Machine Errors and Undervotes in Florida 2006 Revisited

Walter R. Mebane
MACHINE ERRORS AND UNDERVOTES IN FLORIDA 2006 REVISITED*

Walter R. Mebane, Jr.**

ABSTRACT

The 2006 election for U.S. House of Representatives District 13 in Sarasota County, Florida, attracted extensive controversy because an unusually high proportion of the ballots cast lacked a vote for that office, and the unusual number of undervotes probably changed the election outcome. Intensive technical studies based on examining software and hardware from the iVotronic touchscreen voting machines used to conduct the election failed to find mechanical flaws sufficient to explain the undervotes. Studies that examined the ballots used in Sarasota and in some other counties concluded the high undervote rate was caused by peculiar features of the ballot’s format that confused many voters. I show that recorded events involving power failures and problems with the Personalized Electronic Ballots used with the machines correlate significantly with undervote rates in several Florida counties. The relationships between machine events and undervotes are sufficiently substantial and varied to make it unreasonable to discount the likelihood that mechanical failures contributed substantially to the high numbers of undervotes.

INTRODUCTION

The controversial election for U.S. House of Representatives District 13 (CD-13) in Florida in 2006 has been extensively investigated, but the basic question of what happened with the electronic voting equipment used there remains unresolved. An unusually large number of ballots cast in Sarasota County did not include a vote for that office: 18,412 of the 238,249 ballots cast on iVotronic touchscreen machines in the county were undervotes for that race.1 Some of the research regarding the high


** Professor of Political Science and Professor of Statistics, University of Michigan. 7735 Haven Hall, Ann Arbor, MI 48109-1045. Phone: 734-763-2220. Email: wmebane@umich.edu.


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undervote rate has occurred in the context of litigation, some has been done by independent scholars, some was sponsored by the State of Florida, and some was conducted by the federal government. The unusually high undervote rate probably changed the election outcome. Teams of computer scientists examined several features of the software and hardware used to conduct the election but found nothing they considered sufficient to warrant attributing the lost votes to defects in the equipment’s operations. Even though the adequacy of these technical examinations has been seriously questioned, many read the technical reports as largely exculpating the machines. Hence, some argue that the high undervote rate was caused by peculiar features of the ballot’s format that confused many voters.

Frisina et al., in particular, use data from several counties in Florida to show that the undervote rate for the attorney general race was also unusually high in several counties when the choices for attorney general—for which, like CD-13, there were only two candidates running—were placed on the same screen as the governor’s race, which had many candidates. The correlation they demonstrate between the features

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6 See Ash & Lamperti, supra note 3, at 24.

7 See RESULTS OF GAO’S TESTING, supra note 5, at 3–4; YASINSAC ET AL., supra note 4.


10 See Frisina et al., supra note 3, at 25–26.

11 Id. at 26, 32.
of the ballot and the attorney general undervote rate is clear, but the explanation entirely in terms of voter confusion is speculative. There is no direct supporting evidence about the voters’ experiences, although Selker reports some suggestive results based on experiments conducted using subjects from Boston, Massachusetts. Frisina et al. point out, however, that their results set the bar for any competing explanation fairly high: “[A]ny explanation for the CD 13 undervote in Sarasota must be capable of explaining the attorney general undervotes in Charlotte and Lee Counties and the lack of an attorney general undervote elsewhere (not to mention the lack of high undervotes in other races).”

Recent reports examining the use and performance of touchscreen voting machines across Florida in the 2006 election open the door to meeting the standard Frisina et al. propose. Pynchon and Garber document extensive problems with the iVotronic machines that go well beyond the scope of the officially sponsored technical studies. They show that undervote rates for many races were higher in many counties where iVotronic touchscreen machines were used, regardless of the ballot format. Among the physical problems they identify with the equipment, particularly interesting is the suggestion that voting machine power failures occurred frequently with strong adverse effects. Garber remarks that “power supply failures were experienced by voters and poll workers as screen problems... [P]ower problems can affect the responsiveness of the screen. In fact, one of the first symptoms of a power problem is diminished responsiveness.”

Garber demonstrates that an error message that indicates that a voting machine had a power failure correlates strongly with high undervote rates in Charlotte County.

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13 See Frisina et al., supra note 3, at 36.
14 Id. at 40.
16 Id. at 84–86.
18 Garber, Lost Votes Part 2, supra note 17, at 9, 32.
19 See id. at 35–37.
Indeed, in that county, machines in the same precinct as a machine with a power failure message also tend to exhibit high undervote rates. Garber suggests that power-related problems propagated among machines because “counties link their machines together at the polling place in what is termed a ‘daisy chain.’ The first machine is plugged into the wall outlet, the second is plugged into the first, the third into the second, and so on.”

Another possible hole in Frisina et al.’s explanation is their failure to recognize that with iVotronic touchscreen equipment, a distinctive ballot pattern is in fact a distinctive software and hardware configuration. iVotronic machines use a device called a “Personalized Electronic Ballot” (PEB) to load the candidate selection displays into the voting machine for each voter. Indeed, most interactions with the iVotronic machines involve the use of a PEB. When a ballot has a different appearance, the PEBs contain different programming. None of the technical examinations of the equipment used in Sarasota ever examined the PEBs that were used to conduct the election. Mebane and Dill demonstrate that several PEB-related error messages correlate significantly with variations in the Sarasota CD-13 undervote rate. It is possible, then, that the adverse consequences of ballot format that Frisina et al. demonstrate should be explained, at least in part, as results of deficient mechanical operations connected to the PEBs.

