

# Ballot Formats, Touchscreens, and Undervotes: A Study of the 2006 Midterm Elections in Florida<sup>1</sup>

Laurin Frisina<sup>2</sup>

Michael C. Herron<sup>3</sup>

James Honaker<sup>4</sup>

Jeffrey B. Lewis<sup>5</sup>

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<sup>2</sup>B.A. in Political Science, University of Rochester, June, 2006 ([laurinfrisina@hotmail.com](mailto:laurinfrisina@hotmail.com)).

<sup>3</sup>Associate Professor, Department of Government, Dartmouth College and Visiting Associate Professor of Political Economy, Wallis Institute of Political Economy, University of Rochester. 6108 Silsby Hall, Hanover, NH 03755 ([Michael.Herron@dartmouth.edu](mailto:Michael.Herron@dartmouth.edu)).

<sup>4</sup>Assistant Professor, Department of Political Science, University of California at Los Angeles. 4289 Bunche Hall, Los Angeles, CA 90095-1472 ([tercer@ucla.edu](mailto:tercer@ucla.edu)).

<sup>5</sup>Assistant Professor, Department of Political Science, University of California at Los Angeles. 4289 Bunche Hall, Los Angeles, CA 90095-1472 ([jblewis@ucla.edu](mailto:jblewis@ucla.edu)).

## **Abstract**

The 2006 midterm elections in Florida have focused attention on undervotes, ballots on which no vote is recorded on a particular contest. This interest was sparked by the high undervote rate—more than 18,000 total undervotes out of 240,000 ballots cast—in Florida’s 13th Congressional District race, a race that, as of this paper’s writing, was decided by 369 votes. Using precinct-level voting returns, we show that the high undervote rate in the 13th Congressional District race was almost certainly caused by the way that one county’s (Sarasota’s) electronic touchscreen voting machines placed the 13th Congressional District race above the Florida Governor election on a single screen. We buttress this claim by showing that extraordinarily high undervote rates were also observed in the Florida Attorney General race in Charlotte and Lee Counties, places where that race appeared below the Governor race on the same screen. Using a statistical imputation model to identify and allocate excess undervotes, we find that there is a roughly 90 percent chance that the much-discussed Sarasota undervotes were pivotal in the very close 13th Congressional District race. Greater study and attention should be paid to how alternatives are presented to voters when touchscreen voting machines are employed.

# 1 Introduction

Despite widespread concerns that electronic voting machines adopted in the wake of the 2000 presidential election would wreak havoc on the recent 2006 midterm elections, reports of election-altering ballot machine failures have thus far been relatively few. Although the midterm elections included a number of closely contested United States Senate (e.g., Virginia), United States House (e.g., the 2nd Congressional District in Connecticut), and state-level (e.g., the Vermont state auditor) races, few observers or participants have claimed that problems in election administration are to blame for the defeat of a preferred candidate.<sup>1</sup> Indeed, compared to the controversies surrounding balloting in the 2000 Presidential race in Florida (e.g., Merzer 2001, Posner 2001), the 2004 Presidential race in Ohio (e.g., Freeman & Bleifuss 2006), and the 2004 Washington gubernatorial race (in which the final margin separating winning from losing candidate was 261 votes out of over 2.8 million total votes), the aftermath of the 2006 midterm elections has so far been relatively pacific.

Prior to the 2006 elections, concerns over touchscreen voting focused primarily on the susceptibility of electronic voting to tampering and a lack of independently verifiable audit trails (e.g., Feldman, Halderman & Felten 2006). It was widely agreed that electronic voting machines were superior to the punchcard systems that in some cases they replaced insofar as electronic machines prevent overvotes (selecting more than one candidate in a given contest) and produce fewer undervotes (instances in which no candidate is selected) as well (Kimball 2003, Carrier 2005). A widely noted virtue of touchscreen machines is that they can be configured to draw a voter's attention to races that the voter initially overlooked or otherwise failed to record a preference; this is called second chance voting (Celeste, Thornburgh & Lin 2005). In addition, touchscreen machines can be programmed to operate in many different languages.

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<sup>1</sup>Democrat Jim Webb defeated Republican incumbent George Allen by 9,329 votes in the Virginia Senate election; Democrat Joe Cortney defeated incumbent Republican Rob Simmons by 91 votes in Connecticut's 2nd Congressional District; and, Republican incumbent Randy Brock is at the time of this paper's writing leading Democrat Tom Salmon by 137 votes in the Vermont state auditor election pending a recount.

Despite these virtues, the 2006 election revealed that touchscreen machines do not uniformly produce low undervote rates. Indeed, in some instances touchscreen voting machines appear to have generated very high undervote rates, most notably in Florida's 13th Congressional District (hereafter CD 13).

The election night canvass in CD 13 had Democrat Christine Jennings losing to Republican Vern Buchanan by some 377 votes; this very narrow margin triggered an automatic recount under Florida election law.<sup>2</sup> According to the recount, Buchanan beat Jennings by 119,142 to 118,741 votes—a margin of only 401 votes.<sup>3</sup> The same count revealed that 21,303 ballots, approximately 8.2 percent of those cast, in CD 13 recorded no candidate choice in the House race.<sup>4</sup> The undervotes were heavily concentrated in Sarasota County, the largest of the five counties contributing to CD 13. The other four counties are Charlotte, DeSoto, Hardee, and Manatee.<sup>5</sup> Ignoring absentee ballots, which are optical scan, and focusing only on touchscreen ballots, the CD 13 undervote rate is 14.8 percent.

What accounts for Sarasota County's extraordinarily high undervote rate in the CD 13 contest is the focus of this paper. Beyond what the prevalence of CD 13 undervotes might reveal about touchscreen voting in general, they also form the basis of Jennings's legal challenge to Buchanan's election. According to her legal complaint, "The vote totals in the certification are wrong because

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<sup>2</sup>See "Analysis suggests undervote caused by ballot design," *Herald Tribune*, November 15, 2006, downloaded from <http://heraldtribune.com/apps/pbcs.dll/article?AID=/20061115/NEWS/611150751/-1/NEWS0521>.

<sup>3</sup>The Florida Secretary of State calls this "2nd Set of Unofficial Returns," See <http://election.dos.state.fl.us/elections/resultsarchive/enight.asp>. The recount vote totals cited here do not include overseas and military ballots which, as of this paper's writing, have not been counted. As of this paper's writing, the certified margin between Buchanan and Jennings has shrunk to 369 votes, and Jennings has formally contested the election outcome.

<sup>4</sup>This count includes a handful of so-called overvotes in which a voter voted for more than one CD 13 candidate. Overvotes, which are invalid of course, can be cast by voters who use optical scan ballots but not by those using electronic touchscreen machines. The latter are often called DRE (for Direct Recording Electronic) machines. Initial CD 13 recount results were downloaded from <http://election.dos.state.fl.us/pdf/certCanvasCom.pdf>.

<sup>5</sup>Pre-recount and in some cases certified canvasses can be downloaded from <http://www.charlottevotes.com/> (Charlotte County), <http://www.hardeecountyelections.com/> (Hardee County), <http://www.votemanatee.com/> (Manatee County), and <http://www.srqelections.com/> (Sarasota County). The pre-recount canvass from DeSoto County was faxed to the authors and is available from them.

they do not include thousands of legal votes that were cast in Sarasota County but not counted due to the pervasive malfunctioning of electronic voting machines.”<sup>6</sup> CD 13 undervotes have also motivated a lawsuit by Sarasota voters who claim that they were disenfranchised by the failure of Sarasota County’s touchscreen machines. The plaintiffs in this lawsuit are requesting a re-vote.<sup>7</sup>

Whether it is correct to attribute Sarasota’s high undervote rate to “machine malfunction” is in part a question of engineering and in part a question of semantics (what exactly constitutes a “malfunction?”). While we cannot directly address engineering issues here and do not presume to provide a legal definition of “malfunction,” what we do provide is careful documentation of the extent of the undervote problem and its likely effect on the election outcome in Florida’s 13th Congressional District. Although we cannot definitively rule out the possibility that there was some voting machine malfunction in the sense that Sarasota County’s touchscreen machines failed to record and tabulate actual screen touches, we nonetheless do show that such a malfunction must have been very localized if it had occurred. To the point, the iVotronics used in Sarasota did not produce unusually high undervote rates in other races. Furthermore, unusually high undervote rates did not occur in other races in which candidate buttons were located in a similar position on the screen to the candidate buttons for CD 13 as one might expect if certain areas of the screen were less likely to register a touch.

While the Sarasota undervote problem appears to be isolated to the CD 13 race, it does not appear that the undervote rate is attributable to features of the candidates themselves, the office they were contesting, or to features of the Buchanan-Jennings campaign. Indeed, elevated undervoting was not observed in CD 13 outside of Sarasota County nor was it a feature of absentee balloting within Sarasota. As we demonstrate below, the most likely culprit for the high CD 13 undervote

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<sup>6</sup>The Jennings complaint was downloaded from <http://www.heraldtribune.com/assets/pdf/SH81371120.PDF> on November 21, 2006.

<sup>7</sup>This lawsuit is supported by various election advocacy groups. See the press release, titled “Sarasota Voters File Lawsuit for Revote in Congressional Race,” issued by the organization, People for the American Way. The release, which points out that the voter plaintiffs are both Democrats and Republicans, can be found at <http://www.pfaw.org/pfaw/general/default.aspx?oid=23142>.

rate is ballot layout. As has been noted in a variety of press accounts, among counties participating in the CD 13 race only in Sarasota was the CD 13 race itself placed on the same ballot screen with the Governor's race which include seven alternative candidates (including a write-in line). In other counties and on Sarasota's absentee ballot, CD 13 appeared on its own ballot screen, next to (in a horizontal sense) the Florida United States Senate race, or along with a large number of other races in the case of optical scan ballots.

To further buttress our conclusion that the CD 13 undervote problem resulted from the ballot layout used in Sarasota County, we show very similar effects in Charlotte and Lee counties in which the race for Florida Attorney General was combined with the Governor's race on a single ballot screen. We find that Charlotte County's ballot format is associated with an excess of undervotes that was roughly twice as prominent as found in Sarasota's CD 13 ballots (and Lee County's ballot format in the Attorney General race is similar although not quite as pronounced). The focus in the public on the CD 13 race over the Attorney General contest presumably reflects the fact that the former race was exceedingly close whereas the Florida Attorney General was close but not recount-close, so to speak.<sup>8</sup>

It remains possible, of course, that a programming or design flaw in Charlotte County's, Lee County's, and Sarasota County's touchscreen machines caused low vote counts when a race (either the CD 13 rate or the race for Florida Attorney General) was placed on the same page as the Florida Governor's race. However, it is our belief that the CD 13 undervote problem is most likely is related to the combination of a high-profile contest with a large number of alternatives being placed on same screen as a race with only two alternatives.

The question of disparate impact of an election administration practice (in our case, a ballot format) is central to any analysis of electoral institutions and is obviously of paramount interest in CD 13 where the recorded electoral margin between Buchanan and Jennings was razor thin.

