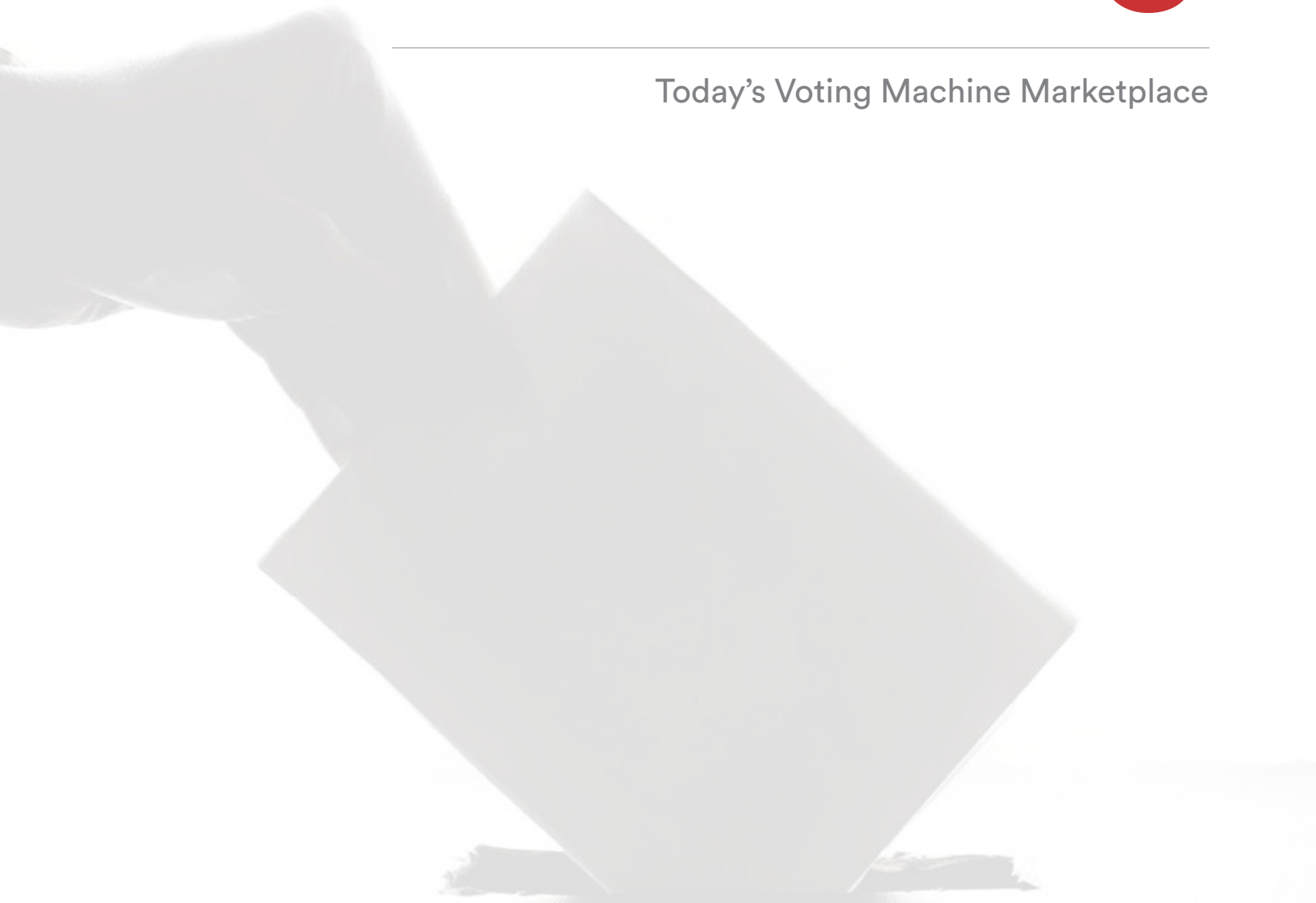


# The Price of Voting

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Today's Voting Machine Marketplace



March 2021

VerifiedVoting

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This report draws heavily on the 2017 study, *The Business of Voting: Market Structure and Innovation in the Election Technology Industry*. We thank Lorin Hitt, who led the study, and the student researchers who contributed. We are also indebted to the many voting industry and policy stakeholders who took the time to read and respond to the report. We appreciate their input and encouragement to continue.

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# Preface



THE PRICE OF VOTING

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## In the spring of 2018, I heard Matthew Caulfield present the findings of the Wharton Public Policy Initiative study, *The Business of Voting*.

It was apparent that the Wharton team at the University of Pennsylvania had produced a seminal report. More systematically than any before, *The Business of Voting* shed light on the dysfunctions of the voting technology market. Many observers had criticized the mediocrity of voting machines and the slow pace of innovation, often blaming vendors for these failings. *The Business of Voting* instead applied economic principles to identify specific barriers to innovation in the voting machine market: the lack of a consistent funding stream; the cost to buyers of switching from one vendor to another; and certification procedures that created expenses and delays. These ideas have informed subsequent policy discussions.

In late 2020, Matthew came to Verified Voting with a problem. He had led a new team of Wharton researchers in completing an ambitious follow-up study, *The Price of Voting*, based on a large collection of voting system contracts. Then the Wharton Public Policy Initiative shuttered, leaving the report orphaned. We quickly decided that we should adopt it.

*The Price of Voting* draws on probably the largest dataset of voting system contracts ever assembled, spanning well over 400 jurisdictions. This wealth of examples provides unprecedented insight into vendors' pricing strategies, including their wide use of ad hoc discounts and their sizable annual support revenues. The report astutely combines quantitative analysis and case studies to make best use of the available data. At the same time, *The Price of Voting* is admirably candid about its limitations and cautious in its generalizations. Public officials preparing to acquire voting systems, and citizens concerned about voting system negotiations and contracts, will better understand the challenges after reading it.

Verified Voting is delighted to publish *The Price of Voting* so this valuable report can find the audience it deserves. Apart from some small updates and copy edits, the report remains as it came to us: the work of a team of student researchers at the Wharton School, led by principal investigator Matthew Caulfield. Opinions expressed in the report do not necessarily reflect the views of Verified Voting.



**Mark Lindeman, Ph.D.**  
Acting Co-Director, Verified Voting



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# Executive Summary

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**It was a staple of the news cycle around the 2020 election that many Americans lacked confidence that their vote would be faithfully counted and worried in particular that the electronic voting machines, which form the backbone of our electoral process, could have been hacked.**

Although restoring trust in the voting process is a public problem, the physical production and distribution of our voting machines belong to the private sector. Back in 2017, the Wharton Public Policy Initiative published *The Business of Voting*, a report that aimed to better understand the dynamics of the election technology industry and the business characteristics of the small coterie of private firms that design, manufacture, install, and maintain all of the electronic voting machines on which the overwhelming majority of votes in U.S. elections are cast and counted. In addition to describing the election technology market itself, the report explored a key concern: why the election technology industry appears to lack the robust level of innovation observed in other technology sectors—a seemingly necessary element for producing the more secure, reliable, and accurate voting systems that the American people deserve.

This study revisits *The Business of Voting*, updates key statistics, and adds a new analysis of voting machine pricing to shed some fresh light on the previous findings. These are the key highlights:

On a macro-level, the broad characteristics of the election technology industry are unchanged since our last report:

- The “big three vendors” (Election Systems & Software, Dominion Voting Systems, and Hart InterCivic) still control 88.8% of the market, a slight reduction from the previous estimate of 92%, which was based on 2014 figures. Much of this difference, though, can be accounted for by just a single transaction: the switching of one large county—Los Angeles—from ES&S, the predominant domestic vendor, to Smartmatic, a major international vendor.
- Although two newer vendors—Clear Ballot and VotingWorks—have expanded their foothold within the U.S. market, these changes have been minor in absolute terms, leaving the shape of the industry essentially the same as it has been.
- This pace of change is not surprising. We elaborate on how the long time horizon of contracting for voting systems slows the pace of significant market change.

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On the micro-level, we offer a new assessment of how voting machines are priced in the marketplace, made possible by our collection of what is, to our knowledge, the single largest dataset of voting system purchasing agreements and contracts ever analyzed for public consumption:

- Our aggregate dataset covers 791 jurisdictions, encompassing 50,844,239 registered voters. The subset of this data, containing more detailed, itemized pricing information—which we used for our analysis of machine pricing strategies—incorporates documents from 387 jurisdictions, covering 44,078,829 registered voters.
- We present summary statistics on pricing trends for a number of different voting machines. The most common one in our sample—ES&S’s Model DS200 optical scanner—had a strikingly consistent mode and median unit price of \$5,750, which is consistent with previous assessments.
- *The Business of Voting* suggested that the prices paid for voting machines were heavily influenced by negotiations at the jurisdictional level between individual election officials and sales representatives for the vendors. Analysis here reveals that the unit prices of voting machines actually are fairly standardized. Pricing becomes more individualized, however, with the application of sometimes arbitrarily-applied vendor discounts, either as trade-ins for old equipment or as bottom-line price markdowns.
- *The Business of Voting* also made certain assertions about “buyer power”—that larger jurisdictions would enjoy an easier time negotiating voting system customizations and seeking lower prices from vendors, and that smaller jurisdictions could heighten their buyer power by forming coalitions for joint bargaining with vendors. Case studies in this new report suggest that high-volume purchasing by a coalition matters more than the number of jurisdictions in a coalition in determining buyer power.
- The analysis also adds a new level of depth to our understanding of annual licensing, support, and maintenance fees—how high they are relative to the initial acquisition costs for new voting machines, as well as what they suggest about the incentives that motivate the behavior of buyers and sellers in the election technology marketplace.

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# Introduction:

## Looking Back and Moving Forward

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### Looking Back: *The Business of Voting*

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The Wharton Public Policy Initiative published *The Business of Voting* in 2017, just a few months after President Donald Trump’s inauguration. In the lead-up to the 2016 election, when the writing of that report first got under way, voting technology was a niche issue in spite of the alarms sounded by a small group of activists, technologists, government officials, policy experts, and public interest journalists who cautioned that voting machines throughout the U.S. were outmoded and vulnerable. Much to their chagrin and our collective detriment, their warnings were not broadly heeded. The public attention dedicated to voting technology vulnerabilities had skyrocketed, however, by the time *The Business of Voting* approached final publication.

Accusations of Russian meddling in the aftermath of the 2016 election, which involved the targeting of election infrastructure in all 50 U.S. states, including a successful hack into the online voter registration system in Illinois, suddenly made the topic of election technology one of national and popular concern.<sup>1</sup> Consequent demands for strengthening election security and integrity inevitably stirred up a host of other fundamental questions about our voting systems: Who are the vendors that design and manufacture America’s voting machines?<sup>2</sup> Who owns those vendors?<sup>3</sup> What are their business practices?<sup>4</sup> What are their incentives?<sup>5</sup> What are these vendors doing (or not doing) to spur the development of more secure and trustworthy voting systems?<sup>6</sup> And what should be done to better oversee their work?<sup>7</sup> *The Business of Voting* provided only the beginnings of the knowledge base necessary to start answering such questions. It is fair to say that when the Wharton team embarked on our initial 2017 study, we did not know what we were getting into. We assumed at the outset that we would be able to access at least fundamental facts and figures about the election technology industry—market size, market share breakdowns, pricing strategies, etc.—through public sources or published research, and then build upon that core knowledge base. But no recent, fundamental industry information was available. While some research and press accounts were dotted with allusions to the state of the market,<sup>8</sup> a full analysis was nowhere to be found.<sup>9</sup>



1. Gopal Ratnam (04-22-2019). Mueller report: Russia hacked state databases and voting machine companies. Roll Call. Available at <https://www.rollcall.com/2019/04/22/mueller-report-russia-hacked-state-databases-and-voting-machine-companies/>; David E. Sanger and Catie Edmondson (07-12-2019). Russia Targeted Election Systems in All 50 States, Report Finds. New York Times. Available at <https://www.nytimes.com/2019/07/25/us/politics/russian-hacking-elections.html>; Igor Derysh (12-03-2019). Russian-owned company caught trying to hack Ohio voting systems on Election Day. Salon. Available at <https://www.salon.com/2019/12/03/russian-owned-company-caught-trying-to-hack-ohio-voting-systems-on-election-day/>; Claire Malone (04-10-2018). What We Know And Don't Know About Election Hacking. FiveThirtyEight. Available at <https://fivethirtyeight.com/features/what-we-know-and-dont-know-about-election-hacking/>; The University of Chicago Harris Public Policy (10-10-2018). New Survey Reveals Concerns about the Security of the Nation's Voting System ahead of the Midterm Elections. Available at <https://harris.uchicago.edu/news-events/news/new-survey-reveals-concerns-about-security-nations-voting-system-ahead-midterm>.
2. Kim Zetter (03-03-2020). Los Angeles County's risky voting experiment. Politico. Available at <https://www.politico.com/news/2020/03/03/los-angeles-county-voting-experiment-119157>. Beyond the vendors we outline for voting machines, there is growing interest in which vendors provide other kinds of services that play into electoral processes. See Rebecca Heilweil (12-02-2017). Nine Companies That Want to Revolutionize Voting Technology. Forbes. Available at <https://www.forbes.com/sites/rebeccaheilweil/2017/12/02/eight-companies-that-want-to-revolutionize-voting-technology/#31ea42a112c1>. Of course, one vendor that has taken a spotlight is Shadow, Inc., the developer of the faulty app used in the 2020 Iowa Democratic Caucuses. See Anna Merlan and Tim Marchman (2-07-2020). Docs: Shadow Inc. Directly Tied to Liberal Media Operation. Vice. Available at [https://www.vice.com/en\\_us/article/dygyaq/docs-shadow-inc-directly-tied-to-left-wing-media-operation](https://www.vice.com/en_us/article/dygyaq/docs-shadow-inc-directly-tied-to-left-wing-media-operation). See also Matthew Rosenberg, Nick Corasaniti, Sheera Frenkel, and Nicole Perloth (02-04-2020). Faulty Iowa App Was Part of Push to Restore Democrats' Digital Edge. New York Times. Available at <https://www.nytimes.com/2020/02/04/us/politics/iowa-caucus-shadow-app.html>.
3. Anders Melin and Reade Pickert (11-03-2018). Private Equity Controls the Gatekeepers of American Democracy. Bloomberg. Available at <https://www.bloomberg.com/news/articles/2018-11-03/private-equity-controls-the-gatekeepers-of-american-democracy>; Associated Press (07-12-2019). Who's Behind Voting-Machine Makers? Money of Unclear Origins. US News & World Report. Available at <https://www.usnews.com/news/politics/articles/2019-07-12/whos-behind-voting-machine-makers-money-of-unclear-origins>.
4. Zack Whittaker (3-27-2019). Senators demand to know why election vendors still sell voting machines with 'known vulnerabilities'. Tech Crunch. Available at <https://techcrunch.com/2019/03/27/senators-security-voting-machines/>. Pam Fessler (05-02-2019). Trips to Vegas and Chocolate-Covered Pretzels: Election Vendors Come Under Scrutiny. NPR. Available at <https://www.npr.org/2019/05/02/718270183/trips-to-vegas-and-chocolate-covered-pretzels-election-vendors-come-under-scruti>.
5. Jessica Huseman (10-28-2019). The Market for Voting Machines is Broken. This Company Has Thrived in It. ProPublica. Available at <https://www.propublica.org/article/the-market-for-voting-machines-is-broken-this-company-has-thrived-in-it>.
6. In a field of research generally neglectful of the vendor landscape, a 2006 report by the National Research Council stands out. It considered the 'role of the private sector in election administration,' a core pragmatic and ethical concern. See National Research Council (2006). Asking the Right Questions About Electronic Voting at pp. 120-122. Indeed, it was remarkably prescient in predicting the consolidation of the electronic voting machine vendor landscape: "A common path in any new niche is the initial proliferation of a large number of small vendors, followed by consolidation as weaker vendors drop out of the market. If this path is followed in the voting systems or election services market, a few large private firms will be in the position of managing and administering elections for a large number of local jurisdictions—raising the possibility that those who control these firms will be able to exert undue and improper influence on election outcomes for either financial or political reasons" (p. 121).
7. Alan Beard and Lawrence Norden (03-02-2020). There Is Shockingly Little Oversight of Private Companies That Create Voting Technologies. Slate. Available at <https://slate.com/technology/2020/03/election-technology-vendors-super-tuesday.html>. See also Lawrence Norden, Christopher R. Deluzio, & Gowri Ramachandran; Brennan Center for Justice (2019). A FRAMEWORK FOR ELECTION VENDOR OVERSIGHT. Available at <https://www.brennancenter.org/our-work/policy-solutions/framework-election-vendor-oversight>. Oversight might be more pressing given that local election officials may not be equipped to exercise oversight themselves. Some cyber security experts have more recently expressed dismay at the willingness of local election officials to purchase machines with documented security issues. See Kartiaky Mehrorta and Margaret Newkirk (11-18-2019). Expensive, Glitchy Voting Machines Expose 2020 Hacking Risks. Bloomberg. Available at <https://www.bloomberg.com/news/articles/2019-11-08/expensive-glitchy-voting-machines-expose-2020-hacking-risks>.
8. For instance, the Presidential Commission on Election Administration (PCEA) reported, "The remaining vendors in the industry are in a difficult position. They face a fragmented market where buying decisions are often left to a multitude of county and local jurisdictions so that a consistent market with which to fund innovation is elusive," and that, "The voting machine market is dominated by a relatively small number of manufacturers." PCEA (2014). THE AMERICAN VOTING EXPERIENCE: REPORT AND RECOMMENDATIONS OF THE PRESIDENTIAL COMMISSION ON ELECTION ADMINISTRATION at pp. 63, 67. See also Michael Riley, Jordan Robertson, & David Kocieniewski (09-29-2016). The Computer Revolution Is Already Crappy, Buggy, and Obsolete. Bloomberg. Available at <https://www.bloomberg.com/features/2016-voting-technology/>. See also National Research Council (2006). Letter Report on Electronic Voting. The National Academies Press at p. 6. Available at <https://doi.org/10.17226/11704>. See also Robert Montjoy (2010). The Changing Nature... and Costs... of Election Administration. Public Administration Review (70)6 at p. 869. Jennifer Nou (2008). Privatizing Democracy: Promoting Election Integrity Through Procurement Contracts, Yale Law Journal 118(4) at pp. 750, 765. See generally Brenda Reddix-Small (2009). Individual Liberties and Intellectual Property Protection—Proprietary Software in Digital Election Voting Machines: The Clash Between a Private Right and a Public Good in an Oligopolistic Market. Fordham Intellectual Property, Media, & Entertainment Law Journal (19)3. For an historical analysis of the early voting machine market, see Electionline.org (2004). Election Reform Briefing: The Business of Elections. Available at <https://electionline.org/resources/the-business-of-elections-august-2004/>.
9. The most complete previous commentary on the market for voting technology can be found in MIT/CalTech Voting Technology Project (2001). VOTING: WHAT IT IS, WHAT IT COULD BE. Available at <https://vote.caltech.edu/reports/1>. See also Stephen Ansolabehere & Ronald Rivest (2013). Voting Equipment and Ballots at pp. 5-8. Available at [https://www.eac.gov/sites/default/files/event\\_document/files/Voting\\_Technology\\_SDA\\_RLR.pdf](https://www.eac.gov/sites/default/files/event_document/files/Voting_Technology_SDA_RLR.pdf).