Indeed, as I will show in the remainder of this Article, both power failure problems and PEB-related problems correlate significantly with undervote rates in several Florida counties. The analysis includes data from nine Florida counties that used iVotronic touchscreen voting machines: Charlotte, Collier, Lake, Lee, Martin, Miami-Dade, Pasco, Sarasota, and Sumter counties. Three of these counties (Charlotte, Lee, and Sumter) used ballot formats precisely of the kind Frisina et al. flag as problematic for the attorney general race. Ballot formats used in Miami-Dade County

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20 Id. at 35.
21 Id. at 19.
22 See Frisina et al., supra note 3 (arguing that the ballot design, not the technology, was to blame for undervotes in Sarasota County).
23 Mebane & Dill, supra note 3, at 3.
24 See id. (noting that PEBs are used for opening and closing the iVotronic machines, for cancelling ballots, and for voting).
25 See YASINSAC ETAL., supra note 4, at 10 (explaining that election staff creates unique election identification codes, defines contests, and identifies the candidates in each contest; each PEB contains this information for the specific precinct at which it will be used).
26 PYNCHON & GARBER, supra note 15, at 29.
27 Mebane & Dill, supra note 3, at 5.
28 Frisina et al., supra note 3, at 36.
30 See infra pp. 380–81 tbl.1, pp. 381–82 tbl.2.
31 See Frisina et al., supra note 3, at 27–29.
exhibited the key feature of having offices with differing numbers of candidate choices on the same screen. Lake and Pasco Counties used ballot formats with offices arranged in two columns on each screen instead of the single-column formats used elsewhere. Ballot formats used in the remaining counties lack purportedly problematic features. The prevalence of observable problems with PEBs and power varies across the counties, and the apparent consequences for undervote rates are diverse. The magnitude of the effects varies both across counties and across offices, tending to be larger for races that have substantially larger undervote rates. The results, I suggest, breathe new life into the likelihood that high rates of undervoting in Florida in 2006 were substantially due to mechanical failures.

MECHANICAL EVENTS AND UNDERVOTES

The foundation for my analysis is the set of vote image and event log files that report, respectively, each ballot cast and every transaction occurring on each iVotronic voting machine used by each county during the 2006 election. Each vote image file contains records showing every candidate selection made on an individual ballot, including a code to indicate the voting machine, PEB, and ballot style used to capture the selections. Cast ballots that contain no candidate selections are also shown. Each event log file shows many of the actions taken on each machine, including a timestamp for each transaction. Tables 1 and 2 summarize the event log file contents for the counties used in the current analysis. In the event log files, each transaction is described by a numeric code and a brief descriptive phrase. Events 20 and 21 correspond to vote casting events. For each of these events, there is a corresponding record in the vote image file. Because the vote records are supposedly included in the vote image file in a random order, to protect voter anonymity, it is not possible to match a particular set of votes to a particular event log file transaction.

33 Id. at slide 21.
34 Id. at slide 19.
36 Voting Image and Log Files, supra note 1.
37 Id.
38 Id.
39 Id.
40 See id.
41 Id.
42 Id.
Table 1: Events Recorded in Event Log Files for Several Florida Counties in 2006

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Charlotte</th>
<th>Collier</th>
<th>Lake</th>
<th>Lee</th>
<th>Martin</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Terminal clear and test</td>
<td>512</td>
<td>818</td>
<td>956</td>
<td>1775</td>
<td>364</td>
</tr>
<tr>
<td>02</td>
<td>Terminal screen calibrate</td>
<td>14</td>
<td>35</td>
<td>219</td>
<td>5</td>
<td>78</td>
</tr>
<tr>
<td>04</td>
<td>Enter service menu</td>
<td>17</td>
<td>1033</td>
<td>1148</td>
<td>966</td>
<td>87</td>
</tr>
<tr>
<td>05</td>
<td>Service password fail</td>
<td>2</td>
<td>3</td>
<td>16</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>06</td>
<td>Enter ECA menu</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>07</td>
<td>ECA password fail</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>08</td>
<td>Date/time change</td>
<td>6</td>
<td>987</td>
<td>927</td>
<td>974</td>
<td>21</td>
</tr>
<tr>
<td>09</td>
<td>Terminal open</td>
<td>512</td>
<td>817</td>
<td>966</td>
<td>1773</td>
<td>365</td>
</tr>
<tr>
<td>10</td>
<td>Terminal close</td>
<td>512</td>
<td>817</td>
<td>956</td>
<td>1773</td>
<td>364</td>
</tr>
<tr>
<td>12</td>
<td>Audit upload</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>13</td>
<td>Print zero tape</td>
<td>125</td>
<td>230</td>
<td>135</td>
<td>398</td>
<td>69</td>
</tr>
<tr>
<td>14</td>
<td>Print Precinct results</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>Modem Precinct results</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Votes recollect</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>Invalid vote PEB</td>
<td>95</td>
<td>166</td>
<td>163</td>
<td>448</td>
<td>121</td>
</tr>
<tr>
<td>19</td>
<td>Invalid super PEB</td>
<td>39</td>
<td>1920</td>
<td>115</td>
<td>19</td>
<td>30</td>
</tr>
<tr>
<td>20</td>
<td>Normal ballot cast</td>
<td>45993</td>
<td>70069</td>
<td>75292</td>
<td>130125</td>
<td>44178</td>
</tr>
<tr>
<td>21</td>
<td>Super ballot cast</td>
<td>57</td>
<td>91</td>
<td>142</td>
<td>392</td>
<td>44</td>
</tr>
<tr>
<td>22</td>
<td>Super ballot cancel</td>
<td>118</td>
<td>161</td>
<td>672</td>
<td>239</td>
<td>74</td>
</tr>
<tr>
<td>25</td>
<td>Open with super votes</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>Terminal left open</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 2: Events Recorded in Event Log Files for Several Florida Counties in 2006