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<sup>8</sup>According to official results from the Florida Department of State, the winning Florida Attorney General candidate, Bill McCollum, received 52.7% of the popular vote. This winning percentage is presumably not sufficiently large so as to think that voters could anticipate the results of the Attorney General race prior to election day.

Whatever doubt remains about the fundamental cause of the large number of CD 13 undervotes in Sarasota County, we can say with very high confidence that the undervote patterns observed in the CD 13 race would not have obtained had Sarasota voters been presented with the same voting machinery and ballot layouts used elsewhere in CD 13. Overall, as we explain in detail later, our statistical models suggest that there is a 90 percent chance that Jennings would have won the CD 13 election had voting in Sarasota employed the machinery and ballots layouts used elsewhere in the district. In particular, we find that Jennings would have picked up between 103 and 2080 had this been the case.

In the sense of documenting what appears to be a disparate impact of an election administration practice, this paper is similar to previous studies of undervoting and residual vote rates (undervotes plus overvotes) more generally, many of which have focused on punchcard voting technology. The literature on residual vote rates has demonstrated that high residual vote rates are associated with particular kinds of voters and are often concentrated in low education, minority, and (consequently) more Democratic precincts (Brady, Buchler, Jarvis & McNulty 2001, Tomz & van Houweling 2003).

In Section 2 we provide some background on the CD 13 race and comment on three explanations purporting to explain the high undervote rate in this contest. In Section 3 we present evidence that the undervote patterns in CD 13 are consistent with election administration problems and not with other claims about their causes, and we show by analysis of other races beyond CD 13 that the mechanism behind the Sarasota undervote rate is a ballot format problem. In Section 4 we show that the CD 13 outcome at the time of this paper's writing—Buchanan over Jennings by approximately 369 votes—could well have been reversed in the absence of said problems. Section 5 considers caveats and explains the data needed to best resolve the questions raised in this paper, and Section 6 concludes.

## 2 Background

Florida has 25 Congressional Districts and 67 counties, and approximately midway up the Gulf Coast sits Sarasota County. Sarasota and its 156 election day precincts lie completely within the 13th Congressional District and this district also includes parts of Charlotte County (eight election day precincts) and Manatee County (134 election day precincts, some of which are split between CD 13 and CD 11, the 11th Congressional District in Florida) and all of DeSoto and Hardee Counties (15 and 12 election day precincts, respectively).<sup>9</sup> The five CD 13 counties vary in their use of voting technologies: Charlotte and Sarasota both use iVotronic touchscreens, manufactured by Election Systems and Software (ES&S), for their election day and early voters whereas DeSoto, Hardee, and Manatee use optical scan voting. All five counties use optical scan ballots for absentee voting, and we will return later to the fact that in this set of counties (and others as well) there is variance across election day voting technology and absentee voting technology.

The fact that some CD 13 ballots do not contain a vote for a given office does not imply a failure of the machinery used to record votes nor does it imply the existence of any sort of election administration deficiency. Intentional undervotes (also commonly known as roll-offs and drop-offs) are a feature of every election. Indeed, the state of Nevada offers voters the explicit option of “None of the Above Candidates” when voting in state-wide races, and this option was exercised by an average of 4 percent of voters across the seven state-wide contests held in the 2006 midterm election (Nevada turnout was 585,986 voters).<sup>10</sup> Beyond discontent with available candidates, deliberately choosing not to vote in a particular contest may reflect indifference among possible

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<sup>9</sup>What is typically called a “precinct” in the vernacular of United States elections is what we call an election day precinct, i.e., a place where voters physically go to vote. In contrast, one can also speak of “absentee precincts,” which are collections of absentee voters albeit not physical voting locations. Some counties (e.g., Hardee in 2004) have a single absentee precinct which includes all of the county’s absentee votes; others have multiple absentee precincts (e.g., Sarasota in 2004), and others (e.g., Sarasota in 2006) associate every absentee voter with a single election day precinct at which she would have voted had she voted on election day.

<sup>10</sup>Data on vote choices are from the Nevada Secretary of State’s *Official Vote Summary* (<http://sos.state.nv.us/nvelection/2006StateWideGeneral/ElectionSummary.htm>). The turnout figure is from <http://www.secretaryofstate.biz/nvelection/2006StateWideGeneral/VoterTurnout.htm>.

candidates or uncertainty about how or why to vote. Presumably some of the average additional 1.8 percent of Nevada ballots which contained no vote in these races reflects intentional abstention.

Nonetheless, the 8.2 percent undervote rate in Florida's CD 13, in conjunction with the 13 percent percent such rate in Sarasota County, was quickly labeled by many observers as extraordinary. As we show below, this observation is completely accurate: Sarasota's approximately 13 percent undervote rate in the CD 13 was extremely high. In modern presidential races, the intentional undervote rates is generally thought to be around 2 percent. In the 2004 presidential election, the overall Florida undervote rate was approximately 0.36 percent, this rate was 0.38 percent in Sarasota County, and it was 0.43 percent in counties that used touchscreens manufactured by ES&S (Florida Department of State 2005). In absolute terms presidential undervote rates are not comparable to Congressional district undervote rates produced in a midterm election. Nonetheless, the figures above suggest that there is no reason to think *a priori* that Sarasota County is prone to high undervote rates.

That election administration broadly defined affects valid vote rates and, relatedly, undervote rates, is known (. Brady et al. 2001, Ansolabehere & Stewart III 2005) For instance, Wand, Shotts, Sekhon, Mebane, Jr., Herron & Brady (2001) show that the butterfly ballot in Palm Beach County, Florida, altered the winner of the 2000 presidential election, and Mebane (2004) shows that same result with regards to overvotes. Another election administration practice known to have effects on vote totals, and hence on very close election outcomes, is the order in which names appear on ballots (Koppell & Steen 2004, Ho & Imai 2006).

## **2.1 Three Explanations for the Sarasota Undervote Rate**

Several explanations—we focus on three—have been offered as to the cause of the seemingly aberrant undervote rate in CD 13. As a side note, as of this paper's writing outright election fraud or deliberate manipulation of voting machines with an intent to cause undervotes do not appear to be among the more common conjectures.

### **2.1.1 Protest Undervotes**

One explanation receiving some attention is that of the “protest undervote” wherein voters abstain from casting a vote in a particular race to express their distaste for any and all candidates running for office. Vern Buchanan, the Republican candidate in CD 13, has speculated that, as characterized by the *Herald Tribune*, “Voters’ disgust with the barrage of often negative campaign ads and mailers could have contributed to the undervote.”<sup>11</sup> Indeed, there is some evidence from U.S. Senate races that the degree of negativity in a campaign is associated with relatively high undervote rates (Ansolabehere & Iyengar 1995). Negativity-induced indifference and pure indifference between candidates could have augmented what is a standard undervote rate in a Congressional race.

### **2.1.2 Ballot Formatting**

Nonetheless, hundreds of citizens who voted in Sarasota have complained about the ballot format they faced, and that “The touch-screen [sic] ballot design concealed the candidates for the 13th District.”<sup>12</sup> What might these voters be alluding to in reference to the use of “concealed” above? The most commonly cited mechanism that may have led to voter confusion in CD 13 revolves around the combination of different races on the same touchscreen pages. In particular, in Sarasota County alone among the five counties in CD 13 the CD 13 race appeared on the same voting page as the Florida gubernatorial race. Recall that Charlotte and Sarasota Counties both use iVotronic touchscreens for their election day and early voters. When a voter confronts an iVotronic, her “ballot” consists of a sequence of pages of candidate choices. In both Charlotte and Sarasota Counties, the first page of choices was for the Florida United States Senate seat. In Charlotte, the second page contained the CD 13 race only, but in Sarasota the second page contained the CD 13 and the Florida governor contest. In Charlotte, the gubernatorial race appeared on the third

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<sup>11</sup>See “Call for paper trail, new election,” *Herald Tribune*, November 16, 2006.

<sup>12</sup>See “13th Congressional District recount: About the recount,” *Herald Tribune*, November 16, 2006.

page and below it was the Florida Attorney General race. The third page of the Sarasota ballot contained the Florida attorney general race, the Florida chief financial officer race, and the Florida commissioner of agriculture race.

Figure 1 displays the first four pages of the Charlotte County 2006 midterm election ballot. As of this paper's writing we do not have corresponding images from Sarasota County.<sup>13</sup> The key point here is variability across iVotronic counties: in Charlotte County, the CD 13 race was alone on a page and in Sarasota it was paired with a multi-candidate race.

In DeSoto, Hardee, and Manatee Counties, election day and early voters voted with two-sided, optical scan ballots. There is no sense in which optical scan voting involves repeated page-turning as is common with touchscreens. A picture of the Manatee ballot is in Figure 2.<sup>14</sup> Absentee voters in all five CD 13 counties used optical scan ballots roughly similar to that of Manatee's election day ballot.

It has been conjectured that the placement of the CD 13 contest (two candidates) next to the gubernatorial contest (six candidates plus a write-in slot) led voters to miss the former.<sup>15</sup> Why precisely this might be true is beyond the scope of this paper. Presumably the questions, "How many races on a page is too many?" and "How many candidate choices on a page is too many?" are amenable to experimental research on human-computer interactions just as the butterfly ballot format was studied experimentally in Sinclair, Mark, Moore, Lavis & Soldat (2000).

### **2.1.3 Voting Machine Malfunctions**

A third explanation for the high Sarasota undervote rate in CD 13 is machine or engineering failure of some sort.<sup>16</sup> There are numerous possibilities in this area: software counting bugs that affected

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<sup>13</sup>Source for the Charlotte ballot screenshots is email received on November 15, 2006 from the office of the Charlotte County Supervisor of Elections.

<sup>14</sup>Source for the Manatee County ballot is <http://www.votemanatee.com/PollLocationPub.asp?PollingId=856>.

<sup>15</sup>See "Analysis suggests undervote caused by ballot design," *Herald Tribune*, November 15, 2006.

<sup>16</sup>See "Buchanan declared winner; rival Jennings sues," *Herald Tribune*, November 21, 2006.



