXPERIENCE

*MIT*

| | |
|---|---|
| 1985–1989 | Assistant Professor of Political Science |
| 1989–1999 | Associate Professor of Political Science |
| 1990–1993 | Cecil and Ida Green Career Development Associate Professor of Political Science (3-yr. term) |
| 1999–present | Professor of Political Science |

*MIT: Administrative*

| | |
|---|---|
| 2002–2005 | Associate Dean of Humanities, Arts, and Social Sciences |
| 2005–present | Head of the Department of Political Science |

*Non-MIT*

| | |
|---|---|
| 1989–1990 | National Fellow, Hoover Institution, Stanford University |
| 1998 (summer) | Visiting Associate Professor of Political Science, Stanford University |

## SEMINARS, COLLOQUIA, ETC.

Note: The following list excludes numerous presentations at professional conferences.

| | |
|---|---|
| May 2006 | “Elections since 2000: *Still* in Search of Accurate Vote Totals?” Talk given to the Milwaukee Public Policy Forum, Milwaukee, Wisconsin. |
| December 2005 | “U.S. Senate Elections before 1914,” seminar in the Department of Political Science, University of Wisconsin. |
| October 2004 | “Increasing Voter Participation and Confidence,” talk given at the symposium on The Integrity of the Electoral Process,” University of Toledo College of Law. |
| April 2004 | “The Long Strange Trip of Election Reform: Why 2004 Won't Be Much Different from 2000,” talk given at the symposium on Voting in an E-Democracy, Yale University |
| April 2000 | "The Inefficient Secret: Organizing for Business in the U.S. House of Representatives, 1789–1861," seminar in the Department of Political Science, New York University. |
| January 2000 | "The Inefficient Secret: Organizing for Business in the U.S. House of Representatives, 1789–1861," seminar in the Department of Political Science, Yale University. |
| November 1999 | "The Inefficient Secret: Organizing for Business in the U.S. House of Representatives, 1789–1861," seminar in the Department of Politics, Princeton University. |
| November 1998 | “Architect or Tactician? Henry Clay and the Institutional Development of the U.S. House of Representatives,” seminar in the Department of Political Science, Columbia University. |
| April 1994 | "Ain't Misbehavin': Reflections on Two Centuries of Congressional Corruption," seminar in the Department of Government, Harvard University. |
| October 1992 | "Stacking the Senate, Changing the Nation: Republican Rotten Boroughs and American Political Development," seminar in the Political Science Department, Yale University. |
| April 1992 | "Stacking the Senate, Changing the Nation: Republican Rotten Boroughs and American Political Development," seminar in the Politics Department, Princeton University. |

| | |
|---|---|
| February 1992 | "Stacking the Senate, Changing the Nation: Republican Rotten Boroughs and American Political Development," seminar in the political economy program, Government Department, Harvard University. |
| November 1991 | "Stacking the Senate, Changing the Nation," seminar in the Department of Political Science, Duke University. |
| November 1991 | "Committee Hierarchies in the Modernizing House of Representatives," seminar in the program on political economy, University of North Carolina, Chapel Hill. |
| March 1991 | "Through a Glass Darkly: The U.S. in the Middle East," lecture in the MIT Community Series on the Middle East. |
| October 1990 | "A Theory of Supreme Court Nominations," presentation to the Harvard/MIT Discussion Group on Political Economy (with Peter Lemieux). |
| April 1990 | "Political Institutions and Fiscal Policy," seminar in the Domestic Studies Program, Hoover Institution, Stanford University. |
| February 1990 | "Parties and Deficits: Some Historical Evidence," seminar in the Department of Political Science, University of California at San Diego. |
| October 1989 | "Advice? Yes! Consent? Maybe. Supreme Court Nominations from Washington to Reagan," seminar in the Workshop on Politics and Organizations, Graduate School of Business, Stanford University. |
| March 1987 | "How Does Reform Change Congress? The Consequences of Budget Reform in the House of Representatives, 1865-1921," presentation in the Seminar on History and Political Economy, The University of Pennsylvania. |

## FIELDS OF INTEREST

American politics
Legislative politics
Campaigns and elections
American political development
Research methods