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Miami-Dade</th>
<th>Pasco</th>
<th>Sarasota</th>
<th>Sumter</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Terminal clear and test</td>
<td>4682</td>
<td>1416</td>
<td>1503</td>
<td>250</td>
</tr>
<tr>
<td>02</td>
<td>Terminal screen calibrate</td>
<td>4404</td>
<td>9</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>04</td>
<td>Enter service menu</td>
<td>7387</td>
<td>40</td>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td>05</td>
<td>Service password fail</td>
<td>120</td>
<td>9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>06</td>
<td>Enter ECA menu</td>
<td>7</td>
<td>7</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>07</td>
<td>ECA password fail</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>08</td>
<td>Date/time change</td>
<td>5091</td>
<td>11</td>
<td>57</td>
<td>6</td>
</tr>
<tr>
<td>09</td>
<td>Terminal open</td>
<td>4680</td>
<td>1441</td>
<td>1503</td>
<td>250</td>
</tr>
<tr>
<td>10</td>
<td>Terminal close</td>
<td>4673</td>
<td>1408</td>
<td>1503</td>
<td>250</td>
</tr>
<tr>
<td>12</td>
<td>Audit upload</td>
<td>1</td>
<td>861</td>
<td>0</td>
<td>390</td>
</tr>
<tr>
<td>13</td>
<td>Print zero tape</td>
<td>1986</td>
<td>169</td>
<td>366</td>
<td>51</td>
</tr>
<tr>
<td>Event Code</td>
<td>Description</td>
<td>Count 1</td>
<td>Count 2</td>
<td>Count 3</td>
<td>Count 4</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>14</td>
<td>Print Precinct results</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>Modem Precinct results</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Votes recollect</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>Invalid vote PEB</td>
<td>1377</td>
<td>205</td>
<td>308</td>
<td>33</td>
</tr>
<tr>
<td>19</td>
<td>Invalid super PEB</td>
<td>515</td>
<td>57</td>
<td>48</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>Normal ballot cast</td>
<td>79115</td>
<td>113429</td>
<td>119772</td>
<td>27399</td>
</tr>
<tr>
<td>21</td>
<td>Super ballot cast</td>
<td>875</td>
<td>171</td>
<td>184</td>
<td>67</td>
</tr>
<tr>
<td>22</td>
<td>Super ballot cancel</td>
<td>2700</td>
<td>159</td>
<td>225</td>
<td>27</td>
</tr>
<tr>
<td>25</td>
<td>Open with super votes</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>Terminal left open</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>Override</td>
<td>9276</td>
<td>77</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>28</td>
<td>Override fail</td>
<td>217</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>Term. clear/test password fail</td>
<td>39</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>Modem Precinct results fail</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>Low battery lockout</td>
<td>409</td>
<td>55</td>
<td>66</td>
<td>6</td>
</tr>
<tr>
<td>37</td>
<td>Nonmaster PEB collection</td>
<td>17</td>
<td>9</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>49</td>
<td>Internal malfunction</td>
<td>13</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>L and A test run-Votes cleared</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>51</td>
<td>PEB/CF Election ID mismatch</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Several transaction codes in the event log files indicate events that may be relevant for studying undervote rates. A need to calibrate the terminal screen (event 02) may suggest misalignment between where vote choices display on the screen and
where touching the screen activates each choice. Such misalignment can cause votes to be misrecorded or lost. Other events indicate problems with passwords or possibly inappropriate access to service menus, and suggest possible security failures (events 05, 06, 07, and 31). Still other events indicate various malfunctions (events 36 and 49) or some problem with PEBs (events 18, 19, 37, and 51). The record of problems contained in the event log files is not necessarily complete. There are several documented instances in which problems with iVotronic machines may have caused the event log files to be corrupted. A bug diagnosed in 2003–2004 in particular causes incomplete records in some cases where the power supplied to a machine fails. Whether that bug or other problems affected the event log files available from the 2006 election is unknown.

For the current analysis I focus on two kinds of events. Event 18 ("Invalid vote PEB") flags a PEB-related error and was a focus of a study of data from Sarasota County by Mebane and Dill. Event 36 ("Low battery lockout") is the event used by Garber to indicate that a voting machine experienced a power failure. Because it is not possible to match particular events to particular individual vote records, nor in general to tell whether a particular vote occurred prior to an event of interest, I define variables to indicate whether a particular voting machine has an occurrence of event 18 (E18) or event 36 (E36).

In light of Pynchon and Garber's observation about voting machines being "daisy chained," with the likelihood that any consequences of power problems on one machine propagated to other machines connected to it, I also define a variable to indicate whether voting machines were in the same location as another machine that had a power failure. No data exist to show which machines were actually connected to one another in each polling place. Garber used the fact of being in the same precinct to measure such connections on election day in Charlotte County. I use an alternative proxy: machines are considered to be related according to E36 if the same PEB was ever used on both of the machines. If machine A is related to machine B by a PEB, and machine B is related to machine C by another PEB, then all three machines are considered to be part of the same PEB cluster. All machines in the same PEB cluster are considered to be at the same location. The power-location variable E36L is set on for all machines in a cluster whenever any machine in the cluster has an occurrence of E36. The rationale for this measure is that machines that were used with the same PEB probably were located close to one another in the polling place, and machines that were located close to one another were more likely to have been daisy chained.

43 See Dill & Wallach, supra note 8, at 4.  
44 Id.  
45 See PYNCHON & GARBER, supra note 15, at 57.  
46 Id. at 43–45.  
47 See Mebane & Dill, supra note 3, at 5–6.  
48 GARBER, LOST VOTES PART 2, supra note 17, at 36–39.  
49 PYNCHON & GARBER, supra note 15, at 40.  
50 GARBER, LOST VOTES PART 2, supra note 17, at 36–37.
Table 3 shows the distribution of the three event-measuring variables in terms of the number and proportion of ballots cast on the affected machines in each county. E18 occurs much more frequently during early voting than on election day. Typically about half of the early voting ballots are on machines that have an occurrence of E18, while on election day the frequency ranges from a low of 6.8% in Sumter County up to about a quarter of the ballots in Lee, Martin, and Miami-Dade Counties. The frequency of E36 is relatively low on election day, ranging from 1.2% in Sumter County to 3.9% in Lake County. Taking PEB clusters into account in most counties greatly increases the number of ballots potentially affected. Sumter County remains relatively low, with 3.1% of ballots having a positive value for E36L, but the percentage for Lake County jumps to 26.6, and Miami-Dade County tops the percentages with a value of 27.4. Only four counties (Charlotte, Collier, Lake, and Lee) show substantial proportions of ballots on machines or in PEB clusters with power failure indicators during early voting.

