

# Voter List Maintenance Errors and Their Racial Burden: Evidence from Wisconsin's Supplemental Movers Poll Books\*

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## Abstract

Administrative records are increasingly used to identify registered voters who may have moved, with potential movers frequently sent postcards asking them to confirm their address of registration. It is important to understand how often registrants are falsely flagged as moving and how often this error is not corrected by the subsequent postcard confirmation process because uncorrected errors often initiate a process that makes it more difficult for a registrant to subsequently vote. Yet federal privacy protections generally prevent researchers from observing the data necessary to estimate these quantities. We are able to study this process in Wisconsin in 2018 because special poll books, available via public records requests, listed those registrants flagged by administrative records as potential movers who did not respond to a postcard. At least four percent of these registrants cast a ballot at their address of registration, with minority registrants being twice as likely as White registrants to do so.

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# 1 Introduction

Voter registration list maintenance, or list maintenance, is a mundane term for a practice that is increasingly at the heart of what Hasen (2012) termed “the voting wars.” Election administrators engage in list maintenance when they update a voter’s registration, including marking it as inactive or removing it entirely. When an election administrator removes a registration, the affected individual must register again before she can cast a ballot. In many states, inactivation starts a process through which a registration is eventually removed. Having such policies is necessary because up to one in every eight registrations is thought to no longer be valid (Pew, 2012). For example, a registrant may have moved, died, or been convicted of a disenfranchising crime. But there is often a tradeoff between voter access and voter integrity when election administrators make policies about registration removal or inactivation (e.g., Merivaki, 2020). This is because election administrators frequently possess evidence that is suggestive, but not conclusive, that a registrant has moved. Failing to remove the registration of a registrant who is ineligible to cast a ballot can reduce electoral integrity (e.g., if that registration is used to cast a ballot) and increase costs (e.g., associated with mailing announcements to registrants who are no longer present). But this must be balanced against the burdens imposed by inactivating or removing the registration an eligible citizen, which potentially include diminished confidence in the voting process, exclusion from certain forms of communication, the time costs of reregistration, and disenfranchisement when a citizen does not reregister before their state’s registration deadline.

This paper focuses on the challenges of using administrative records to identify people who are registered to vote at an address at which they no longer reside. Because of the decentralized nature of election administration in the United States and the lack of a national identity system, election administrators often match registration records to other administrative records to look for evidence suggesting that a registrant has moved. When these two records lack common identifiers, a registrant may be falsely flagged as moving when they are linked, incorrectly, to the administrative record of a distinct individual. Even when a regis-

trant is linked to their own administrative record, determining their current residence can be hard. This is, in part, because of the challenge of distinguishing which of two administrative records is most current.

State election administrators have increasingly joined together for the task of identifying people who are registered to vote, but have since moved. The Electronic Registration Information Center (ERIC), a non-profit corporation governed by member-states, currently assists 30 states in comparing and validating records across jurisdictions as part of these states' list maintenance process. States contact those registrants flagged as potential movers, often using a mailed postcard, and ask them to confirm their address of registration. Registrants who fail to confirm that they reside at their address of registration can have their registration inactivated or removed, depending on state law.

This paper estimates how often potential movers flagged by ERIC did not respond to a postcard despite continuing to reside at their address of registration. Little is known about this quantity despite the widespread use of ERIC data, because the ERIC membership agreement prohibits states from disclosing the list of registrants who are initially flagged as movers or the subset who subsequently do not respond to the state's postcard confirmation process. Our analysis focuses on potential movers flagged by ERIC in late 2017 in Wisconsin. Because of a novel state policy decision, most of the potential movers who failed to respond to a postcard were put into a "Supplemental Movers Poll List" (henceforth movers poll book) for April, August, and November election in 2018. This created a unique window to observe the potential movers flagged by ERIC, because Wisconsin cannot restrict access to poll books. We extracted the voter registration numbers listed in the movers poll books that we collected from representative sample of wards and then matched them to copies of the Wisconsin statewide voter file from early 2018 and early 2019. This allowed us to observe both which of these initially flagged registrations were used to vote and whether these votes were cast at the address of registration flagged as potentially out of date.

