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Vote-by-Mail and Voter Turnout in the Pandemic Election



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SUMMARY

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Technical appendix to this report are available on the PPIC website.

States across the country took extraordinary steps to increase voting by mail for the 2020 election in an effort to minimize in-person contact and virus transmission risk during the COVID-19 pandemic. The biggest such policy change involved mailing every voter a ballot by default. California took additional steps toward facilitating vote-by-mail—such as a statewide ballot tracking system and a later deadline for receiving ballots that had been postmarked by election day—and many counties in the state also adapted their options to accommodate in-person voting.

California is now debating making universally mailed ballots a permanent feature of the state’s elections moving forward, through AB 37. The state has already committed (through SB 29) to extending the approach through 2021, including for any gubernatorial recall election that may occur. At the same time, other US states plan to return to a version of their pre-pandemic approaches or may introduce policies to constrain voting by mail.

In this report, we analyze a wide range of data to identify how recent policy decisions affected voter turnout. Our analysis led to the following findings:

- **States that mail a ballot to every registered voter, including California, see turnout increase an average of 4 percent or more for all voters.** The increase is more than 9 percent for voters who previously voted in-person. These effects were slightly larger in 2020.
- **Other mail voting experiments states pursued had weaker effects.** Mailing every voter an application for mail voting did boost turnout a little under two percentage points during the pandemic, but removing restrictions on signing up for mail balloting might actually have had negative effects last year. That negative effect was measured against the longer-term turnout trends in those counties, which were otherwise generally positive.
- **Different options for in-person voting in California did not clearly increase turnout beyond what resulted from mailing every voter a ballot.** County decisions about the number of drop boxes and in-person voting locations appeared to have little effect.
- **Despite the rise in vote-by-mail, a smaller share of mail-in ballots were rejected in California.** The slight decrease may be due to statewide policy, such as the later deadline for mail-in ballots or the new statewide system for tracking them.

Many dynamics were at play in the 2020 election, including the competitiveness of the presidential election, a surge in turnout overall, the local prevalence of the coronavirus, and the possibility that voters might consider mail reforms differently in the midst of all these changes. Our estimates of policy effect account for all these factors.

If the policy goal in California is to increase voter turnout, the proposed legislation to mail all voters a ballot appears to maximize impact in that area. Our results suggest that changes to in-person voting—such as a switch to “vote centers” available to any voter in the county—might simplify some administrative procedures but do not increase turnout the way mailing voters a ballot does. However, decisions about all-mail balloting and in-person voting options come with administrative changes that should also be weighed and that we do not consider in detail here. There are also important questions about the effect of these reforms on the turnout of underrepresented groups like young people and people of color; the data for those questions are not yet available but should be addressed in future research.

Introduction

The coronavirus pandemic badly upset administrative plans for the 2020 presidential election. Voting in person suddenly became a feared transmission risk. Polling place staff were especially at risk of exposure, and were more likely to come from vulnerable populations like seniors. This made in-person voting not just potentially dangerous but difficult to staff: even if election administrators wanted to offer the same level of in-person voting they might not have been able to do so.

For many, the clearest solution to this problem was to facilitate more voting by mail. A number of states took steps in that direction, from mailing every voter a ballot to relaxing restrictions on absentee voting. Other states made few changes—either because they were already friendly to voting by mail or because they had not been open to the idea before and did not change their minds.

California took more steps than most states to accommodate mail voting. Although the state had high by-mail voting rates before the pandemic, it took the additional step of mailing every voter a ballot. The state also set minimums for the number of in-person voting locations in each county to ensure residents had sufficient choice in voting methods. This strategy led to a variety of approaches at the county level, from continuing with traditional polling places to consolidating polling places and making every location available to any voter in the county. These changes came on top of a significant move toward more mail voting in 15 counties that had been planned before the pandemic.

Now that the 2020 election has passed, states are facing questions about **what to do next**. Should the voting adjustments for the pandemic be permanent, should they be scaled back, or should some in-between approach be considered? Legislation has already been introduced in California to continue sending every voter a ballot permanently, while other states, such as **Georgia and Pennsylvania**, have limited mail voting or are considering further limits on vote-by-mail in the future.

To inform the policy conversation, we analyze how administrative decisions for the pandemic election affected voter turnout, both in California and nationally. After detailing the administrative approaches, we outline California's 2020 voter turnout and compare it to the state's past and to the nation as a whole. In light of the rise in vote-by-mail, we also examine rejection rates for mail ballots in California specifically.

We offer our best estimates for the effect of the various vote-by-mail policy decisions—independent of the other factors at play in the 2020 election. Previous research in California and the nation suggests that at least one policy—mailing every voter a ballot—has led to increased turnout (Barber and Holbein 2020; Gerber et al. 2013; McGhee et al. 2019). We will expand the range of data used for these earlier estimates while also extending them to the 2020 election cycle.

Pandemic Election Administration

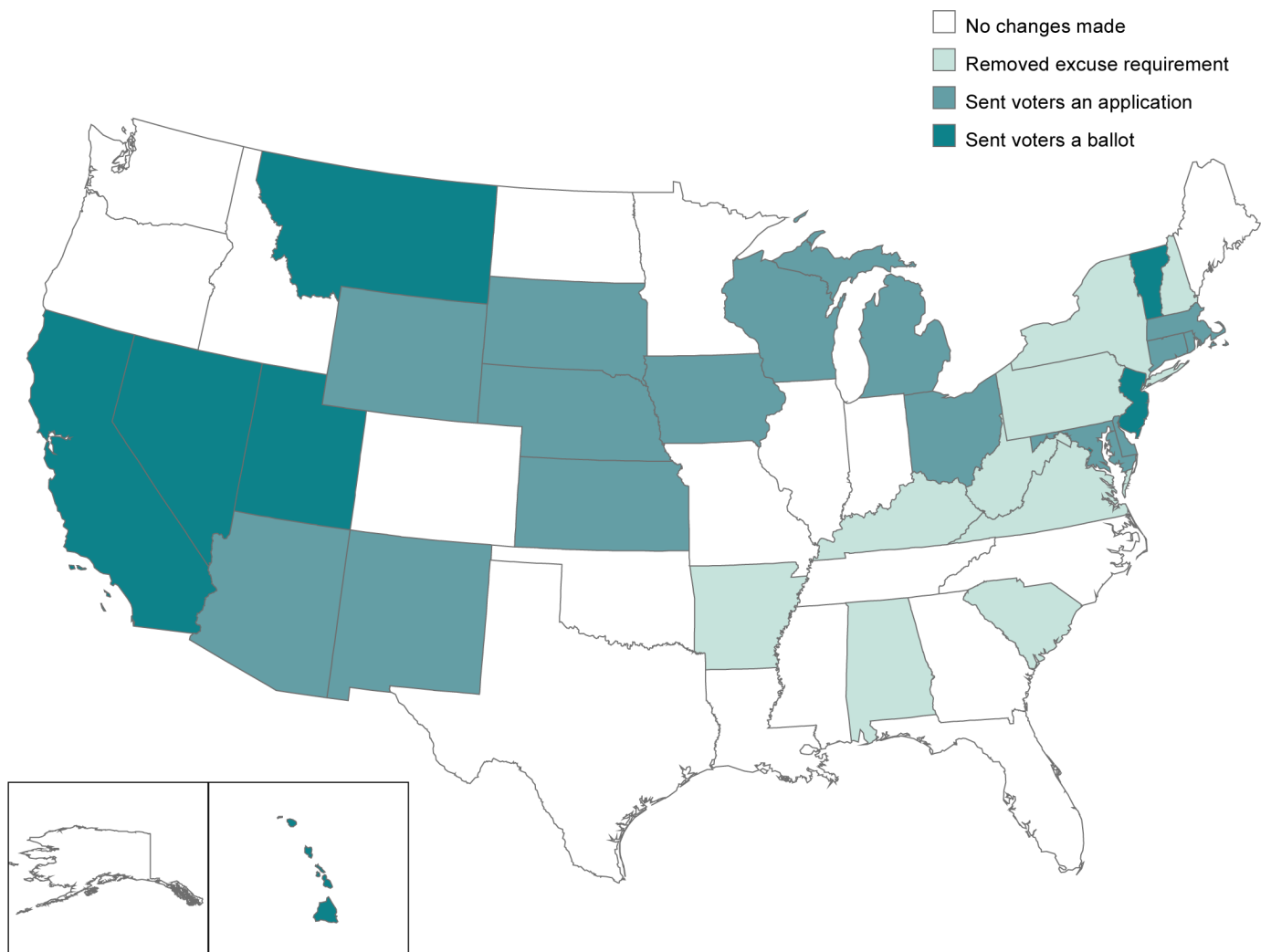
The pandemic prompted states to make a wide range of changes to accommodate mail voting, but we can identify three broad categories: lifting constraints, sending voters an application for a mail ballot, and sending voters a mail ballot (see Figure 1).¹

¹ Rules about processing mail ballots were also a focus of significant change and policy debate in a number of states. These included deadlines for returning ballots, rules and processes for rejecting them, and “curing” periods for voters to fix problems with ballots that were rejected. While these are important policies that might impact turnout, apart from our examination of mail ballot rejection rates in California, we do not consider the impact of such changes here.