## GRANTS AND AWARDS

| | |
|---|---|
| 1989–90, 2000–01 | Everett McKinley Dirksen Congressional Leadership Research Center |
| 1989 | The Everett Moore Baker Memorial Award for Excellence in Undergraduate Teaching, M.I.T. |
| 1991 | Marion and Jasper Whiting Foundation |
| 1991–93 | National Science Foundation, "The Development of the Committee System in the House, 1870-1946," SES-91-12345 |
| 1993–2003 | Margaret MacVicar Faculty Fellow, M.I.T. (10-year term) |
| 1994 | Mary Parker Follett Award, for Best Published Essay or Article, 1993-1994, Politics and History Section, American Political Science Association (with Barry Weingast). |
| 1999 | Franklin L. Burdette Pi Sigma Alpha Award, for Best Paper Presented at the 1998 Annual Meeting of the American Political Science Association. ("Architect or Tactician? Henry Clay and the Institutional Development of the U.S. House of Representatives") |
| 2000–2003 | Class of 1960 Fellow, M.I.T. (3-year term) |
| 2002 | Jewell-Loehenberg Award, for best article to have appeared in the *Legislative Studies Quarterly*, Legislative Studies Section, American Political Science Association (with Steven Ansolabehere and James M. Snyder, Jr.) |
| 2002 | Jack Walker Award, honoring an article or published paper of unusual significance and importance to the field, Political Organizations and Parties Section, American Political Science Association (with Steven Ansolabehere and James M. Snyder, Jr.) |

| | |
|---|---|
| 2002 | Boston Foundation, "Voting in Massachusetts" grant. |
| 2002 | Best Reference Source 2002 by *Library Journal* for *Committees in the United States Congress, 1789–1946.* |
| 2005–07 | National Science Foundation, "Collaborative Research: U.S. Senate Elections Data Base, 1871–1913" (with Wendy Schiller). |

## PROFESSIONAL ORGANIZATIONS

American Political Science Association (Sections: Legislative studies, political methodology) (Member, E.E. Schattschneider Award Committee, 1988–89)
Legislative Studies Section of the American Political Science Association (Member, Richard Fenno Award Committee, 1993–94; Chair, CQ Award Committee, 2002–2003; Chair, Jewell-Loehenberg Award, 2004–05; Council member, 2005–present)
Politics and History Section of the American Political Science Association (Council member, 1995–97; Chair, Mary Parker Follett Award Committee, 2001)
*Legislative Studies Quarterly,* Editorial Board, 2003–present
*Studies in American Political Development,* Editorial Board, 2003–present
*Congress and the Presidency,* Editorial Board, 1994–present
*American Politics Quarterly,* Editorial Board, 1992–1997
Planning committee, Senate Election Study (1990 election)
Midwestern Political Science Association
Southern Political Science Association
American Association for the Advancement of Science

## MIT ACTIVITIES AND COMMITTEES

Housemaster, McCormick Hall (1992–present)
Chair, Housemasters Council (1999–2001)
Bexley Hall Housemaster Search Committee (chair, 1999–2000)
Director, MIT Washington Summer Internship Program (1994–present)
Institute Committees
- Task Force on the Educational Commons (associate chair, 2003–present)
- Task Force on Student Life and Learning (1996–1998)
- Committee on Faculty Quality of Life (co-chair, 2003–present)
- Faculty Policy Committee (2001–2003)
- Committee on Undergraduate Program (1993–1998; chair, 1995–1997)
- Special CUP Subcommittee on Pass/No Record Credit and Advanced Placement (chair, 1999–2003)
- *Ad hoc* Advisory Group on Orientation 1998 (1997)
- *Ad hoc* Advisory Committee on the Principles and Goals of MIT's Residential System (1998)
- Committee on Curricula (*ex offici*, 1995-1997)

HASS-D Review Committee (1993–94)

Department committees

Graduate admissions (1985–1989, 1990–1993, 2002–2004)

Financial aid (1986–1989, 1990–1993, 1994–1995; chair, 1990–1993)

Undergraduate program (1987–1989, 1993–present; chair, 1993–present)

Computer representative (1994–1995)

Independent Activities period coordinator (1985–1987)

Political science search committees

Formal theory and research methodology (1986–1989, 1990–1992)

American politics (1988–1989, 1990–1993, 1997–1998; chair, 1992–1993, 1997–1998, 2004–05)