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## Looking Back: *The Business of Voting*—Continued

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Just like the patent-guarded, confidential technologies they sell, vendors were “black boxes”—we knew their names and some vague information about their selling practices, but little else.<sup>10</sup> It was this realization that directed *The Business of Voting*’s trajectory towards delimiting the most basic facts and incentives at play in the market for voting technology.

That report therefore summarized and put numbers behind key characteristics of the industry that defined the market landscape and seemed to contribute to an alarming state of affairs in American election technology. It described the market dominance of the “big three” vendors (Election Systems & Software, Dominion Voting Systems, Hart InterCivic) and the distinctive market and regulatory dynamics that inhibit incentives for innovation in the development of the more modern, reliable, and secure election systems that everyone says they want.<sup>11</sup>

Industry insights from *The Business of Voting* informed further inquiries into the vulnerabilities of America’s election infrastructure by the National Academies of Sciences, Engineering, and Medicine,<sup>12</sup> as well as by other researchers, journalists, and policymakers.

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10. For an overview of potential conflicts between trade secret protections and democratic accountability, see David S. Levine (2007). *Secrecy and Unaccountability: Trade Secrets in Our Public Infrastructure*. Fla. L. Rev (59)1. For an international perspective on this issue, see Margaret McGaley & Joe McCarthy, *Transparency and e-voting democratic vs. commercial interests* in Prosser, A. & Krimmer, R. (eds.), *Electronic voting in Europe - Technology, law, politics and society*, workshop of the ESF TED programme together with GI and OCG at pp. 153-163. Available at <https://dl.gi.de/bitstream/handle/20.500.12116/29121/Proceeding.GI.47-16.pdf?sequence=1&isAllowed=y>.

11. The only previous broad market share estimates we could locate are: Kathleen Hale & Mitchell Brown. *Adopting, Adapting, and Opting out: State Response to Federal Voting System Guidelines*. Publius: The Journal of Federalism (43)3 at p. 432 (estimating that “three vendors—Election Systems & Software (ES&S), Premier Election Solutions (formerly, Diebold), and Integrity Voting Systems—provide equipment to a combined total of 85 percent of the nation’s election jurisdictions. More than two-thirds of voters (70 percent) use equipment sold by either ES&S (forty states) or Premier Election Solutions (thirty-one states)”). See also MIT/CalTech Voting Technology Project *supra* note 9: (“The four largest manufacturers are Danaher Controls (Guardian Voting Systems), Global Election Systems, Election Systems and Software (ES&S), and Sequoia-Pacific Voting Systems. Together, they make up nearly ninety percent of the market. By far the largest of these is ES&S, which contracts with approximately sixty percent of the counties in the U.S.”). See also Kevin J. Coleman & Eric A. Fischer (2014). *The Help America Vote Act and Election Administration: Overview and Issues* at p. 2 (noting “in 2008 the top four vendors controlled about 70% of the market”). For more information on consolidation of these vendors into the modern big three—ES&S, Dominion, and Hart—see Penn Wharton Public Policy Initiative (2017). *THE BUSINESS OF VOTING: MARKET STRUCTURE AND INNOVATION IN THE ELECTION TECHNOLOGY INDUSTRY* at pp. 14-16.

12. National Academies of Sciences, Engineering, and Medicine (2018). *SECURING THE VOTE: PROTECTING AMERICAN DEMOCRACY*. Available at <https://doi.org/10.17226/25120>.

The report also raised awareness of just how little is known about the companies that manufacture America's voting machines, and prompted investigative reporters and members of the U.S. Congress to dig more deeply into the private equity ownership of the major election technology vendors<sup>13</sup> and to question how a consolidated election technology market may impact election security.<sup>14</sup>

One statistic alone—that the big three vendors controlled over 90 percent of the U.S. market, as measured by their coverage of registered voters—garnered significant attention (and will be re-examined and updated later in this report). In March 2019, when five U.S. Senators wrote to these vendors requesting information on the security of their voting systems,<sup>15</sup> their concerns rested in part on the problems delineated in *The Business of Voting*.

*As the three largest election equipment vendors, your companies provide voting machines and software used by 92 percent of the eligible voting population in the U.S. This market concentration is one factor among many that could be contributing to the lack of innovation in election equipment. The integrity of our elections is directly tied to the machines we vote on—the products that you make. Despite shouldering such a massive responsibility, there has been a lack of meaningful innovation in the election vendor industry and our democracy is paying the price.*<sup>16</sup>

A fundamental premise of *The Business of Voting* is the importance of market-centric analysis in advancing the cause of voting technology integrity and reform.

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13. Congress of the United States (12-06-2019). H.I.G., McCarthy, & Staple Street letters. Available at <https://www.warren.senate.gov/imo/media/doc/H.I.G.%20McCarthy,%20%20Staple%20Street%20letters.pdf>; Benjamin Wofford (10-25-2018). The hacking threat to the midterms is huge. And technology won't protect us. *Vox*. Available at <https://www.vox.com/2018/10/25/18001684/2018-midterms-hacked-russia-election-security-voting>; See also Melin and Pickert *supra* note 3. In recent testimony to Congress, the CEOs of ES&S and Dominion indicated that their companies are owned 80% and 76%, respectively, by private equity firms. The CEO of Hart confirmed that company has a similar structure. See Committee on House Administration, Majority, 2020 Election Security: Perspectives from Voting System Vendors and Experts. Available at <https://youtu.be/Y15D19usS0g?t=5620> at mark 1:33:40.

14. See *Ibid*. Also, referencing a statistic supplied to the Committee by former FBI Deputy Director Andrew McCabe—one that seems to have been pulled from *The Business of Voting*—the U.S. Senate Select Committee investigating the 2016 Russian election interference noted that “the number of vendors selling voting machines is shrinking, raising concerns about a vulnerable supply chain.” U.S. Senate Select Committee on Intelligence. RUSSIAN ACTIVE MEASURES CAMPAIGNS AND INTERFERENCE IN THE 2016 U.S. ELECTION, VOL. 1: RUSSIAN EFFORTS AGAINST ELECTION INFRASTRUCTURE WITH ADDITIONAL VIEWS at p. 44. Available at [https://www.intelligence.senate.gov/sites/default/files/documents/Report\\_Volume1.pdf](https://www.intelligence.senate.gov/sites/default/files/documents/Report_Volume1.pdf). In their initial findings, it also noted that “vendors of election software and equipment play a critical role in the U.S. election system, and . . . represent an enticing target or malicious cyber actors.” U.S. Senate Select Committee on Intelligence (2018). RUSSIAN TARGETING OF ELECTION INFRASTRUCTURE DURING THE 2016 ELECTION: SUMMARY OF INITIAL FINDINGS AND RECOMMENDATIONS, May 8, 2018. Available at <https://www.intelligence.senate.gov/publications/russia-inquiry>.

15. It is worth noting that the vendors eventually agreed to provide more information to the government. See Chris Strohm and Alyza Sebenius (09-05-2019). Voting Machine Makers Give U.S. Access in Fight Against Hackers. *Bloomberg*. Available at <https://www.bloomberg.com/news/articles/2019-09-05/voting-machine-makers-give-u-s-access-in-fight-against-hackers>.

16. News Release (03-27-2019). Ranking Members Klobuchar, Warner, Reed, and Peters Press Election Equipment Manufacturers on Security. Website of United States Senator Amy Klobuchar. Available at <https://www.klobuchar.senate.gov/public/index.cfm/news-releases?ID=CB7B78C2-5313-4FA2-AB83-B4A7C85201F9>.

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## Looking Back: *The Business of Voting*—Continued

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At least at present, a prerequisite for the propagation of secure and trustworthy voting systems is a market that will manufacture, distribute, and continually develop these systems in an accountable and cost-feasible manner.<sup>17</sup> What is the use of producing new election technologies (and standards for those technologies) if they do not meet the needs and expectations of voters, or are not affordable for the jurisdictions responsible for purchasing them?<sup>18</sup> As much of the discourse around election technology has focused more intently on other, albeit vitally important, issues of policy and technology,<sup>19</sup> a sobering determination by the 2014 Presidential Commission on Election Administration still rings true today: “In short, jurisdictions do not have the money to purchase new machines, and legal and market constraints prevent the development of machines they would want even if they had funds.”<sup>20</sup>

While we are glad that those seeking to address market-centric questions about election technology have found *The Business of Voting* useful, much ground remains to be covered, and limited information has emerged since that report was published.<sup>21</sup>

Purchasing activity in the voting technology marketplace began ramping up in the years prior to the 2020 election. The mostly exhausted \$2 billion in appropriations made available for voting system purchases by the Help America Vote Act (HAVA) in 2002 were supplemented by new infusions of federal dollars. In March 2018, President Trump signed the Consolidated Appropriations Act, which made another \$380 million available to states for improving the security of their election systems. In December 2019, the Consolidated Appropriations Act of 2020 authorized an additional \$425 million for states to institute improvements for the administration of elections for federal offices, including the purchase of updated voting technology.<sup>22</sup> While these sums did not allow for the universal replacement of outmoded voting machines across the U.S., they did spur some states—including Georgia, South Carolina, and Delaware—to replace all of their voting machines. A number of other states, such as Ohio, California, Virginia, and Pennsylvania, replaced sizable portions of theirs.<sup>23</sup>

While such infusions of funding seem necessary, funding alone cannot create a well-functioning election technology market. Some have argued that the original HAVA appropriations actually cemented rather than improved the status quo business model, providing substantial revenue to incumbent vendors alongside few incentives to improve technology or heighten the standards to which it is designed and built.<sup>24</sup>

The recent flurry of purchasing activity and the heightened interest in election technology signal an ideal time to revisit and update the initial report. This new update pays particular attention to the vendor side of the market, consistent with the recent focus of public discussion.

The report is structured into two larger sections. The first section re-examines key characteristics of the election technology industry, to see if anything has changed with regard to the highly concentrated market conditions and competitive dynamics that have defined the behavior of election technology vendors in the past. We find that newer entrants have not gained a significant foothold in the industry over the past three years and that many of the market dynamics remain the same.

The second section breaks new ground in analyzing trends in voting machine pricing. We summarize our findings for this second section for the remainder of this introduction.

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17. See also Kathleen Hale, Robert Montjoy, and Mitchell Brown (2015). Administering Elections: How American Elections Work at p. 25. (“Elections officials have to count on companies in the free market to be able and willing to provide products and services at a price they can afford.” They refer to this as a “major dependency” on private vendors and argue that private companies form just one group of actors amidst a multitude of both private and public sub-systems that constitute the “electoral system.” See also National Research Council 2006 Letter on Electronic Voting *supra* note 8 at p. 5-6, emphasizing “the extent and scope of vendor involvement apart from the sale of equipment itself.”)

18. On the role of the vendor and relative expertise in this process, see Peter Lichtenheld (2020). The Role of Election Vendors in Election Administration. In M. Brown et al. (eds.). THE FUTURE OF ELECTION ADMINISTRATION at pp. 201-211. Available at [https://doi.org/10.1007/978-3-030-14947-5\\_12](https://doi.org/10.1007/978-3-030-14947-5_12). See also David A. Bennett (2019). Technology Procurement in Election Systems. In THE FUTURE OF ELECTION ADMINISTRATION: CASES AND CONVERSATIONS. Available at [https://doi.org/10.1007/978-3-030-18541-1\\_24](https://doi.org/10.1007/978-3-030-18541-1_24). See also Mindy Perkins (2019). What is the Role of the Vendor in Modern Elections? In THE FUTURE OF ELECTION ADMINISTRATION: CASES AND CONVERSATIONS. Available at [https://doi.org/10.1007/978-3-030-18541-1\\_10](https://doi.org/10.1007/978-3-030-18541-1_10).

19. See Norden, Deluzio, and Ramachandran; Brennan Center for Justice *supra* note 7 at p. 4. (“The unprecedented attacks on America’s elections in 2016, and repeated warnings by the country’s intelligence agencies of future foreign interference, have raised the profile of election security in a way few could have imagined just a few years ago. The response has largely focused on improving the testing of voting machines before they are purchased and on training state and local election officials to institute best practices to prevent, detect, and recover from cyberattacks. Yet private vendors, not election officials, build and maintain much of our election infrastructure.”); See also Nou *supra* note 8 at p. 776. (“The procurement process has been a conceptually underdeveloped arena for thinking about accountability in election administration.”)

20. See PCEA *supra* note 8 at p. 62.

21. Clear information on annual industry revenue remains particularly elusive. *The Business of Voting* sized the market at around \$350 million annually (over a 10-year period), based on data obtained from the market research firm PrivCo. That calculation was consistent with previous assessments; see MIT/CalTech Voting Technology Project (2013). VOTING: WHAT HAS CHANGED, WHAT HASN’T, AND WHAT NEEDS IMPROVEMENT at p. 22. Available at <http://vote.caltech.edu/reports/6>. Updating market share estimates for the election technology market is tricky, since initial estimates assumed a 10-year revenue period due to the “lumpiness” of the revenue stream from the purchase of new voting machines. Nevertheless, subsequent to publishing *The Business of Voting*, several industry stakeholders verbally affirmed the accuracy of our market revenue estimates.

22. National Conference of State Legislatures (02-28-2020). Funding Elections Technology. Available at <https://www.ncsl.org/research/elections-and-campaigns/funding-election-technology.aspx>; U.S. Election Assistance Commission. 2020 HAVA Funds. Available at <https://www.eac.gov/payments-and-grants/2020-hava-funds>.

23. See Fessler *supra* note 4.

24. One commenter argued that HAVA “stunted a potentially robust market by artificially inflating demand and encouraging quick and expensive investments in still-developing technology. Because suppliers were competing in a relatively new market with eager and impatient buyers, they had little incentive to develop and test products that could better help guarantee election integrity.” See Nou *supra* note 8. In the context of this “unprecedented sales opportunity for the voting industry . . . there was little incentive to develop ‘better’ machines and every incentive to sell as many machines as possible.” Warren Stewart (05-01-2006). Do You Know How Your Vote Will Be Counted? The Washington Spectator. Available at <https://washingtonspectator.org/do-you-know-how-your-vote-will-be-counted/>. See also Eddie Perez; OSET Institute (05-13-2019). With New Threats Continually Emerging, Why Can’t Voting Technology Keep Up? Medium. Available at <https://medium.com/@oset/with-new-threats-continually-emerging-why-cant-voting-technology-keep-up-bbdd8c830e87>. (“Ironically, perhaps the most significant unintended consequence of these market dynamics is the observation that a well intentioned set of post-HAVA regulatory structures . . . may have effectively increased the power of vendors. From the standpoint of the three major vendors, the current distorted conditions continue to be a functional business model: vendors command the domain expertise in a sector with high barriers to entry; as privately held companies, they are not subject to the same disclosure requirements as public ones; they already have certified systems developed to old standards, which they can continue to sell (regardless of whether they are adequate for current national security needs); newer federal standards remain several years away; and election officials have no other choice but to purchase their technology from this small group of vendors. Under the distorted logic of this regulated technology environment, vendors have no reason to do the hard work of fundamentally re-thinking high-assurance computing required for critical infrastructure architecture, because they can continue to generate revenue for their shareholders by marketing newer versions of systems informed by circa-2002 HAVA-era standards.”)

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## Moving Forward: *The Price of Voting*

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The actual cost of voting technology is, and has long been, poorly understood.<sup>25</sup> Sometimes, anecdotal cases are given weight to illustrate costs in the broader market.<sup>26</sup> Some analyses, drawing in part from local news stories, rely largely on reported total acquisition costs, without specifics of unit pricing or long-term maintenance costs.<sup>27</sup> This lack of information is worrisome, especially because, as the GAO has found, maintenance costs pose a major challenge for many jurisdictions.<sup>28</sup> Given the financial constraints upon jurisdictions that seek new voting equipment,<sup>29</sup> clearer and more comprehensive information on pricing is needed.

The most commonly cited estimates for voting machine prices are drawn from the website of the National Conference of State Legislatures (estimating the cost per unit for optical scanners as ranging from \$2,500 to \$5,000, and for voting machines at-large at \$3,000 to \$6,000).<sup>30</sup> Most of the leading studies and reports on election technology rely heavily on these numbers.<sup>31</sup> These unit price estimates still do not provide context on the costs of maintenance or on the dynamics of pricing schedules, especially discounts.<sup>32</sup>

We realized the importance of gathering more direct information about voting machine pricing.<sup>33</sup> In 2019, we collected what we believe to be the largest dataset of U.S. voting machine procurement contracts ever analyzed for public consumption.<sup>34</sup> We use that dataset here to inquire primarily into how vendors price the machines they sell. We attempt to characterize how pricing schedules are typically used in procurement; illustrate the variance in prices, the scope of discounts, and their underlying logic (or lack thereof); and relate the typical costs of long-term maintenance agreements to initial layouts for acquisitions. This analysis allows us to engage some of the most pressing issues that election officials face when procuring equipment. As with previous studies, we found that the unit price of the most common optical scanner system is \$5,750 (again, not including discounts and maintenance costs).<sup>35</sup>

Our approach here offers just a small step forward, and much of our data is suggestive. A more sophisticated quantitative analysis may yield richer insights in the future.<sup>36</sup> That said, we find some surprisingly robust trends that point to broader pricing strategies deployed by vendors in the marketplace.