- Nine states that had required an excuse to vote by mail or had limited the practice to certain populations lifted those constraints for 2020.
- Fifteen states that already had no-excuse mail voting mailed every voter a vote-by-mail *application* to encourage higher mail participation.
- Seven states (plus the District of Columbia) mailed every active voter a *ballot*. A few of these states had already been planning to make this change prior to the pandemic and simply executed their plan, while others made the change expressly in response to the pandemic.

FIGURE 1

Many states changed vote-by-mail policies for the November 2020 general election



SOURCES: National Conference of State Legislatures (election policies), Brennan Center for Justice (Voting during COVID-19).

NOTES: In states where some counties made a change and others did not, the state is classified according to the policy applied to a majority of its registered voters (or voting-age citizens in the case of North Dakota, which has no registration). A few states both removed the excuse for mail voting and mailed every voter an application at the same time; for this map, these states were classified as sending an application. Colorado, Oregon, and Washington are vote-by-mail states and have been mailing registered voters ballots for all elections prior to the November 2020 election.

California fell into the third category: it had been moving toward mailing every voter a ballot, but the pandemic accelerated those plans. Under the 2016 Voter’s Choice Act (VCA), 15 counties—comprising over half the registered voter population—had already made the transition to a new “vote center” model. That is, VCA counties mailed every voter a ballot and replaced the traditional polling place with a smaller number of larger, professionally staffed “vote centers” open to anyone in the county. Voters could choose to mail in their ballot, drop it off at an unstaffed drop box, or take it to a vote center. Every vote center was also electronically connected to the county voter registration list, so voters could also go to a vote center to register to vote or cast a replacement ballot. In the 2020 general election, these 15 counties mostly continued with the plans they already had in place.²

California’s decision to mail every voter a ballot moved the whole state closer to the VCA model, but options for in-person voting continued to vary by county. The state wanted to ensure robust in-person voting without mandating a full vote center approach, so non-VCA counties could choose one of three general options (see Figure 2): the traditional model, a consolidated polling place for assigned voters, or a consolidated polling place open to all county voters.³

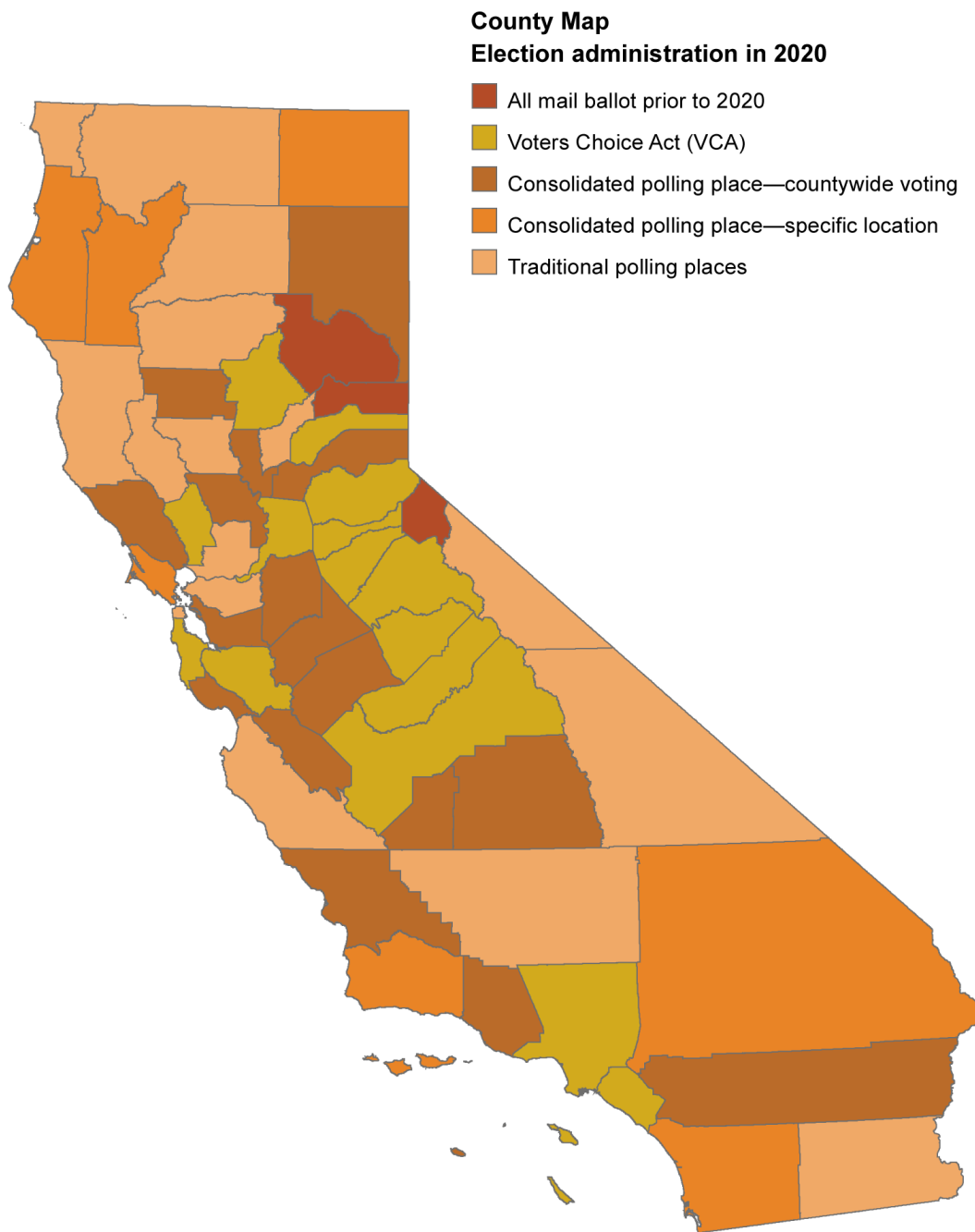
- Sixteen counties continued with the traditional model: voters were assigned to a small neighborhood polling place, with the minimum number of polling locations dictated by existing election law.
- Seven counties consolidated into a smaller number of polling places serving larger geographic areas within the county, but with voters still assigned to a specific neighborhood site.
- Seventeen counties consolidated their polling places but allowed any voter to use any location in the county. This approach was very close to the vote center model, though vote centers also gave voters the option to vote a replacement ballot, had more time to implement the reform, and had been required to conduct more community outreach about the change.

² Los Angeles County was an exception. It had received permission to switch to vote centers in 2020 but to phase in mailing every voter a ballot. The pandemic forced the county to switch to universally mailed ballots sooner than expected.

³ Three small counties—Alpine, Plumas, and Sierra—had switched to all-mail elections with no polling places before 2020.

FIGURE 2

California's counties took a range of approaches to in-person voting in 2020



SOURCES: California Secretary of State, November 3, 2020, General Election; Polling Location and Drop-off Location Statistics as of October 10, 2020.

NOTES: "All mail ballot" refers to three counties that had eliminated all in-person voting before the 2020 election. "Voter's Choice Act" are the Voter's Choice Act counties. "Consolidated polling place—countywide voting" refers to counties that moved to a smaller number of larger polling places according to the new legal guidelines, and made those consolidated locations available to any voter in the county. "Consolidated polling place—specific location" refers to counties that made the same consolidation but required voters to use a specific polling place in their community. "Traditional polling places" refers to counties that continued to follow existing legal requirements for in-person voting.