HASS distribution oversight committee on cultures and societies (1987–1989)

HASS Overview Committee (1999–2000, 2002–05; chair, 2002–05)

Faculty fellow, Burton House (1988–1989)

Truman Scholarship Selection Committee (1988–1989, 1994–1996, 2002)

Burchard Scholar Selection Committee (1992–1996, 2000, 2002–04)

Kelly-Douglas Prize Selection Committee (2002–04)

# PUBLICATIONS

## *Books*

| | |
|---|---|
| Forthcoming | *Fighting for the Speakership: The House and the Rise of Party Government.* Princeton University Press (with Jeffery A. Jenkins). |
| 2002 | *Committees in the United States Congress, 1789–1946*, 4 vols. Congressional Quarterly Press (with David Canon and Garrison Nelson). |
| 2001 | *Analyzing Congress* W. W. Norton. |
| 1989 | *Budget Reform Politics: The Design of the Appropriations Process in the House, 1865-1921.* Cambridge University Press. |

## *Chapters in Edited Collections*

| | |
|---|---|
| 2006 | "Architect or Tactician? Henry Clay and the Institutional Development of the U.S. House of Representatives" in *Process, Party, and Policy Making: New Advances in the Study of the History of Congress*, eds David W. Brady and Mathew D. McCubbins, Stanford University Press (forthcoming). |
| 2006 | "Improving the Measurement of Election System Performance in the United States" in *Institutionalizing Barriers to Mobilizing Democracy*, eds. Margaret Levi, James D. Johnson, Jack Knight, and Susan Stokes (forthcoming) |
| 2005 | "Congress in the Constitutional System," in *Institutions of Democracy: The Legislative Branch,* ed. Sarah Binder and Paul Quirk, Oxford University Press (forthcoming). |
| 2002 | "The Evolution of the Committee System in the U.S. Senate" (with David Canon), in *Senate Exceptionalism,* ed., Bruce Oppenheimer, Ohio University Press. |
| 2002 | "Order from Chaos: The Transformation of the Committee System in the House, 1810–1822," in *Party, Process, and Political Change in Congress: New Perspectives on the History of Congress,* eds. David Brady and Mathew McCubbins, Stanford University Press. |
| 2001 | "The Evolution of the Committee System in Congress," in *Congress Reconsidered,* 7th edition, eds., Lawrence Dodd and Bruce I. Oppenheimer. Congressional Quarterly Press. |

1992 "Committees from Randall to Clark," in *The Atomistic Congress,* eds. Ron Peters and Allen Hertzke. M.E. Sharpe.

1992 "Responsiveness in the Upper Chamber: The Constitution and the Institutional Development of the U.S. Senate," in *The Constitution and the American Political Process,* ed. Peter Nardulli. University of Illinois Press.

1991 "Lessons from the Post-Civil War Era," in *Causes and Consequences of Divided Government,* eds. Gary Cox and Samuel Kernell. Westview Press.

1991 "Tax Reform in the 1980s," in *Politics and Economics in the 1980s,* eds. Alberto Alesina and Geoffrey Carliner. University of Chicago Press, pp. 143-170.

*Articles in Refereed Journals*

2006 “Residual Vote in the 2004 Election” *Election Law Journal* 5(2): 158–169.

2005 “Studying Elections: Data Quality and Pitfalls in Measuring the Effects of Voting Technologies” (with R. Michael Alvarez and Stephen Ansolabehere). *The Policy Studies Journal* 33(1): 15–24.

2005 “Residual Votes Attributable to Technology” (with Stephen Ansolabehere). *Journal of Politics* 67(2): 365–389.

2003 “Out in the Open: The Emergence of Viva Voce Voting in House Speakership Elections” (with Jeff Jenkins). *Legislative Studies Quarterly,* 28(4): 481–508.

2001 "The Effects of Party and Preferences on Congressional Roll Call Voting (with Stephen D. Ansolabehere and James M. Snyder, Jr.). *Legislative Studies Quarterly,* 26(4): 533-572.

2001 “Candidate Positioning in U.S. House Elections,” (with Stephen D. Ansolabehere and James M. Snyder, Jr.). *American Journal of Political Science,* 45(1): 136–159.

