American Economic Journal: Economic Policy 2026, 18(1): 159–189
https://doi.org/10.1257/pol.20240630

Cross-State Strategic Voting[†]

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We estimate that 3.1 percent of US voters, or 6.1 million individuals, were registered to vote in two states in 2020, opening up the possibility for them to choose where to vote. Double registrants are concentrated in the wealthiest zip codes and respond to both incentives and costs, disproportionately choosing to vote in swing states (higher incentive) and states that automatically send out mail-in ballots (lower cost). We call this behavior Cross-State Strategic Voting. While others have documented strategic incentives on who to vote for, this paper is the first to consider strategic incentives on where to vote. (*JEL* D63, D72, K16)

Trust in elections is critical to the legitimacy of a democracy, but many Americans have little confidence in how elections are administered (e.g., Marist Poll, October 2021; MIT Data and Science Lab 2021). Court cases and the literature have focused on *within*-state election issues, such as certification, polling locations, and voter ID laws. Far less is known about *cross*-state issues because states run their elections independently, with no formal mechanism to coordinate voter registrations or votes across states.

The lack of central coordination introduces the possibility that individuals could vote in states they no longer live in, creating concerns about fairness and election integrity. If some individuals can choose where to vote and others cannot, this violates the principle of one person, one vote: "one person's voting power ought to be roughly equivalent to another person's within the same state" (Cornell Law Dictionary 2022).[1] However, individuals who are able to choose which state to vote in can have disproportionate influence, because a vote in a swing state has a greater impact due to the electoral college. Concerns about these cross-state issues have led to recent legislation. For example, Senate Bill 1260, signed into Arizona law in June

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[†]Go to https://doi.org/10.1257/pol.20240630 to visit the article page for additional materials and author disclosure statement(s).

[1] In Reynolds versus Sims (1964), the Supreme Court held that "The Equal Protection Clause requires substantially equal legislative representation for all citizens in a State regardless of where they reside."

2021, specifies that "A person is guilty of a class 5 felony who … [k]nowingly provides a mechanism for voting to another person who is registered in another state."[2]

These concerns and legislative actions exist despite a lack of evidence on how many people are registered to vote in two different states, their characteristics, and their voting behavior. We provide this evidence using comprehensive data from 2020 on all 203 million US voter registrations. This paper is the first in the literature to (i) estimate the number of double registrants and their characteristics, and (ii) document how their voting responds to incentives and costs.

We define a double registrant as the same person listed on two different state voter rolls at the same point in time (specifically, October 2020). This definition is both objective and measurable. Of course, this definition includes cases where individuals have moved and registered in a new state but remain registered in the old state and do not know it. A separate, and interesting, question is how many double-registered individuals *know* they are double registered, but unfortunately, this is difficult to measure.

We identify double registrants using state voter rolls. The same name appearing on the voter rolls of two different states could either be the same person or different people who happen to share a name. If it is the same person, the probability of the same birthday is 1; if they are different people, this probability will be much smaller. We use the empirical frequency that same-named people share the same birthday and the Law of Total Probability to estimate that 3.1 percent of voters are registered in two states. In other words, pairs of registrants in different states with the same name have the same birthday more often than would be expected by chance, and we use that excess probability to estimate that 6.1 million individuals are double registrants.[3]

We next consider the rate of double registration by measures of wealth and income, using the same Law of Total Probability approach. Based on zip code-level housing values, the bottom quartile has a 2.2 percent double-registration rate. This rate jumps in the upper tail of the distribution. For individuals at or above the ninetieth, ninety-fifth, and ninety-ninth percentiles, the rates are 4.7 percent, 5.8 percent, and 8.0 percent, respectively. In other words, compared to the bottom quartile, the rate of double registration is over twice as high among the top 10 percent and 3.6 times as high among the top 1 percent. Using zip code-level income yields a similar pattern. Historically, voting power depended on property ownership and income in the United States; legislation and court decisions have attempted to sever this link. However, our evidence points to richer voters having disproportionately more voting power via double registration. This fact, along with growing concerns about wealth and income inequality (e.g., Piketty and Saez 2003; Smith, Zidar, and Zwick 2023), exacerbates any fairness concerns that come with double registration.

The Law of Total Probability allows us to estimate the size and distribution of the double-registered population, but does not identify which particular individuals

[2] A federal judge issued a preliminary injunction blocking this provision in 2022, but the 9th US Circuit Court of Appeals removed the injunction in 2024.

[3] We emphasize that there is nothing illegal about being registered in two states, as individuals are not automatically de-registered when they move.

Table 1—Summary Statistics for Registered Voters

	All registrants	Registrants with cell phone and other info	Known double registrants
2020 presidential election (*percent*)			
Vote	74.4	78.1	81.3
Vote in first state	–	–	9.8
Voting history (*percent*)			
Vote in general elections	64.0	65.6	66.5
Vote in primary elections	23.0	23.7	22.3
Vote in minor elections	8.7	8.8	6.5
Party and donations (*percent*)			
Republican	31.1	32.7	21.6
Democrat	41.0	41.6	46.9
Independent	28.0	25.6	31.5
FEC donor	1.5	1.8	2.7
Demographics (*percent*)			
Male	47.0	46.4	52.2
White	70.9	70.4	70.7
Hispanic	13.6	14.4	14.0
Black	11.8	11.7	10.7
Asian	3.7	3.5	4.7
Low wealth	32.3	30.2	20.8
Middle wealth	49.3	49.6	49.8
High wealth	18.4	20.2	28.0
Low income	22.7	22.1	18.4
Middle income	57.6	57.1	51.5
High income	19.7	20.8	30.1
Married	40.8	43.5	42.0
Any children	35.5	38.4	44.6
Homeowner	63.8	66.8	49.5
Born pre-1955	22.9	22.7	12.8
Born 1955–1964	17.7	19.7	12.9
Born 1965–1974	16.0	18.2	15.6
Born 1975–1984	15.6	17.7	22.2
Born 1985–1994	16.8	15.5	31.2
Born post-1994	10.9	6.3	5.3
Observations	202,535,296	90,234,280	583,835

Notes: Column 1 reports summary statistics for all registered voters as of October 2020; column 2 for those with the information required to match individuals across states, where the main constraint is the availability of cell phone numbers; and column 3 for registered voters who we identify as double-registrants. "Vote in first state" is an indicator for voting in the first (earlier) state of registration. "Voting history" refers to the share of even-year general, even-year primary, and minor elections that an individual voted in before 2020. In column 3, party affiliation is based on the second (later) state of registration. FEC donor is an indicator for making at least one FEC donation by 2020. Low wealth, Middle wealth, and High wealth denote zip codes where the Zillow monthly average home value index for single-family houses in 2020 is below $200,000, $200,000 to $500,000, and above $500,000, respectively. Low income, Middle income, and High income denote zip codes where average annual adjusted gross income from IRS data is below $50,000, $50,000 to $99,999, and above $100,000, respectively.

are double registrants. To create such a sample, we exploit cell phone data, which we have for a subpopulation of registrants. The characteristics of this group closely match those of the full population (Table 1). We show that two people with the same name, gender, birth date information, and cell phone number registered in two different states are almost certainly the same person. Using this novel approach, we identify a sample of 583,835 double registrants.

Having identified a sample of double registrants, we next turn to their voting behavior in the 2020 presidential election. Ceteris paribus, these individuals may prefer to vote in the state with a strategic advantage. For example, a voter registered in both Mississippi and Georgia may choose to vote in Georgia because it is a swing state and Mississippi is not. Similarly, a voter registered in both Oregon and Idaho may prefer to vote in Oregon because it automatically sends them a mail-in ballot, unlike Idaho. We call this behavior *Cross-State Strategic Voting* (CSSV).[4]

Regardless of voter preferences, most state election laws specify that citizens should vote in the state of their legal domicile, and they can have only one (Greabe 2012). While an individual can be registered in two states, this does not mean they are eligible to vote in either state without regard to their domicile. Characteristics that help courts determine an individual's domicile include where they have a driver's license, where they pay state taxes, and where they spend the majority of the year. For example, the guidance given to service members, who relocate frequently, by the government is: "Your voting residence is within your state of legal residence or domicile … [it] is used for state income tax purposes, and determines eligibility to vote for federal and state elections … You have the option to establish residency or domicile each time you are transferred to a new location. Once you change your residence or domicile, you may not revert to a previous residence without re-establishing a new physical presence according to residency laws of that state" (Federal Voting Assistance Program n.d.).

If individuals are choosing where to vote based on costs and incentives (CSSV), there are two possible ways this could happen. First, someone may vote in a state that is not their legal domicile. This could be purposeful or due to ignorance of state voting laws.[5] Alternatively, voters may be willing to incur some costs to establish—or reestablish—domicile in a state they prefer to vote in. For example, a double registrant who moved from Arizona to California might spend resources or time in Arizona to reestablish domicile there in order to vote in a swing state. Absent these strategic behaviors, we would not expect where double registrants vote to coincide with whether states are swing or whether states make it easier to vote.

Nevertheless, we find strong evidence of CSSV. For each double registrant, we call the state with the earlier date of registration the "first" state and the state with the later registration the "second" state. If an individual's first state is a swing state, but the second is not, their likelihood of voting in the first state is 4.7 percentage points (pp) *higher* than if neither state is a swing state. This amounts to a 48 percent increase relative to a mean of 9.8 percent. In other words, when the opportunity to participate in a consequential election only exists in the first state, voters are more likely to vote there, despite having registered in another state more recently. Likewise, if only the second state is a swing state, they are 1.9 pp *less* likely to vote in the first state.