We estimate that about four percent of the registrants in the movers poll books cast a

vote in 2018 at the address flagged as out of date. In other words, they were flagged by ERIC as potential movers, did not respond to postcards, and did not move. This is a lower bound on the share of registrants in the movers poll books who continue to reside at their address of registrants, because additional registrants in the movers poll books may have continued to reside at their address of registration but did not vote. Among the registrants in the movers poll books who voted in Wisconsin in 2018, we estimate about nine percent cast a ballot at the address of registration flagged as out of date. Consistent with concerns about the potential disparate racial impact of voter list maintenance, we find that minority registrants in the movers poll books were more than twice as likely to vote at the address flagged by ERIC as White registrants in the movers poll books.

## 2 Background

The decentralized nature of election administration in the United States makes it hard to engage in list maintenance. Currently about 10 percent of Americans move to a new residence every year (Frey, 2019). Registrants are not required to, and often do not, tell local elections officials when they have moved. Thus, election administrators need ways to identify and remove such registrants who no longer are eligible to vote at their address of registration.

Administrative records are an important source of information for identifying registrants with a new residence. Registrants who moved may generate a record of having done so with the Department of Motor Vehicles (DMV) when they change the address on their driver's license or with the United States Postal Service (USPS), the latter of which is recorded in the USPS National Change of Address (NCOA) system. Someone registering to vote in a new jurisdiction generates an administrative record of where they resided on the day that they registered to vote. Thus, an election administrator can identify potential movers by linking their registration records with DMV data, the NOCA registry, or registration records from other jurisdictions.

While administrative records can be helpful for identifying potential movers, some of the registrants flagged as potential movers will continue to reside at their address of registration. One issue is that when registration data does not contain common identifiers with administrative data, there is the chance that a registrant will link to a distinct individual's record. Because there is no common identifier that links registrants across states, identifying people with multiple registrations sometimes is done by identifying registrations with similar information in multiple states' voter registration databases using fields like full name, date of birth, and, when available, the last four digits of a registrant's Social Security number. When all of this information is available and accurate, it is unlikely that two distinct registrants would be linked together using this information (Ansolabehere and Hersh, 2017). But this information is not always known or accurate in both states, which can lead to two registrations with similar information that belong to two distinct people being erroneously classified as pertaining to the same person (Goel et al., 2020). When this happens, it can give the false impression that a registrant has moved.

Erroneous linkages may be particularly likely to occur when multiple people live at a single residence. Consider the NCOA registry, which aggregates information people provide when they want the USPS to forward their mail to a new address. Because the primary purpose of the information in the NCOA is to support the USPS, it does not contain all of the information that election officials would ideally want to support list maintenance. For example, the NCOA registry does not contain information on the date of birth of the person filing a change of address request. This can make it challenging to assess who is moving within a household, particularly when multiple people in a household have similar names (e.g., when an adult child moves out of the home they share with a parent with a similar name).

When administrative data are correctly linked to a registrant, data quality issues may make it appear that a registration is out of date even though the registrant remains eligible to vote at their address of registration. Identifying the current residence of a registrant

in administrative data can be challenging, particularly when someone is a frequent mover (Brater et al., 2018). For example, Goel et al. (2020) demonstrate that individuals with multiple registrations sometimes do vote at the address of registration for the registration with an earlier registration date, as might arise when a college student registers to vote while away at school but then returns home after college and resumes voting using an older registration. The broader lesson is that administrative data often contain information on someone's address on the day the administrative record was generated, which may not be their address moving forward. A similar issue can emerge when an individual has multiple residences. For example, DMV records may show where a registrant typically resides in the summer, while their address of registration is based where they typically reside in the winter. Data quality issues also can make it difficult to determine whether addresses in two different administrative data sources represent two distinct addresses or the same address presented differently.