States across the country are **now making decisions** about what to do with the changes they made. Most of the proposed changes would restrict voting by mail after the many expansions in 2020, from restricting the number of ballot boxes to limiting mail voting to subsets of registered voters. At the same time, a significant bill is before Congress that would mandate expanded mail voting for the entire country.

In California, the decision around future election administration currently centers around AB 37, a bill that would make sending every voter a ballot a permanent practice. But this is not the only option. The state could also return to the pre-pandemic status quo and let voters in non-VCA counties (43 out of the state's 58 counties) sign up for vote by mail on their own, with no excuse required, or revert but mail every voter a vote-by-mail application to encourage more people to sign up.

Assembly Bill 37 (AB 37)—Elections: Vote by Mail Ballots (Assembly Members Berman, Cervantes, and Lorena Gonzalez)

Existing law required county election officials to mail ballots for the November 3, 2020 general election and use a specified vote-by-mail tracking system. If passed, AB 37 would extend the requirement to mail a ballot to all active registered voters for all future elections. It would also require the Secretary of State to maintain a system to allow a vote-by-mail voter to track their ballot through the mail system and its processing by the county elections official. Counties could use their own system if they could demonstrate it meets or exceeds the level of service in the state system. This law would make permanent the requirement for elections officials to mail voting materials to every registered voter, with time-sensitive deadlines for the mailing period. This bill does not prevent a voter from casting their ballot at a polling place, vote center, or other authorized location. AB 37 was referred to the Assembly Committee on Elections in January of this year.

California has at least two main options for in-person voting as well. The state could allow all counties to revert to their own individual approach—in most cases just the traditional neighborhood polling place available only to voters in the immediate geographic area. But it could also mandate the VCA approach for more—and perhaps all—counties, since the counties that took the third option listed above came close to a VCA approach already.

2020 Voter Turnout in California and the US

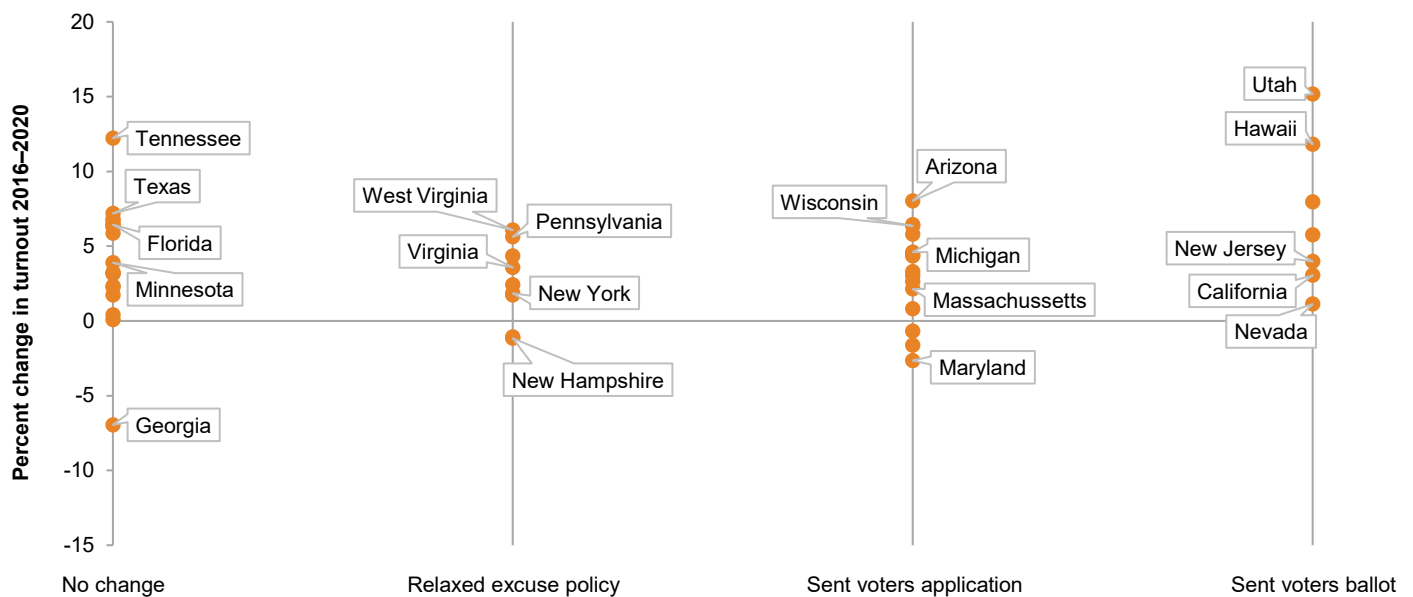
In the 2020 general election, most states featured both higher voter turnout and much higher voting by mail. In the nation as a whole, a remarkable **66.8 percent of eligible citizens voted**, up 7 percent from the previous presidential general election in 2016.

The increase was even larger in California, growing from 58.7 percent in 2016 to 70.9 percent last year. California also witnessed an unprecedented increase in the use of vote-by-mail ballots: mail ballots rose from 57.8 percent of all ballots in the 2016 general election to 86.7 percent in 2020. While mail balloting has increased steadily since the state first adopted no-excuse absentee voting in 1978, the 28.9 percent increase in 2020 marks the single largest growth between two presidential elections.

Figure 3 organizes the change from 2016 in national turnout numbers—this time as a share of the registered voter population—according to each state’s decision about mail voting during the pandemic.⁴ The vertical axis reflects the percent change in voter turnout between the 2016 and 2020 elections. States on the far left made no changes: they did not expand the population of voters receiving mail ballots or send vote-by-mail applications to all voters. This group includes a diverse range of pre-pandemic approaches, from strictly limiting voting by mail to all-mail voting with almost no in-person options. States on the far right are those that moved to send every voter a mail ballot for the first time, with a range of options in between. States that relaxed their vote-by-mail policy did generally see a larger increase in turnout—though in this first look, the relationship is ambiguous and seems clearest for the states that sent every voter a ballot.

FIGURE 3

Across the US, states that moved to universal mail balloting in 2020 saw larger increases in turnout on average



SOURCES: David Leip’s Atlas of US Presidential Elections (turnout and registration); National Conference of State Legislatures (election policies); Election Administration and Voting Survey (election policies).