[4] Strategic voting (e.g., Duverger 1954; Farquharson 1969; Myerson and Weber 1993) typically refers to voting as if one's vote is pivotal, which can lead to voting for a less-preferred candidate if the preferred candidate is unlikely to win. In contrast, voters engaging in CSSV are strategic in their choice of state to vote in.

[5] Voting in a state that is not one's legal domicile is illegal and has resulted in a handful of prosecutions (Wines 2022).

Our measure of voting costs is whether a state automatically mails out ballots. We find that double registrants disproportionately choose to vote in the state that makes voting less costly. If only the first state auto-mails ballots, the likelihood of voting there increases by 20 percent of the mean. However, if only the second state does so, the likelihood of voting in the first state decreases by 31 percent.

We consider a variety of alternative explanations for our findings. First, choosing which state to vote in presupposes that a person will vote in the first place. Thus, one potential concern is that incentive and cost considerations influence the likelihood a person will vote at all, rather than the particular state in which they will vote. We address this concern by considering a subset of double registrants who are at least 99 percent likely to vote based an observable such as their voting history. This "identification at infinity" approach continues to show strong evidence of CSSV.

It is also possible that omitted variables play a role. However, the opposing signs of the coefficients based on whether only the first state or only the second state is a swing or auto-mailed ballot state suggest that (unordered) state-pair omitted variable bias is unlikely to be driving our results. Specifically, our analysis includes both double registrants who move from one state to another and those who move in the opposite direction. If there were an unobserved characteristic associated with state-pairs that included a swing state, both coefficients would have the same sign. Going a step further, when we include ordered state-pair level controls for election administration characteristics, voter roll maintenance, migration flows, and tax rates, the results remain robust.

Additionally, our findings are robust to using a continuous measure for the incentive to vote in a state. The main analysis uses a binary measure for whether a state is a swing state, but not all swing states are created equal: Iowa was much less of a swing state than Georgia in 2020. Moreover, the difference in closeness between a double-registrant's pair of states will also vary. For example, Georgia could be paired with a similarly close swing state like Arizona or with a less close swing state like Iowa. We find that, holding the closeness of the first state fixed, as the second state's election becomes less close, double registrants are more likely to vote in their first state.

We also find robust evidence of CSSV in the 2016 election, as well as using a different sample in 2020, constructed using uncommon names and birthdays (rather than cell phones) to identify double registrants. The pervasiveness of CSSV across different elections and algorithms to identify double registrants indicates that our results are not driven by the idiosyncrasies of the 2020 election or our reliance on cell phone information.

Note that if double registrants are unaware of their status or face significant costs for voting in their first state, this would work *against* us finding evidence of CSSV. Indeed, when we focus on a sample of dual-state homeowners, who are more likely to have an active connection to each state and may be more aware of their double-registrant status, we find larger incentive-based point estimates.

A natural question is whether the same incentives and costs lead double registrants to cast a ballot in both states. CSSV predicts that double voting should be most prevalent when both states are swing states, which is exactly what we find. We also document that auto-mailed ballots increase the likelihood of double voting. While not the focus of this paper, we find double voting to be extremely rare in the

2020 election (at most 0.031 percent of voter registrations), roughly in line with the estimate in Goel et al. (2020) for the 2012 election.

Finally, a back-of-the-envelope calculation indicates that CSSV did not affect the 2020 election; this is because the behavior of Republican and Democrat voters largely canceled each other out. Nevertheless, CSSV could be important in close elections, such as the 2000 election, which was won by 537 votes in Florida. In the same election, only 366 votes separated the candidates in New Mexico. The existence of a large population of double registrants also opens up the possibility that politicians or campaigns could activate them to vote strategically in swing states.

Our paper relates to three strands of the literature. The first tests for the presence of classical strategic voting, where individuals behave as if their vote is pivotal, include Fujiwara (2011); Kawai and Watanabe (2013); Spenkuch (2015); Anagol and Fujiwara (2016); Pons and Tricaud (2018); Spenkuch (2018); and Clark, Montagnes, and Spenkuch (2022). Our contribution is to identify a new and potentially consequential form of strategic voting: *Cross-State Strategic Voting*. In other words, while the existing literature demonstrates a strategic choice of *whom* to vote for, we show that individuals strategically choose *where* to vote.

Second, we contribute to the literature on potential violations of election law (e.g., Gronke et al. 2008; Minnite 2010; Fukumoto and Horiuchi 2011; Ichino and Schündeln 2012; Hidalgo and Nichter 2016; Cottrell, Herron, and Westwood 2018; Eggers, Garro, and Grimmer 2021; Cantoni and Pons 2021; Ferlenga and Knight 2022). Given new legislation targeting double registrants, we contribute by estimating the size and characteristics of this population and examining their behavior.

Third, our paper relates to work exploring the determinants of voting, including features of elections designed to lower voting costs, such as early voting, voting technology, and mail-in ballots (e.g., Braconnier, Dormagen, and Pons 2017; Bursztyn et al. 2017; Yoder et al. 2021; Cantoni 2020; Kaplan and Yuan 2020; Bechtel, Hangartner, and Schmid 2018; Spenkuch and Toniatti 2018; Fujiwara, Meng, and Vogl 2016; DellaVigna et al. 2016; Fujiwara 2015; Ortoleva and Snowberg 2015; Gerber, Huber, and Hill 2013; Gentzkow, Shapiro, and Sinkinson 2011). We find consistent evidence that costs matter using a new empirical design and unique samples of voters.

The remainder of the paper proceeds as follows. The next section describes our voter registration data. Section II estimates the prevalence of double registrants and Section III presents evidence of CSSV. Section IV concludes.

I. Data

Our data on voter registration across the United States is from L2, a well-known, nonpartisan data vendor used by political campaigns and the academic literature (e.g., Allcott et al. 2020; Brown and Enos 2021; Billings, Chyn, and Haggag 2021; Spenkuch, Teso, and Xu 2023; Chyn and Haggag 2023; Billings et al. 2024; Elder, Enos, and Mendelberg 2024). The L2 dataset contains information on registered voters in all 50 states (and DC), including their name, address, birth date, and voting history. In addition, L2 merges the state-level voter files with other administrative and commercial datasets, adding additional voter characteristics, such as cell phone number, and cleans the data.

The data also contain information on individuals' political partisanship. For 34 states (and DC), L2 assigns political affiliation using self-reported voter registration. For the remaining states, L2 infers party using a variety of data sources, including voter participation in primaries, demographics, exit polling, and commercial lifestyle data.[6]

L2 data is regularly tested by political campaigns in the field. Academic papers have also verified the accuracy of the partisanship measures in voter files. For example, Bernstein et al. (2022) validates the accuracy of L2 partisanship by comparing state files to L2 data; Brown and Enos (2021) runs a survey to verify L2 partisanship; Igielnik et al. (2018) compares commercial voter file data to Pew national survey microdata. In addition, when we sum L2's individual-level voting records by state, they closely match certified state totals. In all but six states, the vote totals in the L2 files exceed those in the certified totals (by 0.8 percent on average), consistent with (i) "residual voting" (casting a ballot to vote for some offices but not for president; see Stewart III et al. 2020), and (ii) some ballots not being counted for procedural reasons. In five of the remaining six states, the difference is small (-0.4 percent on average), which could be due to minor differences in when vote totals are certified versus when L2 receives the data.[7]

Another way to validate the quality of L2's registration information is to compare it to official data collected by the Election Administration and Voting Survey (EAVS). Supplementary Appendix Table A1 shows that the number of voters in each state according to the L2 data tends to be around 90 percent of the corresponding number in EAVS, consistent with L2 cleaning its data.[8]

We determine voter registration dates using the information on state rolls. Since North Dakota does not have voter registration and New Hampshire does not report voters' registration dates in 2020, our registration date data covers 48 states and Washington, DC.

A. *Summary Statistics*

The main dataset uses voter roll data as of the month immediately preceding the November 2020 general election. Because the National Voter Registration Act of 1993 does not allow states to purge voters within 90 days of federal elections, we can be sure that the double-registered individuals in our sample are able to vote in either of the states they are registered in.[9]

[6] Party identification is inferred in Alabama, Georgia, Hawaii, Illinois, Indiana, Michigan, Minnesota, Missouri, Montana, North Dakota, Ohio, South Carolina, Texas, Vermont, Virginia, and Washington.

[7] The lone outlier is Utah, where the certified vote total is 16 percent larger than the number of cast ballots in the L2 data. Upon examining the original voter file that L2 received from the state of Utah, we find the same difference. In other words, the discrepancy is attributable to the state of Utah, not L2. As we show later, our results are unaffected by dropping Utah.

[8] The Appendix table also compares active and inactive registrations. The number of active registrations show a similar pattern to the total. The number of inactive registrations is sometimes larger in L2 than in EAVS, likely because some inactive registrants as of October 2020 (when L2 data is recorded) could have voted in the 2020 election, thus becoming active in the EAVS data (collected between November 2020 and July 2021).

[9] There are six states exempt from the Act: Idaho, Minnesota, New Hampshire, North Dakota, Wisconsin, and Wyoming (US Department of Justice [https://www.justice.gov/crt/about-national-voter-registration-act]). As we show later, our results are robust to excluding these states.

Table 1 presents summary statistics. The first column considers the full dataset of L2 voters as of October 2020; the second column is for voters for whom we have the data (e.g., cell phone number) necessary to identify them as double registrants; the final column reports statistics for our sample of identified double registrants. Specifically, these are individuals with the same cell phone number, first name, last name, gender, month of birth, and year of birth, but are registered in two different states. As we will show in Section IIIA, the likelihood of two people from different states having the same matched characteristics but *not* being the same person is less than 0.001 percent.