Figure 2: Picture of Page 1 of Manatee County's 2006 Midterm Election Ballot (Type B04)

B04 OFFICIAL GENERAL ELECTION BALLOT MANATEE COUNTY, FLORIDA NOVEMBER 7, 2006		
<p>• TO VOTE, COMPLETELY FILL IN THE OVAL <input type="radio"/> NEXT TO YOUR CHOICE.</p> <p>• Use only a #2 pencil, the marker provided, or a blue or black pen.</p> <p>• If you make a mistake, don't hesitate to ask for a new ballot. If you erase or make other marks, your vote may not count.</p> <p>• To vote for a candidate whose name is not printed on the ballot, fill in the oval <input type="radio"/>, and write in the candidate's name on the blank line provided for a write-in candidate.</p>		
CONGRESSIONAL	COUNTY	NONPARTISAN
<p><b>UNITED STATES SENATOR</b> (Vote For One)</p> <p><input type="radio"/> Katherine Harris REP</p> <p><input type="radio"/> Bill Nelson DEM</p> <p><input type="radio"/> Floyd Ray Frazier NPA</p> <p><input type="radio"/> Belinda Noah NPA</p> <p><input type="radio"/> Brian Moore NPA</p> <p><input type="radio"/> Roy Tanner NPA</p> <p><input type="radio"/> Write-in _____</p>	<p><b>COUNTY COMMISSIONER</b> <b>DISTRICT 6 - AT LARGE</b> (Vote For One)</p> <p><input type="radio"/> Carol R. Whitmore REP</p> <p><input type="radio"/> Sarah C. Meaker DEM</p>	<p><b>DISTRICT COURT OF APPEAL</b></p> <p>Shall Judge Thomas E. Stringer Sr. of the Second District Court of Appeal be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>
<p><b>REPRESENTATIVE IN CONGRESS</b> <b>DISTRICT 13</b> (Vote For One)</p> <p><input type="radio"/> Vern Buchanan REP</p> <p><input type="radio"/> Christine Jennings DEM</p>	<p><b>NONPARTISAN</b></p> <p><b>JUSTICE OF THE SUPREME COURT</b></p> <p>Shall Judge R. Fred Lewis of the Supreme Court be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>	<p><b>CIRCUIT JUDGE, 12TH CIRCUIT GROUP 21</b> (Vote For One)</p> <p><input type="radio"/> Rochelle Taylor Curley</p> <p><input type="radio"/> Preston DeVilbiss Jr.</p>
<p><b>STATE</b></p> <p><b>GOVERNOR/LIEUTENANT GOVERNOR</b> (Vote For One)</p> <p><input type="radio"/> Charlie Crist / Jeff Kotkamp REP</p> <p><input type="radio"/> Jim Davis / Daryl L. Jones DEM</p> <p><input type="radio"/> Max Linn / Tom Macklin REF</p> <p><input type="radio"/> Richard Paul Dembinsky / Dr. Joe Smith NPA</p> <p><input type="radio"/> John Wayne Smith / James J. Kearney NPA</p> <p><input type="radio"/> Karl C.C. Behm / Carol Castagnero NPA</p> <p><input type="radio"/> Write-in _____</p>	<p><b>JUSTICE OF THE SUPREME COURT</b></p> <p>Shall Judge Barbara Joan Pariente of the Supreme Court be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>	<p><b>SCHOOL BOARD MEMBER</b> <b>DISTRICT 4</b> (Vote For One)</p> <p><input type="radio"/> Bob Gause</p> <p><input type="radio"/> Joe Miller</p>
<p><b>ATTORNEY GENERAL</b> (Vote For One)</p> <p><input type="radio"/> Bill McCollum REP</p> <p><input type="radio"/> Walter "Skip" Campbell DEM</p>	<p><b>JUSTICE OF THE SUPREME COURT</b></p> <p>Shall Judge Peggy A. Quince of the Supreme Court be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>	<p><b>PROPOSED CONSTITUTIONAL AMENDMENT</b></p> <p><b>NO. 1</b></p> <p><b>ARTICLE III, SECTION 19</b></p> <p><b>State Planning and Budget Process</b></p> <p>Proposing amendments to the State Constitution to limit the amount of nonrecurring general revenue which may be appropriated for recurring purposes in any fiscal year to 3 percent of the total general revenue funds estimated to be available, unless otherwise approved by a three-fifths vote of the Legislature; to establish a Joint Legislative Budget Commission, which shall issue long-range financial outlooks; to provide for limited adjustments in the state budget without the concurrence of the full Legislature, as provided by general law; to reduce the number of times trust funds are automatically terminated; to require the preparation and biennial revision of a long-range state planning document; and to establish a Government Efficiency Task Force and specify its duties.</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>
<p><b>CHIEF FINANCIAL OFFICER</b> (Vote For One)</p> <p><input type="radio"/> Tom Lee REP</p> <p><input type="radio"/> Alex Sink DEM</p>	<p><b>DISTRICT COURT OF APPEAL</b></p> <p>Shall Judge Charles A. Davis Jr. of the Second District Court of Appeal be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>	
<p><b>COMMISSIONER OF AGRICULTURE</b> (Vote For One)</p> <p><input type="radio"/> Charles H. Bronson REP</p> <p><input type="radio"/> Eric Copeland DEM</p>	<p><b>DISTRICT COURT OF APPEAL</b></p> <p>Shall Judge Edward C. LaRose of the Second District Court of Appeal be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>	
	<p><b>DISTRICT COURT OF APPEAL</b></p> <p>Shall Judge E. J. Salchines of the Second District Court of Appeal be retained in office?</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>	
VOTE BOTH SIDES OF BALLOT		

otronic machines. This paper is purely a statistical exercise and as such cannot directly address the possibility that engineering issues lie underneath the undervote rates that we study. However, to the extent that voter intentions or ballot formats appear to explain observed undervote rates, this casts doubt on the conjecture that engineering issues like software bugs are responsible for

the CD 13 undervote rate. Of course we cannot distinguish between ballot format problems and software/hardware bugs that perfectly mimic ballot format problems. That is true of any sort of statistical analysis of observed voting data.

Nonetheless, what allows us to study the factors that seemed to have caused the CD 13 undervote are the many sources of within- and across-county variance in voting technologies and ballot formats. Recall, as we noted above, that Charlotte and Sarasota both used iVotronic touchscreens in the 2006 midterm elections. Thus, if there were a generic iVotronic effect in the CD 13 race, it would have affected both Charlotte and Sarasota undervote rates. And, if campaign negativity unduly affected the CD 13 race, it should have affected all voters who participated in it, not just those in one particular county. Finally, within CD 13 there is variance in ballot formats across counties and across time of voting (election day/early and absentee). Below we exploit all of these sources of variance.

### **3 Evidence of Anomalous Undervotes**

This section proceeds as follows. We first present a set of plots that highlight the large CD 13 undervote rate in Sarasota County. Second, we present estimates of several statistical models applied to undervote rates in CD 11, CD 13, and CD 14. Finally, we consider a set of four non-Congressional races (Florida governor, Florida attorney general, Florida chief financial officer, and Florida commissioner of agriculture), and we find strong evidence that the issues at work in Sarasota were generic and affected undervote rates in other races as well.

### 3.1 Evidence of Unusually High Undervote Rates in CD 13

A sense of the magnitude of the Sarasota undervote rate in CD 13 is apparent in Figure 3.<sup>17</sup> In this figure, which describes undervote rates for the five counties that contribute to CD 13, Sarasota is prominent in two ways. First, it has the largest election day versus absentee gap in undervote rates. Second, it contributed the most votes of the five counties in the CD 13 race. This means that the Sarasota numbers in Figure 3 do not reflect the degree of variability that can affect smaller counties, i.e., Hardee with 50 times fewer ballots than Sarasota.

Regarding the election day versus absentee gap in CD 13 undervote rates, on election day the CD 13 undervote rate was approximately 0.139 ( $\hat{\sigma} = 0.00116$ ), but Sarasota absentee voters had an undervote rate of approximately 0.0254 ( $\hat{\sigma} = 0.00105$ ). This translates to a difference of 0.114 ( $\hat{\sigma} = 0.00156$ ). In other words, election day voters in Sarasota County were five times as likely to cast an undervote in the CD 13 race than their absentee counterparts.

Absentee voters are a self-selected group, and perhaps Sarasota absentee voters are simply much more attentive than Sarasota election day voters to undervotes. This seems implausible in light of Figure 4, which plots undervote rates in the Florida United States Senate race.<sup>18</sup> As is evident in this latter figure, there is not much of a gap between the election day (1.3 percent) and absentee (0.9 percent) Senate undervote rates in Sarasota. Unlike the five-fold difference we observe in CD 13, here the election day Senate undervote rate is less than twice as large than the corresponding absentee undervote rate.

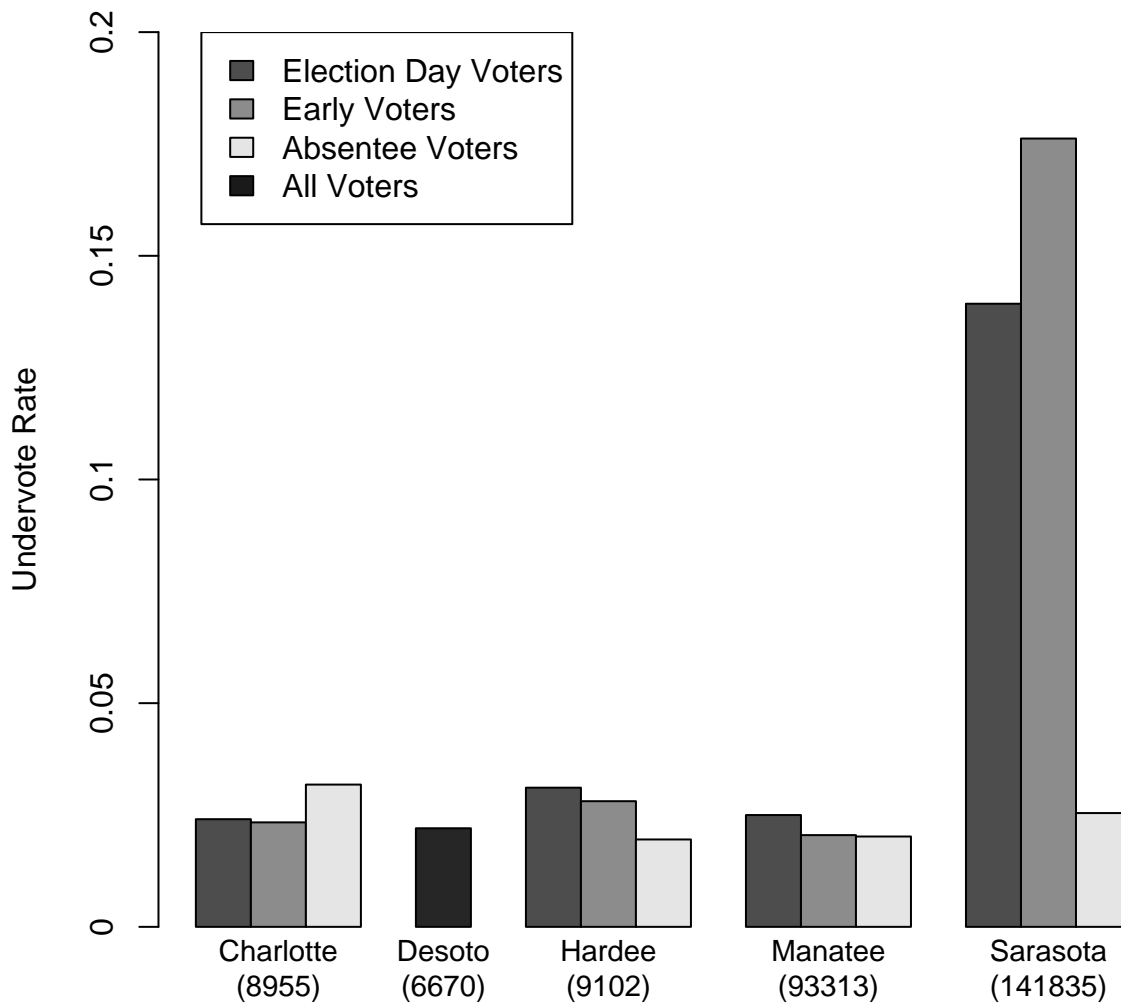
Although not pictured, a plot of election day, early, and absentee undervote rates in CD 13 in 2004 shows no dramatic differences between undervote rates in various counties and time of voting. This is an important point because one could argue that Sarasota election day voters are

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<sup>17</sup>Figure 3, like most other figures in this paper, is based primarily on pre-recount returns. As of this paper's writing the pre-recount, publicly-available canvass for DeSoto County does not break down CD 13 undervote counts by time of voting, i.e., election day, early, and absentee. We do not have access to a certified canvass from DeSoto County. Finally, the figure does not include Manatee County precincts that were split between CD 11 and CD 13.