Because of the challenges of identifying registrants who moved using administrative data, election administrators increasingly are partnering with ERIC to assist in this process. ERIC is a non-profit that assists states in identifying unregistered citizens and maintaining accurate voter registration lists. Member states provide ERIC with their voter registration lists and administrative data, and ERIC returns two categories of lists to each partnering state. One list includes residents who are likely eligible to vote, but who are not registered. The other list includes registrations potentially in need of list maintenance, because the registrant may have moved within their state, moved to another ERIC state, died, or have duplicate registrations within their state. ERIC member states agree to contact most of the individuals on these lists, and either encourage them to register to vote or to confirm whether their registrations are accurate, respectively.

Prior evaluations show that states increase registration by contacting the individual who are not registered, but likely eligible to vote. Bland and Burden (2013) find that the seven states that initially joined ERIC in 2012 increased registration by about one percentage point

more between 2008 and 2012 than states that did not initially join ERIC. Mann and Bryant (2020) report that the people ERIC identified as unregistered in Delaware and Oregon were two percentage points more likely to be registered when sent a postcard encouraging them to register. Similarly, Bryant et al. (First View) estimate that a postcard sent by Pennsylvania increased the registration rate among people ERIC identified as unregistered by about one percentage point.

Much less is known about the consequences of using the lists generated by ERIC to engage in list maintenance. Member states typically send a mailer to the registrants flagged as movers that asks the registrant to confirm whether he or she remains eligible to vote at the flagged registration address. In many states, list maintenance is instigated when a registrant fails to confirm their registration address. Currently, states that are subject the National Voter Registration Act (NVRA) must designate the registrant as inactive for four years before removing them. However, Indiana, although not a member of ERIC, recently attempted to institute a policy in which data provided by Crosscheck, a now defunct alternative to ERIC, were used to immediately remove registrants who did not confirm their eligibility (see generally *Com. Cause Indiana v. Lawson*, 937 F.3d 944 (7th Cir. 2019)). In states like Wisconsin that are not subject to the NVRA because of their historical use of Election Day registration, a registrant flagged by ERIC who does not confirm their eligibility can be removed immediately.

What remains unknown is how many registrants flagged by ERIC fail to confirm their eligibility despite remaining eligible to vote at their address of registration. As this section highlights, there are a number of reasons why someone may appear to move in administrative records despite residing at their address of registration. When such individuals fail to respond to a postcard asking them to confirm their registration, they risk jeopardizing the ability to vote. Media reports highlight that some postcard recipients report believing these postcards were junk mail or a scam, while others reporting never receiving the postcard (Watson, 2019; Parsky, Phillips and Munro, 2020). Whatever the source of this error, any-

thing that results in a valid registrant not receiving or returning their postcard puts them at risk of being removed as a registrant. While Bland and Burden (2013) suggested that an evaluation of ERIC’s list maintenance practices was forthcoming, such an evaluation was never publicly released. Moreover, independent external evaluations have not occurred because ERIC prevents member states from disclosing the data it provides to third parties. In part, this is because disclosure of information derived from DMV records would violate the Driver’s Protection Policy Act. Instead, any disclosure of ERIC data to researchers would be under the terms of a non-disclosure agreement with negotiated with ERIC.

The Member shall not use or transmit any ERIC Data for any purpose other than the administration of elections under state or federal law. Should a Member receive a request to disclose ERIC Data and determines that it is legally obligated, in whole or in part, to comply with such request, it shall not make the disclosure without first obtaining a court order compelling it to do so, a copy of which shall be provided to ERIC.<sup>1</sup>

Thus, it remains unknown what share of the registrants flagged as movers by ERIC remain eligible to vote at their address of registration, as well as how this error rate is distributed across important groups in the population. As with any algorithmic process, we need to understand its overall accuracy and assess mechanism for mitigating any potential discriminatory impact (Corbett-Davies et al., 2017). The goal of this paper is to provide credible evidence about these important public policy questions.

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<sup>1</sup>When rejecting our public records request for all of registrations flagged by ERIC, the WEC noted “while the WEC possesses this data, due to the restrictions in the ERIC Membership Agreement and the statutory directive to comply with the Agreement as outlined above, this request is denied as it would require the transmission of ERIC Data for purposes other than the administration of elections.”