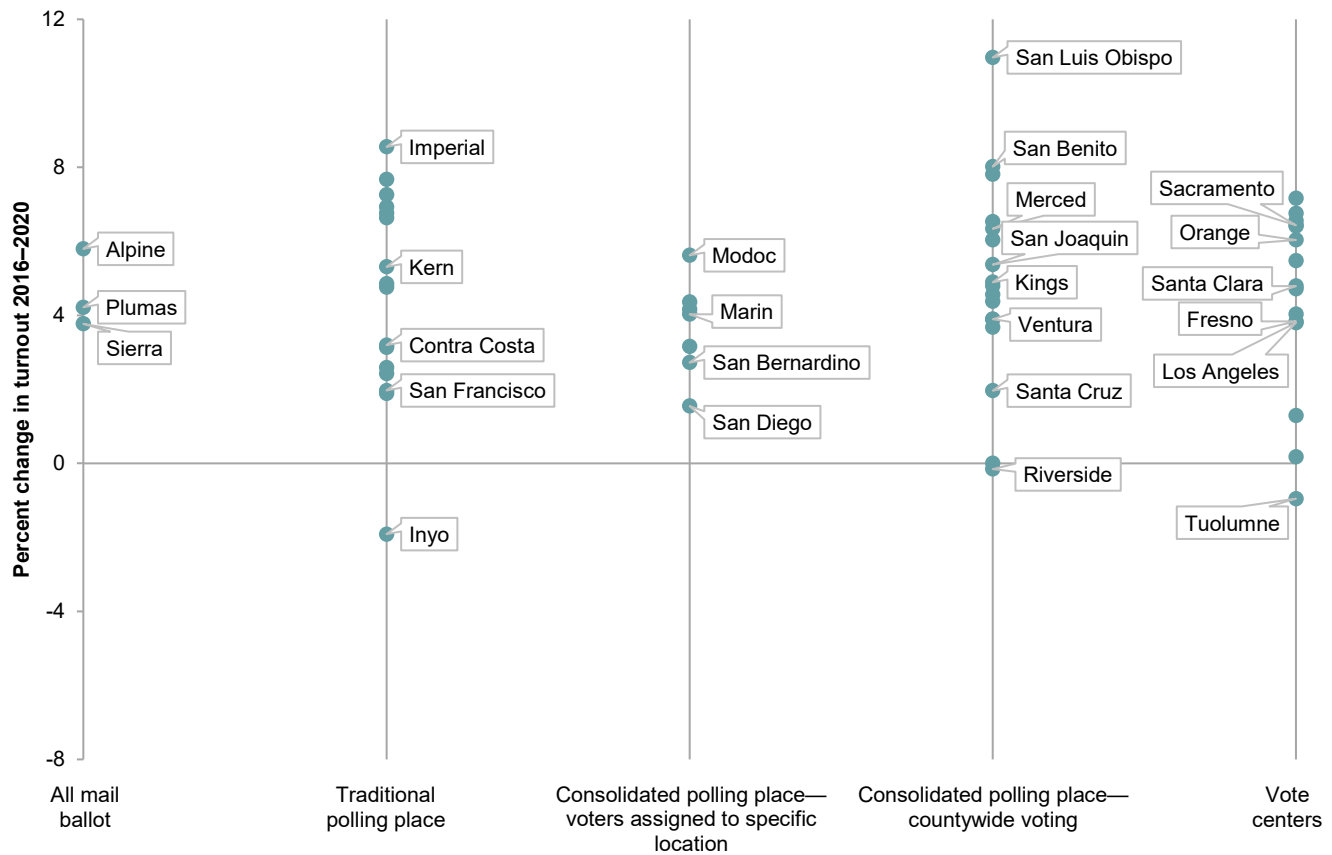
NOTES: Categories of election administration: *Relaxed excuse policy* are states that relaxed valid excuse to vote by mail; *Sent voters application* are states that sent everyone an application to vote by mail; *Sent voters ballot* are states that sent every voter a ballot; and *No change* refers to states that did not make any of the above changes. Turnout data accessed January 2021. In cases where some counties in a state made a change and others did not, the state is classified according to the policy used by a majority of its registered voter population. Colorado, Oregon, and Washington are listed as no change because they did not implement any of these changes for the November 2020 election.

Evidence of a policy effect is harder to see when looking within California at the state’s different approaches to in-person voting. Figure 4 shows the same turnout change from Figure 3, but for California’s counties and categorized by each county’s decision about in-person voting in 2020. Every voter received a ballot in the mail, and consistent with the pattern in Figure 3, virtually every county also had higher turnout in 2020. However, beyond that common increase, there is no clear pattern to discern across the different categories.

⁴ Using registered voters as the denominator makes this analysis consistent with the county analysis in the remainder of the report. Registered voters are easier to work with for counties, where the best estimates of the eligible population from the American Community Survey are often noisy and would need to be aggregated to PUMAs in many cases to achieve higher precision. To test the consequence of this choice of denominator, we ran an alternative model with the natural log of raw turnout as the outcome variable. The results, which can be found in Table A1 in the [Technical Appendix](#), were substantively unchanged.

FIGURE 4

In California, a county's change in turnout was unrelated to its approach to in-person voting



SOURCES: California Secretary of State, November 3, 2020, General Election; Polling Location and Drop-off Location Statistics as of October 10, 2020.

NOTE: Counties grouped by their election administration in 2020.

Turnout Effects

The ways in which states and counties varied their election policies serves as a natural experiment to test the consequences of these decisions. For *mail ballot* policy, this comparison is best made across the entire country, because many states like California implemented one policy for all voters within their borders. We can also use this general approach to get a sense of the consequences of other significant election reforms California implemented statewide between 2016 and 2020. Collectively these reforms might have had their own effect, and comparing California to the rest of the country allows us to test that idea while also accounting for a range of other factors. However, the range of *in-person* voting policies used within California is best understood by comparing counties within the state, and so requires a separate analysis.⁵

⁵ We prefer this comparison to a comparison of fall 2020 to fall 2018, or fall 2020 to spring primary 2020. These other comparisons would mostly just move a few VCA counties into a control category of no change, while introducing the problem of comparisons across types of elections (primary/midterm/presidential). Primary elections also raise questions about the role of the competitiveness of each party's primary and the number of party supporters in each county.

Table 1 shows the results of the national comparison for the last 30 years of presidential elections. Turnout among registered voters was an average of 3.9 percentage points higher after states and counties began mailing every voter a ballot. Our approach allows us to see whether this before-and-after effect was different for the states that adopted the policy in 2020. The results suggest only a small change despite the extraordinary circumstances: states and counties that adopted the policy under the pandemic saw a turnout increase of 4.6 percent, 0.7 percent higher than for states and counties that adopted the policy in earlier elections.

By contrast, mailing every voter a vote-by-mail application (0.8% increase) and removing restrictions on signing up for voting by mail (1.0% increase) have had smaller effects in earlier election cycles. It is worth noting that we identified only one county prior to the pandemic that mailed all voters an application, so pre-pandemic evidence for this policy is highly tentative. In 2020, by contrast, mailing applications produced a modest turnout increase (1.7%). States and counties that removed their excuse requirements last year actually saw their turnout decline (-2.7%), though this decline was measured only against their longer-term trend of rising turnout.⁶ If we ignore these longer-term trends, the switch to no-excuse mail voting had no effect in 2020 at all.

These estimates account for a wide range of factors that people may have considered when choosing whether they would vote. These factors include each county's average COVID-19 caseload in the month before the general election in 2020, the competitiveness of the state in the most recent and earlier presidential contests, and the other significant reforms to the election process that have been adopted in recent years. (Details are in the [Technical Appendix](#).)

In many states and in most counties in California, a high share of voters were already using vote-by-mail before the pandemic. This likely minimized the impact of mailing every voter a ballot, since so many voters had already made the switch to voting by mail. To address this issue, we show estimates in Table 1 of the effect of all-mail elections *on those who voted in person at their local precinct before the change*.⁷ The result suggests a substantial turnout increase of 9.6 percent among this population. Like the overall effect of all-mail elections, this estimate was approximately the same in 2020 (10.6%), even though the election context was very different. This suggests that the pandemic, despite the chaos it has wrought more generally, did not fundamentally alter the dynamics of this reform.

⁶ The estimates in Table 1 come from models that include county-specific linear trends, so every number is measured against where those trends *expect* the county to be at a given point in time. Models without these county-specific trends are in the [Technical Appendix](#), and show that moving to no-excuse mail voting likely had no effect on turnout in 2020 at all. All of these estimates, including the positive effects for mailing all voters a ballot, could be biased in a negative direction if counties that made changes were especially worried about low turnout in 2020. In that case, the apparent effect may be nothing more than county election officials anticipating a turnout decline. It is especially challenging to estimate the effect of mailing all voters an application, because it is difficult to identify every jurisdiction that decided to take this approach. We have done as exhaustive a search as possible, but we were probably more likely to identify the change for states or counties that were especially worried about a decline in turnout and so made a point of announcing the change to the media.

⁷ Following Gerber et al. (2013) we added an interaction between adoption of all-mail elections and the share voting by mail in the last election before the change. This interaction serves as a weight on the treatment effect and leaves the main effect of all-mail elections as an estimate of the treatment effect for a hypothetical county with no by-mail voters.

TABLE 1

Across the US, mailing all voters a ballot had the strongest effect of the mail-ballot reforms

	2020		1992–2016	
	Effect	Margin of Error	Effect	Margin of Error
Mailing all voters a ballot				
Overall effect	4.6%	+/-1.2%	3.9%	+/-1.0%
Effect for precinct voters	10.6%	+/-2.6%	9.6%	+/-2.4%
No-excuse mail voting	-2.7%	+/-0.6%	1.0%	+/-0.4%
Mailing all voters a vote-by-mail application	1.7%	+/-0.6%	0.8%	+/-0.2%

SOURCES: David Leip’s Atlas of US Presidential Elections (county turnout and registration); [Pew Research Center Non-Precinct Place Voting Study](#) (election policies); National Conference of State Legislatures (election policies); Election Administration and Voting Survey (election policies); [Thompson et al. \(2020\) replication file](#) (early Washington vote-by-mail numbers); [New York Times COVID-19 database](#).