<sup>18</sup>The United States Senate race was the first on the ballot among all Florida counties. According to certified vote totals, Bill Nelson (Democrat, 60.3 percent) easily beat Katherine Harris (Republican, 38.1 percent) in the race.

Figure 3: 2006 Undervote Rates among Counties Congressional District 13.



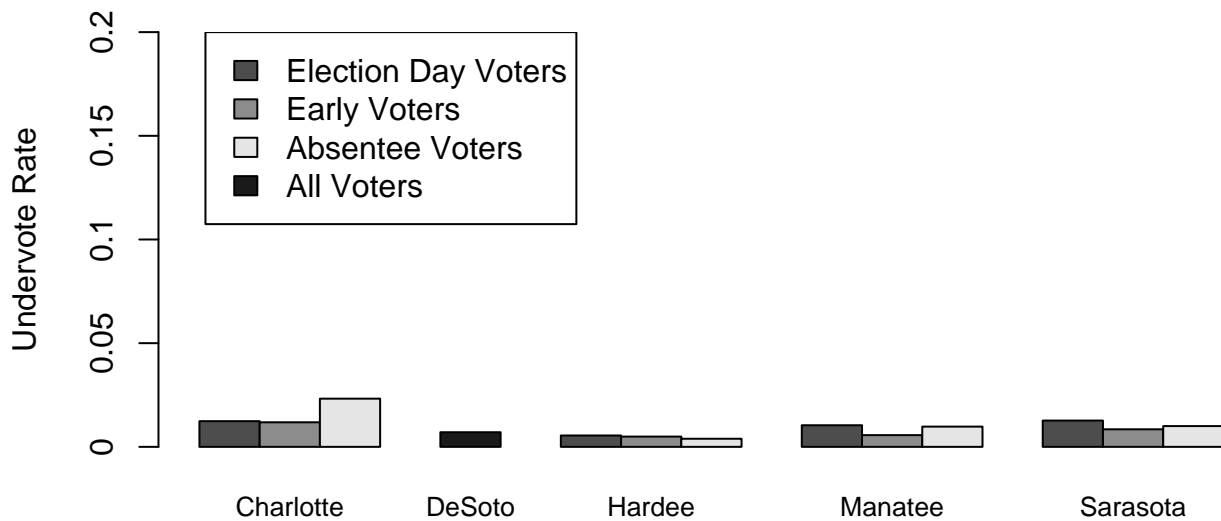
Note: the total of ballots in each county is listed in parentheses under county names.

perhaps unique in their willingness to incur high undervote rates solely in Congressional races.

This argument is not very plausible in light of 2004 undervote rates.<sup>19</sup>

<sup>19</sup>In 2004, Katherine Harris (Republican, 55.3 percent) defeated Jan Schneider (Democrat, 44.7 percent.).

Figure 4: 2006 United States Senate Undervote Rates in the Florida



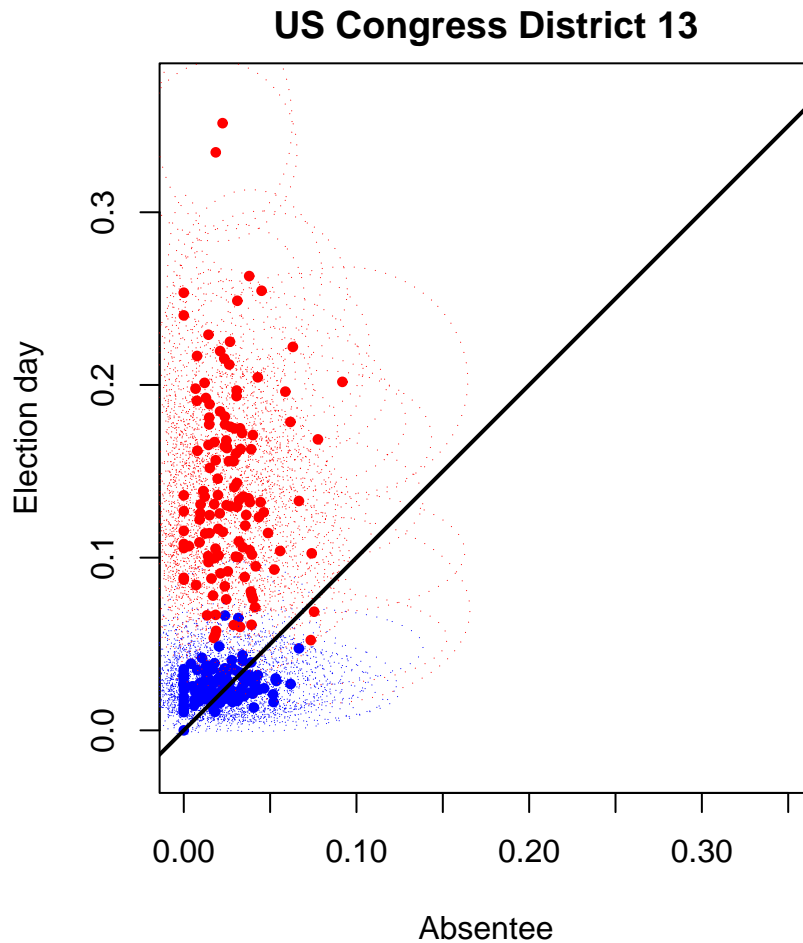
Another perspective on the election day versus absentee undervote difference in CD 13 is provided in Figure 5. Note that the preponderance of Sarasota precincts in the figure are above the pictured 45 degree line: this means that they had election day undervote rates greater than absentee undervote rates. This is a feature unique to Sarasota County, as the figure shows.

### 3.2 Analysis of Undervote Rates in CD 11, CD 13, and CD 14

One limitation of the basic undervote result described above (Figures 3, 4, and 5) is that they do not control for the fact that, presumably, there is variance across CD 13 precincts in the underlying tendency to undervote. Perhaps, that is, (some) Sarasota precincts had high undervote rates because they tend to contain undervoters in general.

With this possibility in mind, we now consider regression analyses that seek to explain precinct-level undervote rates while controlling for precinct partisanship and undervote proclivity. We ana-

Figure 5: Election Day and Absentee Undervote Rates in CD 13



Note: Each red dot in the figure represents a Sarasota precinct and each blue dot a non-Sarasota precinct. The ellipses around the dots represent 95 percent confidence sets.

lyze three separate United States House races, those in CD 11, CD 13, and CD 14, and this reflects the fact that it would be inappropriate for us to study CD 13 in isolation from other Congressional Districts in Florida. If what happened in the CD 13 contest is unique, i.e., if the undervote rate in this race had idiosyncratic features, then we should expect to see a lack of such features in Congressional District races that are physically close to CD 13.

As a caveat, however, we note that the CD 11 and CD 14 races were not at all close elections. In CD 11, the winning candidate received approximately 69.7% of the popular vote, and in CD

14 the corresponding winning percentage is approximately 64.4%. Non-competitive United States House races are hardly atypical in Florida and outside of it. The only Congressional race recount in Florida in the 2006 midterm elections took place in CD 13.

In the analyses that follow we divide each precinct in CD 11, CD 13, and CD 14 into election day, absentee, and early voting components. We then regress at the precinct level the Congressional race undervote rate (i.e., the total number of undervotes divided by number of ballots cast) on the United States Senate undervote rate, the fraction of U.S. Senate ballots cast for the Democratic candidate Bill Nelson, and indicator variables that control for county effects and time of voting (election day, early, and absentee) effects.<sup>20</sup>

Before turning to regression results, though, consider Table 1, which describes election day and early voting technologies used in the CD 11, CD 13, and CD 14 counties. Note that all such counties used optical scan balloting for their absentee voters. Sarasota County, as made clear in the table, is notable insofar as it used iVotronic touchscreens and did not have its Congressional district race on a separate page. The same thing applies to Lee County, about which we have much more to say later. As an aside, the order of top races in all Florida counties was United State Senate, United States Congress, Florida governor, Florida attorney general race, Florida chief financial officer, and Florida commissioner of agriculture. In this paper we do not examine undervote patterns below the commissioner of agriculture race.

Coefficient estimates from our CD 11, CD 13, and CD 14 regressions are in Table 2.<sup>21</sup> We see from this table that precincts with high Senate undervote rates tend to have high Congressional undervote rates and that the precinct-level relationships between these two variables are statistically significant at conventional confidence levels (the three p-values for Senate Undervote Rate are all less than  $1 \times 10^{-6}$ ). This is consistent with Herron & Sekhon (2003), who show using ballot data

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<sup>20</sup>The intercepts in our regressions are suppressed, and all regressions are weighted by number of ballots cast per precinct.

<sup>21</sup>Undervote rates from the three Congressional district races can be modeled hierarchically (since precincts are nested within counties), and future versions of the paper will take advantage of this structure and also add additional Congressional districts to the three considered here.

Table 1: Election Day Voting Technologies Across Congressional Districts 11, 13, and 14

District	County	Technology	Type	Location of Congressional District (CD) Race
11	Hillsborough	Touchscreen	AVC Edge	Two column ballot, CD race right of Senate
	Manatee	Optical Scan	Accuvote	Paper ballot, multiple pages
	Pinellas	Touchscreen	AVC Edge	Two column ballot, CD race right of Senate
13	Charlotte	Touchscreen	iVotronic	CD race on its own page
	Hardee	Optical Scan	Accuvote	Paper ballot, multiple pages
	Manatee	Optical Scan	Accuvote	Paper ballot, multiple pages
	Sarasota	Touchscreen	iVotronic	CD race on same page as governor race
14	Charlotte	Touchscreen	iVotronic	CD race on its own page
	Collier	Touchscreen	iVotronic	CD race race on its own page
	Lee	Touchscreen	iVotronic	CD, governor, and atty. gen. races on same page

that voters who undervote on one top race tend to undervote on others. Of course, it does not follow from Table 2 that the same Florida voters who undervoted on the Senate race also undervoted on the Congressional race. Nonetheless, we also see from the table that Democratically-leaning precincts tend to produce disproportionately many undervotes, and this too is consistent with existing literature.