### Table 3: Frequency of Invalid Vote PEB and Low Battery Lockout Events

<table>
<thead>
<tr>
<th>County</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early Voting</td>
<td></td>
<td></td>
<td>Election Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charlotte</td>
<td>12.4</td>
<td>2.2</td>
<td>9.9</td>
<td>52.6</td>
<td>4.6</td>
<td>13.9</td>
</tr>
<tr>
<td>Collier</td>
<td>15.1</td>
<td>2.6</td>
<td>20.8</td>
<td>41.7</td>
<td>3.9</td>
<td>21.9</td>
</tr>
<tr>
<td>Lake</td>
<td>14.7</td>
<td>3.9</td>
<td>26.6</td>
<td>41.7</td>
<td>2.5</td>
<td>18.2</td>
</tr>
<tr>
<td>Lee</td>
<td>24.2</td>
<td>1.9</td>
<td>19.1</td>
<td>26.5</td>
<td>2.5</td>
<td>23.5</td>
</tr>
<tr>
<td>Martin</td>
<td>23.5</td>
<td>3.5</td>
<td>17.1</td>
<td>64.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Miami</td>
<td>23.9</td>
<td>3.6</td>
<td>27.4</td>
<td>_a</td>
<td>_a</td>
<td>_a</td>
</tr>
<tr>
<td>Pasco</td>
<td>11.6</td>
<td>1.4</td>
<td>15.1</td>
<td>41.1</td>
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<td>0</td>
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<td>Sarasota</td>
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<td>1.4</td>
<td>12.8</td>
<td>54.0</td>
<td>.1</td>
<td>.1</td>
</tr>
<tr>
<td>Sumter</td>
<td>6.8</td>
<td>1.2</td>
<td>3.1</td>
<td>40.7</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>County</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counts</td>
<td></td>
<td></td>
<td>Counts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charlotte</td>
<td>3576</td>
<td>629</td>
<td>2864</td>
<td>9005</td>
<td>787</td>
<td>2374</td>
</tr>
<tr>
<td>Collier</td>
<td>7393</td>
<td>1259</td>
<td>10169</td>
<td>8823</td>
<td>833</td>
<td>4638</td>
</tr>
</tbody>
</table>

51 Whether a machine was used during early voting or on election day is determined from the timestamps for the events reported for the machine. For Miami-Dade County, none of the event records have a timestamp prior to election day. See Voting Image and Log Files, supra note 1.
A ballot has an undervote for an office if the vote image does not include a candidate choice for the office.\textsuperscript{52} For offices that appear on the ballot only in specific jurisdictions, such as U.S. House elections, a non-vote is an undervote only if the vote image is for a precinct and ballot style that indicates the voter is eligible to vote for the candidates in the referent jurisdiction. I focus on votes for five statewide offices (Governor, Attorney General, Chief Financial Officer (CFO), Commissioner of Agriculture, and U.S. Senate) and for seats in the U.S. House of Representatives. Table 4 shows the distribution of undervotes for these various offices across the nine counties. Undervote rates are typically lowest for governor and U.S. Senate, and in many instances they are also low for U.S. House seats. Undervote rates are noticeably higher for commissioner of agriculture and CFO, and they vary quite widely for attorney general. The three attorney general undervote rates that are greater than 20%—for Charlotte, Lee and Sumter Counties—are for the counties where the attorney general race appeared on the same page with the governor’s race.\textsuperscript{53} Among the U.S. House races, the CD-13 race has the second highest undervote percentage.\textsuperscript{54} The result for the U.S. House race with the highest percentage—CD-17 in Miami-Dade—is almost certainly explained by the fact that the Democratic candidate in that district did not face a major party challenger.

Table 4: Undervote Percentages by Office

<table>
<thead>
<tr>
<th>Office</th>
<th>Charlotte</th>
<th>Collier</th>
<th>Lake</th>
<th>Lee</th>
<th>Martin</th>
<th>Miami</th>
<th>Pasco</th>
<th>Sarasota</th>
<th>Sumter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Att’y Gen.</td>
<td>24.7</td>
<td>3.5</td>
<td>3.8</td>
<td>20.7</td>
<td>3.3</td>
<td>9.6</td>
<td>4.9</td>
<td>4.7</td>
<td>23.9</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>5.7</td>
<td>7.5</td>
<td>4.9</td>
<td>5.8</td>
<td>8.0</td>
<td>8.0</td>
<td>5.5</td>
<td>5.3</td>
<td>6.3</td>
</tr>
</tbody>
</table>

\textsuperscript{52} See Voting Image and Log Files, \textit{supra} note 1.

\textsuperscript{53} See \textit{PYNCHON \& GARBER, supra} note 15, at 82.

\textsuperscript{54} \textit{Id.}
The standard proposed by Frisina et al. calls for effects of the invalid PEB and power failure events on the undervote rate that vary across counties,\textsuperscript{55} but nonetheless, it is worthwhile to begin by looking at the average rate of undervoting for each combination of the events, ignoring any differences among counties. Table 5 shows undervote rates for each office for combinations of the two kinds of events, separately for election day and early voting ballots but pooling across all counties. For this display, the undervote counts for all U.S. House seats are treated together.

Table 5: Undervote Percentages by Occurrence of Machine Events

<table>
<thead>
<tr>
<th>Office</th>
<th>No E36E18</th>
<th>No E36E18</th>
<th>No E36L E18</th>
<th>No E36L E18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Election Day</td>
<td>Early Voting</td>
<td>Election Day</td>
<td>Early Voting</td>
</tr>
<tr>
<td>Att’y Gen.</td>
<td>9.7</td>
<td>10.7</td>
<td>10.3</td>
<td>9.7</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>6.6</td>
<td>7.1</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>CFO</td>
<td>6.3</td>
<td>7.2</td>
<td>4.4</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Note: Undervotes as percentage of all ballots cast. Results for “US House” with a district include only ballots in the referent district. “US House” with no district combines all districts for each county. \textsuperscript{a} Office not included in county.