There were 203 million voter registrations as of October 2020 (31 percent Republican and 41 percent Democrat); 74 percent voted in the 2020 presidential election. The characteristics of voters with the required variables for our matching procedure are shown in column 2. The availability of a cell phone number is largely responsible for the reduction in the sample size as we move from columns 1 to 2. The set of voters in the two columns is remarkably similar in terms of voting history, partisan fractions, and demographics.[10] In contrast, double-registered voters (column 3) are quite different. This is unsurprising, because double registrants have necessarily moved, and so tend to have characteristics associated with geographic mobility: higher wealth (28 percent in column 3 versus 20 percent in column 2), higher income (30 percent versus 21 percent), younger (59 percent versus 40 percent for the fraction born after 1975), and less likely to be a homeowner (50 percent versus 67 percent). Double registrants are also less likely to be Republicans (22 percent versus 33 percent). In fact, Democrats outnumber Republicans 2:1 among the double-registrant sample in column 3 (47 percent versus 22 percent), consistent with the fact that Republicans are less likely to move.[11]

Supplemental Appendix Figure A1 plots a histogram for the elapsed time between when an individual registers to vote in their first and second states. The figure shows that two-thirds have a gap between registrations of more than five years. This means that the double-registrant population is not primarily composed of individuals who moved across states and have not yet been purged from their first state voter rolls due to the National Voter Registration Act (NVRA) of 1993 restrictions, which require at least two election cycles (4 years) before removal (52 USC §20507(d)).

II. Prevalence of Double Registrants

We define a double registrant as the same person listed on two different state voter rolls at the same point in time (specifically, October 2020). Among this set of double registrants, there will be some who know they are double registered and others who do not. While the question of how many double registrants know they are double registered is interesting, this is hard to measure with available data.

[10] Even though the means are qualitatively close to each other, since the samples sizes are so large, the means are statistically different.

[11] Using Cooperative Election Study survey data for those registered to vote in 2020, we find that Republicans are 2.6 pp less likely to have moved relative to an overall mean of 8.8 percent.

In Section I, we saw 203 million *registrations* across all 50 states and Washington, DC, but these may not correspond to 203 million unique *individuals*. For example, if a person is initially registered in Arizona and then moves to and registers in California, but remains on the voter roll in Arizona, they will be counted twice in the 203 million total.[12] In this section, we estimate how many of these registrations correspond to the same individual in two states. We also estimate how this prevalence varies by wealth, income, and party.

Before estimating the number of double registrants, we first describe the various ways one can become a double registrant. Because there is no national voter registry, state laws govern registration, and there is limited cross-state coordination regarding voter registries. A necessary condition for double registration is moving across state lines. When individuals register to vote in their destination state, they become double registrants if they have not been de-registered in their origin state. There is no obligation for individuals to de-register, and few do. All but six states are subject to the NVRA, which specifies that states must wait for at least two federal election cycles (four years) before removing a voter from the rolls. In addition, states must comply with certain notification procedures.[13]

A. *Estimation*

We estimate the number of double registrants in our sample by measuring how many people have the same name and birth date in two different states, in excess of the number expected by chance. We define Name Uniqueness (NU) as the total number of times a (first name, last name) combination occurs in our voter registration data. We remove the 54,067,832 registered voters whose names occur only once in the sample (NU $= 1$) because these names have no corresponding match in any other state.

Among the remaining voters, we find pairs with the same first name, last name and birth year in two states, and consider the subset for which we have birth day and month for both voters in the pair.[14]

The estimate proceeds as follows. By chance, pairs of *different* people with the same name and birth year will have the *same* birthday and month in $1/353$ or 0.2833 percent of cases, assuming birthdays are uniformly distributed throughout the year.[15]

[12] L2 performs a data cleaning process before making their data available to academics and campaigns. To the extent that L2 removes some double registrants in this process, our estimate of the number of double registrants will be an underestimate.

[13] In terms of a mover's destination state, they may choose to register deliberately or, in some states, they will be automatically registered to vote when they apply for a driver's license, unless they opt out. We find a larger fraction of registrations on nonelection days for states with automatic voter registration than states without (97.5 percent versus 93.9 percent using the two years prior to the 2018 election).

[14] Twenty-seven states are missing *day* of birth information at a nontrivial rate, and the data often record the day of birth as 1 when information is missing. We estimate the percentage of double registrants among pairs of observations for which day is available and is *not* the first of the month. We apply this estimate to the full population of matched pairs of registrations, based on the assumption that the two missing conditions are uncorrelated with double-registrant status.

[15] We use 353 instead of 365, as we exclude observations with first of the month birthdays, because the data often record day of birth as 1 when day information is missing. Using the empirical distribution of birthdays, instead of assuming uniformity, would not materially alter the results of this calculation. If we instead assume a uniform distribution of birth dates (month, day, and year) over our entire sample, this likewise changes the estimated rate of double registration by less than a tenth of a percentage point.

If the empirically observed percentage of cases with the same birth month and day is higher than 0.2833 percent, then we can infer that some of these pairs are in fact the same person. For a pair of records, we define D_1 and D_2 as the birthday and month of records 1 and 2, respectively. We can then apply the Law of Total Probability:

$$(1)\quad P(D_1 = D_2) = P(D_1 = D_2 \,|\, \text{same person}) \times P(\text{same person}) + P(D_1 = D_2 \,|\, \text{not same person}) \times P(\text{not same person}).$$

Absent recording errors, $\mathrm{P}(D_1 = D_2 \,|\, \text{same person}) = 1$. Assuming births are evenly distributed across days of the year, $\mathrm{P}(D_1 = D_2 \,|\, \text{not same person}) = 0.2833\%$. For each level of NU we can estimate $\mathrm{P}(D_1 = D_2)$. Using this information and rearranging terms, for each NU we obtain

$$(2)\qquad P(\text{same person}) = \frac{P(D_1 = D_2) - 0.2833\%}{1 - 0.2833\%}.$$

For example, when NU = 2, we find that $P(D_1 = D_2) = 87.511\%$, but we would expect this to occur by chance in only 0.2833 percent of pairs if they are not the same person. Using equation (2), we can infer that $\frac{87.511\% - 0.2833\%}{1 - 0.2833\%} = 87.47\%$ of these pairs are the same person, which translates to 1,294,288 voters.[16] Since our sample has 16,923,844 voters with NU = 2, we estimate that 1,294,288/16,923,844 = 7.65% of them are double registrants.

We calculate this for each value of NU from 2 to 150 and plot them in Supplemental Appendix Figure A2. As the value of NU increases, the probability that a pair is the same person registered in two states falls, converging to approximately 2.55 percent. The intuition for this decline is that a pair of registrations with the same very unusual name (e.g., NU = 2) has a considerable chance of being the same person, but this likelihood is much lower (and converges to 2.55 percent) for more common name pairs (e.g., NU = 50 or higher).[17]

Summing over all levels of NU generates an estimate of 5.1 million voters that were double registered for the 2020 general election. This implies that of the 203 million voter registrations there are 192.8 million single registrants and 5.1 million double registrants, so that double registrants make up 2.6 percent of all voters.[18]

This analysis has assumed all double registrants have identical recorded first and last names in both state registrations. However, this is not always the case for a variety of reasons, such as name changes following marriage, name recording errors, use of nicknames (e.g., Thomas versus Tom), and so on. We correct for this by estimating a scaling factor capturing the ratio of double registrants with identically recorded first and last names to the full set of double-registered individuals.

[16] There are 930,548 across-state matches with NU = 2 and nonmissing birth date information, which also share the same birth year; 87.47575 percent of 930,548 is 814,004. Since there are 37.10799 percent across-state matches that have missing birth date information, we assume missing-at-random and scale up 814,004 to 1,294,288.

[17] We performed this calculation for all values up to NU = 150. Because the probability remains approximately 2.55 percent after NU = 100 we use this value from then on.

[18] This estimate is larger than those for 2012 in Goel et al. (2020) and for 2011 in Pew (2012), potentially because COVID disrupted residential stability in unique ways.

To calculate this, we build a reference sample of double registrants *without* matching on both the first and last names, but which correspond to the same person with a high degree of confidence.

Specifically, we begin with all cross-state matches with the same cell phone number, birth date (day, month, and year), and gender. We then apply an additional matching criterion to ensure a high match quality for the reference dataset. We require at least one of the following to match: (i) first name, (ii) last name, (iii) middle initial, or that (iv) the full name matches are above a textual similarity threshold.[19] In the reference dataset, 83.65 percent of pairs have identical first and last names, which means that for every 100 pairs with identically matching first and last names, we estimate that there are an additional 19.5 double registrants without identical names across both of their records, despite being the same person. This yields a scaling factor of 1.1954.

Applying this scaling factor, we estimate there were 6.1 million double registrants, or 3.1 percent of voters, as of October 2020.[20]

B. *Heterogeneity*

Wealth: Figure 1 displays the rate of double-registration using measures of property wealth and income, using the same Law of Total Probability approach. Based on zip code-level housing prices using Zillow's home value index (upper panel), the bottom quartile has a double-registration rate of 2.2 percent. The middle 50 percent (twenty-fifth–seventy-fifth percentile) rises modestly to 3.1 percent. In contrast, individuals living in wealthier zip codes are more likely to double register: the rates are 4.7 percent, 5.8 percent, and 8.0 percent at or above the ninetieth, ninety-fifth, and ninety-ninth percentiles, respectively. In other words, individuals living in the wealthiest neighborhoods are far more likely to have the ability to engage in cross-state strategic voting relative to the majority of Americans.