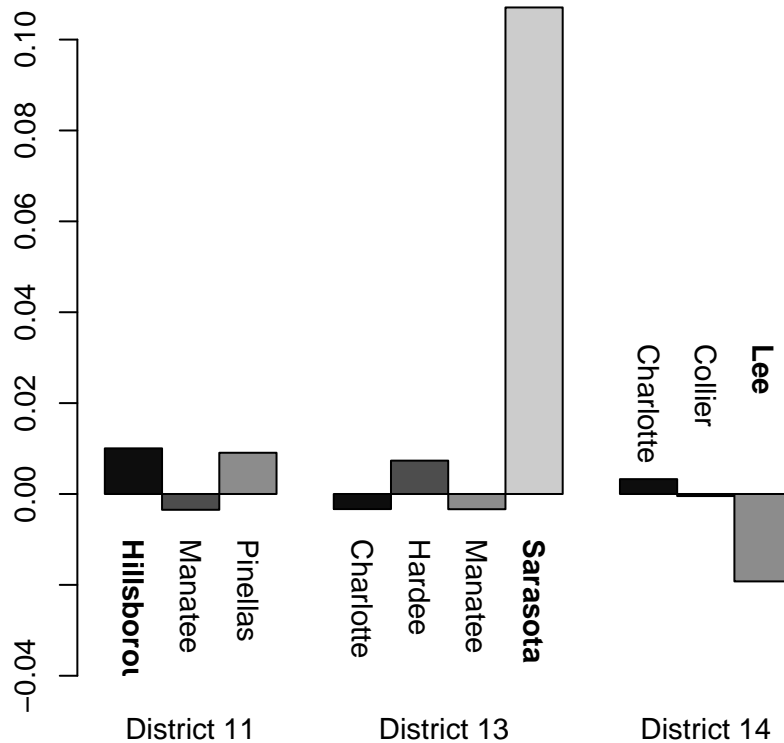
Table 2's many indicator variables for county and time of voting effects are summarized in Figure 6. This figure has one bar for each county and Congressional District, and the value of a bar is the difference between an election day effect of undervoting minus the corresponding absentee effect. For instance, the first bar in Figure 6 is valued at approximately 0.01 because, in the CD 11 section in Table 2, the Hillsborough election day effect on undervoting is -0.00088, the absentee effect is -0.01092, and the difference between these two effects is approximately 0.01. Since Figure 6 shows differences in effects, it implicitly controls for county-wide effects. That is, if all Hillsborough voters had, say, relatively low undervote rates on account of some factor unique to election administration in Hillsborough County, then the effect of this factor would be present in all three Hillsborough estimates in Table 2 and hence not present in the differences in Figure 6.

Positive values in the Figure 6 denote contexts where, controlling for precinct characteristics, there was more election day undervoting than absentee undervoting. Clearly, the most dramatic

Table 2: Results for Congressional District Regressions

District	County	Type	Estimate	Standard Error	Summary Measures
11	Hillsborough	Election day	-0.00088	0.00482	$n = 659$ $R^2 = 0.89$
		Absentee	-0.01092	0.00456	
		Early	-0.00528	0.00517	
	Manatee	Election day	-0.00513	0.01074	
		Absentee	-0.00165	0.02168	
		Early	0.02339	0.03194	
	Pinellas	Election day	0.00945	0.00625	
		Absentee	0.00039	0.00790	
		Early	0.00894	0.00893	
		Senate Undervote Rate	1.01316	0.05720	
	Senate Democratic Fraction	0.03806	0.00719		
13	Charlotte	Election day	-0.0421	0.0131	$n = 891$ $R^2 = 0.90$
		Absentee	-0.0388	0.0169	
		Early	-0.0432	0.0144	
	Hardee	Election day	0.0016	0.0088	
		Absentee	-0.0057	0.0185	
		Early	-0.0025	0.0126	
	Manatee	Election day	-0.0372	0.0096	
		Absentee	-0.0339	0.0093	
		Early	-0.0377	0.0119	
	Sarasota	Election day	0.0737	0.0098	
		Absentee	-0.0334	0.0096	
		Early	0.1111	0.0107	
		Senate Undervote Rate	1.1951	0.1849	
		Senate Democratic Fraction	0.0904	0.0165	
	14	Charlotte	Election day	0.00107	
Absentee			-0.00220	0.00423	
Early			0.00064	0.00372	
Collier		Election day	0.00061	0.00218	
		Absentee	0.00105	0.00225	
		Early	-0.00133	0.00228	
Lee		Election day	-0.00455	0.00233	
		Absentee	0.01469	0.00232	
		Early	-0.00501	0.00251	
		Senate Undervote	0.50015	0.03548	
		Senate Democratic Fraction	0.02388	0.00419	

Figure 6: Effect Across Three Congressional Districts of Election Day versus Absentee Voting on Undervote Rates Controlling for County, Precinct Partisanship, and Precinct Tendency to Under-vote



Note: Values of bars are based on differences between election day and absentee indicator variables from Table 2. Bold county names denote bar values that are significantly different from zero at the 0.05 level.

value in Figure 6 is that for Sarasota County in CD 13: the election day minus absentee difference is on the order of 0.10, meaning that the election day undervote rate among Sarasota County precincts was about ten percent higher than the absentee precinct undervote rate, all things equal.<sup>22</sup>

<sup>22</sup>This 10 percent result is robust to inclusion of two additional variables in the CD 13 regression model: the fraction of precinct voters who supported the first constitutional amendment vote on the 2006 Florida ballot (the amendment passed 59.8% to 40.2% and dealt with budgeting matters) and the fraction of undervotes cast in the first amendment race.

Notably, of the four counties studied in CD 13, only Sarasota had a significant difference between election day and absentee voters. Furthermore, the Sarasota election day versus absentee difference is easily statistically significantly different than the other three CD 13 differences.

Figure 6's other statistically significant election day versus absentee differences are in the Hillsborough part of CD 11 and the Lee County part of CD 14. For the latter, we suspect that the explanation lies in the partisanship of Lee County election day voters versus absentee voters. Namely, the former appear to be much more Democratic than the latter: approximately 53% of them voted for the Democratic Florida United States Senate candidate versus approximately 43% of absentee voters. If strong Democratic partisans simply dropped out of the CD 14 race on account of its being a certain Republican victory, then one might expect to see a negative Lee County election day effect as in Figure 6. The same thing may explain the Hillsborough effect as well in that strong Democratic partisans were more likely to participate in a lopsided Democratic victory. Regardless, in terms of substantive significance Figure 6's Sarasota effect is over five times as large as its nearest competitor.

What might explain this effect? In light of our three conjectures noted earlier, it is hard to imagine that the Sarasota result reflects deliberate voter choices. If, say, CD 13 election day voters were driven away from participating in their Congressional race by a blitz of last-minute negativity, then this should have affected all four counties in the CD 13 race, not just Sarasota. That is, if the explanation for undervotes were campaign negativity, then we would expect to see four roughly similar values for the four CD 13 counties in Figure 6. As to the possibility that Sarasota voters are simply different insofar as tending to overvote regularly, this claim cannot explain the Sarasota effect in Figure 6 because the effect is calculated controlling for county and precinct willingness to undervote.

Rather, recall from Table 1 that among counties studied here Sarasota County was one of two in its use of iVotronic machines in conjunction with a Congressional district race that did not appear on its own ballot page. If, for reasons that transcend this paper, voters are more likely to undervote

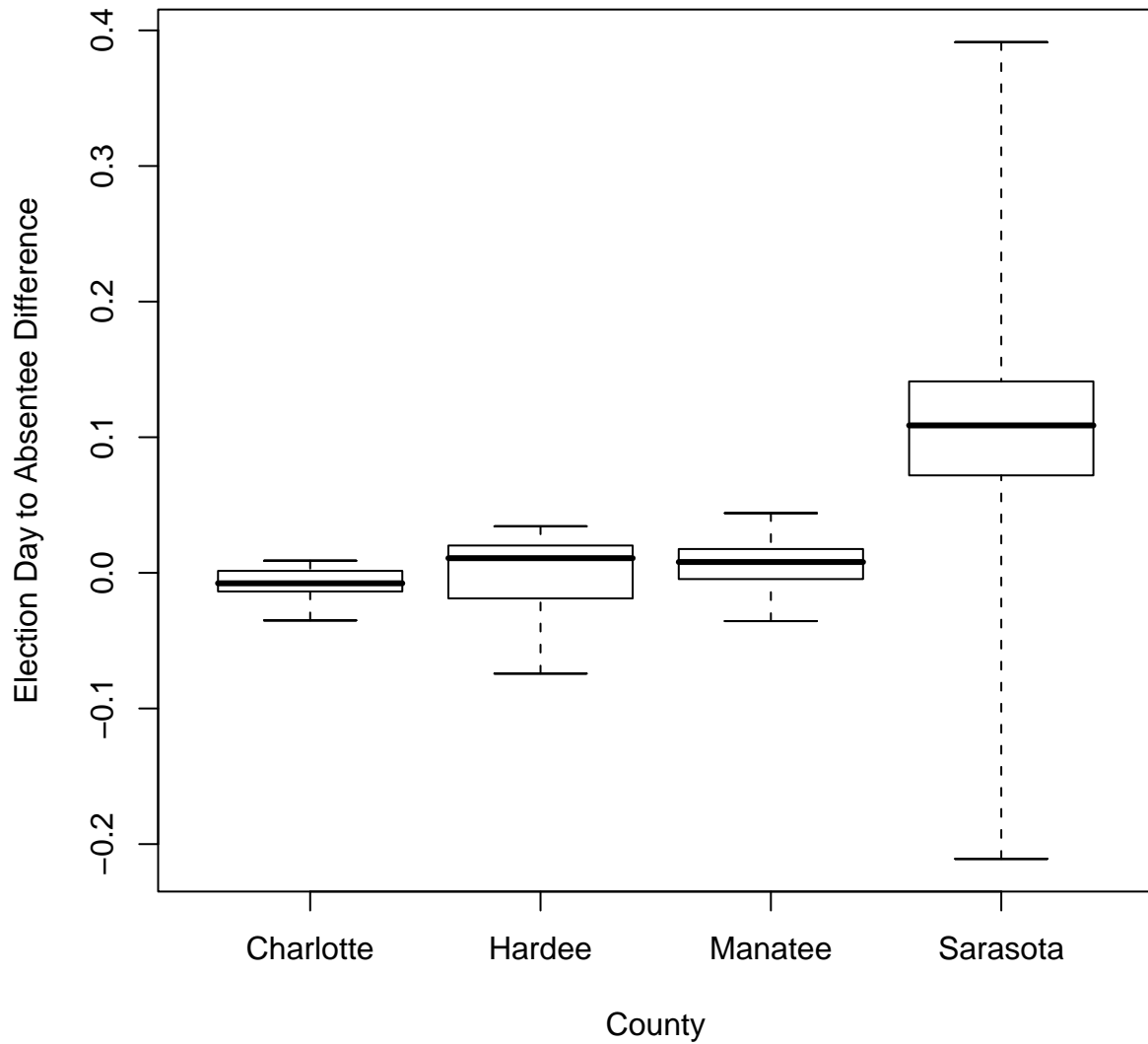
in a two-candidate race that appears immediately above or conceivably immediately below a six-candidate race that includes a write-in option, then we would expect to see a large Sarasota CD 13 effect, precisely what we observe in Figure 6. We might also expect to see a large Lee County CD 14 effect, which we do not see. However, the CD 14 effect, we suspect, reflects partisanship undervoting in a rather lopsided race.