NOTES: Effect estimates come from a difference-in-differences model of county registered voter turnout in presidential elections, 1992–2020. Margins of error are two-tailed 95 percent confidence intervals from the t distribution. Models controlled for other election administration changes, average COVID-19 caseload in the month before the election, state competitiveness in the presidential election, and county-specific time trends. Alternative specifications, including an event study model to test for differential trends pre- and post-treatment, can be found in the [Technical Appendix](#).

In 2020, California used several reforms for the first time in a presidential election besides mailing every voter a ballot. Among other changes, the state extended the deadline for receiving a ballot that had been postmarked by election day, paid for the cost of postage for returning the ballots, created a statewide online ballot tracking service for voters (BallotTrax), spent extra money on communication and outreach, and opened late registration options (called “conditional registration”) at every in-person voting site. The state also made some decisions that might have discouraged voting, such as refusing to require voters to wear a mask when voting in person.

It is difficult to test the effect of the above changes individually because the state adopted all of them at the same time. However, we can say that California’s turnout increased about 1.3 percent (with a margin of error of 1.6%) in 2020 beyond what we would have expected from the other reforms we analyze. We cannot say for certain that this difference stemmed from the policy decisions, but it gives a sense of the magnitude of the likely effect, if there was one.

California altered options for in-person voting in 2020 as well, and Table 2 shows an analysis of these changes using turnout results just from California. The comparison is always against counties that stayed with traditional polling places. The largest effects came from either the VCA (1.5%) or the similar approach of consolidating precincts and allowing countywide access to each one (1.4%). However, the results here are statistically uncertain, in part because the data are more limited. It is important to note that because the comparisons here are all within California, where every voter was mailed a ballot, they capture the *additional* effect of the various in-person options, above and beyond the effect of all-mail balloting in Table 1. This analysis also accounted for the number of drop boxes and in-person voting locations in a county, and these decisions did not seem to have much effect on overall turnout.⁸

⁸ Testing the effect of these policy decisions on in-person voters—as we did with the national comparisons—is difficult in California because the vote-by-mail rate was so high everywhere in the state prior to the switch. For all-mail counties outside of California, the 10th percentile of previous vote-by-mail rates was 8 percent, while in California it was 56 percent. This makes the extrapolation to a hypothetical zero mail county realistic in the national data but unrealistic in California.

TABLE 2

New in-person options in California had only slightly higher turnout relative to traditional polling places

	Effect	Margin of Error
VCA	1.5%	+/-1.8%
Consolidated Precincts		
Countywide access	1.4%	+/-2.0%
Neighborhood-only access	-0.8%	+/-2.4%

SOURCE: California Secretary of State.

NOTES: Effect estimates come from a difference-in-differences model of county registered voter turnout, 1992–2020, with county-specific time trends. Margins of error are two-tailed 95 percent confidence intervals from the t distribution. Full results, plus an alternative specification without the trends, can be found in the [Technical Appendix](#).

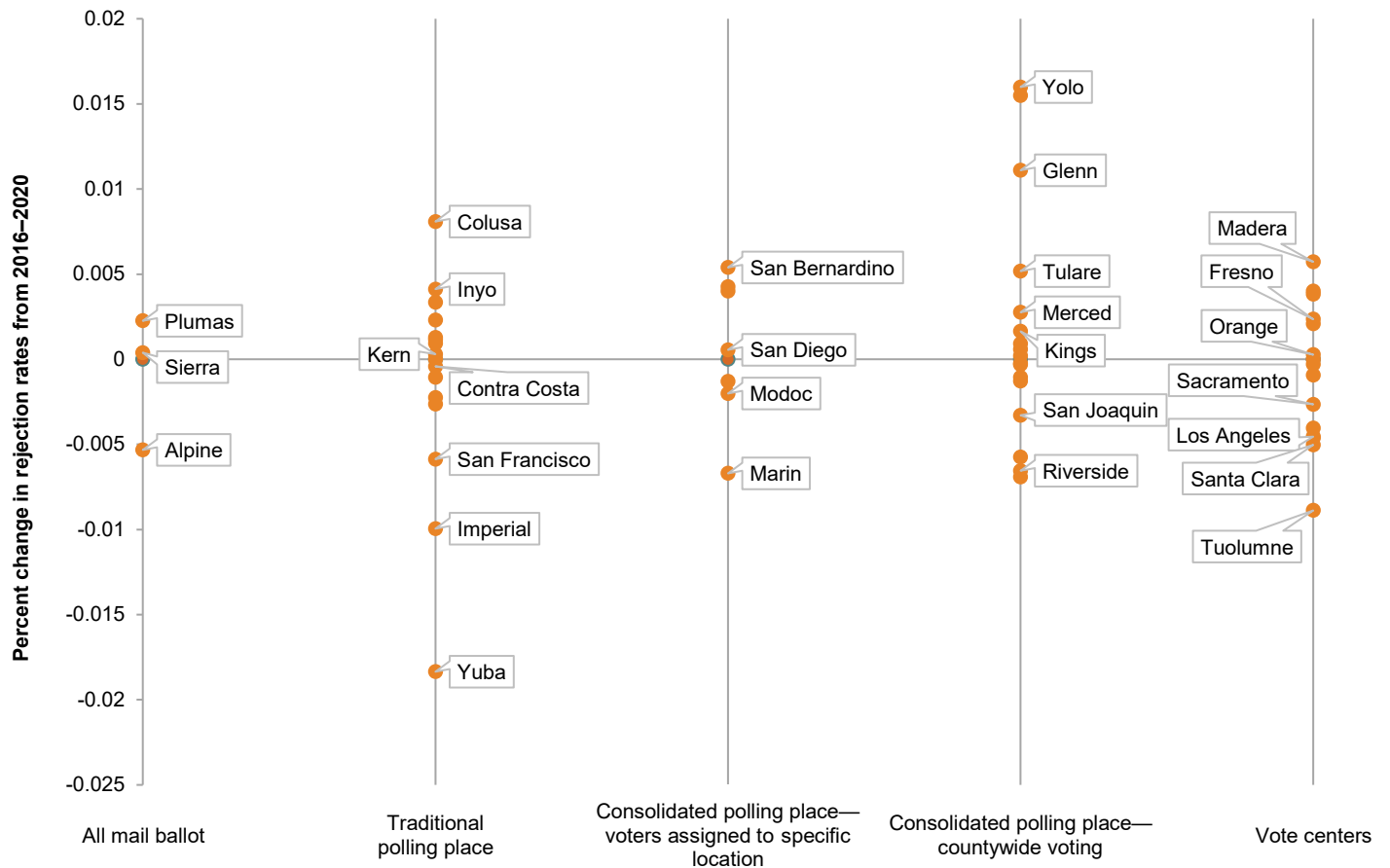
Mail Ballot Rejection

Some mail ballots are rejected each year, mostly because they arrive too late to be counted or because the signature on the envelope does not match the one on file (Alexander and Romero 2020). Election administrators in California worried about higher ballot rejection in 2020, given the large number of people voting by mail for the first time. The state took steps to limit the problem, including extending the ballot deadline to 17 days after the election, increasing the number of drop boxes in many counties, and establishing a statewide ballot tracking system for the first time. The state already had a flexible “curing period” that gave many voters with ballot problems the opportunity to fix them and ensure their ballot was counted.

Despite the higher number of mail voters, the rejection rate for mail ballots in California actually declined 0.1 percent in 2020, from 0.7 percent in 2016 to 0.6 percent. The change was scattered throughout the state, with only 27 out of 58 counties reporting a decline (see Figure 5, and the [Technical Appendix](#) for full county listing). Likewise, the decline in rejection rates was unrelated to the number of drop boxes or in-person locations in a county, or to the county’s method of in-person voting (see Figure A1 and Figure A2 in the [Technical Appendix](#)).

FIGURE 5

Vote-by-mail rejection rates were unrelated to a county's approach to in-person voting



SOURCE: California Secretary of State, November 3, 2020, General Election. Polling Location and Drop-off Location Statistics as of October 10, 2020.
 NOTE: Counties grouped by their election administration in 2020.

The absence of county patterns suggests any overall decline was, if anything, a product of statewide policy, such as the extension of the deadline or the ballot tracking system. There was also strong messaging in 2020 around sending ballots in early to avoid bottlenecks, and ballots did arrive much earlier on average. However, the many people voluntarily sending ballots in weeks early were probably not the same ones that had missed the deadline in years past. That said, the difference is small and we do not have data on the reasons for the rejections to test these ideas explicitly.