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25. National Academies of Sciences, Engineering, and Medicine *supra* note 12 at p. 111. (“The price of voting machines is usually not made public, and costs vary depending on factors such as the number of units purchased, the vendor chosen, and whether or not maintenance agreements are also purchased.”) Caltech/MIT Voting Technology Project *supra* note 9 at p. 48. (“Even the most basic facts about the cost and finance of elections in the United States are unavailable, and the most basic questions remain unexamined.”)
26. The GAO, for instance, relies on a small selection of counties to illustrate costs, reporting only on their total costs of acquisition. See U.S. Government Accountability Office (2018). OBSERVATIONS ON VOTING EQUIPMENT USE AND REPLACEMENT at p. 37-42. Available at <https://www.gao.gov/products/GAO-18-294>. See also, e.g., Verified Voting Foundation. ARE VOTER-VERIFIED PAPER BALLOTS COST-EFFECTIVE? Available at <https://www.verifiedvoting.org/downloads/Newvvpbcosts.pdf>; See also Montjoy *supra* note 8 at pp. 870-873.
27. See, e.g., “Sources and Methodology” in Christopher Deluzio and Kevin Skoglund; Pitt Cyber & Citizens for Better Elections. Pennsylvania Counties’ New Voting Systems: An Analysis. Available at <https://www.cyber.pitt.edu/sources-and-methodology>. We thank Kevin Skoglund for providing more color in correspondence with us on the methodology and challenges they faced in conducting their important research.
28. See U.S. Government Accountability Office *supra* note 26 at p. 22.
29. *Ibid* at 28-29. Also, PCEA *supra* note 8 at p. 30. (“The most universal complaint of election administrators in testimony before the Commission concerned a lack of resources. Election administrators have described themselves as...often the last constituency to receive scarce funds at the local level. . . . In the midst of intense competition for budget dollars, election officials often face significant difficulty in advocating for their cause.”) Also, National Conference of State Legislatures (2018). THE PRICE OF DEMOCRACY: SPLITTING THE BILL FOR ELECTIONS, NATIONAL CONFERENCE OF STATE LEGISLATURES at p. 30. (“About five years ago, state and local election officials began considering when and how to replace elections technology...the cost of replacing technology (and who would pay for it) was a key component, perhaps *the* key component to these efforts, from the legislative perspective.”) Available at [https://www.ncsl.org/Portals/1/Documents/Elections/Final\\_Costs\\_Report-Splitting\\_the\\_Bill\\_for\\_Elections\\_32084.pdf](https://www.ncsl.org/Portals/1/Documents/Elections/Final_Costs_Report-Splitting_the_Bill_for_Elections_32084.pdf).
30. National Conference of State Legislatures (2012). Voting Technology: Current and Future Choices. The Canvass (31) at p. 2. Available at [https://www.ncsl.org/documents/legismgt/elect/Canvass\\_June\\_2012\\_No\\_31.pdf](https://www.ncsl.org/documents/legismgt/elect/Canvass_June_2012_No_31.pdf).
31. We relied upon NCSL estimates in our previous report, *The Business of Voting* (2017) n. 93 and accompanying text. See also National Academies of Sciences, Engineering, and Medicine *supra* note 12 at p. 111; Brennan Center for Justice. ESTIMATE FOR THE COST OF REPLACING PAPERLESS, COMPUTERIZED VOTING MACHINES at n. 120. Available at [https://www.brennancenter.org/sites/default/files/analysis/New\\_Machines\\_Cost\\_Across\\_Paperless\\_Jurisdictions%20%282%29.pdf](https://www.brennancenter.org/sites/default/files/analysis/New_Machines_Cost_Across_Paperless_Jurisdictions%20%282%29.pdf); Sarah Breitenbach (03-12-2016). Aging Voting Machines Cost Local, State Government. Pew. Available at <https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/03/02/aging-voting-machines-cost-local-state-governments>. The Indiana Fiscal Policy Institute also adopted a similar range of \$3,000-\$5,000. See Indiana Fiscal Policy Institute (2010). VOTE CENTERS AND ELECTION COSTS: A STUDY OF THE FISCAL IMPACT OF VOTE CENTERS IN INDIANA at p. 15. Available at [https://www.in.gov/sos/elections/files/Full\\_Report.pdf](https://www.in.gov/sos/elections/files/Full_Report.pdf).
32. The NCSL notes that these costs are also significant to understanding the cost of election administration, but do not provide general estimates for them. See National Conference of State Legislatures *supra* note 30.
33. We share this intuition with Public Citizen, who also published a report on a more limited data set on voting machine pricing. See Aquene Freechild and Hamdi Soysal; Public Citizen (2018). COST OF COUNTING THE VOTE. Available at [https://www.citizen.org/wp-content/uploads/voting\\_equipment\\_pricing\\_mini-report\\_05\\_31\\_18\\_final-1.pdf](https://www.citizen.org/wp-content/uploads/voting_equipment_pricing_mini-report_05_31_18_final-1.pdf).
34. To our knowledge, the largest before us was collected for a report by the Brennan Center in 2006. The Brennan Center requested the contracts from 324 jurisdictions, from which they received 35 responses. They also received 75 supplemental responses to cost surveys sent to 1,694 counties nationwide. See Brennan Center for Justice (2006). THE MACHINERY OF DEMOCRACY: VOTING SYSTEM SECURITY, ACCESSIBILITY, USABILITY, AND COST. Available at [https://www.brennancenter.org/sites/default/files/publications/Machinery\\_Democracy.pdf](https://www.brennancenter.org/sites/default/files/publications/Machinery_Democracy.pdf).
35. As we later note, this is consistent with Public Citizen’s (2018) findings. See Public Citizen *supra* note 33. This also seems to be the case historically. See, e.g., VotersUnite (2005). COST INFORMATION ABOUT VOTING SYSTEMS. Available at <http://www.votersunite.org/info/costhandout.pdf>.
36. As noted in Conny B. McCormack; The Atlantic Council (2016). DEMOCRACY REBOOTED: THE FUTURE OF TECHNOLOGY IN ELECTIONS at p. 17. Available at [https://www.atlanticcouncil.org/wp-content/uploads/2016/03/Democracy\\_Rebooted\\_0323\\_web\\_Updated.pdf](https://www.atlanticcouncil.org/wp-content/uploads/2016/03/Democracy_Rebooted_0323_web_Updated.pdf).
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# The Market Landscape in 2020

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**Over the past couple of years, as many election officials across the U.S. worked at the state and jurisdictional levels to replace aging voting machines in preparation for the 2020 election, election technology vendors scrambled to capture the new uptick in business.**

*The Business of Voting* had characterized the competitive dynamics of the election technology industry as aggressive, in part due to the infrequency of equipment purchases: “For vendors, the process entails substantial investments in direct marketing to election administrators, engagement in lobbying and other political activity, and even the initiation of litigation proceedings over unsuccessful bids.”<sup>37</sup> Recent investigative reporting has only confirmed and added new detail to what is known of these activities, and, in the process, has illuminated a darker side of firm behavior within the industry.

ES&S, the largest U.S. vendor, has been a focus of attention. It emerged in 2018 that the firm had been maintaining an “advisory board” of election officials who, when meeting with ES&S representatives, received plane tickets and hotel accommodations, as well as other pricey giveaways, despite the fact that these same election officials were directly responsible for making decisions on voting system procurement for their home jurisdictions.<sup>38</sup>

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37. See Penn Wharton Public Policy Initiative *supra* note 11 at pp. 24-25.

38. Greg Gordon, Amy Renee Leiker, Jamie Self, and Stanley Dunlap (06-21-2018). Voting machine vendor treated election officials to trips to Vegas, elsewhere. McClatchy DC. Available at <https://www.mcclatchydc.com/latest-news/article213558729.html>; Sue Halpern (01-22-2019). How Voting Machine Lobbyists Undermine the Democratic Process. New Yorker. Available at <https://www.newyorker.com/tech/annals-of-technology/how-voting-machine-lobbyists-undermine-the-democratic-process>. See also Fessler *supra* note 4.

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Even though the advisory board has since been disbanded, other efforts at influence-peddling continued. Several counties in Pennsylvania that purchased ES&S machines in 2019 had those procurements called into question when it was revealed that the company had engaged in undisclosed lobbying activity with local election officials. ES&S is hardly alone in such behavior, however; all the major election technology firms deploy teams of lobbyists not only to address regulatory concerns at the federal and state levels, but to advance sales targets at the local levels.<sup>39</sup>

A series of lawsuits also brought attention to ES&S's willingness to use litigation to head off deals with other vendors. In 2018, ES&S filed a federal lawsuit against Cook County, IL, to block the execution of a \$30 million contract with Dominion, on the grounds that the voting system had not been certified by the Illinois State Board of Elections at the time the contract was made. Cook County previously had been a client of ES&S, so the move can easily be seen as motivated primarily to obstruct the county from switching vendors.

Although it did not prove successful—the suit was dropped and Cook County rolled out the new Dominion machines early in 2020—it illustrates the (likely expensive) tactics ES&S is willing to deploy to maintain its dominant market share. Similarly, in 2018 ES&S filed a legal complaint against the State of Louisiana, after its Secretary of State authorized a \$95 million contract with Dominion to replace outdated machines throughout the state.<sup>41</sup> Again, the case rested on an alleged violation of protocol: the voting system standards that vendors were expected to follow in making their bids were not posted on the Secretary of State's website, as required by Louisiana state law. Louisiana consequently cast aside the agreement with Dominion and went back to square one, initiating a new bidding process in March 2020. This means that voters in Louisiana were again consigned to casting votes on machines from 2005 throughout the 2020 election cycle. In early 2021, the process stopped again, after Hart InterCivic objected to the terms of Louisiana's RFP.

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39. Johnny Kauffman (03-07-2018). Barcodes Stir Anxiety as Georgia Eyes New Voting System. WABE. Available at <https://www.wabe.org/barcodes-stir-anxiety-georgia-eyes-new-voting-system/>; Mark Nieese and David Wickert (11-04-2019). Georgia Hopes New Voting System Will Protect 2020 Elections. GovTech. Available at <https://www.govtech.com/security/Georgia-Hopes-New-Voting-System-Will-Protect-2020-Elections.html>; Megan R. Wilson and Michaela Ross (04-01-2019). Voting Machine Firms Add Lobbyists Amid Election Hacker Concerns. Bloomberg Government. Available at <https://about.bgov.com/news/voting-machine-firms-add-lobbyists-amid-election-hacker-concerns/>.

40. See Wofford *supra* note 13.

41. Josephine Wolff and Miriam Wasserman (02-11-2020). Election Infrastructure and the Market for Voting Technology. EconoFact. Available at <https://econofact.org/election-infrastructure-and-the-market-for-voting-technology>; Melinda Deslatte (11-28-2018). Decision upheld to scrap Louisiana voting machine contract. AP News. Available at <https://apnews.com/95a6f8e4742a4187bf63bc74132b0ae0>; Benjamin Freed (10-11-2018). Louisiana cancels \$95 million contract for new voting machines. State Scoop. Available at <https://statescoop.com/louisiana-cancels-95-million-contract-for-new-voting-machines/>; Associated Press (03-12-2020). Louisiana restarting bid process for new voting machines. KATC. Available at <https://www.katc.com/news/covering-louisiana/louisiana-restarting-bid-process-for-new-voting-machines>; Huseman *supra* note 5.

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Earlier, in 2017, Hart InterCivic sued the state of Texas in an effort to protect its market share—in particular, to prevent counties from replacing Hart machines that did not produce a paper record with new systems from other vendors that did.<sup>42</sup> For a vendor to sue to prevent auditable paper records from being used in voting shows that market dynamics can be starkly misaligned with the public interest. Moreover, the incentive to invest in legal maneuvers, rather than R&D, also has been cited among the drags on innovation that vex the election technology industry.<sup>43</sup>

While the optics of these lawsuits and lobbying efforts are unflattering, it is unclear how far they have helped any major vendor guard its market share. For whatever reasons, judging from available data, little has changed in the distribution of market share (measured by vendor coverage of registered voters) since *The Business of Voting* was published. As before, we sourced data from the Verified Voting Foundation, which details the manufacturer and model of the voting equipment used in jurisdictions across the U.S.<sup>44</sup>

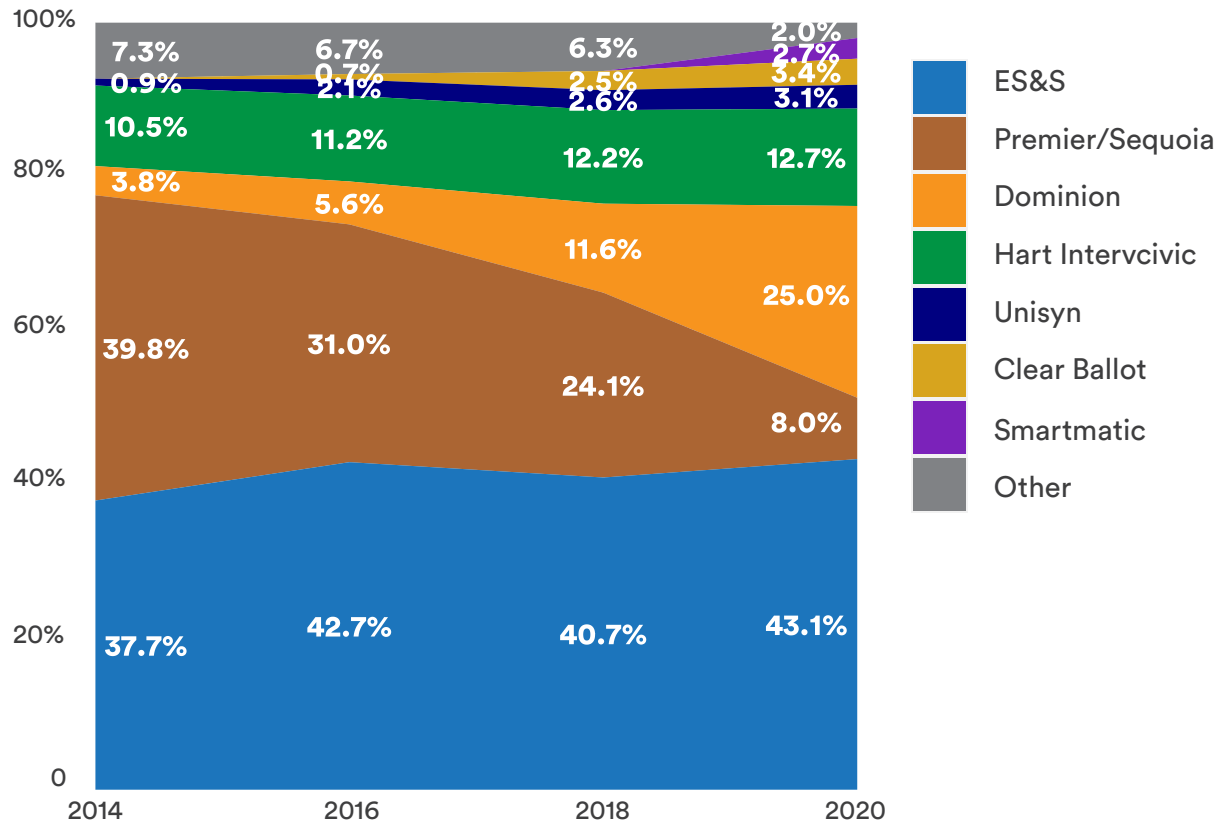
*The Business of Voting* used 2014 data, which showed that the three main vendors controlled approximately 92% of the market. Here we provide updated snapshots of the market share distribution from 2014 through 2020, summarized in Figure 1. These shares were calculated directly by analysts at the Verified Voting Foundation. (Readers may notice that the 2014 shares differ from those reported in *The Business of Voting*, due to differences in methodology and the database version used.) To cross-validate the findings, we also examined data from the Election Administration and Voting Survey (EAVS), collected by the U.S. Election Assistance Commission (EAC). The EAVS dataset is not nearly as comprehensive as the one provided by Verified Voting, but the market share estimates we generated are consistent with Verified Voting’s results. We can reaffirm our previous conclusion: the market is highly concentrated, with three major firms capturing the vast majority of revenue.

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42. Andy Taylor & Associates, PC (08-06-2017). Voting machine maker sues to block rival companies’ paper-using devices. Available at <https://www.andytaylorlaw.com/news/2017/8/6/voting-machine-maker-sues-to-block-rival-companies-paper-using-devices>.

43. Frank Bajak (10-29-2018). US election integrity depends on security-challenged firms. AP News. Available at <https://apnews.com/f6876669cb6b4e4c9850844f8e015b4c>. See also Wofford *supra* note 13. The CEOs of ES&S and Hart testified that they reinvest, respectively, around 19% and 25% of annual revenue in R&D; the CEO of Dominion said it reinvests 20-35% annually. See Committee on House Administration, Majority *supra* note 13 at mark 1:44:47.

44. According to Stephanie Singer, a Data Scientist for Verified Voting, “the data [are] updated on an ongoing basis . . . based on credible media reports and information from primary sources, such as boards of election.” Email communication from Stephanie Singer to Andrew Coopsmith, February 3, 2020.



**Figure 1: Market Coverage of Vendors Over Time\***

\*Market coverage numbers are estimates of market share by coverage of registered voters. Data on voting machines and registered voters was generously provided by the Verified Voting Foundation.

Our present analysis, summarized in Figure 1 above, diverges from the 2017 report by setting apart two voting system vendors that were out of business by 2014: Premier Election Systems (formerly Diebold) and Sequoia Voting Systems. Dominion acquired the intellectual property assets of both these companies in 2010. Accordingly, we previously combined these vendors’ “legacy systems” with Dominion’s own systems in calculating market share. However, while Dominion’s acquisition of Premier and Sequoia established Dominion as a major player in the U.S. voting system market, jurisdictions that continued to use legacy systems did not necessarily contract with Dominion for support. In some cases, Dominion continued to support Premier and Sequoia equipment. In others, it sold the support rights to ES&S or to other companies. Even if we had comprehensive data on support rights and contracts, market share calculations arguably would be somewhat arbitrary. Here we visually represent the ambiguity by placing Premier and Sequoia between Dominion and ES&S. It is apparent that Dominion has captured much of the market to replace those legacy systems; ES&S and other vendors have made lesser inroads.

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Overall, the market share of the “big three” vendors (plus the remaining Premier and Sequoia systems) has drifted slightly downward, from 91.8% of registered voters in 2014 to 88.8% in 2020. Remarkably, most of the difference between these numbers is accounted for by a single transaction: Los Angeles County’s contract with Smartmatic, a UK-based company, to build their unique, customized “Voting Solutions for All People” (VSAP). (The county previously used the InkaVote system, distributed by ES&S.) LA County, the most populous county in the U.S., contains over 3% of the nation’s voting population.<sup>45</sup> Also notable is the expansion of Clear Ballot’s market share, which more than tripled between 2016 and 2018, and has continued to creep upward since then. In absolute numbers, though, the difference is small: the company has grown from encapsulating 0.75% of the market in 2016 to covering 3.4% in 2020.

Market share in the election technology industry is “sticky.” Changes come very slowly, in part because voting machines have longer product lives (typically 10 years or more), and thus jurisdictions purchase new ones only infrequently. It is not as though the market has an opportunity each year, or even every three years, to remake itself. No matter how adept or appealing a new entrant may be, we cannot expect a huge change in market share in a short time.<sup>46</sup> Given this limitation, even the relatively smaller shifts in market share accomplished by Smartmatic and Clear Ballot are worthy of closer attention. Below we explore further what these developments—as well as the recent entry of one more new player into the market—suggest about the current state of the election technology industry.