Could the Sarasota effect in Figure 6 reflect ballot machine failure, engineering problems in iVotronics, software bugs, and so forth? There are several ways to think about this question. First, if voting hardware or software were the problem, then there must be something unique to Sarasota's use of iVotronics that in November, 2006 did not dramatically affect, say, Charlotte County's or Lee County's machines. Whether iVotronic software is tailored for individual counties is not something we know. If, though, it is not, then there must be some sort of an interaction with a generic iVotronic software problem and Sarasota's use of it. Perhaps Sarasota's iVotronic maintenance program is different than the maintenance program in surrounding counties.

Second, if there were hardware or software problems among Sarasota's iVotronics, then they affected practically all such machines. This is an important point in light of our regression results in Table 2. One can always ask, that is, if a small group of aberrant precincts affected a set of regression. To see that this did not happen in our case consider Figure 7, which displays a box plot of differences between election day and absentee undervote rates among precincts in CD 13.

Figure 7 shows that the median election day minus absentee CD 13 undervote rate difference in Sarasota County was much greater than the maximum such values in Charlotte, Hardee, and Manatee counties. The box plot also shows the first quartile of differences, the third quartile, and the minimum and maximum differences. The implication of Figure 7 is that the CD 13 regression results in Table 2 do not reflect a few precincts with enormous undervote rate problems but rather a consistent pattern among Sarasota precincts. Thus, if there were hardware and/or software issues at play in Sarasota, they were pervasive and not restricted to a few problematic precincts or even voting machines within precincts.

Figure 7: Differences in Congressional District 13 Election Day and Absentee Undervote Rates among Four Counties



### 3.3 More Evidence of Ballot Format-Induced Undervotes

If Sarasota's grouping of races on its iVotronic touchscreen machines drove the CD 13 undervote in that county, then we should expect to see similar evidence of unusually high undervote rates when

we observe other groupings of races in counties that use iVotronics. To this end we turn to the top four Florida races among the eight counties that comprise CD 11, CD 13, and CD 14. As before we consider all election day, early voting, and absentee precincts in these counties and calculate undervote rates for the following Florida races: governor, attorney general, chief financial officer, and commissioner of agriculture. The latter three races are called cabinet races.

Among the eight counties we study four use iVotronics: Charlotte, Collier, Lee, and Sarasota. For these four counties Table 3 describes notable groupings for the governor and cabinet races akin to the way that the CD 13 race was grouped with the Florida gubernatorial race in Sarasota County. As noted earlier, the governor’s race in Florida had six candidates plus a write-in slot whereas the cabinet officers all had two candidates and no write-in possibility.

Table 3: Groupings among Governor and Cabinet Races in iVotronic Counties

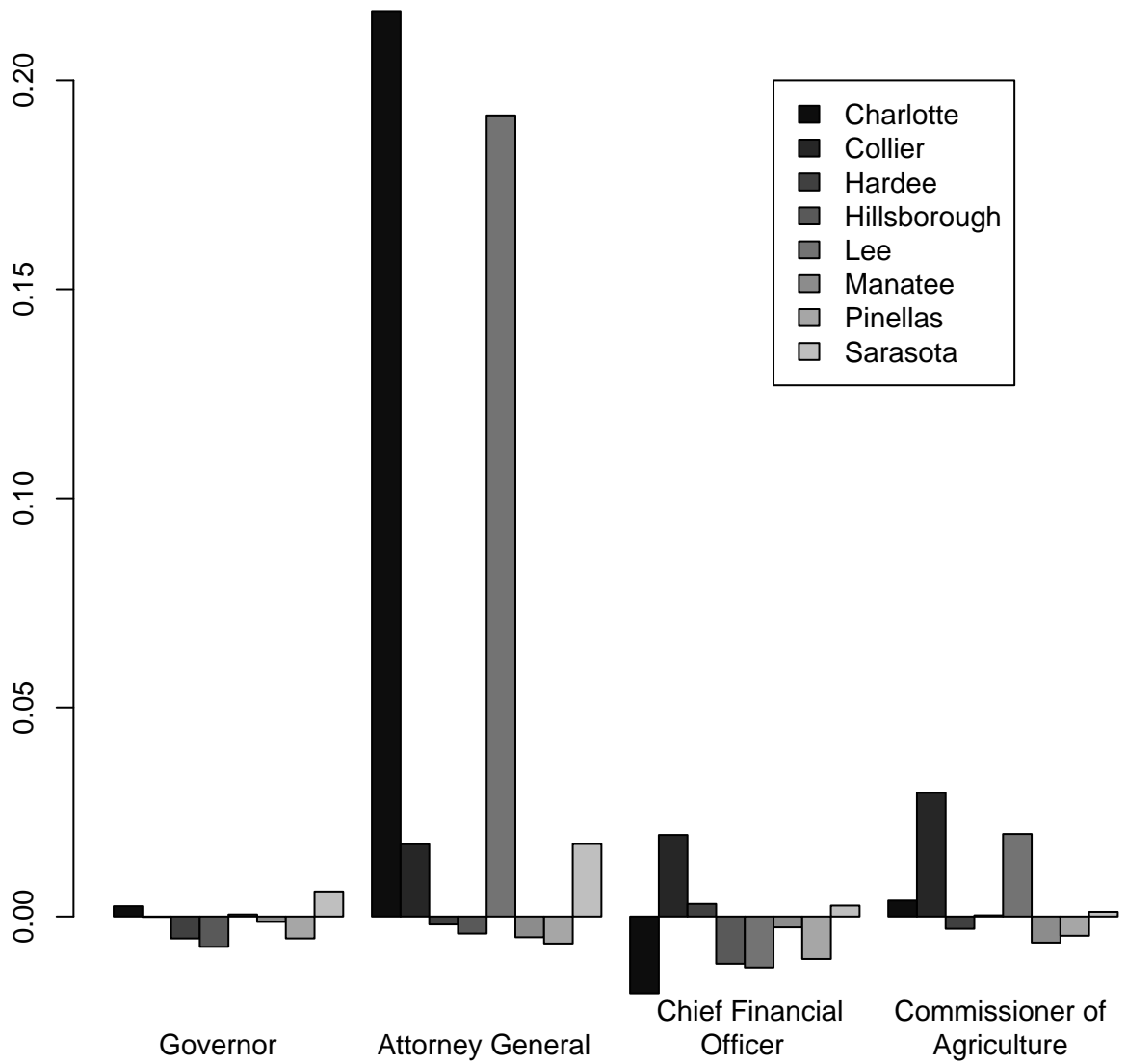
County	Groupings
Charlotte	Governor paired with Attorney General
Collier	Governor alone, then three cabinet races on next page
Lee	Governor paired with Attorney General
Sarasota	Governor with CD 13, then cabinet races together

In light of Table 3 and the CD 13 findings we have described already, we should expect to see large election day versus absentee differences for the attorney general race in Charlotte and Lee Counties. These reflect the most asymmetric groupings in the table just as Sarasota grouped a small CD 13 race with a multi-candidate gubernatorial contest. We also might expect to see grouping effects in Collier County insofar as this combined all cabinet races on a single page.

With this in mind, we estimate four weighted least squares regressions, one for each top Florida race. Each regression produces 26 slope estimates: a Senate undervote estimate, a Senate Democratic share estimate, and 24 (eight by three) estimates for eight counties cross three different times of voting. Complete regression results are available from the authors. Figure 8 summarizes election day minus absentee differences, controlling for precinct undervote tendencies and parti-

sanship using, as we did before, the fraction of Senate undervotes by precinct and the fraction of Democratic Senate votes.

Figure 8: Effect on Top Florida Races of Election Day versus Absentee Voting on Undervote Rates Controlling for County, Precinct Partisanship, and Precinct Tendency to Undervote



There are two notable features of Figure 8. First, with respect to the Florida attorney general race, Charlotte and Lee Counties had enormous gaps between election day and absentee voting propensities to undervote. The difference here is on the order of 20 percent, which is about twice as large as the CD 13 effect identified in Sarasota County. These gaps are consistent with the race grouping conjectures that follow from Table 3.

Second, Collier County shows a consistent effect of election day voting although nothing nearly as dramatic as the Charlotte and Lee effects noted above. These Collier effects seem roughly consistent with the consequences of grouping three races on a page, i.e., too many similarly sized races on a single page leads to undervotes.

The reason that Figure 8 is so important is because it suggests that the reasoning offered here for the CD 13 undervote in Sarasota is compelling. If one were to take seriously the notion that voter indifference, potentially induced by campaign negativity, drove the CD 13 undervote rate in Sarasota, one would have to argue that voter indifference over Florida attorney general candidates affected voters in Charlotte and Lee Counties. How this might happen is not clear. If Florida voters were in general indifferent between attorney general candidates, why would they act on their indifference only in two counties and why on election day but not via absentee voting, controlling for precinct tendencies?

Similarly, the case for hardware and software problems in Sarasota becomes more difficult to make given Figure 8. If Sarasota experienced a generic machine malfunction of some type, then this same malfunction affected two other neighboring counties but only in one particular race (and not in the same race that the malfunction appeared in Sarasota). Of course this could have happened: flaws in software code can interact in ways that are hard to predict, and we can never rule out the possibility that the culprit here is iVotronic software or hardware that malfunctions when races are grouped.

Nonetheless, without engineering or laboratory evidence this seems to be a hard case to make. At this point the argument that ballot formatting drove the CD 13 undervote in Sarasota and the

attorney general undervote in Lee and Collier is more compelling.

## **4 Allocating CD 13 Undervotes to Buchanan and Jennings**

We now consider the question, what would have happened in CD 13 if the undervotes cast in Sarasota followed patterns similar to those cast elsewhere in the district? In Sarasota County, a total of 120,686 touch screen ballots were cast in either early or election day voting. Of these, 17,811, or 14.8 percent, did not vote in the CD 13 race while only 2.6 percent undervoted across other Charlotte, Hardee, Manatee Counties in this same race. If we assume that a similar 2.6 percent of voters in Sarasota preferred to have undervoted in the CD 13 race, then approximately 14,750 voters in Sarasota county would have cast a vote in this race if the Sarasota touchscreen ballot had been no different than the ballots in Charlotte, Hardee, and Manatee.

### **4.1 Two Stylized Stories about the Source of Sarasota Undervotes**

There are two stylized stories we might tell to explain why these 14,750 voters did not cast a vote in the CD 13 race. One, the surplus level of undervoting in Sarasota might have been driven entirely by some voters accidentally not seeing the CD 13 candidates, or, two, it might have been driven by indifference on the part of certain types of voters. That is, some Sarasota undervotes were caused by individuals who saw the CD 13 race and chose not to vote while the rest were caused by voters who did not initially see the CD 13 race because of ballot design but would have seen it if given a better ballot format. Call these *suppressed* ballots and the votes which would have been cast from the suppressed ballots the *intended* votes.<sup>23</sup>

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<sup>23</sup>Certainly, some suppressed voters who did not see the Congressional race on the ballot would have gone on to undervote deliberately in CD 13 if they had seen it. Thus, we assume that some fraction of intended votes would have been cast as undervotes.