Conclusion

The decision to mail every voter a ballot likely increased turnout by several percentage points in California and in states across the nation. This substantial effect for universal mailed ballots came on top of extraordinarily high turnout for a presidential election. By contrast, no clear evidence shows that the different options California counties offered for in-person voting had a significant effect on turnout, though approaches that offered countywide access to any polling location might have increased turnout about 1.5 percentage points. Finally, the

mail-ballot rejection rate improved in 2020 but had no clear patterns at the county level, making it likely that, if anything, a change in statewide policy was the cause of the improvement. The meaningful policy change might have been the extension to the deadline for returning ballots or the new ballot tracking system.

These results suggest that, of the options considered here, making the pandemic-induced decision to mail every voter a ballot permanent would be the most effective approach to increasing turnout. It also appears that this approach could increase turnout without moving to a full VCA-style system. One possible in-between approach—mailing every voter a vote-by-mail *application* instead of an actual ballot—does not appear to be as effective at increasing turnout, though it did appear to encourage participation in other states during the pandemic.

Our analysis reviews only patterns of turnout and ballot rejection. We do not make any claims about which approaches are more administratively feasible or cost-effective. There are arguments on both sides of the change in terms of security, sustainability, technical simplicity, and cost. Nor do we evaluate the equity of these policies. Policies might have increased turnout overall while exacerbating turnout gaps between underrepresented groups such as Latinos or young people and others. This will be an important question moving forward when data become available.

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Vote-by-Mail and Voter Turnout in the Pandemic Election

Technical Appendix

CONTENTS

Appendix A. Full model results and alternative specifications

Eric McGhee, Jennifer Paluch, and Mindy Romero

Appendix A. Full Model Results and Alternative Specifications

Understanding the turnout consequences of policy decisions about voting by mail requires accounting for many variables in motion in the 2020 election. States changed more than just their policies on voting by mail; a number of them also used registration reforms like automatic voter registration for the first time in a presidential election. The coronavirus itself might have been a factor in turnout by discouraging voters from participating where caseloads were high. And there were the normal dynamics of a presidential election, where battleground states likely had higher turnout than others. Even beyond all these visible forces there were likely invisible ones that drove higher or lower turnout in certain areas of the country for reasons that are not easy to identify.

The tremendous diversity in election policies and other dynamics across the country's more than 3000 counties can help us isolate the effect of the vote-by-mail policies themselves. This can give us perspective on the consequence of mailing ballots in states like California, where the universality of the policy would otherwise make it difficult to understand its effects. A similar comparison of counties within California can estimate the effect of the in-person voting options. This appendix contains the results of difference-in-differences models run on county-level data from 1992 through 2020 that leverage this variation.

We ran nine national models, each with county and year mean centered data to estimate a full difference-in-differences model:

- **Model 1** included an interaction between all-mail balloting and the share of ballots cast by mail the last election before the reform was adopted (as a way of estimating the effect on in-person voters); county-specific linear trends; controls for average COVID cases in the last month before the election, the state's absolute presidential vote margin, a dummy for counties where the denominator was active registrants only, election reforms other than all vote-by-mail, and interactions with the 2020 election year. Because no state or county adopted election-day registration or early voting in 2020, we did not interact those two reforms with the 2020 dummy.
- **Model 2** was identical to Model 1 and also included an interaction between a California dummy and the 2020 election year, to explore California's unique experience under the pandemic.
- **Model 3** was identical to Model 1 but did not include the interaction with the VBM rate in the last election before all-mail balloting.
- **Model 4** was identical to Model 3 but without the county-specific linear trends.
- **Model 5** was identical to Model 4 but without the 2020 interactions, and with county-by-decade fixed effects to test for non-linear changes over time.
- **Model 6** used the natural log of raw county turnout as the outcome variable, to test the consequences of total registration as the denominator. The model omitted the interactions with the 2020 election year, but did include the county-specific linear trends.
- **Model 7** was identical to Model 4 but without the interactions with the 2020 election year.
- **Model 8** was identical to Model 4 but included only the all mail ballot reform to explore the possibility that its estimate was drawn from too limited a number of states.
- **Model 9** was an event study design to explore the possibility of pre- and post-treatment trends in all-mail ballot counties.

The models with county-specific linear trends test the parallel trends assumption of the difference-in-differences model. Because the point estimate for all vote-by-mail is largely the same, we choose to report the estimates from these more complete specifications in the [main text](#). The other models test the robustness of the significant all-vote-by-mail effect. All of these results are reported in Table A1. We also tested models that used the total

number of COVID cases in the month before the election and the linear case trend in the month before the election. The results were substantively identical.

Table A2 contains the estimates of the effect of in-person options in California. Here we ran four models: one with linear time trends, one without, and a version of each with controls for the number of drop boxes and in-person staffed voting locations in the county.

TABLE A1

Model results—all U.S. counties in presidential elections, 1992-2020

	Model 1 (main)	Model 2	Model 3 (main alternate)	Model 4	Model 5	Model 6 (outcome= ln(turnout))	Model 7	Model 8	Model 9 (event study)
Mail ballots to all	0.096 (0.012)	0.097 (0.012)	0.039 (0.005)	0.046 (0.005)	0.040 (0.004)	0.029 (0.005)	0.041 (0.004)	0.047 (0.004)	--
Mail ballots to all X last VBM %	-0.122 (0.020)	-0.126 (0.021)	--	--	--	--	--	--	--
No-excuse VBM	0.010 (0.002)	0.010 (0.002)	0.009 (0.002)	0.009 (0.002)	-0.006 (0.001)	0.004 (0.002)	0.007 (0.001)	--	0.008 (0.001)
VBM applications to all	0.008 (0.001)	0.008 (0.001)	0.007 (0.001)	0.032 (0.001)	-0.003 (0.002)	-0.005 (0.003)	-0.005 (0.002)	--	-0.007 (0.002)
Automatic voter registration	0.028 (0.005)	0.028 (0.005)	0.030 (0.005)	0.034 (0.004)	-0.012 (0.002)	-0.003 (0.004)	-0.014 (0.002)	--	-0.015 (0.002)
State presidential vote margin	-0.021 (0.008)	-0.021 (0.008)	-0.026 (0.008)	-0.022 (0.008)	-0.038 (0.007)	-0.111 (0.009)	-0.033 (0.008)	-0.023 (0.008)	-0.035 (0.008)
Permanent vote- by-mail	-0.018 (0.005)	-0.018 (0.005)	-0.012 (0.005)	-0.005 (0.004)	-0.020 (0.005)	--	-0.003 (0.004)	--	-0.010 (0.004)
Election-day registration	-0.004 (0.004)	-0.005 (0.004)	-0.016 (0.004)	0.013 (0.003)	-0.004 (0.003)	-0.001 (0.004)	0.011 (0.003)	--	0.012 (0.003)
Early voting	-0.006 (0.002)	-0.006 (0.002)	-0.006 (0.002)	0.002 (0.002)	-0.001 (0.002)	0.012 (0.003)	0.002 (0.002)	--	0.001 (0.002)
Active registrants as denominator	0.001 (0.005)	0.001 (0.005)	0.000 (0.005)	0.002 (0.004)	-0.023 (0.005)	-0.002 (0.005)	-0.006 (0.004)	-0.011 (0.004)	-0.006 (0.004)
Mail ballots to all X 2020	0.010 (0.014)	0.011 (0.014)	0.007 (0.005)	0.009 (0.004)	--	--	--	-0.018 (0.004)	--
Mail ballots to all X last VBM % X 2020	-0.013 (0.022)	-0.017 (0.022)	--	--	--	--	--	--	--
No-excuse VBM X 2020	-0.037 (0.003)	-0.037 (0.003)	-0.037 (0.003)	-0.008 (0.003)	--	--	--	--	--
VBM applications to all X 2020	0.009 (0.002)	0.009 (0.002)	0.009 (0.002)	-0.035 (0.003)	--	--	--	--	--