\textsuperscript{55} See Frisina et al., \textit{supra} note 3 (observing anomalous undervoting at the precinct level).
Governor 1.1 1.3 .8 1.0 1.1 1.2 .8 1.0
US House 6.7 7.3 6.3 7.4 6.7 7.2 6.9 8.1
US Senate 2.5 3.0 1.0 .9 2.4 2.8 1.0 .9

<table>
<thead>
<tr>
<th>Office</th>
<th>E36 Election Day</th>
<th>E36 Early Voting</th>
<th>E36L Election Day</th>
<th>E36L Early Voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Att'y Gen.</td>
<td>9.8</td>
<td>10.3</td>
<td>14.7</td>
<td>2.1</td>
</tr>
<tr>
<td>Comm'r Agric.</td>
<td>7.5</td>
<td>7.6</td>
<td>5.7</td>
<td>6.9</td>
</tr>
<tr>
<td>CFO</td>
<td>7.3</td>
<td>9.0</td>
<td>4.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Governor</td>
<td>1.4</td>
<td>1.5</td>
<td>.7</td>
<td>.8</td>
</tr>
<tr>
<td>US House</td>
<td>7.6</td>
<td>7.2</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>US Senate</td>
<td>3.3</td>
<td>3.6</td>
<td>1.2</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Note: Undervote percentages with and without the indicated type of event, pooling data from all nine counties. E18 and E36: events 18 and 36 on the ballot's machine. E36L: event 36 on a machine in the ballot's PEB cluster. "US House" includes all districts in all counties.

In the subtable showing the breakdowns among the election day ballots, in the absence of a power failure indication for the particular machine (No E36) or for the PEB cluster (No E36L), the undervote rate is always higher on machines that have an invalid vote PEB event than on machines that do not have such an event. The largest such differences are differences of 1% for attorney general in the No E36 case and for the CFO in the No E36L case. Other races in these same conditions typically show a difference of about half a percent in the undervote rate across values of E18, except for the governor race where the differences are smaller. In the subtable showing the election day breakdowns in the presence of power failures (E36 or E36L), the pattern of differences in the undervote rate across values of E18 is similar except the differences are smaller. Also, there is one reversal: for U.S. House with E36, the undervote percentage is smaller with E18 than it is with No E18. An invalid vote PEB event is on average typically associated with a higher undervote rate on election day. In the subtables showing the undervote percentage breakdowns for early voting ballots, the differences with respect to E18 do not exhibit a consistent pattern.

Focusing on the differences with respect to E36 and E36L for comparable values of E18, among the election day ballots the undervote rate is typically greater for an office for the ballots that have E36 or E36L than for ballots that have No E36 or No E36L. Power failures are on average typically associated with a higher undervote rate on election day. Again, the pattern of differences among the early voting ballots is mixed.
In terms of gross averages, then, each of the two types of voting machine events is typically associated with a tendency to have a higher undervote rate, at least among election day ballots. In view of the large number of ballots being considered across all nine counties, it is perhaps not surprising that most of the differences apparent in Table 5 are statistically significant if all of the votes for each office are treated as statistically independent of one another. Nonetheless, the differences across conditions in Table 5 are small as percentages of ballots cast, and of course the overall averages do not address the need to demonstrate that the differences vary across counties.

Table 6 presents the first set of results that bear on the question of diverse effects. The table shows the simple percentage difference in the undervote rate for each office in a single county when the condition measured by each of the event variables is, respectively, present versus absent. I assess the statistical significance of each difference by testing for independence between each event variable and a variable measuring whether each ballot has an undervote for the respective office. The test level is the conventional value .05, but symbols in the table also address the fact that across the whole analysis we are looking at dozens of separate tests. One symbol indicates that an association is significant even when we adjust for the number of tests being done for an event in the particular county, and one indicates significance even when we adjust for the number of tests being done in all nine counties.56

Table 6: Undervote Percentage Differences by Occurrence of Machine Events I

<table>
<thead>
<tr>
<th>Office</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Att’y Gen.</td>
<td>.2</td>
<td>.5</td>
<td>.1</td>
<td>-.2</td>
<td>.3</td>
<td>.3</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>.3</td>
<td>-.2</td>
<td>.0</td>
<td>-2.0</td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td>CFO</td>
<td>.3</td>
<td>-.5</td>
<td>.2</td>
<td>-.4</td>
<td>-4.0</td>
<td>-4.0</td>
</tr>
<tr>
<td>Governor</td>
<td>.0</td>
<td>.3</td>
<td>.3*</td>
<td>.1</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td>US House 13</td>
<td>.9*</td>
<td>2.3*</td>
<td>.8*</td>
<td>-2.4‡</td>
<td>-12.9</td>
<td>-12.9</td>
</tr>
<tr>
<td>US Senate</td>
<td>.0</td>
<td>.2</td>
<td>.0</td>
<td>-.1</td>
<td>-.9</td>
<td>-.9</td>
</tr>
</tbody>
</table>

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot’s machine. E36L: event 36 on a machine in the ballot’s PEB cluster. *: Two-way association significant at level .05; ‡: at level .05 adjusting for tests across all counties.

56 I use the Bonferroni adjustment. Letting \( m_j \) denote the number of offices being analyzed in county \( j \) and \( m \) the number summing across all nine counties the single test level is .05, the within county test level is \( .05/m_j \), and the cross-county test level is \( .05/m \). Pearson chi-squared is the test statistic.
The results in Table 6 show undervote rate differences for Sarasota County. The substantial and significant differences occur mainly for the CD-13 race. There are significant differences for E18 among both the election day and the early voting ballots. Oddly, the direction of the difference varies between the two election periods. The undervote rate is lower on machines with an invalid vote PEB event during early voting, but the rate is higher on such machines on election day. Also, among the election day ballots, the undervote percentage is higher in the presence of a power failure event. The effect is smaller for E36L than for E36, but it is large enough to give some support to the idea that the consequences of power failure propagated among nearby machines.  