### 4.1.1 Suppression by Random Accident

At one extreme, we might suppose that the rate of suppressed votes is explained entirely by ballot mechanics. That is, the touchscreen ballot design in Sarasota County led to a certain probability of “accidents” where voters did not see the election and did not ever face the choice they would otherwise have made between voting for a Republican or Democratic candidate or indeed choosing not to cast a CD 13 vote at all. If surplus undervoting in Sarasota County were driven by completely random accidents, then the suppressed voters are a completely random sample of the voters in each precinct.

From the assumption that ballot mechanics explain everything, two points can be made. First, the distribution of intended votes should follow (within sampling variance) the distribution of votes cast by voters who were not suppressed. If this model were true, then the roughly 15,000 intended votes would have fallen in about the same split as the unsuppressed votes in Sarasota County and thus split roughly 7,500 for Jennings and 6,500 for Buchanan. This would result in Jennings picking up 1000 votes over Buchanan and overcoming the 369 vote deficit on the day.

Second, both candidates received fewer votes than they would have received if the intended votes had been cast, as suppression transferred votes from each of their columns to the undervote column. This second point can be clearly demonstrated with precinct data. Suppose that we calculate vote shares as the percent of the votes cast for the Democratic candidate out of all ballots cast including undervotes, such as:

$$\text{Democratic Voteshare} = \frac{\text{Democratic Votes}}{\text{Dem. Votes} + \text{Rep. Votes} + \text{Undervotes}}. \quad (1)$$

Then, under the story of suppression caused by accident, we should expect some voters who intended to vote Democratic to instead undervote, thus the numerator above gets smaller while the denominator stays the same size as votes are simply transferred from Democratic votes to undervotes. Thus the Democratic vote share, as a share of *all votes cast*, should be decreased by

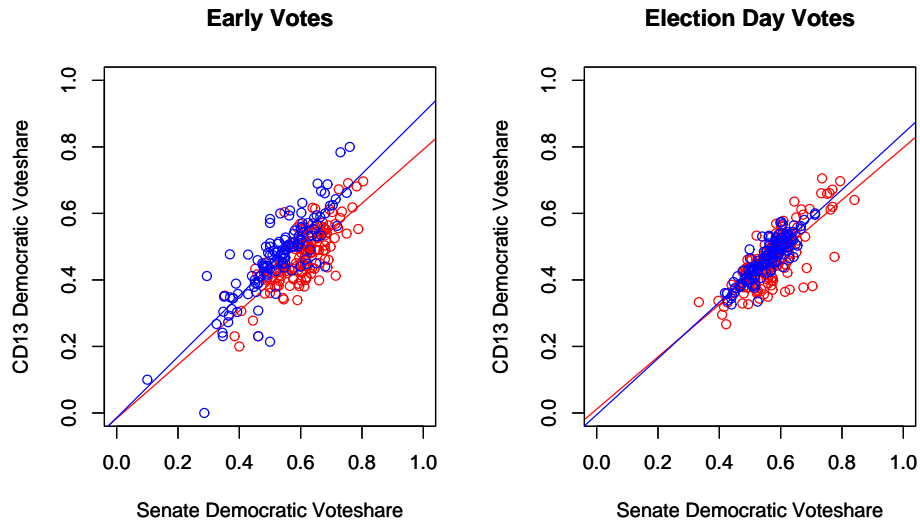


Figure 9: Democratic Vote Shares in Senate and CD 13 Races for Early and Election Day Voters

Note: Each red dot in the figure represents a Sarasota precinct and each blue dot a non-Sarasota precinct.

accidents. The Republican vote share would similarly be reduced.

Is this accident theory plausible in any sense? Figure 9 plots the vote shares of Jennings vertically and for the Democratic Senate candidate horizontally. These two vote shares should predict each other: as more (or fewer) voters in a district cast ballots for the Senate Democratic candidate, we would expect more (or fewer) voters to also cast a ballot for Jennings in her House race.<sup>24</sup>

What is clear from Figure 9 is that, at any level of Democratic Senate support, the number of Democratic votes for Jennings is below what is expected: red points are clustered horizontally below blue points and the red summary line dips below the blue summary line. Similarly, Buchanan vote share in Sarasota County falls below what would be expected given Senate vote shares.<sup>25</sup> This effect seems to be more pronounced in the early voting than in the election day voting, which is

<sup>24</sup>The United States Senate race is chosen for this example as of all races it has the strongest relationship with the Congressional race.

<sup>25</sup>The corresponding figure is not shown, but patterns in it are as predicted by accidents that suppress Republican votes and change them into undervotes.

consistent with the story that some poll workers were warned of the problematic Sarasota ballot format problem and tried to pass on this warning to voters who voted on the day of the election. The slope of the Sarasota lines in Figure 9 is smaller than the non-Sarasota lines, which is what we would expect if some constant fraction of all votes were being randomly suppressed and converted to undervotes.<sup>26</sup>

#### **4.1.2 Suppression by Indifference**

Beyond this accident story, there is an alternate stylized conjecture for how suppressed intended votes would have turned out had they not been suppressed. Suppose that there are two types of voters, engaged and disengaged. Engaged voters followed the CD 13 election closely, clearly prefer one candidate over another, and care deeply about the outcome. When faced with a choice, engaged voters vote for the candidate they prefer. Disengaged voters may have no information about the CD 13 race, or are disenchanted with both candidates, or for some other reason they do not care about the outcome of the House race. When faced with the choice, Buchanan versus Jennings, disengaged voters may deliberately choose to undervote or they might choose between the candidates in a random fashion out of a perceived duty to vote. Disengaged voters may be very knowledgeable and care deeply about other races on the ballot; we simply assume that they are not interested in the CD 13 House race.

In these two hypothetical extremes, engaged voters would be expected to search the ballot for their preferred House candidate and would not likely be tripped up by a ballot design flaw. Moreover, if an engaged voter initially and accidentally misses voting for her preferred House candidate, when an electronic review screen warns her that she has not voted in the House election, she is inclined to make the added effort to go back and correct this oversight. Conversely, disengaged voters are not seeking out the House election on the ballot, they are consequently more

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<sup>26</sup>In every other statewide race voted on in the 2006 midterm elections in Florida, the relationship in Sarasota County predicting vote share from other election results is exactly the same as the relationship outside of Sarasota County (these results to be presented in a forthcoming appendix).

likely to accidentally miss voting, and when they are warned they have made this error they are less likely to spend the effort to go back and correct an undervote. In this story, one about engaged and disengaged voters, the former are less likely to be suppressed the latter, more likely.

According to this way of thinking, at the extreme, if all suppressed votes were wholly disengaged voters, then intended votes would have been equally split between Buchanan and Jennings. Thus, if about 15,000 votes were suppressed, each candidate would have received an equal apportionment of about 7,500 each. Jennings would not pick up votes on her opponent, and Buchanan would still have won the election by 369 votes.

Let us now redefine the vote share of the Democratic candidate among votes cast for the Democratic or Republican candidates, that is excluding undervotes, as:

$$\text{Democratic Voteshare} = \frac{\text{Democratic Votes}}{\text{Dem. Votes} + \text{Rep. Votes}} \quad (2)$$

If the story of suppression owing to indifference occurs, an equal number of votes should be removed from Buchanan and Jennings. If Jennings were previously winning by some number of votes, say 100, then subtracting an equal number of votes from her and from her opponent will cause the vote share for the winning candidate to *increase* as a 100 vote lead, i.e., a smaller total number of votes cast will look like a greater ratio. If the earlier story about undervotes was instead correct and suppression was caused completely by accident, then votes would be removed from Jennings vote share in proportion to how votes were cast. Thus, under the “accident” story Jennings (or Buchanan) vote share, as calculated above, should not change when suppression occurs but under the “indifference” story, the winner in any precinct should seem to have a greater share of the cast ballots when indifferent voters are suppressed.

Figure 10 shows the relationship between Senate Democratic and CD 13 Democratic vote shares but now using this different measure of vote share that excludes undervotes. What we see here is that the Sarasota distribution, and the red line, is now *above* the blue distribution and blue

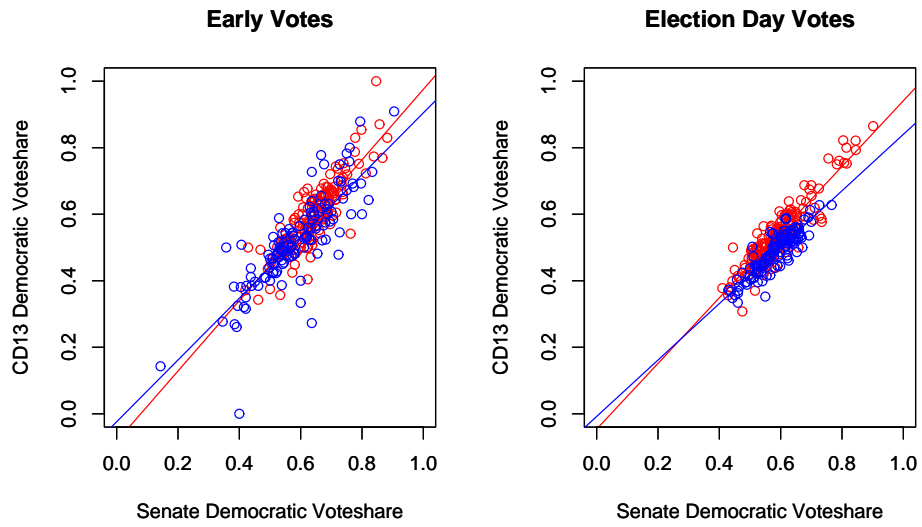


Figure 10: Democratic Vote Shares in Senate and CD 13 Races for Early and Election Day Voters, Normalizing by Valid Votes Cast

Note: Each red dot in the figure represents a Sarasota precinct and each blue dot a non-Sarasota precinct.

line. Thus the margin of victory is more dramatic in Sarasota precincts in the House race than would have been predicted given the relationship between the margin of victory in Senate and House races in other counties. This supports the theory that suppression did not occur completely randomly; instead, voters who were indifferent were more likely to be suppressed causing the margin of victory to increase.

#### **4.1.3 Combining the Two Stylized Versions of Undervotes**

The true process that occurred in Sarasota county is undoubtedly a mixture of our accident and indifference stories. Almost certainly some Sarasota voters were suppressed by the grouped race ballot design completely at random and completely by accident; these voters would be drawn randomly from the set of voters in a given precinct. However, with respect to the CD 13 race the iVotronic review screen that rescues some voters from being suppressed was probably more likely to rescue engaged voters than voters who were indifferent and did not want to spend extra effort voting in a race they had weak or no preference in. Thus some greater proportion of the suppressed vote was indifferent voters who might be expected to split their votes evenly between the candidates. This means that the observed margin of victory in suppressed precincts will be greater than would have been observed if the precinct had not been suppressed.