Income: In the lower panel, we use zip code-level adjusted gross income from IRS tax data.[21] The bottom quartile has a double-registration rate of 2.8 percent. The middle half is similar. However, the highest-income zip codes have much higher rates: 4.9 percent ($\geq$90th), 5.6 percent ($\geq$95th), and 6.8 percent ($\geq$99th). This pattern mirrors the gradient in the upper panel, albeit less pronounced.

Historically, voting power in the United States was directly tied to either owning property or paying taxes. A series of legislative reforms and court decisions served to grant voting power more equally. However, the evidence here points to the right

[19] Textual similarity is determined by removing spaces between the text of the full name, then calculating the fraction of letter pairs that match, irrespective of position. For example, BOB SMITH and ROB SMITH have a textual similarity score of 6/7 because 6 out of the 7 pairs of adjacent letters match. We require this to be above 0.2.

[20] Recall from Section I that L2 cleans its data in order to provide high-quality data for political campaigns. To the extent that L2's cleaning removes double registrants from their voter files, this would result in us underestimating the size of the double-registrant population.

[21] The variable for individual-level income in L2 is missing 60 percent of the time. Moreover, individual-level income is not missing at random, with a higher double-registration rate among those with missing income. Therefore, we use a zip code-level proxy.

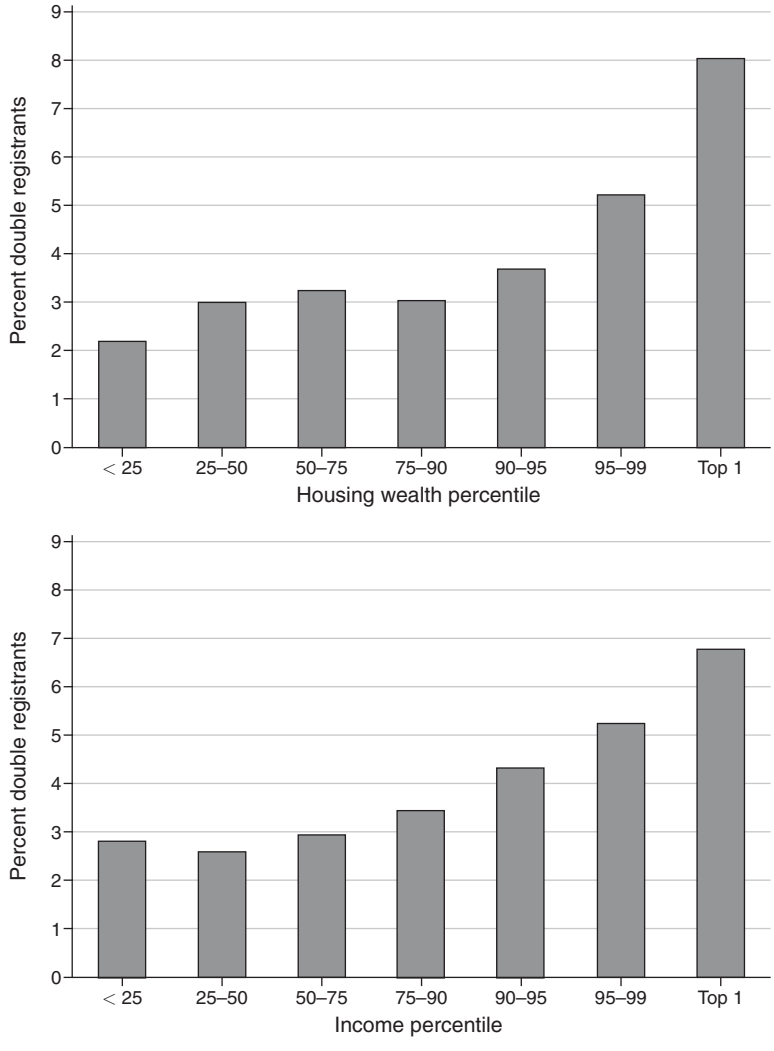


Figure 1. Double Registration Rates by Housing Wealth and Income

Notes: These bar charts report the share of double registrants in bins of housing wealth and income. Housing wealth is measured using Zillow zip code-level data to assign each voter to a housing value bin. The bottom chart uses IRS adjusted gross income by zip code to measure income. The first three bars in each chart represent the first three quartiles, and the subsequent bars break out the top quartile.

tail of the wealth and income distributions having disproportionately more voting power via double-registration.

Party: Next, we consider heterogeneity by party affiliation. We find that Republicans have a double-registration rate of 1.9 percent. In contrast, Democrats have a substantially higher rate of 3.4 percent (Independents have the highest double-registration rate of 4.2 percent). Combined with the fact that there are more Democrats than Republicans in the voter population, this means that Democrat

double registrants outnumber Republicans two to one. Therefore, Democrats have more opportunity to exert voting power via double-registration.

Automatic Voter Registration: Finally, we find similar rates of double-registration for states with and without automatic registration: 3.2 percent versus 3.0 percent. This suggests being a double registrant is mainly driven by the *first* state keeping individuals on the voter rolls after a move and less about them automatically becoming registered in their *second* state.

III. Cross-State Strategic Voting

A. *Identifying a Sample of Individual Double Registrants*

The preceding section allows us to estimate the size of the double-registered population, but does not identify which individuals are double registrants. To construct a sample of identified double registrants, we take advantage of cell phone data. As we showed in Table 1, the characteristics of the population for which we have cell phone data closely match those of voters without it. We match voters from different states on first name, last name, gender, year and month of birth, and cell phone number. Note that cell phone number is a nonredundant piece of information for matching because numbers are merged to an individual voter registration using name and *address* by the data provider (and hence within each state voter file) before we perform cross-state matching.

The analysis proceeds as follows: We first find all pairs of voters from different states that have the same first name, last name, gender, year of birth, and matching first nine digits of their cell phone number. The tenth digit of each voter's cell phone number and month of birth are used as "check digits" to ensure a correct match; we use two check digits instead of one to minimize the effects of recording errors on our calculations.[22] At the pair level, we have the following conditional probabilities:

$$\text{P(Either check digit matches} \mid \text{same person)} \approx 1$$

$$\text{P(Either check digit matches} \mid \text{not same person)} = 1 - (9/10 \times 11/12) = 0.175$$

Empirically, we find that among the 629,035 matches, 99.9703 percent of them have at least one check digit that matches (either the same cell phone tenth digit, same month of birth, or both). Using the above conditional probabilities and the Law of Total Probability, we find that 99.964 percent of our matches are indeed the same person. To define our sample, we require that *both* check digits match (reducing the sample to 611,129 matches). Applying Bayes' rule yields a final estimated

[22] We do not use day of birth to define the sample, as this would exclude individuals in states that do not consistently record day of birth, as noted in Section II.

probability of over 99.999 percent that the matches in our sample correspond to the same person. For our final regression sample, we further drop voters registered in more than two states or those with missing state registration date.[23] This leaves us with a sample of 583,835 double registrants.

B. *Cross-State Voting Incentives and Costs*

We now explore whether which state a double registrant chooses to vote in depends on that state's election characteristics. Specifically, elections in "swing states" are more consequential for national-level outcomes, which may incentivize voters to participate more in them. Indeed, despite the near-zero probability that an individual vote will be pivotal in any election, individuals seem more likely to vote in closer elections (e.g., Blais 2006; Alvarez, Boehmke, and Nagler 2006; Bursztyn et al. 2017). In addition, some states make it easier to vote. For example, they automatically mail ballots to all registered voters, which lowers the time and effort cost of voting. We call voting that responds to these incentives and costs when choosing where to vote Cross-State Strategic Voting (CSSV).

To put our analysis in context, a majority of states have laws that restrict voting to one's state of domicile. Domicile is a legal term: "the place where a person has fixed his habitation and has a permanent residence, without any present intention of removing there from" (Black's Law Dictionary). Individuals may have multiple residences but only one legal domicile at a time. Typically, the government determines a person's domicile based on characteristics such as where they have a driver's license, where they pay state taxes, and where they spend the majority of the year. For example, service members, who relocate often, are advised that "Your voting residence is within your state of legal residence or domicile … [it] is used for state income tax purposes, and determines eligibility to vote for federal and state elections" (Federal Voting Assistance Program n.d.).

If double registrants are choosing where to vote based on incentives and costs (CSSV), there are two possible ways this could happen. First, they could vote in a state that is not their legal domicile, either purposefully or due to ignorance of state laws. Alternatively, they could incur some costs to establish or reestablish domicile in a state. Returning to our service member example, the government instructs: "You have the option to establish residency or domicile each time you are transferred to a new location. Once you change your residence or domicile, you may not revert to a previous residence without re-establishing a new physical presence according to residency laws of that state" (Federal Voting Assistance Program n.d.). Absent any strategic behaviors among double registrants, we would not expect where they vote to coincide with whether states are swing states or whether states make it easier to vote. Among our sample of 583,835 double registrants, we know the date of voter registration in each of their two states; we call the state with the earlier registration the "first" state and the state with the later

[23] We also exclude registered voters whose birthdays are on January 1 because there is an abnormal mass of voters, suggesting that some states assign this date by default when only the year of birth is known. We finally drop a handful of voters recorded as registering in two states on the same day.