2000 “Old Voters, New Voters, and the Personal Vote: Using Redistricting to Measure the Incumbency Advantage” (with Stephen D. Ansolabehere and James M., Snyder, Jr.), *American Journal of Political Science*, 44(1): 17–34.

1999 — “The Value of Committee Seats in the United States Senate, 1947–91,” (with Tim Groseclose), *American Journal of Political Science.* 43(3): 963–973.

1998 — "The Value of Committee Seats in the House, 1947-1991," (with Tim Groseclose) *American Journal of Political Science,* 42(2): 453–474.

1994 — "Let's Go Fly a Kite: Correlates of Involvement in the House Bank Scandal," *Legislative Studies Quarterly.* 19(4): 521-535.

1992 — "Committee Hierarchies in the Modernizing House, 1875-1947," *American Journal of Political Science,* 36(4):835-56.

1992 — "Stacking the Senate, Changing the Nation: Republican Rotten Boroughs, Statehood Politics, and American Political Development," (with Barry Weingast) *Studies in American Political Development,* pp. 223-271.

1990 — "Television Markets and Senate Elections," (with Mark Reynolds) *Legislative Studies Quarterly,* 15(4): 495-524. (See *LSQ* 16(3):327 for correction of table 2 misprint.).

1989 — "A Simultaneous Determination Model of Senate Elections," *Legislative Studies Quarterly,* 14(4): 567-601. Reprinted in *The Changing World of the U.S. Senate,* ed. John Hibbing. IGS Press.

1988 — "Budget Reform as Strategic Legislative Action: An Exploration," *Journal of Politics,* 50(2): 292-321.

1987 — "Does Structure Matter? The Effects of Structural Change on Spending Decisions in the House, 1871 to 1922," *American Journal of Political Science,* 31(3): 584-605. Reprinted in *The Congress of the United States, 1789-1989,* eds. Joel Silbey, et al. Carlson Publishing.

*Other Publications*

2003 — *Voting in Massachusetts.* Report by the Caltech/MIT Voting Technology Project.

1996 — Review of *Ethics in Congress: From Individual to Institutional Corruption,* Dennis F. Thompson, *American Political Science Review,* 90(1): 206-207.

1994 — Contributor to the *Encyclopedia of the United States Congress,* ed. Donald C. Bacon, et al. Simon and Schuster. Essays on the House Appropriations Committee and the 1921 Budget and Accounting Act.

| | |
|---|---|
| 1994 | Contributor to the *Encyclopedia of the American Legislative System,* ed. Joel H. Silbey, et al. Scribner's. Essay on Congressional Appropriations Committees. |
| 1991 | Contributor to the *Encyclopedia of American Political Parties and Elections,* ed. L. Sandy Maisel. Garland Publishing Company. Articles on Henry Clay, Thomas P. O'Neill, Samuel J. Randall, Sam Rayburn, Thomas B. Reed, Champ Clark, Tony Coelho, George Norris, James P. Clarke, William Frye, Thomas Taggart, Norman Mack, Conservative Coalition, Democratic Study Group, Democratic Congressional Campaign Committees (House and Senate), and Republican Congressional Campaign Committees (House and Senate). |
| 1989 | Review of *Balanced Budgets and American Politics,* James D. Savage, *Congress and the Presidency,* 16(1): 77-79. |
| 1986 | Review of *Representation and Responsibility,* eds., Bruce Jennings and Daniel Callahan, *American Political Science Review,* 80(4): 1322-1323. |

*Unpublished manuscripts*

| | |
|---|---|
| 2004 | "Party Control and Legislator Loyalty in Senate Elections Before the Adoption of the 17th Amendment" (with Wendy Schiller), paper presented at the annual meeting of the American Political Science Association. |
| 2004 | "More than Just a Mouthpiece: The House Clerk as Party Operative, 1789-1870" (with Jeff Jenkins), paper presented at the annual meeting of the American Political Science Association. |
| 2004 | "U.S. Senate Elections before 1914" (with Wendy Schiller), paper presented at the annual meeting of the American Political Science Association. |
| 2003 | "The Gag Rule, Congressional Politics, and the Growth of Anti-Slavery Popular Politics" (with Jeff Jenkins), paper presented at the annual meeting of the Midwest Political Science Association. |
| 2001 | "Sophisticated Behavior and Speakership Elections: The Elections of 1849 and 1855-1856" (with Jeff Jenkins), paper presented at the annual meeting of the Midwest Political Science Association. |
| 2000 | "Sophisticated Behavior and Speakership Elections: The Elections of 1849 and 1855-1856" (with Jeff Jenkins), paper presented at the annual meeting of the American Political Science Association. |