	Model 1 (main)	Model 2	Model 3 (main alternate)	Model 4	Model 5	Model 6 (outcome= ln(turnout))	Model 7	Model 8	Model 9 (event study)
Automatic voter registration X 2020	-0.060	-0.060	-0.059	-0.067	--	--	--	--	--
	(0.005)	(0.005)	(0.005)	(0.004)					
Average COVID cases last month X 2020	0.000	0.000	0.000	0.000	0.000	0.000	--	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
State presidential vote margin X 2020	-0.022	-0.025	-0.023	-0.045	--	--	--	-0.030	--
	(0.013)	(0.013)	(0.012)	(0.011)				(0.010)	
California X 2020	--	0.013	--	--	--	--	--	--	--
		(0.008)							
Treatment lag -3 or more	--	--	--	--	--	--	--	--	-0.013
									(0.003)
Treatment lag -2	--	--	--	--	--	--	--	--	-0.002
									(0.002)
Treatment year	--	--	--	--	--	--	--	--	0.031
									(0.004)
Treatment lead +1	--	--	--	--	--	--	--	--	0.047
									(0.006)
Treatment lead +2	--	--	--	--	--	--	--	--	0.050
									(0.005)
County mean centering	X	X	X	X		X	X	X	X
Year mean centering	X	X	X	X	X	X	X	X	X
County trends	X	X	X			X			
Decade X county mean centering					X				
RMSE	0.038	0.038	0.038	0.046	0.037	0.051	0.047	0.047	0.046
N	23037	23037	23044	23044	23044	23044	23044	23044	23044

SOURCES: David Leip's Atlas of U.S. Presidential Elections (county turnout and registration); Pew Research Center Non-Precinct Place Voting Study (election policies); National Conference of State Legislatures (election policies); Election Administration and Voting Survey (election policies); Thompson, et al. (2020) replication file (early Washington vote-by-mail numbers); New York Times COVID-19 database.

NOTES: Cell entries are ordinary least squares coefficients with clustered standard errors. Treatment lags for the event study model are defined in relation to the adoption of all-mail balloting; one-election lag is omitted to identify the model. Lagged vote-by-mail rate (from 2016) was not available for Vermont, so for that state only we used the vote-by-mail rate from the following midterm election (2018).

TABLE A2

Model results: California counties in presidential elections, 1992–2020.

	Model 1	Model 2	Model 3	Model 4
Consolidated precincts available to anyone in county	0.014 (0.010)	0.024 (0.010)	0.023 (0.013)	0.004 (0.015)
Voter's Choice Act	0.015 (0.011)	0.021 (0.009)	0.021 (0.013)	0.003 (0.016)
Consolidated precincts available to neighborhood	-0.008 (0.013)	0.011 (0.012)	0.015 (0.013)	-0.021 (0.015)
All-mail (no in-person)	0.008 (0.023)	-0.008 (0.006)	-0.009 (0.006)	0.006 (0.023)
Drop boxes per 10,000 voting-eligible residents	--	--	-0.004 (0.003)	0.004 (0.002)
Staffed voting locations per 10,000 voting-eligible residents	--	--	-0.001 (0.003)	-0.002 (0.002)
County mean centering	X	X	X	X
Year mean centering	X	X	X	X
County trends	X			X
RMSE	0.025	0.029	0.029	0.025
N	464	464	464	464

SOURCES: California Secretary of State.

NOTES: Cell entries are ordinary least squares coefficients with clustered standard errors.

TABLE A3

Data balance: number of counties using each reform by year

	1992	1996	2000	2004	2008	2012	2016	2020
No-excuse VBM	540	750	1113	1179	1447	1574	1661	2405
Mail ballots to all	0	2	38	43	75	78	162	327
VBM applications to all	0	0	0	0	0	0	1	719
Automatic voter registration	0	0	0	0	3	3	198	677
Election-day registration	147	311	311	311	466	466	530	588
Early voting	749	881	1349	1798	1900	1964	1978	1978

SOURCES: David Leip's Atlas of U.S. Presidential Elections (county turnout and registration); [Pew Research Center Non-Precinct Place Voting Study](#) (election policies); National Conference of State Legislatures (election policies); Election Administration and Voting Survey (election policies); [Thompson, et al. \(2020\) replication](#) (early Washington vote-by-mail numbers); [New York Times COVID-19 database](#).

NOTES: Cell entries are the total number of counties that used each reform in each year.

TABLE A4

Data balance: counties newly adopting only the specified reform in each year

	1992	1996	2000	2004	2008	2012	2016	2020
No-excuse VBM	212	173	82	0	268	102	87	631
Mail ballots to all	0	1	36	5	32	1	20	49
VBM applications to all	0	0	0	0	0	0	1	582
Automatic voter registration	0	0	0	0	3	0	195	227
Election-day registration	146	164	0	0	155	0	0	0
Early voting	420	95	187	383	102	37	14	0

SOURCES: David Leip's Atlas of U.S. Presidential Elections (county turnout and registration); [Pew Research Center Non-Precinct Place Voting Study](#) (election policies); National Conference of State Legislatures (election policies); Election Administration and Voting Survey (election policies); [Thompson, et al. \(2020\) replication file](#) (early Washington vote-by-mail numbers); [New York Times COVID-19 database](#).

NOTES: Cell entries are the total number of counties that added that reform—and only that reform—for the first time that year. For example, a county that added only two reforms—Election Day registration in 2012 and automatic voter registration in 2016—would be counted with each reform in the corresponding year but not in any other cell. By contrast, a county that added the same two reforms in the same year would be counted nowhere, because it had never adopted a reform by itself.