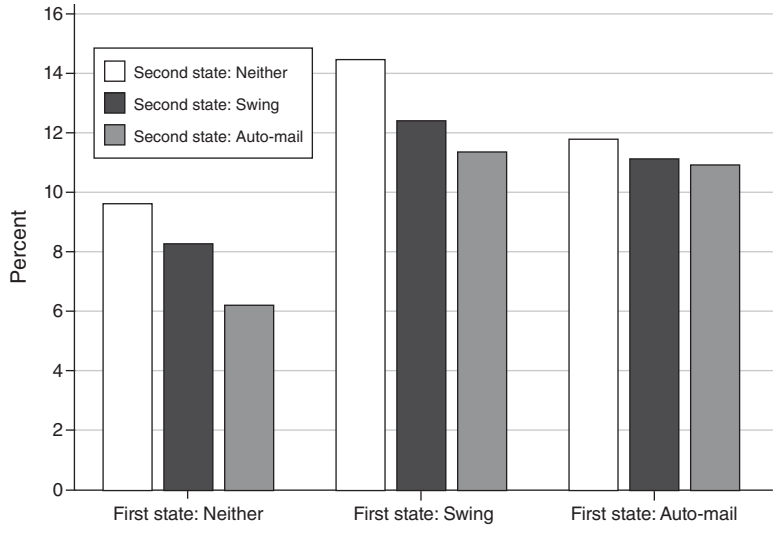


FIGURE 2. SHARE OF DOUBLE REGISTRANTS VOTING IN THEIR FIRST STATE OF REGISTRATION

Note: This figure shows the share of double registrants voting in their first state of registration by state-pair characteristics. We create a 3 × 3 matrix of first-state characteristics (swing, auto-mail, and neither) × second-state characteristics (swing, auto-mail, and neither). For example, the leftmost white bar shows the share of double registrants voting in their first state when it is neither auto-mail nor swing and when their second state is also neither swing nor auto-mail. Swing is an indicator for the 13 states where the probability of winning for any candidate on October 3, 2020, did not exceed 80 percent (PredictIt 2020); auto-mail indicates states that automatically sent mail-in ballots to registered voters in 2020 (National Conference of State Legislatures 2020b). Nevada is the only swing and auto-mail state; we include it once in each group.

registration the "second" state. A voter's second state is their most likely state of domicile, as this is the one they most recently registered to vote in. Consistent with this, only 10 percent of double registrants in our sample voted in their first state in the 2020 presidential election.

In Figure 2, we show the share of double registrants voting in their first state of registration by first state characteristics (swing, auto-mail, and neither) × second state characteristics (swing, auto-mail, and neither). The first thing to note is that the white bars are always taller than the corresponding black and grey bars within each group of three bars. This indicates that second states, which are neither swing nor auto-mail, lose the largest share of votes to first states. For example, when first states are swing states (the middle group of three bars), neither state (white bar) loses around 14 percent of votes to first states, whereas swing states (black bar) and auto-mail states (grey bar) only lose 12 percent and 11 percent, respectively.

The second thing to note is that the leftmost group of three bars is always shorter than the other groups. This indicates that first states that are neither swing nor auto-mail attract the fewest votes from second states. For example, first states that are neither swing nor auto-mail (leftmost white bar) attract less than 10 percent from neither second states, whereas swing and auto-mail first states (the other white bars) attract around 14 percent and 12 percent, respectively.

We estimate these effects more systematically in the following regression framework:

$$\begin{aligned}(3)\quad \textit{Vote first}_i \;=\; & \gamma_0 + \gamma_1 \textit{Only first swing}_i + \gamma_2 \textit{Both swing}_i + \gamma_3 \textit{Only second swing}_i \\ & + \gamma_4 \textit{Only first auto-mailed ballot}_i + \gamma_5 \textit{Both auto-mailed ballot}_i \\ & + \gamma_6 \textit{Only second auto-mailed ballot}_i + \epsilon_i.\end{aligned}$$

Vote first$_i$ is an indicator equal to one if individual i, who is double registered in a pair of states, voted in their first state in the 2020 presidential election, and zero otherwise. The omitted categories are pairs of states that are both not swing states, and pairs that are both not auto-mailed ballots. We identify swing states as those for which the less favored party has at least a 20 percent chance of winning, according to the betting market PredictIt (PredictIt 2020), one month before the election (October 3, 2020); see Table A2 for state-by-state classifications.[24] This regression exploits the variation across 2,176 ordered-state pairs (out of a theoretical maximum of $49!/(49\text{-}2)! = 2{,}352$).

Our identification strategy is based on a cross-sectional OLS regression. Therefore, to interpret the CSSV coefficients as causal, we need to make a relatively strong assumption that there are no confounders in swing or auto-mailed states. Later in Section IIIE, we test this assumption by controlling for a variety of state-level characteristics.

C. *Main Results*

We find strong evidence of CSSV in Table 2. The positive and statistically significant coefficient on *Only first swing* in column 1 indicates that when the first state is a swing state, but the second is not, double registrants are 4.7 pp more likely to vote in their first state, which translates to a 48 percent increase relative to the mean. Moreover, when double-registrants' second state is swing, and their first is not, they are 19 percent *less* likely to vote in their first state relative to the mean.

The fact that we find coefficients of opposite signs based on whether the first state is swing or the second state is swing suggests that state-pair omitted variable bias is unlikely to be driving our results. Specifically, our analysis includes both double registrants who move from one state to another and those who move in the opposite direction. If there were an unobserved characteristic associated with state pairs that included a swing state, both coefficients would have the same sign.[25]

In interpreting the incentive-based voting result in Table 2, we recognize that outside forces could be encouraging individuals to vote. For example, a campaign could target voters in swing states rather than in safe states, so that individuals registered

[24] We consider alternative definitions of swing state in Supplemental Appendix Table A3: those listed by the Corasaniti, Cai, and Lu (2020), aggregated opinion polling by Wikipedia (2020), and actual vote margin (MIT Election Data and Science Lab 2017). Our main results are robust to swing-state definition.

[25] For an omitted variable to be a concern, it would have to be correlated with the direction of moves *within* state pairs, for reasons unrelated to states' swing status. For example, even if Arizona (a swing state) is different from other states, this difference would have to affect the likelihood of voting there *differentially,* depending on whether Arizona is the first or second state in a pair.

Table 2—How Incentives and Costs Affect Voting in First State of Registration in 2020

	Dependent variable: Vote in first state of registration		
		Near certain general election voters	
	All double registrants (1)	Voter in primary (2)	Predicted voter Pr $\geq$ 0.99 (3)
Only first swing	4.719	5.873	7.715
	(0.794)	(1.087)	(1.527)
Both swing	1.421	1.339	1.703
	(0.901)	(1.231)	(1.179)
Only second swing	−1.889	−4.018	−4.585
	(0.678)	(0.970)	(1.053)
Only first auto-mailed ballot	1.919	2.869	1.900
	(0.844)	(1.077)	(1.004)
Both auto-mailed ballot	1.932	0.160	1.933
	(2.032)	(2.743)	(4.393)
Only second auto-mailed ballot	−2.983	−7.557	−6.747
	(0.632)	(0.747)	(1.040)
Observations	583,835	173,075	62,305
R^2	0.007	0.017	0.018
Outcome mean (percent)	9.77	11.16	11.58

Note: The variables *Only first …*, *Both …*, and *Only second …* indicate whether the first state, both the first and the second states, or only the second state are swing states or have auto-mailed ballots. Swing is an indicator for the 13 states whose PredictIt winning likelihood for the less favored party on October 3, 2020, is at least 20 percent (PredictIt 2020). Auto-mailed ballot denotes states that automatically sent mail-in ballots to registrants in 2020 (National Conference of State Legislatures 2020b). All independent variables are divided by 100 for presentation purposes. Column 1 uses all double registrants in the sample; column 2 uses double registrants who voted in a 2020 primary election; and column 3 uses double registrants whose predicted likelihood of voting in the 2020 presidential election is 0.99 or higher (see note to Suppllemental Appendix Figure A3 for details). Standard errors in parentheses are clustered at the state-pair level.

in both a swing and a safe state will be more likely to receive communications associated with their swing state. It is also possible that state governments of swing states could choose to nudge double registrants into voting in their state via streamlined voting procedures. Regardless, this result demonstrates that votes among double-registered individuals flow to the more consequential states.

We also find evidence that the cost of voting affects where double registrants choose to vote. Automatically receiving a mail-in ballot reduces the effort required to vote and, so, typically increases voting participation (e.g., Gerber, Huber, and Hill 2013; Hodler, Luechinger, and Stutzer 2015).[26] We find that if only the first state automatically mails out ballots, the likelihood of voting there increases by 20 percent relative to the mean (column 1). However, when only the second state has auto-mailed ballots, double registrants become less likely to vote in their first state (−31 percent). Note that our estimates for CSSV in response to incentives (swing states) and costs (auto-mailed ballots) are largely independent, as only one state—Nevada—had both characteristics in 2020.

[26] While the USPS will not forward ballots, a mail-in ballot is still more flexible than early in-person voting or in-person voting on election day.

In Supplemental Appendix Table A4, we explore heterogeneity by characteristics that might be associated with more strategic behavior: income and retirees. We find some evidence that retirees engage in more incentive-based CSSV, perhaps because they have the time and are more likely to own a second home to be strategic. Indeed, when we focus on a sample of dual-state homeowners (in Section IIIE), we also find larger effects.

In Supplemental Appendix Table A5, we also report heterogeneity by party affiliation. Using these estimates, we conduct a back-of-the-envelope calculation to explore how CSSV affected the 2020 election (see Supplemental Appendix B). This calculation requires several assumptions, including extrapolating estimates from our regression sample to the broader voter population and inferring voting behavior from party affiliation. With these caveats in mind, we find that CSSV did not change the outcome of the 2020 election. This is because the CSSV behavior of Republicans and Democrats largely canceled each other out on both the incentive- and cost-based margins in this election.