### 3 Evaluating Vote List Maintenance Using Wisconsin Data

In October 2017, ERIC provided data to the Wisconsin Elections Commission (WEC) indicating that 341,855 registered voters had potentially moved. These registrants were identified in one of three ways: (1) a list of registrants identified as in-state movers, based on matching Wisconsin registration and motor vehicle data; (2) a list of registrants identified as cross-state movers, based on matching Wisconsin registration data to other participating states' registration or motor vehicle data; and (3) a list of registrants identified as submitting a national change of address form.

In addition to the general challenges associated with identifying movers in administrative data, there also were some specific issues that caused some of these 341,855 registrants to be identified as potential movers despite continuing to reside at their address of registration. Motor vehicle data and voter registrations are not integrated in Wisconsin in the same way that they would be in a state subject to the NVRA. According to a 2019 memorandum produced by the DMV, “[s]taff identified several data discrepancies that caused voters to appear on the Movers list who may have not moved, such as differences in spelling between the street name on their voter registration record versus their DMV record, or cases where the new address was a PO Box” (Wisconsin Elections Commission, 2019). Because Wisconsin is not subject to the NVRA, a DMV transaction also does not make reference to voter registration like it would in a state subject to the NVRA. The WEC concluded that “while available data from the DMV implied many had moved, some of the voters, in fact, had not moved. Some reasons for this include voters who registered a vehicle or obtained a driver’s license at an address other than the address they considered to be their voting residence. This included persons who registered a vehicle at a business address, vacation home, or their child’s college address, and college students who obtained a driver’s license when they are temporarily living away from home” (Wisconsin Elections Commission, 2019).

The WEC sent postcards to the 341,855 potential movers identified by ERIC. 6,153 of these 341,855 registrants flagged as potential movers responded to a postcard sent by the WEC confirming that they continued to be eligible to vote at their address of registration. The remaining 335,702 registrants were removed either because there was no response to the postcard (251,959 registrants) or the postcards were returned undelivered (83,743 registrants). A state subject to the NVRA would not have been able to remove these registrations, and likely would have made them inactive instead.

A unique policy intervention gives us an unusual opportunity to observe registrants who continued to reside at their address of registration despite not responding to the WEC's postcard. After a number of people whose registrations were removed showed up to vote in Wisconsin's statewide primary election in February 2018, the WEC took two actions that inform our understanding of the "false mover error rate," which we define as individuals removed for having apparently moved despite residing at their registration address. First, Wisconsin proactively reactivated 12,133 of these removed registrations between January and March 2018 because of some questions about data quality. This means that among those registrants who failed to return a postcard, 3.6% of registrants were likely incorrectly flagged as having moved.

Second, Wisconsin created separate movers poll books, which contained those registrations removed by the state because they were flagged by ERIC and for which no postcard response confirming eligibility had been received, for the April, August, and November statewide elections. These poll books excluded registrations that had been reactivated when these elections were held (i.e., were not the 12,133 registrants automatically restored by the WEC or registrants whose current address of registration was confirmed in some other way prior to the election). Registrants listed in the movers poll books who showed up to vote at their address of registration would sign their name in these poll books, which certified that they still resided at their registration address and wanted to remain registered at it. Wisconsin law says that the state cannot restrict the public from observing a poll book, despite the

ERIC policy agreement described above. We next explain how we collected copies of these poll books for a random sample of precincts, extracted the voter registration number of all of the listed registrants, and identified these registrants' records in the Wisconsin statewide voter file from February 2018 and January 2019.

We use the data described in the previous paragraph to estimate the share of removed registrants who voted at the registration address flagged by ERIC. The advantage of this estimate is that it provides a clear lower bound for our understanding of the false mover error rate. However, a registrant must vote in order for us to be able to identify that the initial removal was incorrect. As a result, we also examine the relative error rate among registrants in the movers poll books who voted in 2018, whether at their original address or a new one. We define a removed voter as someone who used a voter registration number contained in a movers poll book to vote in at least one of the April 2018, August 2018, or November 2018 elections. The advantage of focusing on voters is that the act of voting causes a registrant's address of registration to update if it has changed. Thus, registrants who cast a ballot in one of these elections will have a different address in the January 2019 statewide voter file than they did in the February 2018 statewide voter file if that ballot was not cast at the registration address flagged by ERIC.