TABLE A5

Vote-by-mail ballot rejection rates by county, 2016 and 2020

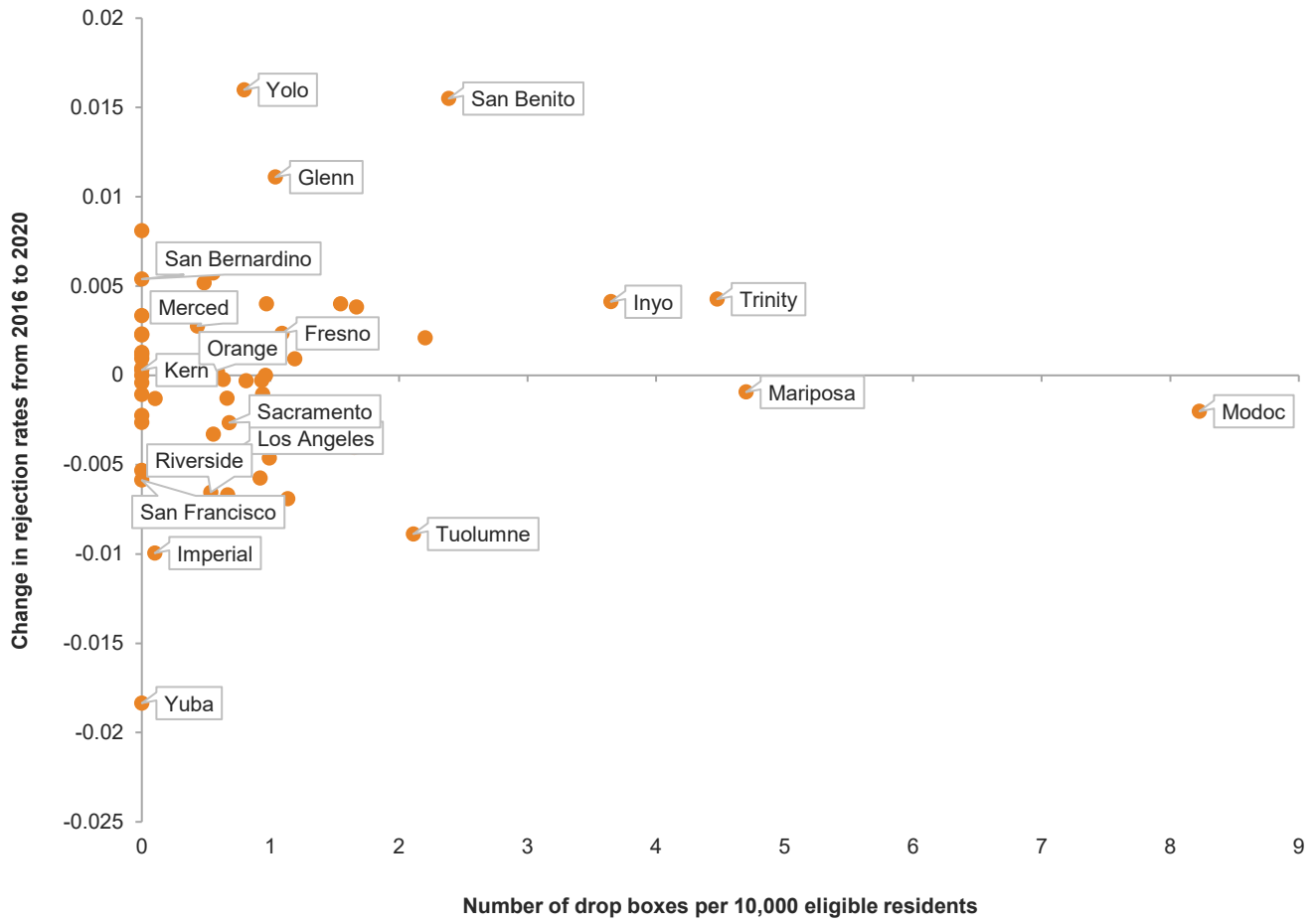
	2016	2020	Change (2020 – 2016)		2016	2020	Change (2020 – 2016)
Alameda	0.44%	0.50%	0.06%	Orange	0.39%	0.42%	0.03%
Alpine	0.80%	0.27%	-0.53%	Placer	0.48%	0.37%	-0.11%
Amador	0.20%	0.41%	0.21%	Plumas	0.01%	0.24%	0.23%
Butte	0.95%	0.49%	-0.46%	Riverside	1.28%	0.62%	-0.65%
Calaveras	0.34%	0.73%	0.38%	Sacramento	0.52%	0.26%	-0.26%
Colusa	0.54%	1.35%	0.81%	San Benito	0.65%	2.20%	1.55%
Contra Costa	0.41%	0.36%	-0.04%	San Bernardino	0.49%	1.03%	0.54%
Del Norte	1.93%	1.71%	-0.22%	San Diego	0.44%	0.49%	0.06%
El Dorado	N/A	0.37%	N/A	San Francisco	0.82%	0.23%	-0.59%
Fresno	1.13%	1.37%	0.23%	San Joaquin	0.69%	0.36%	-0.33%
Glenn	0.35%	1.46%	1.11%	San Luis Obispo	1.18%	0.60%	-0.58%
Humboldt	0.43%	0.83%	0.40%	San Mateo	0.42%	0.39%	-0.03%
Imperial	2.04%	1.04%	-1.00%	Santa Barbara	0.72%	0.59%	-0.13%
Inyo	0.45%	0.86%	0.41%	Santa Clara	0.70%	0.20%	-0.50%
Kern	0.82%	0.85%	0.03%	Santa Cruz	0.38%	0.35%	-0.03%
Kings	0.20%	0.37%	0.16%	Shasta	0.41%	0.30%	-0.11%
Lake	0.87%	0.97%	0.09%	Sierra	0.37%	0.41%	0.04%
Lassen	0.20%	0.29%	0.09%	Siskiyou	0.41%	0.75%	0.33%
Los Angeles	1.07%	0.62%	-0.45%	Solano	0.29%	0.52%	0.23%
Madera	0.49%	1.06%	0.57%	Sonoma	0.49%	0.51%	0.02%
Marin	1.03%	0.36%	-0.67%	Stanislaus	0.89%	0.76%	-0.13%
Mariposa	0.71%	0.62%	-0.09%	Sutter	1.04%	0.35%	-0.69%
Mendocino	N/A	0.22%	N/A	Tehama	0.53%	0.65%	0.13%
Merced	0.77%	1.04%	0.28%	Trinity	0.61%	1.04%	0.43%
Modoc	1.21%	1.01%	-0.20%	Tulare	0.92%	1.44%	0.52%
Mono	0.65%	0.77%	0.12%	Tuolumne	1.07%	0.18%	-0.89%
Monterey	0.69%	0.42%	-0.26%	Ventura	0.48%	0.46%	-0.02%
Napa	0.71%	0.31%	-0.40%	Yolo	0.18%	1.78%	1.60%
Nevada	0.06%	0.46%	0.40%	Yuba	2.79%	0.95%	-1.84%

SOURCES: California Secretary of State.

NOTES: Rejection rates are rejected ballots as a share of all vote-by-mail ballots returned. Missing data indicates nonreporting counties.

FIGURE A1

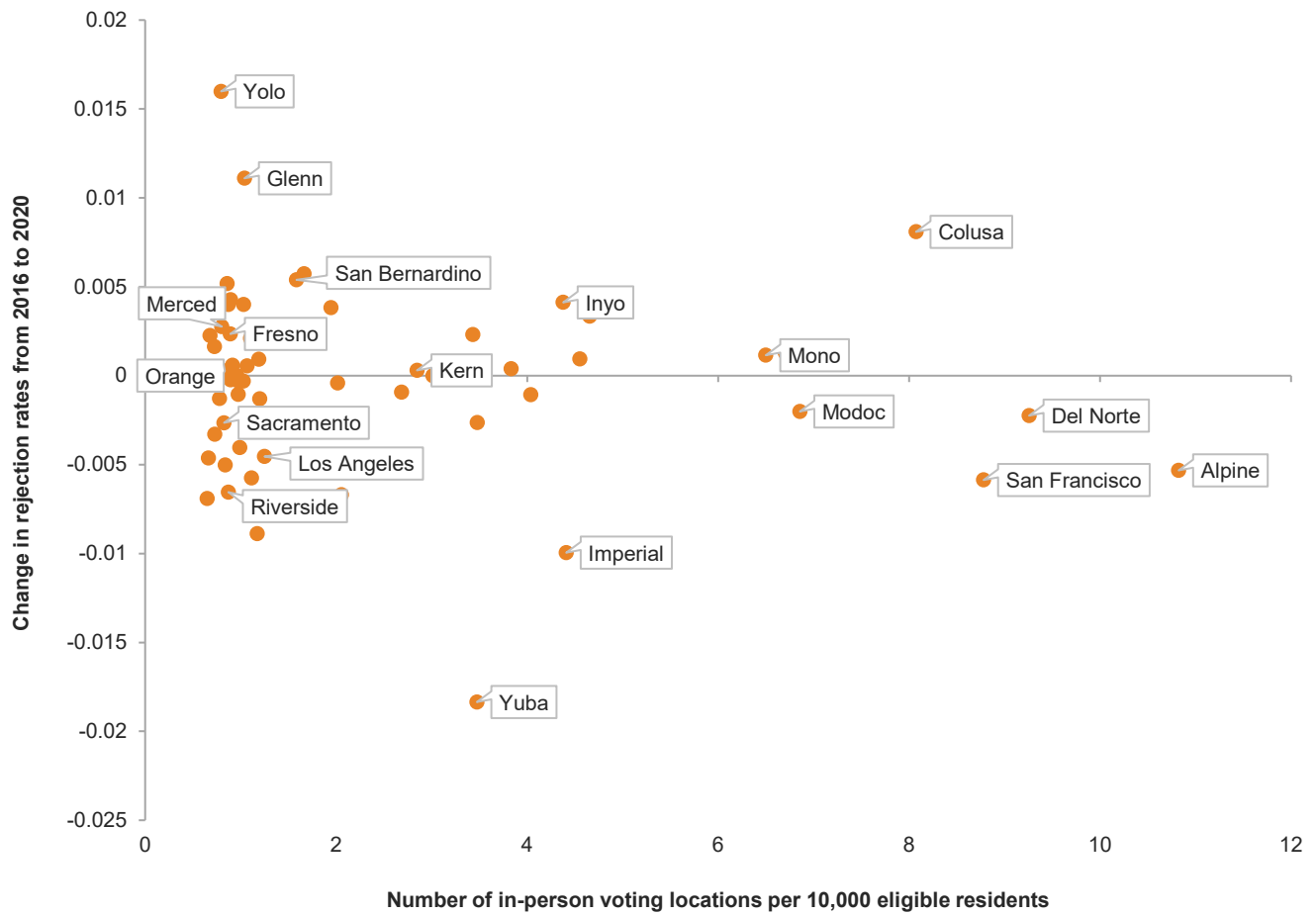
Change in county vote-by-mail rejection rates by number of drop boxes



SOURCE: California Secretary of State.

FIGURE A2

Change in county vote-by-mail rejection rates by number of in-person voting locations



SOURCE: California Secretary of State.



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