D. *Near-Certain Voters*

Our outcome variable potentially embeds two components: (1) deciding whether to vote, and (2) conditional on voting, choosing which state to vote in. Only the second of these two would be considered CSSV. To isolate this second component, in Table 2, columns 2 and 3, we consider registrants who are predicted to vote in the 2020 presidential election with a very high probability ex ante. In column 2, we select all individuals who voted in the 2020 primary election. This group has a 97.4 percent chance of voting in the general election. In column 3, we select individuals who have a high predicted probability of voting estimated from a probit model with demographics interacted with political donor status and voting history (see Supplemental Appendix Figure A3). We use individuals with a predicted probability of voting at or above 99 percent.

This "identification at infinity" approach (d'Haultfoeuille and Maurel 2013) is the cleanest evidence for CSSV because it nets out the decision of whether to vote, which leaves only the choice of where to vote. Reassuringly, the estimated coefficients are larger among these near-certain voters. While the sample sizes are much smaller in columns 2 and 3, and hence the standard errors increase, the coefficients remain statistically significant. For incentive-based CSSV, the coefficient on *Only first swing* is 7.715 in column 3 (relative to 4.719 in column 1) and *Only second swing* is −4.585 (relative to −1.889). For cost-based CSSV, three out of four relevant coefficients in columns 2 and 3 are at least 50 percent larger compared to those in column 1.

The larger coefficients could be due to two reasons. First, 19 percent of double registrants do not vote at all, which will attenuate the coefficients in column 1. Second, near-certain voters might be more politically engaged and therefore more responsive to strategic incentives.[27]

[27] There are 2.7 percent of double registrants who are FEC donors; this rises to 4.9 percent among primary voters and to 7.6 percent among those who have a predicted probability of voting at or above 99 percent.

In summary, the strategic behavior documented here, particularly among near-certain voters, indicates that at least some portion of the double-registrant population is both aware of their status and able to act on it.

E. *Robustness*

Evidence from the 2016 Election.—Our main analysis focuses on 2020 because the data is superior in a couple of dimensions. First, in 2020, our data vendor L2 pulled data from all states in the same month: October 2020 (just one month before the election). The National Voter Registration Act of 1993 prohibits states from purging voters within 90 days of a general election. This means that we can be certain that individuals in our sample of double registrants have the possibility to vote in both states they are recorded as being registered in. Second, cell phone data is consistently available in the L2 voter database for the 2020 election. By 2020, most people had cell phones and kept the same number when they moved. This is important because it helps us uniquely identify double registrants across states.

The data is less ideal for the 2016 election because state files are collected at different points in time, and cell phone data is not consistently available.[28] The state files not being collected at the same time could introduce measurement issues, and the absence of cell phone data requires an alternative way of identifying double registrants.

With these caveats in mind, we analyze CSSV for the 2016 election as a robustness check. We exploit uniquely named individuals—people whose names are so unique that their names appear only twice, in two separate states, and also share the same birth date. For example, if a unique name only appears on the California and Arizona voter rolls and happens to share the same birth date, we can be nearly certain this is the same person registered in two different states. Using this alternative approach, we can identify 665,641 double registrants.

Results for 2016 using the unique-name sample are reported in Table 3. We find strong evidence for both incentive-based and cost-based CSSV, especially in our cleanest sample of near-certain voters. For example, for voters with a high predicted probability of voting (column 3), the *Only first swing* and *Only second swing* coefficients are 10.763 and −3.976, respectively.[29] For our measure of cost-based CSSV, we use early voting in 2016 instead of auto-mailed ballots, as we did in 2020, because auto-mailed ballots only became a widespread phenomenon following the COVID pandemic.[30] This cost of voting measure yields strong evidence of CSSV, as indicated by the coefficients of 6.610 on *Only first early voting* and −6.123 on *Only second early voting* in column 3.

[28] In 2016, the timing of L2's collection varied across states. For some states, L2 collected data in, for example, March and August and, for others, May and September. Data from larger and swing states were collected multiple times per year while smaller states were often collected just once a year (and not necessarily for the same month).

[29] For the 2016 election, we set the voting probability cutoff for near-certain voters to be greater or equal to 95 percent, as otherwise the sample becomes too small. If we apply the same cutoff of 95 percent instead of 99 percent to the 2020 election, results are very similar: *Only first swing* is 6.397 (SE = 1.184), *Only second swing* is −3.198 (0.918), *Only first auto-mailed ballot* is 1.895 (0.799), and *Only second auto-mailed ballot* is −5.609 (0.875).

[30] Auto-mailed ballots were used in only four states in 2016 (6.3 percent of the voter population) versus 11 states in 2020 (21.7 percent of the voter population).

Table 3—Evidence from the 2016 Election

	Dependent variable: Vote in first state of registration		
		Near certain general election voters	
	All double-registrants (1)	Voter in primary (2)	Predicted voter Pr $\geq$ 0.95 (3)
Only first swing	3.185	6.045	10.763
	(0.823)	(2.114)	(2.955)
Both swing	2.366	3.797	2.504
	(0.874)	(2.099)	(1.547)
Only second swing	0.121	−2.429	−3.976
	(0.564)	(1.267)	(1.094)
Only first early voting	0.255	5.349	6.610
	(0.647)	(1.706)	(2.288)
Both early voting	−1.609	−1.663	−0.658
	(0.743)	(1.560)	(1.659)
Only second early voting	−1.751	−5.825	−6.123
	(0.779)	(1.432)	(1.479)
Observations	665,641	113,743	58,857
R^2	0.003	0.020	0.032
Outcome mean (percent)	9.48	11.93	12.66

Note: This table replicates Table 2 using double registrants from the L2 2016 data. Double-registered individuals in this sample are identified from voter records with unique names—people whose first and last names are so uncommon that their names appear only twice, in two separate states, and also share the same birthdate. The variables *Only first* …, *Both* …, and *Only second* … indicate whether the first state, both the first and the second states, or only the second state are swing states or have early voting. Swing is an indicator for the 12 states whose PredictIt winning likelihood for the less favored party on November 1, 2016, is at least 20 percent (PredictIt 2020). Early voting refers to states that allowed voting for at least 19 days before November 8, 2016 (the same cutoff used for the 2020 election) (National Conference of State Legislatures 2020a). The sample is composed of 2016 double registrants who were still registered to vote in 2017, to ensure that they were eligible to vote in the 2016 election. All independent variables are divided by 100 for presentation purposes. Column 1 uses all double registrants in the sample; column 2 uses double registrants who voted in a 2016 primary election; and column 3 uses double registrants whose predicted likelihood of voting in the 2016 presidential election is 0.95 or higher. Standard errors in parentheses are clustered at the state-pair level.

Alternative Samples for the 2020 Election.—

Unique-Name Sample: As an additional robustness check for our 2020 election results, we construct a unique-name sample of double registrants following the same approach in the previous section. This sample of 804,610 double registrants has only around a 20 percent overlap with our main sample of double registrants constructed using cell phone numbers. We reproduce Table 2 using this new sample of double registrants. The results are reported in Table 4.

Although the samples of double registrants are largely independent, the results in Table 4 are consistent with those in Table 2. For example, among near-certain voters (column 3), the *Only first swing* coefficient is 6.598 (versus 7.715 in Table 2), and the *Only second swing* coefficient is −2.553 (versus −4.585). Similarly, the cost-based coefficients share the same pattern across the tables.

To the extent that double-registered cell phone users are different on unobservables (we showed in Section I that cell phone users are similar on observables to the

Table 4—Alternative Sample for the 2020 Election

	Dependent variable: Vote in first state of registration		
		Near certain general election voters	
	All double-registrants (1)	Voter in primary (2)	Predicted voter Pr $\geq$ 0.99 (3)
Only first swing	3.448	4.722	6.598
	(0.703)	(1.057)	(1.304)
Both swing	0.341	0.231	1.425
	(0.788)	(1.174)	(1.137)
Only second swing	−1.231	−3.183	−2.553
	(0.828)	(1.240)	(0.875)
Only first auto-mailed ballot	3.227	4.325	1.505
	(1.397)	(1.662)	(0.845)
Both auto-mailed ballot	2.359	1.483	6.138
	(2.342)	(3.389)	(5.153)
Only second auto-mailed ballot	−3.421	−8.483	−5.219
	(0.556)	(0.720)	(0.915)
Observations	804,610	203,247	60,677
R^2	0.005	0.017	0.016
Outcome mean (percent)	10.34	11.86	9.51
Fraction in cell phone sample (percent)	17.57	20.61	22.99

Notes: This table replicates Table 2 using an alternative sample of double registrants from the 2020 L2 data. Double-registered individuals in this sample are identified from voter records with unique names—people whose first and last names are so uncommon that their names appear only twice, in two separate states, and also share the same birthdate. The overlap between the main, cell phone sample of double registrants and this sample is reported in the bottom row. Standard errors in parentheses are clustered at the state-pair level.

rest of the population), these results provide evidence using a largely independent sample of voters where we do not select on cell phone.

Dual-State Homeowner Sample: While ownership of property in two states is not a necessary condition to engage in CSSV, it may facilitate strategic behavior since these individuals have an active connection to each state and may be more aware of their double-registrant status. To build a sample of these individuals, we take the union of our cell phone and the unique-name samples and match it to CoreLogic's Tax Assessment Database, a near-comprehensive dataset of properties.[31] We match on owners' first name, last name, and longitude and latitude of an address, since these variables appear in both the L2 voter and CoreLogic property databases.[32]

Table 5 presents the results. Using this sample of dual-state homeowners, we find substantially larger incentive-based CSSV, consistent with the idea that individuals

[31] We start with our sample of double registrants and then match it to the Corelogic data. We cannot start with a sample of cross-state property owners because Corelogic, unlike L2, does not have sufficient identifying information, such as birth date or cell phone, to identify the same individual across two states.