The results for Charlotte and Sumter Counties likewise show substantial differences in the undervote rate occurring largely for the office that was subject to the peculiar ballot feature. In both counties there are significant relationships between power failure events and election day attorney general undervote rates. Table 7 shows the significant differences for Charlotte County are of comparable magnitude whether machine-specific events or PEB cluster events are considered. There are also significant power-related increases in the undervote rate for a few of the other offices, but these increases are smaller in magnitude than the increases for the attorney general race. Table 7 shows that in Sumter County power failures are associated with significant decreases in the election day attorney general undervote rate. In Sumter on election day, there is also a significant increase in the CD-5 undervote rate associated with machine-specific power failure events. Neither county exhibits significant undervote rate differences associated with invalid vote PEB events, except for a small decline in the early voting governor undervote rate that achieves single-test significance.

Table 7: Undervote Percentage Differences by Occurrence of Machine Events II

<table>
<thead>
<tr>
<th>Office</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Att’y Gen.</td>
<td>-.1</td>
<td>5.6†</td>
<td>4.6‡</td>
<td>.3</td>
<td>-1.8</td>
<td>-.8</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>-.7</td>
<td>2.5*</td>
<td>1.8‡</td>
<td>.4</td>
<td>.7</td>
<td>.0</td>
</tr>
<tr>
<td>CFO</td>
<td>.1</td>
<td>.0</td>
<td>1.0*</td>
<td>.3</td>
<td>-.5</td>
<td>-.8*</td>
</tr>
<tr>
<td>Governor</td>
<td>-.2</td>
<td>.4</td>
<td>.4</td>
<td>.2</td>
<td>-.4</td>
<td>-.2</td>
</tr>
<tr>
<td>US House</td>
<td>.2</td>
<td>.6</td>
<td>.7*</td>
<td>-.1</td>
<td>.5</td>
<td>.6</td>
</tr>
</tbody>
</table>

Table 3 shows that nine times as many ballots have a positive value for E36L as have a positive value for E36, but the percentage difference in Table 6 is not correspondingly nine times smaller. *Compare supra* pp. 384–85 tbl.3, *with supra* p. 388 tbl.6.

See infra pp. 389–90 tbl.7.
<table>
<thead>
<tr>
<th>Office</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
<th>E18</th>
<th>E36</th>
<th>E36L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Att'y Gen.</td>
<td>-.9</td>
<td>-6.6*</td>
<td>-5.5*</td>
<td>-.3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Comm'r Agric.</td>
<td>.0</td>
<td>.9</td>
<td>-1.3</td>
<td>.4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>CFO</td>
<td>-.2</td>
<td>-1.3</td>
<td>-.5</td>
<td>-.1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Governor</td>
<td>-.1</td>
<td>.4</td>
<td>.1</td>
<td>-.3*</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>US House 5</td>
<td>-.8</td>
<td>3.2*</td>
<td>.4</td>
<td>.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>US Senate</td>
<td>-.2</td>
<td>-.1</td>
<td>-.3</td>
<td>-.2</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot’s machine. E36L: event 36 on a machine in the ballot’s PEB cluster. *: Two-way association significant at level .05; †: at level .05 adjusting for all tests in this county; ‡: at level .05 adjusting for tests across all counties. Results for “US House” with a district number include only ballots in the referent district. “US House” with no district number combines all districts for each county. b No events.

Lee County provides the principal exception to the general finding that undervote rates for the office that appeared with the peculiar ballot feature are significantly associated with invalid vote PEB or power failure events. Table 8 shows no significant differences for the attorney general race. A significant increase in the election day commissioner of agriculture undervote rate is associated with invalid vote PEB events.

Table 8: Undervote Percentage Differences by Occurrence of Machine Events III

<table>
<thead>
<tr>
<th>Office</th>
<th>Election Day</th>
<th>Early Voting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E18</td>
<td>E36</td>
</tr>
<tr>
<td>Att’y Gen.</td>
<td>.4</td>
<td>-.6</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>.5†</td>
<td>-.3</td>
</tr>
<tr>
<td>CFO</td>
<td>.2</td>
<td>.0</td>
</tr>
</tbody>
</table>
Governor  .1  .2  -.1  .1  .2  .0
US House 14 .1  .4  -.1  -.2  -.9*  .1
US Senate  .1  -.1  .0  -.1  -.4  -.2

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot’s machine. E36L: event 36 on a machine in the ballot’s PEB cluster. *: Two-way association significant at level .05; †: at level .05 adjusting for all tests in this county.

The results for Collier County, reported in Table 9, show no significant election day undervote rate differences. Among the early voting ballots one significant increase in undervote rates (for the governor race) is associated with invalid vote PEB events, one is associated with machine-level power failures (for the U.S. Senate race) and one is associated with PEB cluster-level power failures (for the combined U.S. House races, but principally for the CD-14 race). Frisina et al. place Collier County in contrast to Charlotte and Lee Counties because the ballot format used in Collier did not have the purportedly confusing feature of races with very different numbers of candidate choices placed together on the same screen. Frisina et al. do not consider undervote rates in the early voting data.