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45. Smartmatic’s share of annualized revenue surely is larger, because (as we discuss below) LA County spent more per registered voter on the VSAP contract than is typical.

46. The recent infusions of federal dollars into the election technology market may change that to some degree. But we have not assessed the extent to which the effort to purchase voting machines before the 2020 election extended to jurisdictions whose machines had not reached the end of their product life.

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## Smartmatic

As described in *The Business of Voting*, Los Angeles County launched its Voting Solutions for All People initiative because of a perceived gap in the election technology market. Election officials in LA County, which is the largest voting jurisdiction in the U.S. in terms of voting population, geographic span, and language diversity, felt that no existing voting system adequately provided what the county's constituents wanted: a comprehensive system that not only was accessible to voters with various disabilities and allowed for voting in a multiplicity of languages, but that also accommodated different voting methods, such as early voting and voting by mail. VSAP was to be a unique system, built from scratch with open source software and otherwise publicly owned, and the citizens of LA County were to be involved throughout the development process.

It was also an extremely lucrative endeavor: the contract for building, servicing, and maintaining the VSAP system was valued at \$282 million. To put this into context, *The Business of Voting* sized the national market at around \$350M per annum over a 10-year period. Assuming VSAP is used for at least 10 years, this purchase constitutes \$28.2M per annum, i.e. a full 11.3% of the original size of the market. Of course, this does not represent a mere shift of one well-defined piece of the market from ES&S to Smartmatic. At least over a 10-year period, the purchase of VSAP will be much more expensive for LA County than the purchase of market-ready ES&S machines would have been. VSAP therefore represents not just a shift in market share, but a noticeable expansion of the size of the market itself.<sup>47</sup>

For Smartmatic, the LA County contract marked a spectacular entry into the U.S. market. Smartmatic, a multinational company founded in part with seed money from a Venezuelan entrepreneur and headquartered in the United Kingdom, had been deploying election systems around the world since 2000, but had experienced challenges in trying to enter the U.S. market.<sup>48</sup>

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47. Of course, some predict that VSAP—especially with its open source technologies—will fundamentally alter the business model of voting technology for the country going forward. We do not address that hypothesis here.

48. For a more in-depth dive into Smartmatic's past, see Zetter *supra* note 2.

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In 2005, Smartmatic purchased Sequoia Voting Systems, a U.S. company that at the time provided voting systems and related voting services to jurisdictions in 17 U.S. states and the District of Columbia. But the takeover of an American election technology company by a foreign firm raised eyebrows. Rep. Carolyn Maloney, Democratic Congresswoman of New York, pressed the U.S. Treasury Department to scrutinize Smartmatic’s purchase of Sequoia as a matter of national security, because of alleged ties between Smartmatic and the Venezuelan government. The Treasury’s Committee on Foreign Investment in the United States (CFIUS) moved to open an investigation, but before CFIUS could proceed, Smartmatic announced it would sell Sequoia, which was then purchased in 2007 by SVS Holdings, a group of U.S. private investors.<sup>49</sup>

Controversy continued, however, as it later was revealed that Smartmatic nevertheless had retained the software licensing rights and intellectual property rights for Sequoia voting machines, and still controlled Sequoia’s ability to take up new business outside the U.S.<sup>50</sup>

Sequoia ultimately was sold in full to Dominion Voting Systems in 2010—part of a process of vendor consolidation among U.S. firms in the election technology industry that is depicted in more detail in *The Business of Voting*.<sup>51</sup> The VSAP project in LA County presented Smartmatic with a unique opportunity to reenter the U.S. market.

Perhaps the most remarkable aspect of the vendor selection process in Los Angeles was that Smartmatic faced so little competition. LA County instituted a two-step Request for Proposals (RFP) bidding process for VSAP, which involved vetting both “primary contractors” that could manage the entire build-out of VSAP, as well as “specialty contractors” and subcontractors that would support particular aspects of the larger project. Round one determined the vendors that had the capacity to take on a venture as sizable and complicated as VSAP, and then those vendors submitted final proposals for consideration in round two. According to documents available on the VSAP website, ES&S, which had built the voting system for LA County that VSAP would replace, was the only major U.S. election technology vendor to participate in the process.<sup>52</sup>

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49. Tim Golden (10-29-2006). U.S. Investigates Voting Machines’ Venezuela Ties. New York Times. Available at <https://www.nytimes.com/2006/10/29/washington/29ballot.html>; Smartmatic Announces Sale of Sequoia Voting Systems. Website of Rep. Carolyn B. Maloney (11-08-2007). Available at <https://maloney.house.gov/media-center/press-releases/smartmatic-announces-sale-sequoia-voting-systems>; U.S. Voting Technology Leader Sequoia Voting Systems Announces New Corporate Ownership. Business Wire (11-08-2007). Available at <https://www.businesswire.com/news/home/20071108005402/en/U.S.-Voting-Technology-Leader-Sequoia-Voting-Systems>.

50. Brad Friedman (05-21-2008). Voting Machine CEO Reportedly Lies About Foreign Ownership of Firm. Brad Blog. Available at <https://www.alternet.org/2008/05/voting-machine-ceo-reportedly-lies-about-foreign-ownership-of-firm/>.

51. Penn Wharton Public Policy Initiative *supra* note 11 at pp. 15-16.

52. VSAP Conference Participant List. Available at <https://vsap.lavote.net/wp-content/uploads/2017/10/Proposers-Conference-Participant-List.pdf>; VSAP Phase 1 Prequalified Vendors + Potential Subcontractors List. Available at <https://vsap.lavote.net/wp-content/uploads/2017/12/Companies-Phase-1-Dec-19-2017.pdf>.

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After round one, ES&S was approved as a viable primary contractor and advanced to the second round with just two other companies: Smartmatic and CGI, a vendor that (like Smartmatic) was headquartered in London and did not have a foothold in the U.S. market. In the end, though, ES&S withdrew from the RFP process without submitting a final bid. LA County's choice for a primary vendor thus came down to two global firms that did not already supply voting machines for any other U.S. jurisdictions.

It is striking that the most lucrative contract in the recent history of U.S. election technology was not ultimately pursued by any U.S. incumbents. Fernando Hernandez, Vice-President of Voting Systems at Smartmatic, found it "remarkable that even with an incentive of hundreds of millions of dollars, established vendors didn't participate." To him, their restraint reflected the very reasons why the leaders of LA County said VSAP was necessary in the first place. "There were literally no voting systems available in the market that met Los Angeles' needs," Hernandez said, and the size of LA County and the variety and complexity of the voting problems the county wanted to solve were formidable.<sup>53</sup> A representative from ES&S, however, offered a different perspective. According to Kathy Rogers, ES&S's Senior Vice President of Government Relations, it was not the case that the company could not meet, or did not want to meet, VSAP's costly specifications, but rather that ES&S's existing certified products already "delivered the functionality desired in the VSAP system." There was no need to build something different: "Despite some of the media hype, when you peel back the onion, there is no unique advantage of the Los Angeles VSAP system."<sup>54</sup> According to ES&S, then, investing in the build-out of VSAP didn't make sense for the company or for LA County's taxpayers.

We cannot know what best explains the reluctance of U.S. incumbents to compete for LA County's business. Either way, whether the vendors did not want to incur the costs associated with developing a highly customized system, or felt that doing so was superfluous, the implication is the same: they did not see the \$282 million VSAP contract as a valuable proposition.

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53. Email communication from Fernando Hernandez to Andrew Coopersmith, July 31, 2019, attachment TheBusinessOfVotingPartII\_ReplyFromSMTT.docx.

54. Email communication from Kathy Rogers to Andrew Coopersmith, March 25, 2020.

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Perhaps other factors contributed to that assessment. When VSAP started, it was touted as a potentially revolutionary project that, in the words of Dean Logan, the Registrar-Recorder/County Clerk of Los Angeles, “would break the mold of the traditional voting system acquisition model.” Whereas the traditional model involved “end-to-end agreements with private vendors, wherein one company provides the software, hardware, and support for a voting system, offering little flexibility in pricing, use, and design,” Los Angeles County was to own and manage its own software, and thus be “independent from the single-vendor schema,” with “relative control over the types of hardware it invests in and the amount of money it spends.” By escaping the grip of the major three vendors, VSAP was to result in “a more competitive landscape that could allow jurisdictions to replace systems at a lower cost than in the past.”<sup>55</sup> Given such aspirations, it is unsurprising that major U.S. incumbents would demur.

When LA County launched VSAP, the intention was to treat it as an open source asset. The code behind the system was supposed to be accessible and readable by anyone who wanted to see it. Traditionally, election system software is proprietary, and vendors have been quick to initiate lawsuits against any perceived threat to their intellectual property. Thus, incumbents may have feared that VSAP would cannibalize other business of theirs. By contrast, Smartmatic and CGI had no existing U.S. business to cannibalize.

The Open Source Election Technology Institute predicts that public expenditures in an open source voting technology vendor, compared to the status quo, could be reduced by about 60 percent.<sup>56</sup> If this estimate is correct, current vendors’ profits likely would fall in an open source market with its reduced market control and lower barriers to entry.<sup>57</sup> Such assessments may have influenced incumbents’ decisions not to bid.<sup>58</sup>

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55. Dean Logan quoted in Penn Wharton Public Policy Initiative *supra* 11 at p. 43.

56. Lucas Laursen (04-27-2020). What Open Source Technology Can and Can’t Do to Fix Elections. IEEE Spectrum Tech Talk. Available at <https://spectrum.ieee.org/tech-talk/computing/it/what-open-source-technology-can-cant-do-fix-elections>.

57. As reported in *The Business of Voting*, this is a feature championed by open source advocates such as Gunnar Hellekson, an executive at Red Hat Inc. and board member of the Open Source Election Technology Institute. See Penn Wharton Public Policy Initiative *supra* 11 at p. 46.

58. Open source advocates sometimes argue that there will still be a role for vendors even in a reformed system—that “investments in public election technology need not, and should not, be construed as a replacement for market structures. On the contrary, they are in partnership with the private sector, for the purpose of elevating the nation’s overall security capabilities.” See Perez *supra* note 24. But fundamental to understanding vendor incentives is to understand, comparatively, whether the status quo or that counterfactual is more favorable to their bottom line. We find little reason to conclude that increased competition and a more marginalized role within voting tech markets, involving only commercializing and supporting otherwise public technology, would improve their bottom lines.



Although the VSAP project leaders succeeded in implementing the new system in 2020, their stated aspirations to transform the election technology market have not been realized, at least not yet. Indeed, despite the big three's abstention from the process, the successful vendor, Smartmatic, has still been sued for patent infringement by ES&S, which claims that Smartmatic's ballot marking device design included elements that had been patented by ES&S.<sup>59</sup> These events provide further insight into how the election technology market functions. *The Business of Voting* had suggested that it was specifically large jurisdictions like LA County that would have the "buyer power" to demand voting system customizations from the major U.S. vendors and thus move the needle on innovation in the manufacture of voting machines. LA County field-tested this buyer power and evidently discovered its limits.

It also does not appear that LA County successfully transcended what it called the "single-vendor schema." Although the VSAP software does not ultimately belong to Smartmatic, this one vendor has been responsible for pretty much the entire assembly, testing, and implementation of the VSAP system, and will continue to provide ongoing service and maintenance.

The open source promise of making the software code publicly accessible, which might allow others to continue studying and improving upon it, also has not been fulfilled, at least at time of publication. While California stakeholders seem glad that the code is publicly owned, they have been perplexed as to why the code has not been released, as previously promised by public officials, now that VSAP has been deployed as a voting system.<sup>60</sup>

A 2018 public records request by San Francisco Elections Commissioner Chris Jerdonek for VSAP's source code was denied on various grounds, including exceptions for records that include proprietary or trade secret information or that relate to potential vulnerabilities of the information technology systems of a public agency.<sup>61</sup> LA County more recently reiterated its commitment to releasing the code, but told Politico that it still needs to address "security protocols and licensing requirements."<sup>62</sup> The lack of transparency is exacerbated by some significant issues found in the underlying VSAP technology and its deployment.<sup>63</sup>

At present, VSAP is publicly owned, which is a significant break from standard practice already. But it does not seem to have broken with the past as much as it had hoped to, at least not yet.

59. Complaint, Election Systems & Software, LLC v. Smartmatic USA Corp., No. 1:18-cv-01259 (August 17, 2018). Available at [https://insight.rpxcorp.com/litigation\\_documents/13033219](https://insight.rpxcorp.com/litigation_documents/13033219).

60. See Zetter *supra* note 2; Laursen *supra* note 56.

61. News Release (08-21-2018). Secretary of State Alex Padilla Certifies Los Angeles County's New Vote Tally System Making it California's First Certified Open-Source Election Technology. Available at [https://osvtac.github.io/files/meetings/2018/2018-09-13/packet/LA\\_County\\_Records\\_Request.pdf](https://osvtac.github.io/files/meetings/2018/2018-09-13/packet/LA_County_Records_Request.pdf) as cited in <https://opensource.org/node/944>.

62. See Zetter *supra* note 2.

63. *Ibid.*; Rebecca Heilweil (03-03-2020). Voters struggled with LA's fancy new voting machines on Super Tuesday. Vox Recode. Available at <https://www.vox.com/recode/2020/3/3/21163700/los-angeles-california-voting-machines-technical-flaws>.

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## Clear Ballot

At the time *The Business of Voting* was published, Clear Ballot was a regional company, specializing in the reading and tabulation of mail-in ballots, and was still developing its foothold in the American Northwest. Self-described as “the fastest growing election company in the country,”<sup>64</sup> Clear Ballot now offers a full suite of voting technologies that are used in 11 states, and aspires to be in every U.S. state by 2025.

Clear Ballot’s growth may reflect certain shifts in the market on the demand side. Back in the early 2000s, when jurisdictions were buying new voting machines after the debacle in Florida during the Bush-Gore contest, election officials were eager to do away with paper ballots and moved toward electronic machines offering paperless touchscreen voting, which would obviate the problem of “hanging chads,” and which officials thought voters would find easy to use. But as trust in those machines eroded over the past several years, paper has made a comeback. More election officials, as well as voting rights advocates, came to want voting systems with an auditable paper trail. This is Clear Ballot’s specialty. As Clear Ballot’s then-CEO Jordan Esten put it to us in an interview in 2019, the election technology market has been “catching up” with Clear Ballot in finally putting auditability front-and-center.<sup>65</sup>

Moreover, as evidenced by VSAP, as well as by the STAR Vote initiative that had been attempted in Texas several years ago, at least some election officials have been hungry for something new—a viable alternative to the systems that ES&S, Dominion, and Hart have historically provided.

Clear Ballot does offer a different type of voting system. Unlike the legacy vendors, Clear Ballot uses a more modular design based entirely on commercial-off-the-shelf (COTS) hardware components, which are integrated with the company’s proprietary software. The potential of COTS for reshaping the election technology industry is more fully delineated in *The Business of Voting*, including possible reduced development costs for vendors, reduced acquisition costs for buyers, greater ease of use for poll workers and voters, and new election services that could expand the election technology industry as a whole. (Some Dominion systems also use COTS equipment, but less extensively.)

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64. Clear Ballot Group (2018). RESPONSE TO: STATE OF GEORGIA, ERFI at p. 4. Available at [https://sos.ga.gov/admin/files/Clear%20Ballot%20RFI\\_Redacted.pdf](https://sos.ga.gov/admin/files/Clear%20Ballot%20RFI_Redacted.pdf).

65. Interview with Jordan Esten conducted by Andrew Coopersmith, December 13, 2019.

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Clear Ballot’s financing also is somewhat different, in that it has attracted venture capital funding, as is more typical among startups in other technology sectors. In 2017, the company raised over \$18 million from three VC firms (Bessemer Venture Partners, Ventureforgood, and DN Capital), which invested alongside several eminent, Boston-based individual investors. (It bears noting here that Smartmatic also is a venture-backed company.) As described by former CEO Jordan Esten, an element of impact investment also is evident. Operating within Boston, with access to experienced private investors who are “excited about impact” and who believe “stale markets signify big opportunities,” in his estimate, has been “huge” for Clear Ballot’s efforts to secure capital.<sup>66</sup>

While Clear Ballot’s appeal to venture capital firms and the company’s embrace of COTS-based, modular system design represent departures from typical vendor behavior, its operations are still noticeably shaped by long-established industry trends. With regard to financing, private equity is still significantly involved. In 2019, when North Carolina was gearing up to help around one-third of its counties replace their voting machines, the state required all election technology companies submitting bids to disclose the identities of any individual or entity holding at least a 5% ownership stake in their company, in a parent company, or any subsidiary. Clear Ballot’s response to North Carolina suggests that none of the VC firms that invested in Clear Ballot reached even that 5% threshold. But the private equity firm Raging Capital Management did—although Clear Ballot was quick to clarify that neither the Raging Capital fund nor any investor in the fund possessed a controlling interest.<sup>67</sup> Nonetheless, as indicated in *The Business of Voting*, given the typical investment strategies of PE companies, and without any internal income data to the contrary, we can only infer that the voting tech market, despite its size, is seen as one that can produce the profits PE firms typically seek.

And while Clear Ballot has been a frontrunner in deploying commercial-off-the-shelf components to create an alternative to proprietary systems offered by ES&S, Dominion, and Hart, the regulatory structures of the election technology industry continue to place strictures around the use of COTS. The existing certification guidelines for election technology, described in *The Business of Voting*, cannot keep up with the rate of innovation in commercial IT products. Jordan Esten recounted that the biggest regulatory hurdle for Clear Ballot was not with its software, but rather with getting approval for COTS hardware. The certification process was so prolonged that Clear Ballot could not necessarily deploy the most up-to-date iteration of hardware components for their customers. The new Voluntary Voting System Guidelines 2.0, approved by the U.S. Election Assistance Commission in February 2021, make some changes that may speed up the certification process for COTS components.

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66. Ibid.

67. See Associated Press *supra* 3.

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## VotingWorks

Another up-and-coming election technology vendor, VotingWorks, was able to get its COTS-based voting machine into the U.S. market by working around the prevailing regulatory regimes. VotingWorks secured Choctaw County, MS as its first client in part because “Mississippi is one of only a few states in the country to allow the use of voting machines that have not been certified by federal authorities, and the state has no certification process of its own.”<sup>68</sup> Instead, discretion is vested with the Mississippi Secretary of State’s office.