[32] After matching, the cell phone sample consists of 15,038 double registrants and the unique-name sample consists of 12,771; the union of the two is 25,308. Because these samples are relatively small, we use the union to increase precision.

Table 5—Sample of Dual-State Homeowners for the 2020 Election

	Dependent variable: Vote in first state of registration		
		Dual-state homeowners: Near certain general election voters	
	Dual-state homeowners: All double registrants (1)	Voter in primary (2)	Predicted voter Pr $\geq$ 0.95 (3)
Only first swing	11.689	11.502	13.084
	(1.632)	(2.556)	(2.327)
Both swing	0.563	−3.046	−1.825
	(1.838)	(3.392)	(2.886)
Only second swing	−6.690	−15.224	−11.654
	(1.092)	(1.960)	(1.651)
Only first auto-mailed ballot	4.489	7.255	4.727
	(1.110)	(2.231)	(2.178)
Both auto-mailed ballot	5.183	0.116	4.133
	(2.328)	(2.892)	(2.604)
Only second auto-mailed ballot	−0.561	−6.727	−2.238
	(2.020)	(2.725)	(2.797)
Observations	25,308	8,084	13,363
R^2	0.027	0.042	0.040
Outcome mean (percent)	17.63	25.01	22.01

Notes: This table replicates Table 2 using double registrants who own a property in each of the two states where they are registered to vote. We identify homeownership by matching double registrants to CoreLogic Tax Assessment data (the most recent data from the 2021 file) using first name, last name, and the latitude and longitude of an address (requiring the distance between a CoreLogic address and a voter address to be no greater than one mile). The double-registrant sample is the union of the cell phone sample used in Table 2 and the unique-name sample used in Table 4. Column 1 uses all double registrants in this sample; column 2 uses those who also voted in a 2020 primary election; column 3 uses those whose predicted likelihood of voting in the 2020 presidential election is 0.95 or higher. We use a cutoff of 0.95 in column 3 (instead of 0.99 as we do in Table 2), as the latter would result in too small a sample (only 4,700 individuals). Everything else follows Table 2. Standard errors in parentheses are clustered at the state-pair level.

can more easily vote where they own a property.[33] For example, for the near-certain general election voters in column 3, the *Only first swing* coefficient is 13.084, and the *Only second swing coefficient* is −11.654. These point estimates are substantially larger compared to those in Table 2. This analysis complements our main finding by demonstrating stronger incentive-based CSSV in a subpopulation where it is more likely to occur.

Additional Controls.—A remaining concern is that there are characteristics at the state-pair level related to our setting and data, such as voter roll maintenance, that could confound the analysis. To address this type of concern, in Table A6 we report the results of alternative specifications for Table 2, column 1, that control

[33] For cost-based CSSV, the prediction for how the effects should change is unclear. On one hand, it is easier to vote in person if an individual has a physical presence in each state, making auto-mailed ballots less relevant; on the other hand, if an individual owns a property, they will automatically receive a ballot in the mail if they are registered, potentially making auto-mailed ballots more relevant.

for state-pair level election features, voter roll maintenance, migration flows, or tax rates. Our CSSV estimates are generally robust to these additions.

Column 1 includes indicators for only the first state allowing early voting, for only the second state allowing it, and for both allowing it. In a similar fashion, columns 2, 3, and 4 include indicators for automatic mailing of absentee applications, automatic registrations, or election day registration, respectively.

Columns 5 and 6 include control variables for how well states maintain their voter rolls. In column 5, we use the 2020 Election Administration and Voting Survey (EAVS) to categorize states with an above-median voter removal rate and construct indicators mirroring the specification in column 1. Column 6 similarly controls for how frequently states update voter registration dates, as measured by how often the state registration date matches L2's.[34]

Column 7 controls for 2018–2019 state-pair level migration flows from the first state to the second state using data from the IRS Statistics of Income.[35] Column 8 accounts for differences in state tax burdens (Tax Foundation 2020) in a similar manner to column 1. Column 9 includes all controls together.

Another way to control for state-level characteristics is to use state fixed effects, which we do in Supplemental Appendix Table A7. The first column reports our baseline specification (from Table 2, column 1). The second column includes 49 dummies, one for each state if it appears in the pair. Notice this means *Both swing* and *Both auto-mailed* are no longer identified because they are linear combinations of these dummies. The inclusion of these 49 fixed effects does not appreciably change the coefficients on *Only first swing*, *Only second swing*, *Only first auto-mailed*, or *Only second auto-mailed*.

Note that we cannot include *ordered* state pair fixed effects, because that is the level of identifying variation. With *unordered* pair fixed effects, the analysis is nuanced. To understand why, ignore Nevada, which is the only state that is both swing and auto-mailed. In this case, including unordered state pair fixed effects only allows us to identify a single coefficient.[36] This is because no swing states are auto-mailed, and no auto-mailed states are also swing.

For each double registrant, we can represent the ordered pair of states they are registered in as (First State, Second State). Including unordered fixed effects means the coefficient on *Only first swing–Only second swing* is estimated by comparing observations of the type (Swing State, Not Swing State) with (Not Swing State, Swing State). The estimated effect of 5.529 is reported in column (3) and is similar to the difference between the estimated coefficients on *Only first swing* and *Only second swing* in column (1) of 5.901 ($= 4.719–(-1.1889)$). Similarly, *Only first auto-mailed–Only second auto-mailed* is estimated by comparing observations of the type (Auto-mailed State, Not Auto-mailed State) with

[34] L2 attempts to retain the original date a voter was registered in a state, while many states update this date in their records as voters interact with the registration system.

[35] In a separate and untabulated analysis, we regress migrant inflows per capita on whether only the destination state is swing, only the origin state is swing, or both are swing. The estimates on all three indicators are small and insignificant.

[36] Since Nevada is in our data, we could technically identify two coefficients. However, the extra identifying variation would come only from pairs that include Nevada.

(Not Auto-mailed State, Auto-mailed State). This yields an estimate of 1.184 in column (4), which is smaller than the difference in estimated coefficients from column (1) of 4.902.

State Subsets.—States vary considerably by population size, with many more double registrants being registered in a large state like California than in a small state like New Hampshire. To examine whether any one state is driving our results, Supplemental Appendix Figure A4 plots the incentive-based and cost-based CSSV coefficients when we exclude one state at a time. Estimates are stable across samples.

Supplemental Appendix Table A3, column 4, excludes states identified in Goel et al. (2020) as having potentially lower data quality in the 2012 presidential election due to multigenerational households. Column 5 excludes states exempt from the NVRA: Idaho, Minnesota, Wyoming, and Wisconsin (North Dakota and New Hampshire are already excluded because they do not provide information on registration date). In both columns, results are robust.

Finally, since there were many changes in the provision of auto-mailed ballots in the 2020 election, we show results that drop all auto-mail states from the analysis (i.e., we drop double registrants where either registration is in a state that auto-mails ballots). Supplemental Appendix Table A8 shows that the incentive-based CSSV estimates are similar among this subset of states.

F. *Relative Closeness of Elections*

Thus far, we have used a binary measure for whether a state is a swing state and compared swing to non-swing states. However, not all swing states are equally close: Iowa (which went +8 percent for Trump) is much less of a swing state than Georgia (+0.2 percent Biden). Moreover, the difference in closeness between a double-registrant's pair of states will also vary. For example, Georgia could be paired with a similarly close swing state like Arizona (+0.3 percent Biden) or with a less-close swing state like Iowa. If the relative closeness of elections affects CSSV behavior, the incentive to vote in Georgia should be higher when it is paired with Iowa.

Figure 3 and Table 6 explore these effects. Panel A of Figure 3 plots the probability of voting in the first state against the first state "win gap," defined as the absolute value of the Democratic minus Republican win probability in prediction markets. As the first state's win gap becomes larger (i.e., the election becomes less close), individuals are less likely to vote there. Panel B changes the horizontal axis to be the *difference* in win gaps between the second and first state in each pair. While panel A has 49 values for the win gap (48 states plus DC), panel B has 2,176 values for the difference in win gaps (the number of ordered state pairs in our sample). There is a clear positive slope in panel B, indicating that as an individual's incentive to vote in their first state increases (because the difference in win gaps between their second and first state is larger), they are more likely to vote in their first state. Panels C and D repeat these graphs but residualize out the auto-mailed ballot variables of Table 2 from the voting probability. This reduces the dispersion of the observations around the fitted lines without appreciably changing the slopes.