In addition to characterizing the overall false mover error rate, we also investigate how the share of suspected movers who voted at the registration address varies as a function of characteristics of the registration. The share of suspected movers who voted at the registration address flagged by ERIC should be increasing in the joint likelihood that ERIC incorrectly flagged a registration as being ineligible and a postcard validating the registrant's address was not received by the state. Thus, we should observe that the share of suspected movers voting at their registration address is higher among registrations with a given characteristic if ERIC is more likely to falsely flag registrations with that characteristics as being ineligible and/or people with that characteristic are less likely to return a validation postcard conditional on still residing at their registration address.

We first examine whether minority flagged registrants are more likely than White flagged registrants to continue to reside at the registration address flagged by ERIC following the postcard confirmation process. Understanding whether list maintenance policies burden racial and ethnic minorities more than Whites is one of the most important academic, legal, and policymaking questions about list maintenance and algorithmic fairness more generally. Some recent research suggests that minorities may be more burdened by registration removal than Whites. Feder and Miller (First View) show that the share of registrations that were removed increased in counties that were previously subject to Section 5 of the Voting Rights Act because of their history of discrimination against the voting rights of minorities after *Shelby County v. Holder* (570 U.S. 529 [2013]). But it is unclear whether this reflects increased incorrect removals or instead an ability to more easily remove ineligible registrants now that these counties are free of federal oversight. Similarly, Morris and Pérez (2018) highlight that between September 2016 and May 2018, minorities were more likely than Whites to have their registrations removed in 90 of 100 North Carolina counties. But some differences in the removal rates of minorities and Whites is to be expected given that minorities are more likely than Whites to move in a given year Moore (2017). Examining whether minority removed voters are more likely than White removed voters to continue to reside at the registration address flagged by ERIC is a more direct test of differential burden.

One reason why we expect minorities will be more likely than Whites to be falsely flagged as movers is that they are more likely to be frequent movers. Brater et al. (2018) note, for example, that election administrators can find it challenging to identify the most recent address of a frequent mover using ERIC data. We theorize that a disproportionate number of minorities will be falsely flagged as moving because Black and Hispanic families are more likely than White families to move multiple times in a relatively short interval.<sup>2</sup>

Another reason why we expect that minorities will be more likely to be falsely flagged as movers is that they tend to reside in multi-unit buildings. We expect that they will be more

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<sup>2</sup>See, for example, <https://www.nschdata.org/browse/survey/results?q=5225&g=606>

likely to reside in multi-unit buildings (Cilluffo, Geiger and Fry, 2017). As we discussed in the previous section, failure to link a voter registration record to other administrative records that establish a registrant’s residence may increase the chance that someone is falsely flagged as no longer residing at their address of registration. We hypothesize that the additional complexity of addresses in multi-unit buildings reduce the chance that an address links to itself over administrative data sources.

A final reason why we expect that minorities will be more likely to be falsely flagged as movers is that they tend to reside in larger households. As we discussed in the previous section, it may be hard to distinguish movers from non-movers when only some members of a household are moving. This may be particularly true when the movers and non-movers share a similar name. This will cause a disproportionate number of minorities to be falsely flagged as moving because minorities, and particularly Hispanics, tends to live in larger households.<sup>3</sup>

While we have focused our discussion so far on the reasons ERIC might be more likely to flag minority registrations for having moved, we also note that these same factors may also increase the chances that a person sent a postcard informing them that their registration had been flagged for removal would be less likely to return it. Mail may be less likely to reach a person living in buildings where occupancy changes more frequently, in multi-unit buildings, and in large households where multiple people receive mail at the same address. Minorities may also be less likely to return the postcard than Whites, for example if they are more likely to perceive that the post card is junk mail or a scam.