VotingWorks is in some ways similar to the other newer election technology ventures discussed above, while bringing a different business model to the market. In addition to offering a COTS-based system for hardware, as Clear Ballot does, its software is open source, like VSAP’s, except that VotingWorks has already made all of its software publicly available on Github. It also specifies that its software is designed to be “self-service, so election administrators who are less comfortable with computers can still administer an election from beginning to end without paying for additional support.”<sup>69</sup> Perhaps the most radical aspect of VotingWorks, however, is its incorporation as a nonprofit organization,<sup>70</sup> and its concomitant belief that something as sensitive and critical as the machinery of our electoral process should not be in the hands of private enterprises. Matt Pasternack, VotingWorks’s co-founder and president, describes the company’s philosophy in this way: “We want the operating system of democracy—all the software, hardware, and processes we use to elect our represented officials—to be publicly owned” and thus “publicly accountable.” The fulfillment of such a vision would represent a major paradigm shift. Its strategy, Pasternack told us, was initially inspired by *The Business of Voting’s* exposition of the ills that follow from the extant market, characterized as it is by privately-owned monolithic systems.

At the moment, though, VotingWorks’s market share is minute. In addition to Choctaw County, VotingWorks piloted its machines in February 2020 in Fulton, Wisconsin, in collaboration with Microsoft. (This pilot debuted Microsoft’s highly anticipated election security software, ElectionGuard.)<sup>71</sup> VotingWorks’s pilots are no-cost,<sup>72</sup> so even a successful pilot would not necessarily count towards “market share.” As with any new vendor in this slow-to-shift industry, it will take some time to see if VotingWorks can penetrate the market more widely, and if so, how this nonprofit alternative will affect the industry.

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68. Jessica Huseman (11-12-2019). The Way America Votes Is Broken. In One Rural County, a Nonprofit Showed a Way Forward. ProPublica. Available at <https://www.propublica.org/article/the-way-america-votes-is-broken-in-one-rural-county-a-nonprofit-showed-a-way-forward>.

69. Email correspondence from Matt Pasternack, VotingWorks’s co-founder and president, to Matthew Caulfield, May 27, 2020.

70. The OSET Institute is also organized as a non-profit, and has been working on an election technology platform, ElectOS: <https://electos.org/>.

71. Aaron Holmes (02-02-2020). Microsoft says people don’t trust election results — and it’s pitching its own technology as the solution. It just faced its first real-life test. Business Insider. Available at <https://www.businessinsider.com/microsoft-electionguard-security-voting-booth-wisconsin-2020-2>; Matt Pasternack informed us that their pilots are no-cost.

72. See Pasternack *supra* note 69.

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VotingWorks’s leaders believe that the low cost of their machines will aid their market expansion. VotingWorks Executive Director Ben Adida argues, “Because we leverage a lot of existing technology, we’re able to build machines that are a third [of] the price of other systems.” The system deployed in Mississippi entailed a base cost of \$5,000 for the county plus an additional charge of \$3,500 per precinct.<sup>73</sup> The ongoing charge for annual service and support is \$699 per precinct. Since then, they have adopted a fixed pricing model, which, unlike extant vendors, they plan to post publicly on their website: Ballot Scanners for \$1,999, Ballot Marking Devices for \$1,499, and annual service fees (for repairs, upgrades, support, and/or training) of \$1.00 per registered voter for the first 10,000 voters, with decreasing per voter costs thereafter. This pricing structure, according to Adida, “completely changes the game, especially in places like Mississippi, which, frankly, don’t have big budgets.” VotingWorks sees cost as a central factor in designing voting systems: “one of the things that’s less well understood is that county clerks across the country don’t have big budgets. Counties don’t have budgets to buy fancy equipment. So again, making equipment that’s more affordable is critical.”<sup>74</sup>

In fact, very little is known about how voting systems are priced, and what different counties pay for specific machines. It is to this topic—which indeed is essential not only to cash-strapped counties but to the revenue streams of election technology vendors—that our report now turns.

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73. Ibid.

74. Ben Adida (2020), Building Better Voting Systems. Talk delivered at Harvard University, May 12, 2020. Available at <https://cyber.harvard.edu/events/virtual-building-better-voting-systems>.



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# The Price of Voting

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***The Business of Voting* focused largely on the barriers to innovation within the election technology industry. A significant caveat in the quest for innovation among the consumers of election technology, however, is the need to contain costs.**

Given most jurisdictions' severe budgetary constraints, the price of new voting machines is a pressing concern, one that we were not able to delve into deeply in the original report. This update to *The Business of Voting* allows us to examine these acquisition costs more closely.

## Data Collection

The fundamental obstacle to cost analyses of voting systems is the lack of available data. The details of voting system purchasing contracts and district-vendor relationships have long been hard to aggregate, especially since most purchasing happens at the local level<sup>75</sup> there is no single repository for procurement records. We therefore had to collect data through direct outreach to individual jurisdictional offices.<sup>76</sup> Using public sources, we compiled a distribution list with the addresses of the auditors, treasurers, clerks, election supervisors, and election bureaus responsible for voting machine acquisition, for as many jurisdictions for which we could locate this information. The final list encompassed 2,311 jurisdictions. We then designed an automated process for emailing each of them with a request for information, seeking a copy of the contract(s) or sales order(s) from their most recent procurement of election technology.<sup>77</sup> A sample of the email text is included in Appendix A.

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75. According to a 2007 analysis of a small sample of contracts, it was found that despite public records laws, in contracts, "the unit prices that a vendor charges are typically claimed as proprietary." One 2001 contract between the voting machine arm of Diebold, Global Elections Systems, and Alaska was flagged as illustrative, which included the provision that "it is expressly understood between the parties that [...] unit pricing constitute proprietary information the nature of which is a trade secret, and that disclosure of this information may place [DESI] at a competitive disadvantage." See Joseph Lorenzo Hall (2007). Contractual Barriers to Transparency in Electronic Voting. USENIX/ACCURATE Electronic Voting Technology Workshop, 2008 at p. 5. Available at SSRN: <https://ssrn.com/abstract=1341210>. We did not come across similar evidence in our study.

76. Local news sources, which often report on the acquisition of new voting systems, rarely provide more than a handful of details about the financing and terms of the acquisition.

77. In some cases, our research team also filled out a specific information request form required by the state or jurisdiction.

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The first email went out on April 22, 2019. We sent a second message on May 13, 2019 to those who had not yet responded. Some jurisdictions also required that we submit an official request or information disclosure form in order to authorize the release of procurement data. In the end, we received 791 replies: a 34.2% response rate.

The content of the responses varied greatly. Many jurisdictions sent exactly what we were seeking: complete documentation, detailing both the costs associated with the initial acquisition of their voting systems as well as ongoing maintenance and service agreements. Some sent only partial records—for instance, just a service agreement but no initial purchase agreement, or vice versa—because that was all they had on file. Some replied with only a text email, summarizing what they could recall from memory, or apologizing because they had no information to share at all because the original documentation had been lost or destroyed, or had never been stored, or because they did not know where to find it. (It is not surprising that such records might have been misplaced in certain cases, since some jurisdictions last purchased voting equipment decades ago, in the mid-1990s.) In one instance, our outreach yielded a reply from the county’s District Attorney’s office, stating that it was seeking authorization from the State’s Office of the Attorney General to deny our request and to withhold the procurement documentation, on account of “confidentiality of information relating to competition and trade secrets” as well as “financial information exceptions.”<sup>78</sup> The vendor was copied as well, notifying them of our effort to obtain the public records.<sup>79</sup> In another case, we received a contract for which all costs and totals were redacted.<sup>80</sup> In many instances, of course, we received no reply at all. Despite such obstacles, though, we were able to collect purchasing agreement information from over half of the election officials who responded to our emails—447 jurisdictions<sup>81</sup>—and we are deeply grateful to all of the public officials who helped us. We owe a great debt to these officials.

Encouragingly, the vendors are represented in our sample roughly in proportion to their overall market share, as described above (see Figure 1).<sup>82</sup> Still, the dataset has significant limitations. We cannot be confident that the sample is sufficiently random to reflect the overall distribution of pricing related to voting system acquisition. Although the documents we received allow us to draw productive inferences about common selling practices and pricing structures and strategies, we must emphasize that even quantitative findings presented here can only be taken as suggestive and should not be construed as statistical inferences.

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78. Correspondence from Brazoria County, Texas, on file with the authors.

79. That a vendor would be notified by county officials about who is seeking records, and what records they are seeking, as well as that vendors are given a right to object to the release of records, are all points of concern that deserve further attention. In a similar instance in 2011, ES&S sued King County, WA, to prevent the county from complying with a public records request to see a contract proposal, on the grounds that it would reveal the “company’s confidential financial information.” See Complaint, Election Systems & Software Inc. vs King County Procurement, No. 11-2-15011-9 (April 26, 2011).

80. Document provided by Poweshiek County, Iowa.

81. We were also able to obtain information about Georgia’s recent state-wide technology acquisition through publicly accessible sources.

82. Smartmatic is overrepresented because of the sheer size of Los Angeles County.

The purchasing contracts themselves are not always fully informative. As noted above, some of the documentation we received was incomplete; or, depending on how the sales representative(s) recorded the transaction, some aspects of a purchase might not be itemized clearly. Consequently, for some parts of our analysis, we only examine a subset of the documents we collected in our sample. Also, while contracts can provide the initial purchase price for voting systems, they may not fully reveal the long-term costs. As will be discussed in more detail later, most contracts include provisions for ongoing licensing, maintenance, and/or service fees that are liable to be adjusted upward annually by a specified maximum percentage. Because we do not know the actual adjustments, in some cases we can only approximate the total costs of ownership. More fundamentally, we recognize that contracts only tell one part of the story. In a few instances we obtained additional context from election officials, but our account is by no means comprehensive.

One final note: while many purchasing agreements for voting systems include costs for other products and related services, such as election day management, such costs are not addressed here. As in *The Business of Voting*, our analysis here focuses specifically on voting machines.<sup>83</sup> We examine three components of voting machine costs: the unit price for voting machines, prior to discounts; the discounts that are extended by vendors (either in the form of trade-in allowances for older equipment or as bottom-line markdowns); and the fees for software licensing and system maintenance and services, which are charged to jurisdictions annually after their initial purchase.

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83. Throughout this section of the report, all references to specific contracts come from the catalog of documents collected directly from election officials for our dataset.

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## Unit Pricing

We begin with an analysis of unit prices—the base prices set by contract for each machine. Unit prices should be interpreted cautiously: as we will see, discounts and annual fees can substantially alter the total cost of ownership. Nevertheless, given that the contract information available to us often is incomplete, unit prices provide the simplest basis for broad comparison. Our study finds that unit prices are legitimately informative, in two respects. First, many jurisdictions in fact pay the unit price: discounts are common, but far from universal. Second, vendors do not appear to manipulate unit prices in order to offer some jurisdictions inflated discounts from abnormally high unit prices. So, although a unit price is not the “bottom line,” it sets a meaningful baseline. Unit prices do vary, and we set out to understand the variation.

### *Previous Work*

In 2018, the nonprofit Public Citizen published a study of voting machine prices, with a particular emphasis on paper ballot optical scanners. Using data from 43 counties across 10 states, Public Citizen observed that different jurisdictions were paying significantly different unit prices for the same machines.<sup>84</sup> The machine that appeared the most commonly within their sample was ES&S’s DS200 precinct-based ballot scanner and vote tabulator. Fourteen of the counties in the Public Citizen investigation had purchased it, and according to their data, the unit price for it ranged between \$4,873-\$6,325, with a modal price of \$5,750. Other makes and models showed similar, and in some cases more significant, unit price discrepancies. The authors of the Public Citizen study attributed the disparities to differing outcomes in the contract negotiations between individual election officials and the sales representatives of the election technology vendors—basically, some local officials exerted more buying power or were savvier dealmakers than others. Election officials therefore would do better to work in concert, and not individually, in making purchases: “It’s important that counties band together or engage state authorities where appropriate to negotiate prices and get the best contract terms for voting equipment,” the study concluded.

*The Business of Voting* also had suggested that price disparities would result from variations in buyer power and in negotiation skills at the local level. However, analysis based on our new dataset suggests a somewhat different and more nuanced story.

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84. See Public Citizen *supra* note 33. That study covers counties in states including California, Florida, Iowa, Kentucky, Minnesota, Ohio, Oregon, Pennsylvania, Texas, and Virginia.

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### ***Unit Pricing is Largely Standardized***

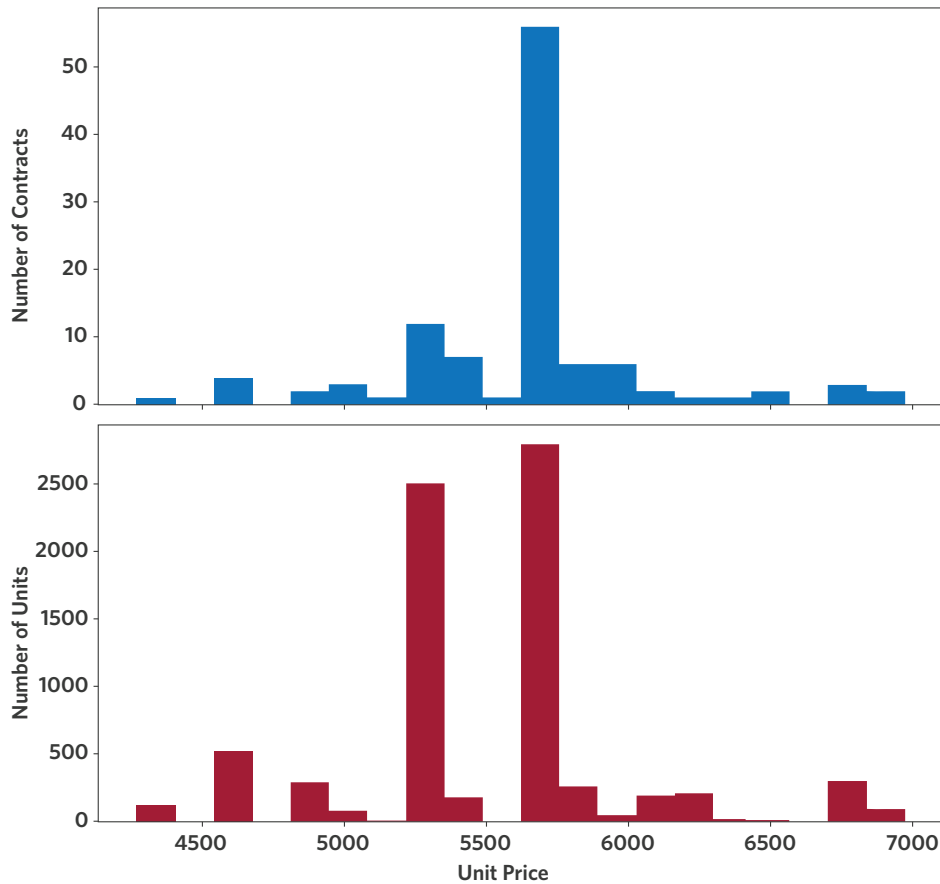
ES&S's DS200 scanner is one of the most widely used voting machines on the market; it was used in 38 states and territories in the 2020 election.<sup>85</sup> Consequently, as with the Public Citizen study, the ES&S DS200 model was the most common in our dataset. We also found that the modal as well as the median price for that machine was \$5,750, and that there were at times significant deviations from it. Figure 2 illustrates the distribution of DS200 unit prices in our sample; Appendix B provides a fuller set of descriptive statistics. (Herein, we denote median with  $\tilde{x}$ .)

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85. Verified Voting Foundation, The Verifier equipment search, <https://verifiedvoting.org/verifier/#mode/search/year/2020/model/DS200>.

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**Figure 2: ES&S DS200 Prices by Number of Contracts and Number of Units in Our Sample**



Jurisdictions in our sample paid as little as \$4,270 ( $\bar{x}$  - \$1,480) and as much as \$6,975 ( $\bar{x}$  + \$1,225) for the DS200. Examining the actual structures of costs in many of these contracts helps illuminate these variations.

The contracts collected and analyzed in our dataset indicate that the DS200, when priced at its median of \$5,750, typically comes with certain specific features. In addition to the scanner itself, buyers get a backup battery, a plastic ballot box with a steel door and “e-bin,” a paper roll, a 4GB flash drive, and a 1-year warranty. Modifications to that standard package, however, can increase or decrease the price. When La Crosse County, WI got the DS200 with a carrying case instead of a plastic ballot box, they paid a unit price of \$5,300 ( $\bar{x}$  - \$450). Or when Coconino County, AZ opted for a collapsible ballot box instead of the plastic ballot box, they paid \$5,450 ( $\bar{x}$  - \$300).

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Voting machine vendors do not make pricing information available on their websites, but contract documents collected from York County, VA include a pricing schedule from ES&S that lays out other customizations for the DS200 package. Buying the system without a ballot box or a carrying case lowers the price to \$5,035 ( $\bar{x} - \$715$ ). Substituting a metal ballot box that has a diverter, which assists with ballot sorting, in place of the standard plastic ballot box without the diverter, drives the price up to \$6,495 ( $\bar{x} + \$745$ ).

The way delivery costs are handled also appears to affect the unit price. The median \$5,750 price typically does not include shipping and handling.<sup>86</sup> There are many other instances, though, where shipping and handling are noted as “included” within the contract, but where the unit price is larger than the median. In these cases, shipping and handling do not seem to be waived by the vendor, but rather folded into the DS200 unit cost. Buyers like Eau Claire, WI and Guadalupe, TX had shipping included in their contracts, and both saw a slightly inflated unit price: \$5,810 ( $\bar{x} + \$60$ ) and \$5,830 ( $\bar{x} + \$80$ ), respectively. Braintree, MA, on the other hand, paid a unit price of \$6,548 ( $\bar{x} + \$798$ ) for the DS200 with delivery costs included, plus a carrying case and an additional year of warranty beyond the standard one year.