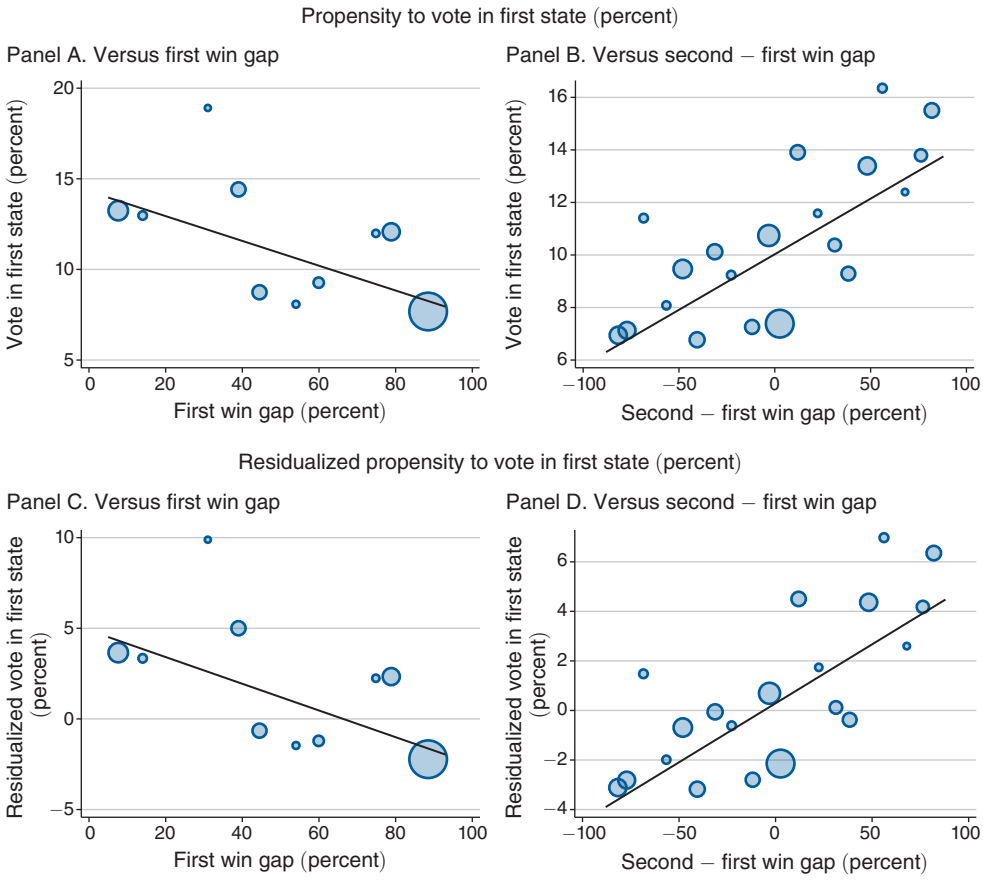


FIGURE 3. VOTING IN FIRST STATE OF REGISTRATION AND ELECTION CLOSENESS

Notes: These plots are binscatters of a double-registrant's probability of voting in their first state plotted against (i) the win gap in their first state, i.e., the predicted closeness of an election (panels A and C), and (ii) the difference in the win gap between their second and first states, i.e., the relative closeness of the elections in a pair (panels B and D). Win gap is defined as the absolute value of the Democratic minus Republican win probability in prediction markets on October 3, 2020 (PredictIt 2020). Panels A and B plot the raw vote probabilities on the y-axis, while panels C and D residualize out the auto-mailed ballot variables in Table 6. Dot sizes are proportional to the number of observations.

Table 6 mirrors Table 2, but we replace the binary measures for swing states with two continuous variables: (i) the first state win gap (*First win gap*) and (ii) the difference in win gaps between the second and first state (*Second—first win gap*). We find that a one standard deviation (30 pp) increase in the first state's predicted win gap (*First win gap*) reduces a double-registrant's likelihood of voting there by 1.3 pp (30×-0.043). A one standard deviation increase in *Second—first win gap* (46 pp) increases the likelihood of voting in the first state by 1.6 pp (46×0.034). In other words, holding the first state win gap fixed, as the second state's election becomes less close, voters are more likely to vote in their first state. The coefficients on the auto-mailed ballot variables are largely unaffected.

Table 6—Relative Closeness of Elections and CSSV Behavior in 2020

	Dependent variable: Vote in first state of registration
First win gap	−0.043
	(0.014)
Second—first win gap	0.034
	(0.009)
Only first auto-mailed ballot	2.410
	(0.846)
Both auto-mailed ballot	2.456
	(1.992)
Only second auto-mailed ballot	−2.909
	(0.676)
Observations	583,835
R^2	0.008
Outcome mean (percent)	9.77

Notes: This table reports the relationship between a double-registered individual's probability of voting in the first state and the closeness of the election in the first state, as well as the difference in the closeness between the first and second states. "First win gap" refers to the absolute difference in the PredictIt winning likelihood between the Democratic and the Republican parties in the first state on October 3, 2020, and "Second—first win gap" refers to the difference in the win gaps between the second and the first state. The auto-mailed ballot variables are divided by 100 for presentation purposes. Other variable definitions and sample selection follow those in Table 2 column 1. Standard errors in parentheses are clustered at the state-pair level.

These results complement the evidence in Section IIIE, arguing against omitted variables bias. In Figure 3 (and the corresponding Table 6), we rely on *relative* differences in competitiveness across state pairs for identification. The results in this section require that any omitted variable would not only have to affect directionality but also intensity.

G. *CSSV and Double Voting*

Finally, a natural question is whether double-registrants double vote for president, since this is illegal under the Voting Rights Act of 1965 (52 USC §10307(e)).[37] We observe a mean rate of double voting of 1.0 percent among double registrants in our sample.[38] This amounts to 0.031 percent of voter registrations. Hence, we reach the same conclusion as Goel et al. (2020)—that double voting is exceedingly rare.

Moreover, even this low rate is likely an overestimate for two reasons. First, outcome means close to zero are sensitive to small data recording errors in this setting (Goel et al. 2020). While data recording errors could inflate the *level* of

[37] National Conference of State Legislatures (2021) finds that there have only been a small number of cases of double voting prosecuted under state law and none under federal law.

[38] The remaining 99 percent of double registrants are made up of those who do not vote at all (18.9 percent), those who vote only in their first state (8.8 percent), and those who vote only in their second state (72.2 percent).

Table 7—How Incentives and Costs Affect Voting in Both States of Registration in 2020

	Dependent variable: Vote in both states of registration		
		Near certain general election voters	
	All double registrants (1)	Voter in primary (2)	Predicted voter Pr $\geq$ 0.99 (3)
Only first swing	0.262	0.687	1.805
	(0.125)	(0.249)	(0.449)
Both swing	0.415	1.019	1.854
	(0.165)	(0.407)	(0.708)
Only second swing	0.009	−0.124	−0.296
	(0.122)	(0.264)	(0.412)
Only first auto-mailed ballot	1.229	1.893	2.556
	(0.211)	(0.426)	(0.647)
Both auto-mailed ballot	1.122	0.788	0.506
	(0.212)	(0.308)	(0.556)
Only second auto-mailed ballot	0.258	−0.190	−0.147
	(0.111)	(0.212)	(0.425)
Observations	583,835	173,075	62,305
R^2	0.002	0.002	0.004
Outcome mean (percent)	1.01	1.88	3.24

Notes: Independent variables and samples mirror those in the corresponding columns in Table 2, including dividing independent variables by 100 for presentation purposes. Standard errors in parentheses are clustered at the state-pair level.

double voting, they should not inflate the coefficient estimates for incentives and costs, which are the main focus of the paper.[39]

Second, even if a voter did cast a ballot in two states, this need not imply double voting for president. Failing to vote for president despite turning in a ballot is not uncommon ("residual voting"). In fact, Stewart III et al. (2020) finds that 1.4 percent of ballots were residual votes in the 2016 election. "Ballot roll-off" is a closely related concept, where someone votes for president but not for other items on the ballot. Because how an individual votes is confidential, in our data we only observe whether someone cast a ballot but not which items they voted on. Thus, it is possible that a double voter cast a ballot in state A for president (but not for US senator), and in state B cast a vote for senator (but not for president).

We now investigate whether the same CSSV forces that affect which state to vote in—incentives and costs—influence the likelihood of double voting. We estimate equation (3) but change the outcome to be an indicator for voting in two states in the 2020 presidential election. Table 7 reports the results and finds evidence of CSSV. When only the first state is a swing state, the probability of double voting increases by 26 percent of the mean in column 1, and when both states are swing states, this rises to 41 percent. Double registrants respond even more strongly to costs. Double voting increases by 111 percent if both states send out auto-mailed ballots. The

[39] Meyer and Mittag (2017) show that a binary dependent variable with conditionally random measurement error attenuates coefficients in most situations.

effect is similar for *Only first auto-mailed* (122 percent) and smaller for *Only second auto-mailed* (26 percent), likely because cost considerations matter less in the state where double registrants live.

Columns 2 and 3 condition on near-certain voters, as in Table 2. The influence of incentives increases, with the coefficient in column 3 on *Both swing* rising to 57 percent of the subsample mean. For cost-related variables, we see a decrease in effect sizes relative to the mean.

IV. Conclusion

US states administer federal elections independently, giving rise to the possibility of double-registered voters. We estimate there are 6.1 million of these individuals and that they respond to incentives and costs, voting more often in swing states (higher incentive) and states that automatically send out mail-in ballots (lower cost).

Double registration is relevant to long-standing discussions about election policies and campaign behavior. Reforms targeting double registrants may reduce their number, but at a potential cost to political enfranchisement and state autonomy.[40] While our back-of-the-envelope calculation indicates that CSSV did not affect the outcome of the 2020 election, it could be important in closer elections such as the 2000 election, where the gap was 537 votes in Florida and 366 in New Mexico. Moreover, there is the possibility that campaigns could target double registrants—or encourage people to become double registrants—in swing states to increase the impact of CSSV.

Regardless of how CSSV interacts with election policy or campaign strategy, the fact that some individuals are choosing where to vote violates the principle of one person, one vote by providing some Americans with more voting power than others. Moreover, the voters who receive this additional power are not random: double registrants are 3.6 times as prevalent in the wealthiest 1 percent of zip codes compared to the bottom quartile. This fact is not only antithetical to the progress made by courts and legislators to decouple voting power from wealth, but also concerning because redistributive policies are often on the ballot.

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[40] Even if states could correctly identify double registrants via cross-state information sharing, disenfranchisement is a risk, because identifying an individual's domicile is difficult. Some states participate voluntarily in the Electronic Registration Information Center (ERIC), which collects their voter registrations and, upon request, sends reports to member states.

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