## **4.2 Allocating Suppressed Votes**

Our approach to the problem of suppressed votes is to use available aggregated precinct data to estimate what the precinct vote totals in Sarasota County would have been if the ballot design and equipment there had been equivalent to those used in the other counties in CD 13. Note that in precincts in CD 13 which are outside Sarasota County we can observe all the relationships between results in other races and the result in CD 13 race. These relationships will help us predict how we would have expected the Congressional election in each Sarasota precinct to turn out, given that we know how all the other races turned out in the same precinct.

In precincts inside Sarasota county, we obviously do not observe the counter-factual answer we are seeking; thus, the Sarasota precincts cannot straightforwardly contribute information to our model of the relationships between the CD 13 race and other races on the ballot. However, these precincts do also contain some useful information. Although we do not know how the vote totals in such precincts would have turned out if there had not been any ballot design issues, we do know that, with respect to Buchanan and Jennings totals, these totals must be higher than the totals that resulted on the day of the election. That is, the ballot design issue we have discussed could only transfer intended votes from each candidate and turn them into undervotes. Therefore, although we can not observe intended votes, we know Buchanan and Jennings would have received *more* votes than he or she received, respectively, on election day.

Our statistical model of Sarasota undervote reallocation makes two key assumptions:

- *The relationships between electoral races are the same across all precincts in CD 13.* This is not an assumption that all districts appear or vote the same. Clearly some vote heavily for one candidate and some for another. Rather, we assume that the ability to predict one race given knowledge of all the other races applies inside Sarasota in the same way that it applies in non-Sarasota precincts.
- *Both candidates, Buchanan and Jennings, would not have received fewer votes if the ballots were correctly designed than they did on the day with the flawed ballot design.* That is, the issue of race grouping (CD 13 with Florida governor) did not add votes to either candidate but only changed actual votes into undervotes.

From these assumptions, we derive a statistical model as follows. We assume the the vote share for candidates, as well as the proportion of voters intentionally undervoting, are additive-logistic-normally distributed as in Katz & King (1999), and we set up a full-information likelihood function using the constraint that candidate vote shares are nondecreasing. We draw predicted values of the Sarasota precinct totals to give us a distribution of imputed values (Schafer 1997,

King, James Honaker & Scheve 2001), truncating the posterior distribution to obey our censoring constraint (Honaker, Katz & King 2002). Full technical details will be presented in a forthcoming appendix.

Our model gives us a probability density over all precinct results and thus cumulatively over all election outcomes. We take one thousand random draws from this predicted density and calculate one thousand predicted election outcomes. From our random draws we can answer key questions such as, what fraction of Sarasota undervotes were suppressed votes of voters who intended to cast a ballot for a candidate, how would those votes have broken between Buchanan and Jennings, and how might that have influenced the election outcome. Additionally, and crucially, we can express our degree of confidence in each of these quantities.

Our results are summarized in Table 4. This table provides estimated election results among early and election day voters in Sarasota County. What is key is how many more votes Buchanan and Jennings would have received if Sarasota undervotes had not been influenced by ballot design. This is expressed as the *pickup* for each candidate and for undervotes as well. The undervote pickup is negative as, according our reallocation, votes move from the undervote to Buchanan and Jennings. The vote totals and pickups reported in Table 4 are the most likely, or expected, values. In addition, associated 90% confidence interval estimates provide a measure of uncertainty in our pickup totals.

Looking first at early voting, we can see that the confidence interval for the undervoting column is -4396 to -4685, so we can be 90 percent confident that there would have been between 4396 and 4685 fewer early voting undervotes if there had been no ballot design problem in Sarasota County. Our best guess is that 2436 suppressed voters intended to vote for Jennings and 2110 voters intended to vote for Buchanan in the early voting. Thus, Jennings would gain 326 votes over Buchanan among early suppressed voters.

In election day voting we can be 90 percent confident that Jennings would gain between 5002 and 5861 more votes in Sarasota had there been no ballot design issues. Similarly, we can be 90

Table 4: Summary of Allocation Results

EARLY VOTING:			
	Jennings	Buchanan	Undervote
Estimated Vote:	16903	12943	866
Estimated Pickup:	2436	2110	-4546
Lower bound of 90% Confidence Interval:	2176	1852	-4685
Upper bound of 90% Confidence Interval:	2702	2362	-4396
ELECTION DAY VOTING:			
	Jennings	Buchanan	Undervote
Estimated Vote:	45267	41123	2283
Estimated Pickup:	5421	4647	-10068
Lower bound of 90% Confidence Interval:	5002	4244	-10310
Upper bound of 90% Confidence Interval:	5861	5060	-9811
EARLY + ELECTION DAY VOTING:			
	Jennings	Buchanan	Undervote
Election Returns:	54313	47309	17763
Estimated Totals:	62171	54066	3148
Projected Pickup:	7858	6757	-14615
Lower bound of 90% Confidence Interval:	7352	6267	-14896
Upper bound of 90% Confidence Interval:	8383	7231	-14322

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**Predicted probability of Jennings pickup > 369: 0.896**

percent confident that between 4244 and 5060 voters intended to vote for Buchanan were instead counted as undervotes.

Overall, what do these numbers mean? Looking to combined results, we can be 90 percent confident that *between 14,322 and 14,896 voters in Sarasota county were suppressed from voting in the thirteenth district race*. Of these more than 14,000 votes, our best estimate is that Jennings would have received 7858 and Buchanan, 6757. This would cause Jennings to gain 1101 votes over Buchanan, thus overcoming her 369 vote deficit and changing the outcome of the CD 13 race.

However, it is important to realize that all of these numbers are simply best guesses. The truth

in each case (early and election day, Buchanan and Jennings) might be higher or lower. From all our simulated election results, we calculated the total number of votes gained by Jennings over Buchanan. When this number is greater than 369, then Jennings would have won the election; when this number is less than 369 (and is possibly negative), Jennings would have lost the election. Crucially, we are interested in the fraction of the time the vote gain by Jennings is greater than 369. That is, we want to know the probability that if the suppressed votes in Sarasota had been recorded, Jennings would have won the election to the House of Representatives. This probability, according to our vote imputation model, is 89.6 percent.

## 5 Caveats

While our precinct-level imputations provide reasonable results about what would have happened in Sarasota County in the absence of a ballot format problem, they are not without limitations. In particular, associated with them are several potential sources of bias, and the amount of information contained in aggregate precinct returns is not sufficient to determine definitively whether balloting problems resulted in Buchanan's victory over Jennings by 369 votes. And, as mentioned above, our statistical model cannot pin down the exact mechanism that led to excess undervotes in the Attorney General and CD 13 elections when those elections were presented on the same ballot screens as the Florida Governor race.

Our models are predicated on two fundamental assumptions: (1) Net of any voting machine effects, precinct-level variation in early voting and election day undervote rates and support levels for candidates is similar across counties conditional on precinct-level absentee voting and voting in other races common to those counties. That is, we assume that, if elections were commonly administered across counties, knowing that a precinct was located in a given county would provide no additional predictive leverage on undervote rates or candidate support beyond what can be learned by observing other election results from that precinct. (2) There are no further substantial

and systematic voting machine or ballot format effects beyond the grouping issues identified.

Violation of either assumption could bias our findings. However, in order to assess the validity of these assumptions, we have performed a number of statistical experiments in which we imputed election returns among CD 13 counties for offices in which there are no reasons to suspect ballot format problems. In those experiments, our imputed values closely approximated observed election returns.

Assuming that our two key assumptions are not grossly violated, the precinct-level data we have described here pin down the magnitude of the undervoting problem in CD 13 to within plus or minus 300 undervotes. Nonetheless, the allocation of those undervotes to Buchanan and Jennings is not as precise as we would like given the closeness of the race, our assessment of the probability of Jennings winning the election absent balloting problems in Sarasota County is more sensitive to model assumptions and specification than we would like and, obviously, a confidence interval of plus or minus 1,000 votes net pickup for Jennings while small in percentage terms is large relative to the 369 vote difference that separates her and Buchanan.

We are currently in the process of collecting and analyzing individual-level ballot data which will allow us to relax the assumptions made in our precinct-level analysis and gain much more precise estimates of the ballot format effects in CD 13 and in the Attorney General races. By moving inside precincts to look at patterns of voting at the individual level, we will be able to paint a precise picture of the nature of undervotes. In particular, we will be able to compare patterns of voting on other races among those that did and those that did not cast a valid vote for CD 13 or Attorney General.

## **6 Conclusion**

The motivation for this paper was the unusually high undervote rate in the 13th Congressional District race in Sarasota County, Florida. This race featured Republican Vern Buchanan versus

Democratic Christine Jennings, and we have explained the undervote rate by drawing on variance in ballot formats across counties and types of voters (election day, early, and absentee). In particular, we highlighted the way that the touchscreen voting machines in Sarasota County grouped races and in particular grouped a Congressional race with the Florida governor's race. The problematic grouping method that Sarasota employed—having a two-candidate United States House race on the same touchscreen page as the Florida gubernatorial race—was employed by other counties, albeit with different races, and in these other counties and associated races we generally find high undervote rates. The only times we see a problematic grouping without a large undervote is when the associated race is not at all close.

Thus, what looks on the surface like a Sarasota County issue is in fact more general. Moreover, like the butterfly ballot format used in Palm Beach County in the 2000 presidential race, it appears that the Sarasota ballot format in the 2006 midterm elections was pivotal to the winner of tightly-contested 13th Congressional District race in Florida. We estimate that, had Sarasota used a ballot format akin to those in neighboring counties, with probability 0.9 Jennings would have beaten Buchanan.

There remain two key issues over which we do not have leverage. The first is the precise reason as to why grouping races on touchscreens is a problem. Is the issue asymmetry between races, i.e., a race with two candidate grouped with a race with multiple candidates? Or, is it total number of candidates on a page? Or, is the issue vertical stacking of races versus horizontal grouping? Or, is there a tradeoff between grouping races and the number of pages in a ballot wherein greater number of pages itself leads to undervotes? We cannot address these questions at this time, but work in the vein of Herrnson, Abbe, Francia, Bederson, Lee, Sherman, Conrad, Niemi & Traugott (2005), Herron & Lewis (2006), and Herrnson, Bederson, Niemi, Conrad, Hanmer & Traugott (2006) may be applicable here.

Second, and as mentioned previously on several occasions, because this paper presents a statistical analysis of vote patterns and not a physical examination of voting machines, we cannot

completely rule out voting machine malfunction as a source of the Sarasota undervote. Is it technically possible that software or hardware glitches are responsible for the Sarasota undervote and the Charlotte and Lee undervotes? Yes, this is possible. However, it seems to be a significant stretch of the imagination: if the issue is a software or hardware glitch, the glitch would have had to have manifested itself among almost all voting machines in Sarasota County but affected only one race and then have manifested itself in almost all machines in Charlotte and Lee Counties yet affected a different race.

We conclude with what we believe is a simple and conservative implication of our main finding: iVotronic touchscreen voting systems should not combine important races on the same voting page. Regardless of why exactly combining races is a problem, this proposal seems likely to avoid it.

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