| | |
|---|---|
| 2000 | “Speakership Elections and Control of the U.S. House: 1839-1859,” paper presented at the annual meeting of the Midwest Political Science Association. |
| 1999 | "The Inefficient Secret: Organizing for Business in the U.S. House of Representatives, 1789–1861," paper presented at the annual meeting of the American Political Science Association. |
| 1998 | “The Development of the Senate Committee System, 1789–1879” (with David Canon), paper presented at the annual meeting of the American Political Science Association. |
| 1998 | “Committee Assignments as Side Payments: The Interplay of Leadership and Committee Development in the Era of Good Feelings,” (with Jeffery A. Jenkins), paper presented at the annual meeting of the Midwest Political Science Association. |
| 1996 | "Careerism and Career Ladders in the Early Days," (with Bill Bianco) paper presented at the annual meeting of the American Political Science Association. |
| 1995 | "Taking Care of Business: The Revolution of the House Committee system before the Civil War," (with David Canon) paper presented at the annual meeting of the American Political Science Association. |
| 1994 | "Ain't Misbehavin': Reflections on Two Centuries of Congressional Corruption," paper presented to the Government Department, Harvard University. |
| 1990 | "A Theory of Supreme Court Nominations," (with Peter Lemieux) paper presented at the Conference on Political Economy, National Bureau of Economic Research, Cambridge, Massachusetts, December. |
| 1990 | "Senate Confirmation of Supreme Court Nominations from Washington to Reagan," (with Peter Lemieux), Hoover Institution Working Paper Series, Domestic Studies Program, P-90-3, April. |
| 1990 | "Parties and the Deficit: Some Historical Evidence," (with James Alt) presented at the Workshop on Political Economics, National Bureau of Economic Research, Cambridge, Massachusetts, February. |

# LIST OF THESES SUPERVISED

*Ph.D. Thesis: Primary Supervision: Completed*
Bruce Bimber
Seong Ho Lim
Amy E. Black
Stephen Minicucci
Beth Rosenson

*Ph.D. Theses: Secondary Supervision: Completed*
Lee Perlman
Rob Stowe
Jean Peretz
John Coleman
David Guston
Jeff Lewis
Sharon Weiner
Judy Layzer
Jocelyn Crowley
David Burbach
Marsha Simon
Rachel Cobb
David Konisky
Douglas Kriner (Harvard)

*PhD. Theses: Primary Supervision: In Progress*
Suzanne Neill

*Ph.D. Theses: Secondary Supervision: In Progress*
William LeBlanc

*S.M. Theses: Primary Supervision: Completed*
Nancy Otis
Gregory Mayew
Nancy Cohen
Jay Youngclaus
Brooks Mendall

*S.M. Theses: Secondary Supervision: Completed*
Reid Lifset
Robert Snyder
Sarah Lawrence
Anders Hove

*S.B. Theses: Primary Supervision: Completed*
Thomas Murphy
Christopher Crowley (Course 6, Computer Science)
Andrew Fish
Daniel Pugh
T. Michael Smith (Course 6, Computer Science)
Clifford Rothenberg
John Abbamondi
Karen Kaplan (joint with Course 14, Economics)
Andrei Saunders
Janice Yoo
Brooks Mendell
David Kessler (joint with Course 14, Economics)
J. Paul Kirby
Colin Page
Robert Fowler
Norman Brodesser
William LeBlanc
Sarah Anderson
Orion Smith
Andrew Montgomery (Course 6, Electrical Engineering and Computer Science)
Melanie Wong
Courtney Shiley
Kristie Tappan

*S.B. Theses: Secondary Supervision: Completed*
Michael Sununu
David Alcocer
Christine Coffey
Rebecca Berry
Alice Yao
Karl Erdmann
Miranda Priebe
Kaitlin E.M. Lewis

*S.B. Theses: Primary Supervision: In progress*
David Tobias

*S.B. Theses: Secondary Supervision: In progress*