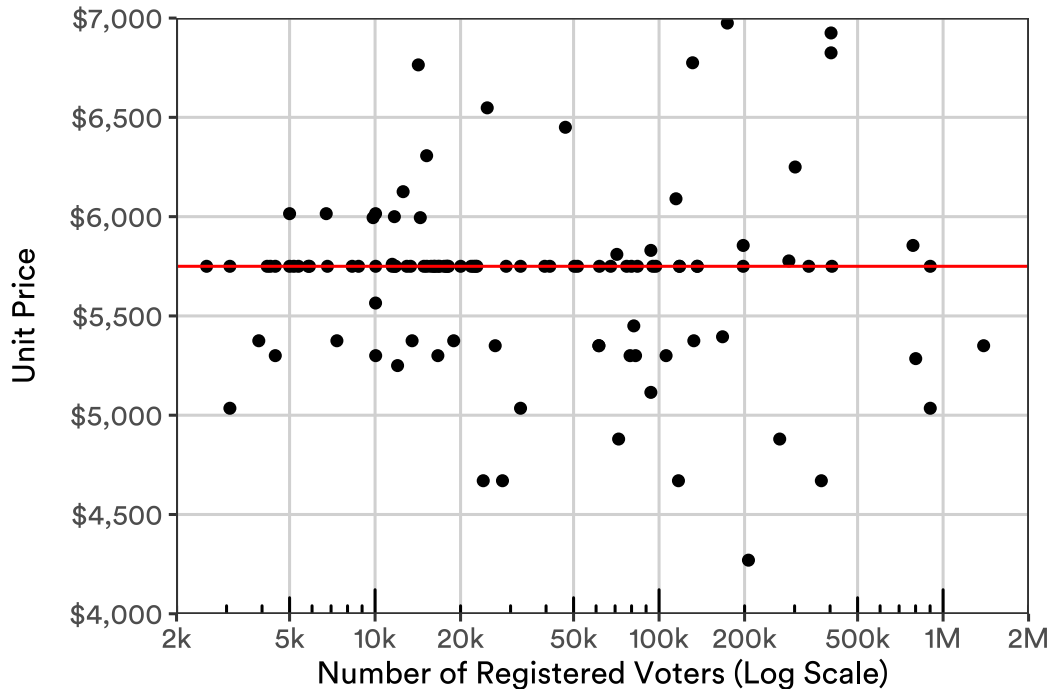
This analysis leads us to temper our previous conclusion, which was paralleled by Public Citizen, that unit price variations are determined largely by differentiated buying power. Whereas our prior report assumed that unit prices were negotiated on a contract-by-contract basis, the DS200 data generally indicate predictable increases and decreases based on modifications to a standard package. While the data do provide counterexamples,<sup>87</sup> the variations from standard pricing do not seem to be attributable to buying power. Figure 3 illustrates the unit pricing of DS200’s across jurisdictions of varying size. We observe no evidence that larger jurisdictions generally enjoy better unit prices for the DS200. (They sometimes, but not necessarily, obtain larger discounts, as we discuss below.)

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86. Across the whole sample, there were 182 contracts that itemized shipping and handling costs. The median per capita shipping cost was \$0.12.

87. The contract for Westborough, MA indicates that they purchased the standard DS200 package with no modifications, but paid \$6,000 per unit. Nearby Hanover, MA, paid slightly more than Westborough. Others paid less: Freeborn, MN got the base package at a lower price of \$5,375. Nevertheless, at least in our sample, variations in the makeup of DS200 packages account for most of the observed variations in unit price.

**Figure 3: Unit Prices of ES&S DS200's by Number of Registered Voters**



#### ***Unit Pricing & Coalitions: The Exception to the Rule***

The previous analysis treats counties as separate entities—but what if they band together? *The Business of Voting* had recommended that jurisdictions should seek to develop coalitions to increase their negotiating power, a prescription also found in several other reports.<sup>88</sup> We pointed to two anecdotal examples—one in Kansas, one in Florida—where counties were in the process of jointly bargaining for new voting machines. We now know the results, which suggest that coalition-building can, under certain conditions, result in considerable savings.

In Kansas, the counties of Johnson, Sedgwick, Shawnee, and Wyandotte—the four largest counties in the state, encompassing around 832,965 registered voters—banded together and designated representatives from Sedgwick to serve as their “Lead Agent” for “soliciting proposals from qualified vendor(s) for the replacement of their current voting systems.”<sup>89</sup>

88. See Public Citizen *supra* 33. See also National Research Council *supra* 6 at p. 8 (“[T]he committee urges that to the extent possible, jurisdictions should band together in their interactions with vendors. With 9,500 election jurisdictions in the nation and only a handful of major electronic voting system vendors, it is clear that the leverage of jurisdictions vis-a-vis vendors would be increased significantly if they could present their requirements collectively, for example as part of a negotiating consortium.”); See also Brennan Center for Justice *supra* 34 at p. 129. (“Vendors offer significant volume discounts. To the extent that counties and states can pool their purchases, they are likely to save considerably in the purchase of their voting systems.”)

89. Sedgwick County, Kansas, Division of Finance, Purchasing Department (2015). Request for Proposal #15-0078: Voting System at p. 3. Available at [https://www.eac.gov/sites/default/files/eac\\_assets/1/28/Kansas.RFP%2015-0078%20Voting%20System.pdf](https://www.eac.gov/sites/default/files/eac_assets/1/28/Kansas.RFP%2015-0078%20Voting%20System.pdf).

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The coalition's joint RFP yielded proposals from six vendors, and the Sedgwick County Elections Office ultimately voted to move forward with the bid from ES&S. It was the second-lowest bid, with an estimated 10-year cost of \$6,662,270. As noted in Sedgwick County records, the contract with ES&S "include[d] a volume pricing provision," recognizing the combined size of the four Kansas counties.<sup>90</sup> The unit price for each piece of voting system hardware would be reduced as they collectively reached certain thresholds.

We summarize the considerable cost savings for Sedgwick County in Figure 4. Its order included 200 units of ES&S's DS200 tabulator, which according to the initial proposal from ES&S, should have cost \$5,522 each, a 4% discount compared to what the cost would have been under the standard \$5,750 DS200 unit price. But in the actual contract with Sedgwick County, ES&S offered an even lower unit price of \$4,880—a discount typically reserved for the highest-volume orders of 700 units or more. Moreover, the Sedgwick County package included installation, for which buyers usually paid an extra fee of \$115 per unit. A county purchasing 200 DS200 units at the standard unit price would have paid \$1.173M for the acquisition and installation; Sedgwick paid just \$976,000. The Kansas coalition ended up saving Sedgwick County a total of \$197,000, looking only at unit price and installation.

Sedgwick also purchased ES&S's ExpressVote ballot marking device, for which the standard package (including battery, ADA-compliant keypad, 4GB flash drive, headphones, and a one-year warranty) typically would cost \$3,325. (As noted in Appendix B, that is the median price for the ExpressVote among the 71 jurisdictions in our dataset that purchased it.) Jurisdictions that also purchased a soft carrying case for the ExpressVote would pay an additional \$175 per unit for it, bringing the total cost to \$3,500. Sedgwick, however, paid \$3,320 for its order of 900 units and cases, saving an additional \$162,000. And as with the DS200's, the ExpressVote installation fee, for which many other jurisdictions paid \$150 per unit, was included in Sedgwick's quoted price. Accounting for that brings the savings on the ExpressVote purchase alone to \$297,000.

Moreover, Sedgwick saved a little on its purchase of a central counter, the ES&S DS850, paying \$108,900 for the machine plus installation—\$6,100 less than the amount charged to most other jurisdictions (\$111,500 equipment cost and installation fee of at least \$3,500). In all, as reflected in Figure 3, just in hardware expenses, Sedgwick saved over \$500,000. And that does not include the shipping and handling charges, which also were wrapped into the prices Sedgwick received.

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90. Sedgwick County, Kansas (2016). Board of Bids and Contracts July 7, 2016. Available at [https://www.sedgwickcounty.org/media/28055/bmin\\_070716.pdf](https://www.sedgwickcounty.org/media/28055/bmin_070716.pdf).

**Figure 4: Cost Savings of Sedgwick County, KS**

\*A \$150 per unit installation charge for the DS850 appeared in many but not all of the contracts in our sample. Sedgwick County was not charged the installation fee, so we count it here as a discount.

Item/Service	Typical Cost	Sedgwick	Savings per unit	# Units	Total Savings
DS200	\$5,750	\$4,880	\$870	200	\$174,000
DS200 Installation	\$115	\$0	\$115		\$23,000
ExpressVote Ballot Marking Device	\$3,325	\$3,320	\$5	900	\$4,500
ExpressVote soft carrying case	\$175	\$0	\$175		\$157,500
ExpressVote Installation*	\$150	\$0	\$150		\$135,000
DS850 Central Counter	\$111,500	\$108,900	\$2,600	1	\$2,600
DS850 Installation	\$3,500	\$0	\$3,500		\$3,500
<b>Total :</b>					<b>\$500,100</b>

The contract for the other county in the coalition for which we have data, Wyandotte, shows that it received precisely the same pricing that Sedgwick County did, even though, as a comparatively smaller jurisdiction, it placed a correspondingly smaller order with ES&S. The power of coalition bargaining appears to have worked well for these four Kansas counties. When the four-county collaboration was announced, though, one of the stated hopes was that any reduced pricing enjoyed by the coalition partners would spill over into the other, smaller Kansas counties. According to the Kansas data in our sample, that did not happen. The price reductions appear to have gone only to the large counties that formed the coalition, which were poised to place the largest orders in the state for new voting systems.

The challenges faced by smaller jurisdictions are apparent in a second example of county-level collaborative bargaining. Around the same time that the Kansas coalition came together, twelve counties in Florida also joined forces to negotiate the purchase of new voting systems from ES&S. But unlike in Kansas, where the four counties were the largest in the state, the twelve counties in the Florida coalition were all small. Of the 67 counties that comprise Florida, all twelve were in the bottom half in terms of population size. Six were in the bottom quintile.

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Our sample includes contract data from five of the twelve Florida counties in the coalition. Nothing in those contracts suggests that the counties received any kind of break from ES&S with respect to unit pricing. The unit prices for their hardware purchases followed the standard pricing structures described above for the DS200 and DS850 machines, and did not reflect reduced pricing along the lines of what the Kansas counties enjoyed. Yet, after the negotiations in Florida had concluded, a representative from one of the coalition members, Franklin County, nevertheless remarked that the collective action had “save[d] the taxpayers a considerable amount of money.” The savings to which he was referring, though, do not appear to have come from ES&S, but rather from the state of Florida. Alongside the coalition’s discussions with the vendor, they also engaged in joint talks with the Florida Secretary of State for financial support, in light of the stringent fiscal constraints that small counties such as theirs face. It was those negotiations with the state government that yielded fruit and offered relief in the form of a \$1.5 million grant to be split between the twelve counties.<sup>91</sup> This money came from HAVA, and thus represents taxpayer dollars.

The differential outcomes in Kansas and Florida suggest that if jurisdictions want to increase their buyer power, coalition-building alone may not be sufficient. The coalition must bring high volume purchasing to the table. The four counties in Kansas collectively promised to purchase hundreds of units of the same hardware, and in the case of one machine (the ExpressVote), over a thousand units. The Florida coalition could not match that. Even collectively, the twelve Florida counties were poised to buy at most dozens of hardware units, not hundreds. Smaller counties seeking to increase their buyer power would probably do better to partner with at least one very large county, as opposed to a host of other smaller ones.

In keeping with this conclusion, the lowest prices we found for ES&S products were achieved through state-level purchasing negotiations. Ohio provides a useful illustration. In anticipation of the 2020 election cycle, Ohio appropriated \$104.5 million in 2018 to help the state’s 88 counties replace their aging voting equipment.<sup>92</sup> Most of the existing voting machines throughout the state were from 2005-06, when Ohio took advantage of \$115 million in HAVA federal funding.<sup>93</sup> Ohio negotiated prices with multiple vendors to replace those outdated systems, leaving it to the counties to select the option each preferred. ES&S’s price agreement with Ohio is telling. The state-level negotiations with ES&S yielded a unit price for the DS200 of just \$4,670 (x̄ - \$1,080). That price was the lowest in our sample that included all component parts of the standard package.<sup>94</sup>

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91. Deborah Buckhalter (09-16-2015). Secretary of State Visits Jackson County. Jackson County Floridian. Available at [https://www.dothaneagle.com/jcfloridan/news/sec-retary-of-state-visits-jackson-county/article\\_9c7faad4-fd34-5456-a557-473a822ccef.html](https://www.dothaneagle.com/jcfloridan/news/sec-retary-of-state-visits-jackson-county/article_9c7faad4-fd34-5456-a557-473a822ccef.html).

92. Adora Namigadde (01-16-2019). Franklin County Voters May Use New Voting Machines Next Election. WOSU Public Media. Available at <https://radio.wosu.org/post/franklin-county-voters-may-use-new-voting-machines-next-election#stream/0>.

93. Chris Stewart (05-23-2018). New, updated voting machines could be coming for Ohio voters. Dayton Daily News. Available at <https://www.daytondailynews.com/news/state--regional-govt--politics/new-updated-voting-machines-could-coming-for-ohio-voters/yVfGVrCfPd8nvLqWceHoXP/>.

94. This included a backup battery, plastic ballot box with steel door and e-bin, paper roll, and 4GB jump drive. The unit price for Ohio counties that bought the DS200 with a collapsible ballot box instead of the plastic ballot box was \$4,270—the absolute lowest in our sample.



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It also included an extra perk: a five-year warranty, as opposed to the standard one year. Ohio also obtained the lowest price in our dataset for the ExpressVote ballot marking device: \$2,864, as opposed to the usual \$3,325—again, with a five-year warranty from the vendor instead of the standard one year. (For a histogram of the ExpressVote prices in our dataset, see Appendix C.) Consequently, the same unit prices for ES&S equipment that were extended to the counties of Montgomery and Lorain (Ohio's 5th and 9th largest counties in population) also were available to Crawford and Madison (the 54th and 56th largest), despite the wide disparities in units purchased.

### ***Other Vendors***

Similar themes emerged in looking at other popular voting machines: Dominion's ImageCast Precinct (ICP) tabulator, and the OpenElect Voting Optical Scanner (OVO) from Unisyn. Unit pricing for those systems also varied, but typically followed discernable patterns. Unlike the DS200, variations in the unit pricing for the ICP and OVO did not reflect add-ons or modifications to a standardized base package. Instead, the timing of purchase and the involvement of third-party sellers accounted for much of the variation. Also, as with ES&S in Ohio, state-level negotiations were a significant factor.

For the ICP, our dataset included purchase agreements with three different third-party sellers: ElectionSource, Butler Swyers, and LHS. While ElectionSource typically sold the ICP for \$4,900, Butler Swyers usually charged \$5,500. Transactions with LHS, which was the third-party seller for most of the ICP machines in our sample, showed greater variation in unit pricing, from \$5,500-\$7,000, but unit prices declined over time, with 2017 apparently an inflection point. All of the ICP machines in our dataset purchased from LHS between 2013-2016 had a unit price ranging from \$5,700-7,000. All of those purchased from LHS between 2018-2019 ranged from \$5,500-5,700. But the lowest unit price in our dataset for the ICP was found in Wisconsin, which negotiated at the state level with Dominion to obtain a unit price of \$5,295. Similarly, variations in the unit price of the Unisyn OVO reflected, at least in part, the third-party seller that was involved in the sale (Henry Adkins & Sons, RBM, Liberty Systems, and Election Systems Online are represented within our sample). The lowest unit price we found was the state-negotiated one in Ohio (\$4,625). For histograms of our ICP and OVO data, see Appendix C.



## Discounts

While the unit pricing of voting systems generally follows certain conventional parameters, the final prices that jurisdictions pay can be drastically affected by discounts. Beyond the potential reductions in unit pricing through high-volume purchasing described above, vendors also extend discounts in the form of trade-in allowances for older machines, as well as flat or percentage bottom-line cost deductions. These types of discounts are exceedingly common in our contract sample. After excluding contracts from jurisdictions that did not purchase machines or for which our information is incomplete,<sup>95</sup> we were left with 356 jurisdictions to consider. Notably, 277 of them (77.8% of jurisdictions) received some sort of discount. ES&S extended discounts with the greatest frequency—in 120 of 143 (83.9%) ES&S purchases included in this subset of our sample—but all of the major vendors represented in our dataset offered discounts most of the time.

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95. More specifically, we exclude contracts which (a) are not complete and may be missing discount data; (b) are from jurisdictions that do not participate in the electronic voting machine market; or (c) that represent leases and not purchase agreements.

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**Table 1: Discounts on Contracts by Vendor<sup>96</sup>**

Vendor	Total Contracts in Sample	# with Discount(s)	% with Discount(s)
<b>Clear Ballot</b>	10	6	60.00%
<b>Dominion</b>	106	79	74.53%
<b>ES&amp;S</b>	143	120	83.92%
<b>Hart</b>	26	21	80.77%
<b>Unisyn</b>	53	43	81.13%

The documents in our sample reveal not only the pervasiveness of discounts, but also their variety. Aside from the trade-ins for old equipment and price reductions documented generically as “discounts,” we also found the following:

- Discounts for paying acquisition costs in full (i.e., not in installments)
- New customer discounts
- Returning customer/loyalty discounts
- Hardware upgrade discounts
- Group discounts
- Small county discounts
- Quantity discounts
- Reimbursements for unused maintenance
- “No RFP” discounts
- Early adopter discounts
- Test pilot partner discounts
- Special state discounts (e.g., a “Missouri discount,” “Ohio discount,” “State of Arkansas discount,” or “Commonwealth of Massachusetts discount”)

96. The chart only accounts for contracts with vendors that are currently active in the election technology market.

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**Discounts can add up.** These discounts could be combined, sometimes to significant effect. Wayne County, MO, for instance, received a new customer discount and a “Southeast Missouri discount,” as well as a trade-in allowance for its old equipment, which together took 40% off the acquisition cost for new Unisyn voting systems. The sales agreement between Cowley County, KS, and ES&S included a “Customer Discount” and an “Other Discount,” plus a trade-in allowance for outdated ES&S machines, which amounted to a 25.37% discount. Other combined discounts were more modest. Dominion extended Dakota County, MN, an “early adopter discount” for a high-volume purchase of ImageCast Evolution systems, along with general discounts on both its hardware and software components, plus a trade-in on legacy equipment, for a total reduction that covered 15.1% of the initial cost. Jefferson County, TX, received a general discount of almost \$175,000 from Hart Intercivic, as well as an equipment buyback valued at over \$75,000, and a “BuyBoard Discount” (presumably for using third-party BuyBoard’s online cooperative purchasing platform to complete the purchase), yielding a combined acquisition cost reduction of 13.54%.<sup>97</sup> Looking at the data more broadly, the median per capita non-trade-in discount in our sample was \$.60 and the median per capita trade-in discount was \$.30.

**Discounts seem to be largely arbitrary or idiosyncratic.** The discount rates varied greatly, even when different jurisdictions were buying the same equipment from the same vendor in the same state. When Mono County, CA, purchased ImageCast Evolution systems from Dominion in 2017, they received a bottom-line discount amounting to 4.9% off the original purchase price of \$223,850. But Dominion issued a much larger 24.5% discount to nearby Placer County, CA, totaling over a million dollars, for their acquisition of the same ImageCast machines. Floyd County, TX, received a “Special Discount” from Hart InterCivic equating to 5.83% off the \$111,769 acquisition cost of new Verity Touch systems, but the “Special Discount” extended to Nueces County, TX, for the Verity Touch was even more special: an 11.01% reduction on the over \$4.1 million purchase price.