Table 9: Undervote Percentage Differences by Occurrence of Machine Events IV

<table>
<thead>
<tr>
<th>Office</th>
<th>Election Day</th>
<th>Early Voting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E18</td>
<td>E36</td>
</tr>
<tr>
<td>Att’y Gen.</td>
<td>-.1</td>
<td>.0</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>.0</td>
<td>-.1</td>
</tr>
<tr>
<td>CFO</td>
<td>-.2</td>
<td>-.4</td>
</tr>
<tr>
<td>Governor</td>
<td>-.1</td>
<td>.2</td>
</tr>
<tr>
<td>US House</td>
<td>.0</td>
<td>.3</td>
</tr>
<tr>
<td>US House 14</td>
<td>.1</td>
<td>.5</td>
</tr>
<tr>
<td>US House 25</td>
<td>-.3</td>
<td>-.3</td>
</tr>
<tr>
<td>US Senate</td>
<td>.2</td>
<td>.1</td>
</tr>
</tbody>
</table>

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot’s machine. E36L: event 36

59 See Frisina et al., supra note 3, at 34.
60 See id.
on a machine in the ballot’s PEB cluster. *: Two-way association significant at level .05. Results for “US House” with a district number include only ballots in the referent district. “US House” with no district number combines all districts for each county.

The ballot format used in Martin County exhibited no remarkable features, yet Table 10 shows a significant association between machine events and undervote rates for a couple of offices. For CFO there is an early voting association with invalid vote PEB events and an election day association with machine-level power failure events. There is also a significant negative association between election day attorney general undervotes and PEB cluster-level power failure events. Garber observes that the voting machines in Martin County had maintenance histories that differed in several respects from what was done in other Florida counties and that officials in Martin County exerted special efforts to recalibrate the screens of the voting machines. 61

**Table 10: Undervote Percentage Differences by Occurrence of Machine Events**

<table>
<thead>
<tr>
<th>Office</th>
<th>Election Day</th>
<th>Early Voting</th>
<th>Martin</th>
<th>Early Voting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E18</td>
<td>E36</td>
<td>E36L</td>
<td>E18</td>
</tr>
<tr>
<td>Att’y Gen.</td>
<td>-.1</td>
<td>-.7</td>
<td>-.6*</td>
<td>.2</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>.3</td>
<td>1.3</td>
<td>-.1</td>
<td>.5</td>
</tr>
<tr>
<td>CFO</td>
<td>.6</td>
<td>1.9*</td>
<td>.1</td>
<td>1.0†</td>
</tr>
<tr>
<td>Governor</td>
<td>.0</td>
<td>-.3</td>
<td>-.1</td>
<td>.2</td>
</tr>
<tr>
<td>US House 16</td>
<td>.1</td>
<td>.5</td>
<td>-.1</td>
<td>.2</td>
</tr>
<tr>
<td>US Senate</td>
<td>.2</td>
<td>.6</td>
<td>.2</td>
<td>.2</td>
</tr>
</tbody>
</table>

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot’s machine. E36L: event 36 on a machine in the ballot’s PEB cluster. *: Two-way association significant at level .05; †: at level .05 adjusting for all tests in this county. b No events.

The ballot format used in Miami-Dade County differed in significant respects from the ballot format used in the other counties, featuring in particular the property of having offices with very different numbers of candidate choices together on the same screen. 62 As Table 11 shows, the county also exhibits a large number of significant associations between election day undervote rates and machine events. Every office except CD-21 has a significant association between the undervote rate and

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61 See Garber, Lost Votes Part 2, supra note 17, at 40–42.
either invalid vote PEB events or power failure events, and several offices show significant associations with both kinds of events.

Table 11: Undervote Percentage Differences by Occurrence of Machine Events VI

<table>
<thead>
<tr>
<th>Office</th>
<th>Miami-Dade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Election Day</td>
</tr>
<tr>
<td></td>
<td>E18</td>
</tr>
<tr>
<td>Att’y Gen.</td>
<td>.3*</td>
</tr>
<tr>
<td>Comm’r Agric.</td>
<td>.1</td>
</tr>
<tr>
<td>CFO</td>
<td>.6‡</td>
</tr>
<tr>
<td>Governor</td>
<td>.2‡</td>
</tr>
<tr>
<td>US House</td>
<td>.8‡</td>
</tr>
<tr>
<td>US House 17</td>
<td>- .3</td>
</tr>
<tr>
<td>US House 18</td>
<td>.6*</td>
</tr>
<tr>
<td>US House 21</td>
<td>-.1</td>
</tr>
<tr>
<td>US House 25</td>
<td>.4</td>
</tr>
<tr>
<td>US Senate</td>
<td>.1</td>
</tr>
</tbody>
</table>

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot’s machine. E36L: event 36 on a machine in the ballot’s PEB cluster. *: Two-way association significant at level .05; †: at level .05 adjusting for all tests in this county; ‡: at level .05 adjusting for tests across all counties. Results for “US House” with a district number include only ballots in the referent district. “US House” with no district number combines all districts for each county. * Early voting data not available.

Lake and Pasco Counties differ from the other iVotronic counties because the ballot formats used in the two counties presented choices on the voting machine screens in two columns. Table 12 shows that between the two counties the associations between undervote rates and machine events differ considerably. In Lake County, undervotes for almost every office are significantly associated with one or the other type of machine event, and sometimes with both types. Only the governor race and perhaps the race for CD-8 are exempt. In Pasco County, only two offices exhibit a significant association between undervote rates and one of the machine events: PEB cluster-level power failures are negatively associated with election day

63 See Herron, supra note 32, at slide 21; see also E-mail from Kitty Garber, Research Director, Florida Fair Elections Center, to Walter R. Mebane, Jr., Professor of Political Science and Statistics, University of Michigan (Mar. 8, 2008, 20:02:55 EST) (on file with author).
attorney general undervotes and positively related to U.S. House undervotes. The latter association manifestly does not describe the separate congressional districts, so on the whole the evidence for substantial machine event associations with undervote rates in Pasco County should be viewed as weak. It is not the appearance of the ballots that sharply distinguishes the undervote experience in these two counties. Rather, it is the association with voting machine error conditions that differs.

Table 12: Undervote Percentage Differences by Occurrence of Machine Events VII

<table>
<thead>
<tr>
<th></th>
<th>Lake</th>
<th>Early Voting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Election Day</td>
<td>Early Voting</td>
</tr>
<tr>
<td></td>
<td>Office</td>
<td>E18</td>
</tr>
<tr>
<td>Att'y Gen.</td>
<td>.3</td>
<td>.7</td>
</tr>
<tr>
<td>Comm'r Agric.</td>
<td>.5</td>
<td>1.2*</td>
</tr>
<tr>
<td>CFO</td>
<td>.2</td>
<td>1.2*</td>
</tr>
<tr>
<td>Governor</td>
<td>.2</td>
<td>.2</td>
</tr>
<tr>
<td>US House</td>
<td>.7*</td>
<td>1.5*</td>
</tr>
<tr>
<td>US House 5</td>
<td>.5</td>
<td>1.1</td>
</tr>
<tr>
<td>US House 6</td>
<td>-.1</td>
<td>1.3</td>
</tr>
<tr>
<td>US House 8</td>
<td>.0</td>
<td>1.4</td>
</tr>
<tr>
<td>US Senate</td>
<td>.1</td>
<td>.7†</td>
</tr>
</tbody>
</table>

|                  | Pasco                     | Early Voting           |
|                  | Election Day             | Early Voting           |
|                  | Office                   | E18 | E36 | E36L | E18 | E36 | E36L |
| Att'y Gen.       | .1 | -.4 | -.4*|.1  | —   | —   |
| Comm'r Agric.    | .1 | -.1 | .0  | .1  | —   | —   |
| CFO              | .1 | -.8 | -.2 | -.3 | —   | —   |
| Governor         | .1 | .2 | .0  | .0  | —   | —   |
| US House         | .4 | .6 | .5* | .3  | —   | —   |
| US House 5       | .5 | .3 | .1  | .6  | —   | —   |
| US House 9       | -.1| -1.3| -.6 | -.1 | —   | —   |
| US Senate        | .0 | -.2| .0  | -.1 | —   | —   |

Note: Differences between undervote percentages with and without the indicated type of event. E18 and E36: events 18 and 36 on the ballot's machine. E36L: event 36 on a machine in the ballot's PEB cluster. *: Two-way association significant at level
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.05; †: at level .05 adjusting for all tests in this county;‡: at level .05 adjusting for tests across all counties. Results for “US House” with a district include only ballots in the referent district. “US House” with no district combines all districts for each county. bNo events.

CONCLUSION

Plainly the two kinds of PEB and machine events examined here are not sufficient to explain the pattern of undervotes, neither in the CD-13 race in Sarasota County nor in the other Florida counties included here. The measured events are not always associated with high undervote rates (e.g., Lee County), and even where there are strong associations, the magnitude of the apparent effects is usually too small to fully account for a high proportion of the undervotes that occurred. In a few instances, the invalid vote PEB or power failure events are associated with declines, not increases, in the percentage of undervotes. Citing the kinds of events studied here hardly settles the question of what caused the excessive numbers of undervotes.

The point of the current exercise is not to supply an adequate explanation for the undervotes, but merely to demonstrate that the relationships between machine events and undervotes are sufficiently substantial and varied to make it unreasonable to discount the likelihood that mechanical failures contributed substantially to the high numbers of undervotes. In three of the four cases considered by Frisina et al.64 and Selker,65 where ballot format purportedly confused voters and consequently produced dramatic increases in undervoting—the CD-13 race in Sarasota County and the attorney general race in Charlotte, Lee and Sumter Counties—I find significant associations between invalid vote PEB events or power failure events and substantial variations in undervoting, particularly for the offices of interest. Even if one focuses narrowly on those four races in those places, there is every reason not to rule out mechanical effects. Undervotes also appear significantly related to events for other offices in other counties. Of the nine counties examined here, only Collier and Pasco Counties emerge relatively unscathed in terms of significant associations between events and election day undervotes. When early voting is included, no county escapes unblemished.

When thinking about the small magnitude of the percentage differences associated with the invalid vote PEB and power failure events, it is important to remember that the event log file entries that are the basis for measuring these conditions are at best symptoms of whatever was wrong with the PEBs, machines, or polling environments where the problems occurred. There is reason to believe the event logs do not include every occurrence even of the precise kinds of flaws in focus here. Recall, for instance, the software bug diagnosed in 2003–2004 that sometimes caused events not to be

64 See Frisina et al., supra note 3.
65 See Selker, supra note 12.
reported in cases of power failure.66 And it is merely a hypothesis that the two kinds of events highlighted here are especially important markers for high undervotes. As we saw in Tables 1 and 2, several other kinds of events might well also indicate conditions that produce excessive undervotes. The current analysis most likely understates how much mechanical defects contributed to the problem of excessive undervotes in the 2006 election.

A definitive explanation for the undervotes requires technical examinations of the hardware, software, and practices used in the election that go considerably beyond the officially sponsored reviews that have occurred. Detailed administrative and maintenance records of the kind partially collected and reviewed by Pynchon and Garber67 are needed to supplement the kinds of tests described by Dill and Wallach68 and others. Unfortunately, it is likely that we will never have a sufficient explanation for the pattern of undervotes in the 2006 election. Key equipment, such as the PEBs actually used during the election, has not been preserved.69 Experts have not been allowed sufficient latitude to fully test even the equipment, both hardware and software, that was preserved.70 From some counties it is impossible to obtain the necessary kinds of administrative records, and for others to do so is infeasible.

Nonetheless, simply because a sufficient explanation is not forthcoming, there is no reason to treat a partial and incomplete explanation as if it were adequate. While it is tempting to fall back on an explanation that blames the voters—were voters confused?—there is not sufficient evidence to support doing that. While undoubtedly voter confusion prompted by unfortunate ballot formats had a hand in increasing the number of undervotes for some offices, the magnitude of this effect is unclear, and clearly that is not all of what happened.

66 See PYNCHON & GARBER, supra note 15, at 43–45.
67 See PYNCHON & GARBER, supra note 15.
68 See Dill & Wallach, supra note 8.
69 See PYNCHON & GARBER, supra note 15, at 29 (suggesting that it may be too late to examine the PEBs actually used in the election).
70 See GARBER, LOST VOTES PART 2, supra note 17, at 48.