Jurisdictions making larger purchases did not necessarily obtain larger percentage discounts. Dodge County, WI, got over 25% knocked off the initial cost of its purchase of DS200 scanners and ExpressVote ballot marking devices from ES&S. Scott County, IA, received a similar deal: \$213,365 in discounts for an order initially priced at \$895,910. Polk County, FL, however, fared less well. They bought the same machines that Dodge County and Scott County did—and, importantly, at greater volume, along with additional equipment those other two counties did not buy. But Polk received a comparatively miniscule rebate: a combined trade-in allowance plus general discount totaling only around 3.7% of the over \$2.5 million base purchase price. Two counties in Texas, McLennan and Burnet, initiated purchase agreements within weeks of each other in 2005 for Hart’s eSlate systems.

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97. Hart is included on the list of “BuyBoard Current Texas Vendors,” dated Wednesday, January 8, 2020. Available at <https://www.lavegaisd.org/BUYBOARD%20CURRENT%20TEXAS%20VENDORS.pdf>.

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Burnet bought significantly less, but got a much greater discount: 23.00% (\$108,600) off its \$472,072 purchase, compared to the 2.50% discount (\$33,150) that McLennan received for its \$1,328,307 order. Likewise, both Arlington County, VA, and Spotsylvania County, VA, purchased Unisyn Open Elect systems in 2015. Arlington's acquisition cost was more than double Spotsylvania's, and while both counties received an "Act of Good Faith Customer Loyalty Discount," Arlington's was 20% lower (a \$20,000 reduction compared to Spotsylvania's \$25,000).

There is thus an arbitrariness to when vendors extend discounts and when they don't. The documents we collected from Missouri included four from counties that purchased new systems from Dominion in 2015. All four got the same base product: the ImageCast Precinct tabulator. But there was one significant difference: three of the counties (Carroll, Saline, Nodaway) received a written pledge of a 10% discount on the Year 1 acquisition costs, if they paid in full up front. The contract for the other county (Harrison) failed to present that discount opportunity, and in fact offered no discounts whatsoever. When Gila County, AZ, signed a sales agreement with ES&S in 2016, it received an "Arizona Customer Discount" that reduced the acquisition costs by 7.83%. Yuma County, AZ, however, received a generic "Customer Discount" two years later that amounted to a full 21.90% savings on its purchase of ES&S's ExpressVote, DS450, and DS200 machines. Coconino County, AZ, then bought these same products just a few months after Yuma did, but received no bottom-line markdown at all, merely a trade-in allowance for old AccuVote machines that brought down the acquisition cost by just 3.80%. The fact that the "Arizona Customer Discount" is not extended to all Arizona counties implies that the naming of these discounts can be as arbitrary as their extension.

Despite the inconsistency and opaqueness surrounding discounts, they clearly are an integral part of the election technology purchasing process, which raises the question: Why are discounts so widespread? The apparent reasons vary. One type of discount in our dataset—"No RFP" discounts—work to overcome a distinctive barrier to entry in the election technology industry. *The Business of Voting* had noted that the highly complicated, cumbersome, and time-consuming request for proposals (RFP) process that jurisdictions use for procuring voting machine systems gives an edge to established vendors, who have greater experience and resources to research and prepare successful RFP submissions. It therefore is not surprising that Clear Ballot, as an emerging market player, would have extended No RFP discounts to several counties in Oregon and Washington—for as much as 10% off the initial hardware, software, and service costs—to bolster the company's efforts to enter the market. Clear Ballot offered these No RFP discounts in addition to other "early adopter" discounts, as well as a unique "first piggy back" discount to one buyer, Lewis County, WA.

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Most election technology discounts, however, seem geared to do what discounts in other industries do: attract, reward, and maintain customers in a competitive marketplace. It seems that unit pricing is relatively standardized, but the real negotiation begins when discounts enter the conversation. As we have already seen, the results vary wildly. Most of the discounts are noted simply as “Discounts” or “Special Discounts” or “Trade-in Allowances,” without any details or rationales, only seemingly arbitrary dollar figures. And as noted above, even those with more specific monikers are inconsistent: beyond the Arizona customer discount that was not enjoyed by all Arizona customers, we found “loyalty discounts” that varied by thousands of dollars irrespective of purchase amount, even when occurring within the same state. But as will be discussed in more detail below, vendors have a compelling financial reason to use discounts, and to use them flexibly, to protect and expand their market share.

## Annual Fees

Vendors may be so willing to give discounts on acquisition costs because a lot of their revenue actually is derived from associated fees. Some of these fees relate to auxiliary services, such as training days for poll workers or management support on election days. Such fees can be enormous, but we exclude them from this analysis. We focus instead on the annual fees collected by vendors for the post-acquisition upkeep of the voting systems they sell. These annual fees involve the renewal of software and firmware licenses, system maintenance warranties, as well as technical support service agreements, all of which can come at a substantial cost. As reported in *The Business of Voting*, one financial intelligence firm determined that “[l]ong term service contracts can sometimes be worth half as much as new equipment.”<sup>98</sup> Previous reports note that these costs can eclipse the initial acquisition cost.<sup>99</sup> The data we collected substantiate these assertions.

In assessing the value of annual fees, we assumed voting systems would have a 10-year life—which, for most jurisdictions, would entail paying nine years of annual fees, since the initial acquisition cost would cover expenses for Year 1. We found that many contracts in our dataset incorporate annual fees that amount to at least another 40% of the original acquisition cost. Some jurisdictions, however, faced fees that were far steeper than that. The Unisyn machines purchased by Davis County, IA initially cost \$75,937, but came with annual licensing and warranty fees of \$7,620, which would amount to \$68,580 (90.31% of the acquisition cost) by the end of Year 10. Lyon County, KS paid almost \$451,000 to ES&S for its initial purchase, but would be responsible for another \$400,770 in fees (88.87% of the acquisition cost) over the subsequent nine years. Similarly, the purchase of Dominion systems by Hernando County, FL initially cost \$608,541, but the commitment for annual hardware warranties and software licenses would add another \$506,592 in fees (83.25% of the acquisition cost) through Year 10. These figures may actually underestimate the extent of the fees, since most vendors reserve the right to incrementally increase the fees by a certain annual percentage.<sup>100</sup>

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98. See Penn Wharton Public Policy Initiative *supra* note 11 at p. 23.

99. See National Research Council *supra* note 8 at p. 133.

100. Of course, all of these figures are in absolute terms and are not time-discounted to reflect the present value of costs over the 10-year period, which would reduce the ratio of fees to initial acquisitions.

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Annual fees are one aspect of pricing where state-level negotiations do not seem to matter. Colorado, for instance, signed a Master Voting System Agreement with Dominion in 2016, which set the terms of sale for Colorado counties that wished to purchase from that vendor. Nevertheless, some of the highest annual fees we found associated with Dominion voting machines were for counties in Colorado. Documentation from Arapahoe County shows that it acquired systems from Dominion with a purchase price of \$1,098,107.63; by Year 10, though, the county would spend in total almost the same amount in additional annual fees: \$1,056,618. Other counties in Colorado actually stood to pay more in annual fees over a 10-year life span than they paid for acquiring their systems in the first place. The most extreme example we found was Boulder County. It paid \$378,092.64 for ImageCast systems from Dominion, but faced annual licensing and warranty fees of \$58,927, which would come to \$530,393 through Year 10. In other words, 140.27% of Boulder’s original acquisition cost would be paid out again through additional fees.<sup>101</sup> Again, these projections do not even account for the annual percentage increases in fees that are authorized in the contracts. Perhaps it was because of such high add-on costs that most of the Colorado counties in our sample that contracted with Dominion elected to enter “managed service agreements.” These are essentially lease arrangements where the county would remit a set annual payment for use of voting machines over a specific number of years (usually eight), with no initial cost for outright purchase.

These annual fee data reinforce certain conclusions regarding industry revenues that we explored in *The Business of Voting*. The consistent revenue stream for voting system vendors is not exclusively found in the development of new or innovative machines. Indeed, it is not necessarily in their financial interest to roll out new systems with regularity, in the way Apple churns out new iterations of the iPhone, but rather to sustain long-term relationships with counties that entail ongoing annual payments.<sup>102</sup>

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101. Again, this is without time-value-of-money discounting.

102. In *The Business of Voting*, we cited one particularly stark assessment by the Miami-Dade Office of the Inspector General, now nearly two decades old, rendered in the aftermath of a failure-prone 2002 midterm election: “[T]he relationship between ES&S and the County can be summed up in one word: dependence,” the report asserted. “ES&S’ intention is to sell the County extended Hardware Maintenance Agreements, and not to assist the County to become self-sufficient.” See Miami-Dade County Office of the Inspector General, “Miami Dade County Voting Systems” (2003), p. 39. On file with authors. See also U.S. Government Accountability Office *supra* note 26 at pp. 45-46. The GAO presents testimony expressing a similar sentiment, noting: “One state election official said that the cost of certification may discourage vendors from developing new systems and pursuing EAC certification for their systems, which could limit their ability to sell or supply their systems to state and local election jurisdictions. In addition, this state election official noted that costly federal certification of voting systems has limited the voting equipment choices for election officials.” The GAO also reports that “some stakeholders said they believed that the voluntary guidelines and associated testing and certification processes take too long, and thus limit the choices of voting equipment on the market and make it difficult to make improvements to existing equipment.”



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This is especially true given the upfront costs detailed in *The Business of Voting*, related to designing and certifying voting machines in each state.<sup>103</sup> From this perspective, even relatively modest initial purchases can ultimately yield more significant gains.<sup>104</sup>

Take, for example, the small county of Umatilla, OR, which in 2002 bought a Model M550 Optical Scanner and associated software and hardware from ES&S. At the time, the system cost \$96,095. The contract, though, also included provisions for an annual hardware maintenance fee of \$3,375, as well as annual software maintenance fees of \$9,365, which would “automatically renew for an unlimited number of successive one year periods,” barring termination of those provisions by the county. This means that by the time we collected this contract from Umatilla in 2019, ES&S would have stood to collect at least \$203,840 in annual fees—perhaps even more, since the contract allows the fees to be increased by up to 5% each year. In any case, the fees would amount to more than double what Umatilla initially paid.

Even if counties do not wind up paying more in annual fees than they did for their original purchases, the fees still add up. When Solano County, CA, made a \$4,187,659 purchase from ES&S in 2005, they also committed to hardware maintenance fees, firmware licensing fees, and other software fees totaling \$118,540 annually, which would have accrued since then to over \$1.5 million in post-acquisition payments. Likewise, Taylor County, TX, made a system acquisition in 2005—in its case, from Hart InterCivic for \$866,145. The annual fee of \$38,395 listed in that contract would translate into more than \$500,000 in additional payments over the intervening years. And such extra charges just keep accumulating as counties hold on to their voting systems. The lucrativeness of these long-term contracts may intensify the competitive dynamics of the industry. As the story on the following page illustrates, vendors will go to extreme lengths to keep their clients from purchasing new machines from a rival.

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103. See Penn Wharton Public Policy Initiative *supra* note 11 at p. 38. See also Presidential Commission on Election Administration *supra* note 8 at p. 64: “Even when [a voting machine] works as designed, the certification process is costly and burdensome. Vendors complain about the length of time and expense (well over \$1 million for a new voting machine) of receiving certification from one of the few approved testing labs.” See also U.S. Government Accountability Office *supra* note 26 at p. 46 that “officials from one vendor said that they submitted a new voting system for EAC testing and certification and spent over \$12 million before they learned that there were significant issues with getting their system certified ... The vendor decided to withdraw its system from the testing and certification process.”

104. It is important to note that the discussion here does not include the additional charges for the many other administrative services that vendors provide, including significant hourly fees training poll workers and managing election days. An entire, separate study could be done on those types of administrative service fees. Expenditures for voting processes can balloon far more than what it might take to purchase and maintain a set of machines. See, e.g., Brennan Center for Justice (2020). ESTIMATED COSTS OF COVID-19 ELECTION RESILIENCY MEASURES. Available at <https://www.brennancenter.org/our-work/research-reports/estimated-costs-covid-19-election-resiliency-measures>.

## The Curious Case of a ~90% Markdown

Since jurisdictions purchase voting systems infrequently, and since the revenue stream for vendors depends on the steady inflow of annual fees, vendors compete aggressively to sign contracts with new customers, and to keep the customers they have at all costs. An extreme but illustrative example of this dynamic can be seen in an acquisition by Asotin County, WA.



Asotin signed an agreement with Hart InterCivic at the end of 2018 to replace its existing electronic equipment with a Verity Touch ballot marking device, which along with the associated hardware, software, and accessories, came to a total acquisition cost of \$149,225. But Hart did something extraordinary: the company extended Asotin a “Special Discount” of \$133,676. Cost-wise, it covered the entirety of the initial purchase price, except for the \$15,549 annual license and support fee for the first year of Asotin’s ownership. It was a bottom-line markdown of almost 90% for the initial purchase.

The discount is all the more remarkable because Asotin, a rural county of approximately 22,000 people situated along Washington’s border with Idaho, did not negotiate with Hart as part of any broader coalition of counties that promised high volume purchasing, or with any assistance from Washington state. Nor does the discount appear to be the triumph of an expert negotiator working on behalf of the county. As explained in an email from Darla McKay, the Asotin County Auditor, “The reason we ended up with such a great deal was Hart wanted to keep us as customers and there was a new up and coming Election Tabulation Software Company”—we presume, Clear Ballot—“that was securing contracts with many counties across the state of Washington.”<sup>105</sup> Although Asotin had been a client of Hart since 2005, the county evidently was very close to switching and signing a contract with this new, upstart vendor. A discount of unprecedented proportions helped to prevent that.

Still, at first glance, the discount that Asotin County received is puzzling. Why would the third-largest election technology vendor go to such great lengths, and swallow the cost of giving a \$133,676 discount, to keep the business of a relatively small jurisdiction? Part of the answer may be in the annual fees. The contract that Asotin County signed with Hart projected a 10-year service life for the new Verity Touch system. Each year, the county would be responsible for paying the annual license and support fee of \$15,549—bringing the total 10-year cost of ownership to \$155,490, which Hart would collect. Even with a mammoth discount, Hart stood to gain financially in the end, while also keeping Asotin County as a client to cultivate for the indefinite future.

105. Email correspondence from Darla McKay to Andrew Coopersmith, March 27, 2020.

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Charging annual fees and thus smoothing cash flow over a number of years can benefit companies in several ways. First, it may function to make the machines seem “less expensive” to the acquirers; there is at least anecdotal evidence that some election officials do not fully appreciate that assessing the actual cost of voting machines requires that they factor in annual maintenance.<sup>106</sup> The U.S. Election Assistance Commission (EAC) warns officials that:

*Determining the cost of ownership of a voting system is not easy. The true cost is the cost to purchase or lease, operate, and maintain a voting system over its life span. It's probably more than you think .... Contemporary pricing structure for voting systems may shift costs around—they may be front-loaded into the purchase, back-load, or deferred .... Know how the vendor(s) plan to be profitable on this contract.<sup>107</sup>*

Second, smoothing the cash flow may function to counter what we described in *The Business of Voting* as the “lumpiness” or cyclicity of equipment procurement.<sup>108</sup> Given the mass purchasing of machines that occurred after the passage of HAVA in 2002, and that machines have a common life span of around 10 years, we should expect that peaks in equipment purchases will be clustered around certain time periods in 9-11 year increments.<sup>109</sup> The MIT/CalTech Voting Technology Project was prescient in their pre-HAVA, 2001 prediction regarding the problem of cyclicity for vendors:

*One perverse effect of the current push to purchase new equipment is that it may hasten the need to develop a new business model in order for firms to survive. Suppose that all counties with obsolete or inferior equipment upgrade within the coming year, so all counties have relatively new, relatively good equipment. This will kill demand over the succeeding years.<sup>110</sup>*

This effect apparently has been a core concern of some vendors. It spelled a “problem of recurring revenue” that reportedly even led one now-defunct vendor to worry that “its products were too reliable.”<sup>111</sup> Making machines that jurisdictions could hold on to for a decade or more was, in a way, bad for business.

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106. See Riley, Robertson, and Kocieniewski, *supra* note 8.

107. U.S. Election Assistance Commission (2017). TEN THINGS TO KNOW ABOUT SELECTING A VOTING SYSTEM. Available at <https://www.eac.gov/documents/2017/10/14/ten-things-to-know-about-selecting-a-voting-system-cybersecurity-voting-systems-voting-technology>.

108. See Penn Wharton Public Policy Initiative *supra* note 11 at p. 23.

109. See also Brandon Fail (2006). HAVA's Unintended Consequences: A Lesson for Next Time. Yale Law Journal 116(2) at p. 499 (noting that more infrequent purchasing disincentivizes entrants into the highly concentrated voting machinery market). Available at <https://www.yalelawjournal.org/comment/havas-unintended-consequences-a-lesson-for-next-time>.

110. See MIT/CalTech Voting Technology Project *supra* note 9 at p. 54.

111. See Riley, Robertson, and Kocieniewski, *supra* note 8. In his Congressional testimony, the CEO of ES&S confirmed that revenue “varies very substantially from year-to-year,” depending on the purchasing needs of jurisdictions. See Committee on House Administration, Majority *supra* note 13 at mark 1:38:08.

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The larger market, in generating annual fees as well as providing an array of auxiliary election services to jurisdictions, found a solution that one account calls “an enhancement of the old razors-and-blades strategy: Sell the razors cheap and make money on the blades, and make even more money by making the razors so hard to use that customers pay you to give them a shave.”<sup>112</sup> ProPublica draws a slightly more modern analogy: “Over time, the industry has shifted from making money on the voting equipment itself to making money on services and supporting materials, not unlike what the early cellphone companies did—sell the phone for cheap, then bring in far more with long-term service contracts and data plans.”<sup>113</sup>

While these analogies may seem apt, we should not hastily conclude that annual fees are an exploitative tactic on the part of vendors to furtively make more and more money. Jurisdictions may rationally prefer to pay much of their costs over time rather than up front. Some jurisdictions may want to avoid creating a sense of sticker shock when disclosing acquisition costs to the public or presenting them within the context of political budgetary deliberations. Some may simply find it easier to amortize expenses over several years than to fund large capital expenditures.<sup>114</sup> It is possible that companies reduce the initial purchase price with a concomitant increase in annual fees in anticipation of this preference. In their 2006 analysis, the Brennan Center for Justice referred to a similar dynamic. While “voting systems that initially seem least expensive will often become more expensive than other systems after a few years,” the Brennan Center reported that nevertheless, “jurisdictions may decide that, given the constraints of current funding for voting systems and the time value of money, they care most about a voting system’s initial costs.”<sup>115</sup>

Similar considerations can drive a decision to lease rather than purchase equipment.<sup>116</sup> Just as lessees may be willing, for budgetary or political reasons, to pay a bit more over time in exchange for a reduced initial capital outlay, even the election officials who are purchasing machines may also prefer to defer some costs, even if at a premium. We cannot say that voting machine contracts are always, or even usually, designed in the jurisdictions’ interests. We only note various possible incentives, on both sides, that may influence the structure and shape of procurement agreements.

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112. *Ibid.*

113. See Huseman *supra* note 5.

114. Authors of the Pitt Cyber-Citizens for Better Elections study noticed that counties that sought to pay out of operating budgets spread out costs whereas counties that had a sizable capital budget would frontload costs. Email correspondence from Kevin Skoglund to Matthew Caulfield, May 20, 2020.

115. See Brennan Center for Justice *supra* note 34 at p. 133.

116. As profiled by the GAO, this was the case of Anne Arundel County, MD, whose officials cited “lower upfront costs” as a primary reason it chose to lease equipment. See GAO report *supra* note 26 at p. 39. See also MIT/CalTech Voting Technology Project *supra* note 9 at p. 52. (“Leasing avoids the huge upfront expenditure for purchasing equipment.”) Anne Arundel County also cited distinctive benefits in offering flexible, early access to new equipment. This has been echoed in previous analyses. See generally Fail *supra* note 108. See also MIT/CalTech Voting Technology Project *supra* note 9 at p. 52. (“Leasing . . . leads to greater flexibility for upgrades.”) However, the market does not appear large enough to support a secondary market of new cutting-edge machines solely to cater to the flexible demand of lessees. Instead, as several reports have detailed, officials often fail to find the equipment they want, with larger counties even having resorted to attempts to develop in-house voting systems as a result. See generally Presidential Commission on Election Administration *supra* note 8, and National Academies of Sciences, Engineering, and Medicine *supra* note 12. Brandon Fail, an advocate for the leasing approach, acknowledges that “offering machinery for short-term leases is only attractive in high-demand periods.” It has become clear since the publication of *The Business of Voting* that the relatively small market for voting technology, hampered by legislatures that are reticent when it comes to appropriations, likely cannot sustain consistently high demand to enable a robust leasing market that would provide access to more frequently improved or enhanced equipment. So while leasing might in theory offer jurisdictions more flexibility to replace equipment, this benefit may be illusory.

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# Conclusion

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When we presented the 2017 Business of Voting report to the Committee on the Future of Voting at the National Academies of Sciences, Engineering, and Medicine, one of the first questions posed was by Lee Bollinger, President of Columbia University and one of the Committee's Co-Chairs. He asked an important and perfectly natural question: What had we found a voting machine typically would cost? We answered, with candor, that we really did not know. With this report, we have added significantly to the sparse previous research on the pricing of voting machines, while offering a few key updates on the market landscape. We refer the reader back to the initial Executive Summary for a rundown of the main takeaways from this analysis.

In concluding, we want instead to stress that this report may be just as notable for what it excluded as for what it included. We have still only scratched the surface of voting machine procurement issues. In particular, due in part to data limitations, we were not able to provide estimates or averages for the total cost of ownership (TCO) of any voting machine models. Local election officials, who need to make financially consequential decisions on voting system acquisitions, would greatly benefit from comprehensive TCO information. Moreover, looking beyond voting machines, there are other huge costs we do not address, including those associated with training, supplies, election day management services, pollbooks, and a host of other products and services that contribute to the actual total costs which jurisdictions must cover.

Even after all the time spent collecting, logging, and analyzing the data for this report, it is still difficult to generalize about voting machine TCO, since different districts have different needs; purchase different core and peripheral systems, products, and services; and are subject to varying financial, political, and legal constraints. Many costs are also not specified at the time of initial acquisition, and so could not be determined from the procurement contracts we aggregated. Add to this that even purchases for identically named systems from the same vendor can often have differing underlying software or hardware that could account for cost differentials.

The lack of standardization across jurisdictions and regulatory regimes not only inhibits technological innovation, as we argued in *The Business of Voting*, but also makes it uniquely difficult for researchers or policymakers to fully understand what is happening on the ground. In an important sense, we now know what voting machines cost (see, in particular, Appendix B). We have shed more light on how voting machines are priced, and how discounts and ultimate costs might be negotiated. But in a broader sense, there is still so much more that needs to be learned.



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## Appendix A: Sample Email Sent to Jurisdictions

[DATE]

I am writing from the Wharton Public Policy Initiative at the University of Pennsylvania. We have been conducting an academic study of the voting technology industry, with a particular emphasis on the competitive dynamics of the industry. Our initial finds were published in 2017, in a report titled *The Business of Voting*. Currently, we are working on an update to that report, which will specifically focus on understanding the variations in prices of voting equipment across the country. We very much would like to include data from your jurisdiction in our updated report.

With that in mind, I am writing to ask if you would share copies of any contracts from your most recent voting machine procurement. We understand that the most recent procurement might have been several years ago, but hope you'll agree that these public records are in the public interest and will contribute significantly to our understanding of how the voting technology industry operates.

Please let me know if you would be able to provide this information or can connect me to someone who has access to it. My direct email address is [ascooper@wharton.upenn.edu](mailto:ascooper@wharton.upenn.edu).

I very much appreciate your time, and thank you in advance for your assistance.



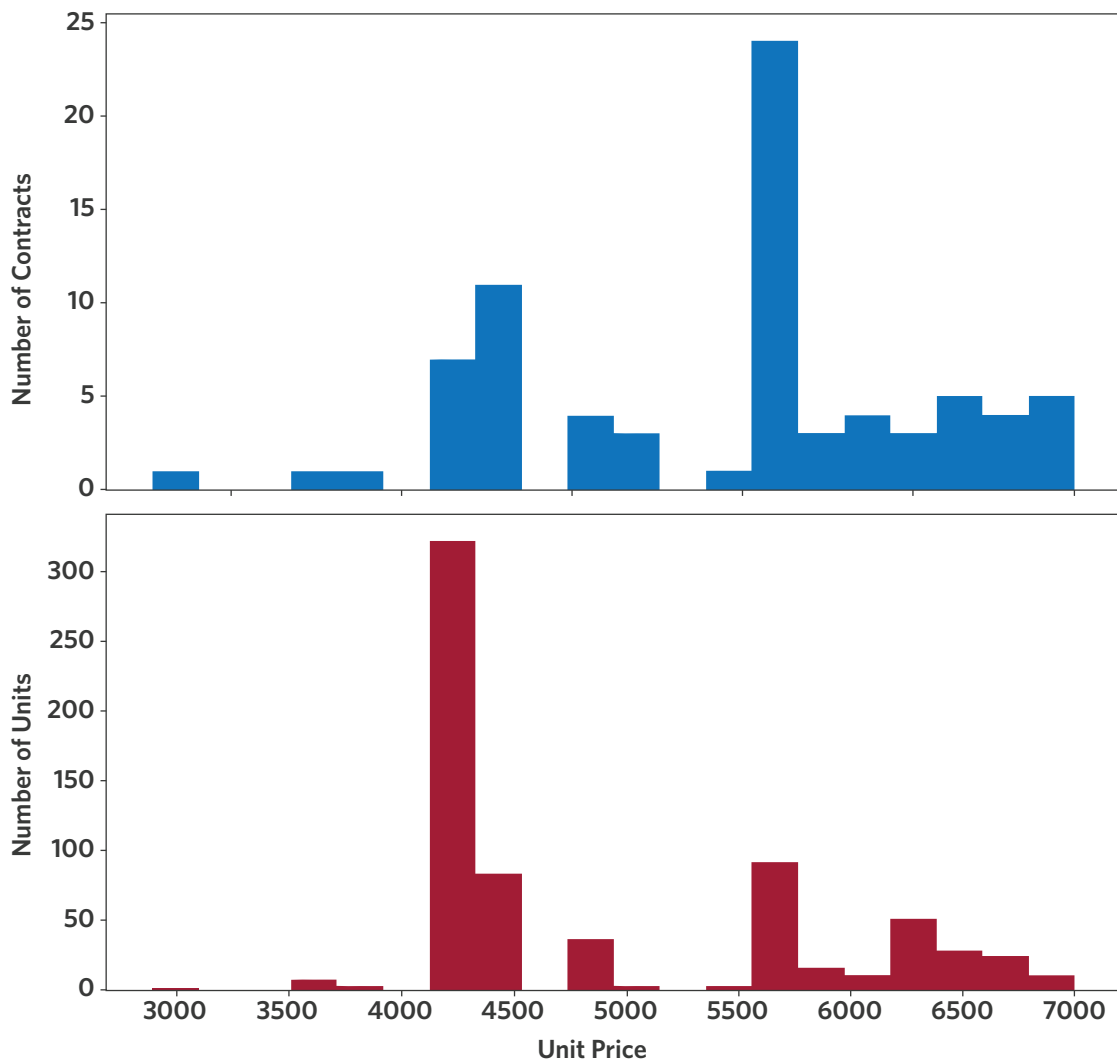
## Appendix B: Descriptive Statistics for Voting Machines Included in Our Sample

Model	Number of Contracts	Number of Machines	Median Price	Median Per Capita Price	
Model DS200	110	7241	\$5,750	\$3.65	ES&S Machines
Model DS650	9	11	\$45,000	\$0.80	
Model DS100	12	513	\$5,150	\$3.60	
Model DS450	14	18	\$49,950	\$1.21	
Model DS850	27	55	\$111,500	\$1.11	
ExpressVote	70	8377	\$3,325	\$4.00	
ExpressVote XL	2	390	\$8,250	\$14.90	
ICP	77	705	\$4,500	\$2.91	Dominion Machines
ICE	24	1833	\$7,200	\$4.58	
eSlate	18	4664	\$2,254	\$2.36	Hart Machines
eScan	2	81	\$5,400	\$2.62	
Verity Touch Writer	20	1178	\$4,650	\$3.97	
VerityScanner	5	63	\$6,100	\$5.94	
OVO	57	1093	\$5,320	\$4.77	Unisyn Machines
OVI	32	572	\$3,345	\$3.56	
OVI-VC	13	379	\$3,890	\$3.36	
OVCS	4	5	\$44,750	\$1.21	
MiniOVCS	5	6	\$10,950	\$0.78	Clear Ballot Machines
ClearCount6800	3	4	\$60,000	\$2.17	
ClearCount6400	2	3	\$40,000	\$1.49	
ClearCast Table Top	4	202	\$7,200	\$8.95	

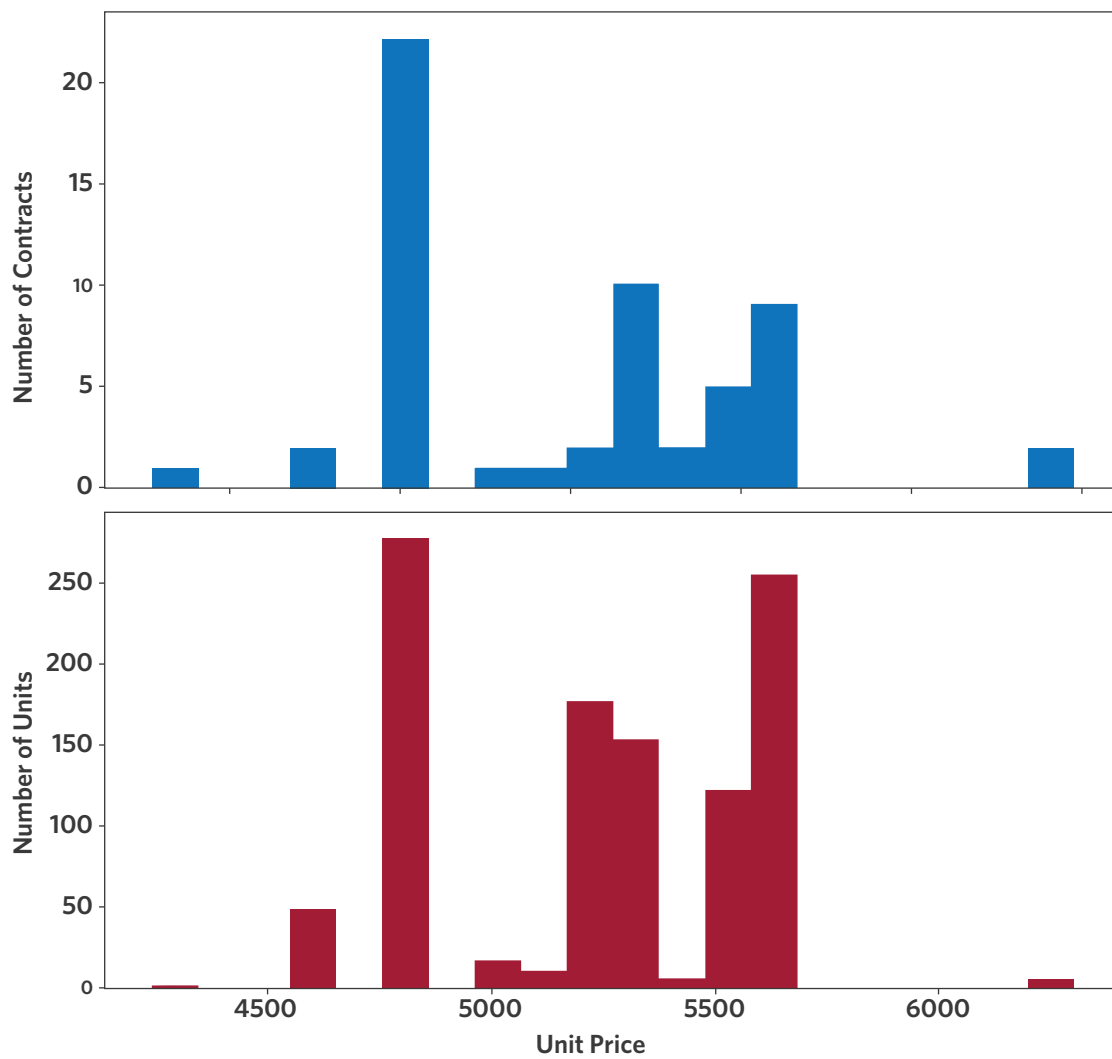
\*Price information reflects unit prices, exclusive of other discounts, trade-ins, and other initial or subsequent maintenance, training, licensing, or other costs. Median Per Capita Price was calculated dividing total unit price (unit price \* number of units purchased) for each contract by the number of registered voters in its respective jurisdiction. The median of these values was then selected. Cases in which we collected two distinct contracts for the same jurisdiction were counted as two distinct data points. Only the subset of data which allowed for the backing out of specific machine prices was analyzed here.

### Appendix C: Histograms of ICP, OVO, and ExpressVote Prices by Number of Contracts and Number of Machines in the Sample

**Dominion ImageCast Precinct Prices by Contracts and Units**

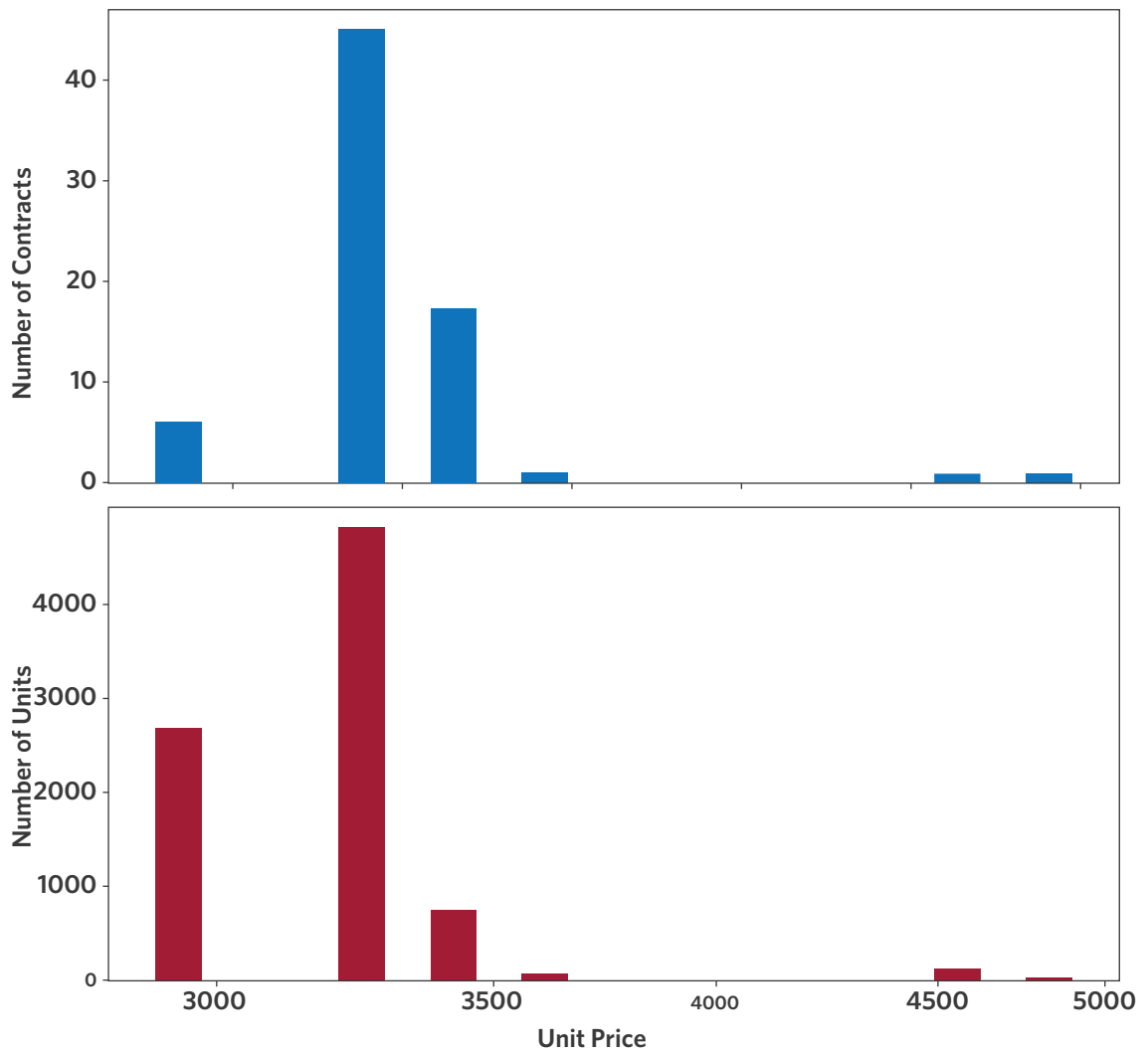


### Unisyn OpenElect Voting Optical Scan Prices by Contracts and Units





### ES&S ExpressVote Prices by Contracts and Units





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