### 3.1 Sampling movers poll books

We sent public records requests to a subset of Wisconsin municipalities that were selected based on a stratified random sampling strategy. Because of our sampling strategy, our analysis weights observations from sampled municipality  $m$  according to the inverse of their probability of being selected into our sample,  $\pi_m$ .  $\pi_m$  is calculated by multiplying  $\gamma_{s(m)}$ , the

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<sup>3</sup>See, for example, <https://www2.census.gov/programs-surveys/demo/tables/families/2019/cps-2019/tabavg1.xls>.

probability of sampling a municipality in strata  $s(m)$ , by  $\lambda_m$ , the probability of a ward being sampled in municipality  $m$ .

We put each of the 1,780 municipalities in Wisconsin that administer elections into one of three strata. The first strata contained the 20 biggest municipalities. We sampled municipalities in the first strata with probability one. The second strata contained the next 124 largest municipalities. We sampled 31, or 25 percent, of the municipalities in the second strata. The third strata contained the 1,636 smallest municipalities. We sampled 82, or 5 percent, of the municipalities in the third strata. Hence,  $\gamma_1 = 1$ ,  $\gamma_2 = .25$ ,  $\gamma_3 = .05$ ,

The FOIA we sent to sampled municipalities initially asked for copies of the movers poll books used in the April, August, and November 2018 elections for all wards. Some municipalities, particularly those in the first and second strata, responded that they did not have the resources to copy movers poll books for every ward in their municipality. In such cases, we used a systematic sampling strategy to collect poll book from a subset of wards in the municipality. In each sampled municipality, we drew a random integer  $X$  between 1 and 10. We then asked them to provide copies of poll books for wards  $X$ ,  $X + 10$ ,  $X + 20$ , ... until the resulting number was higher than the largest ward number in the municipality. Hence,  $\lambda_m = 1$  if we collect the universe of poll books in municipality  $m$  and  $\lambda_m = .1$  if we collected a systematic sample of wards from municipality  $m$ .

There are two types of missing data in our sample. First, we did not receive copies of poll books from four municipalities which we believe had at least one ERIC registration: the City of Tomahawk, the City of Watertown, the Town of Eau Pleine, and the Village of Marshall. Second, Table 7.1 in the Appendix shows that a number of municipalities were only able to provide copies of the movers poll books for one or two of the three requested elections. Lacking the April movers poll book is particularly problematic because the act of voting in the April election is one reason why a registration flagged by ERIC would not appear in the August or November poll books. Section 7.4 in the Appendix uses data from the municipalities that provided us all three poll books to investigate how results change

when data from certain poll books are excluded from the analysis.

## **3.2 Processing movers poll books**

Once we collected and scanned the poll book records, we wrote a computer program to perform optical character recognition (OCR) and identify the voter registration numbers contained on each page of the files provided to us. Section 7.2 describes the steps we took to check and correct for errors in this process.

We merged all of the voter registration numbers found in the movers poll books to the February 2018 voter file. This provides us with each registrant’s address prior to any 2018 election. We then searched for a record in the January 2019 voter file (the voter file that contains information about voting in 2018 and includes updated address information for anyone whose registration details changed in 2018) with the same voter registration number and last name anywhere in the state. Section 7.2 in the Appendix shows the results of an audit that evaluated how well this process performed at accurately capturing the voter registration records of the registrants contained in copies of the movers poll books that we collected. This audit reveals that our process generated a dataset that accurately represents the data contained in the copies of the movers poll books that we collected.

## **3.3 Inferring a registrant’s racial and ethnicity**

Because the Wisconsin voter file does not include information on a registrant’s race or ethnicity, we imputed this information using Imai and Khanna’s (2016) method that combines information on a registrant’s surname and the racial composition of a registrant’s census block group. Section 7.3 in the Appendix describes how we used this method to calculate predicted race and ethnicity scores for each registrant in the movers poll book and a random sample of the Wisconsin voter file.

Table 1: 2018 turnout among registrants in movers poll books

	<b>N</b>	<b>Voted</b>	<b>Voted &amp; Same Address</b>	<b>Voted &amp; Different Address</b>
Sampled movers poll books registrants	68,515	19,315 28.2%	1,895 2.8%	17,425 25.4%
Population estimate of movers poll books registrants	259,650 (45,885)	77,450 (15,960) 29.8% (1.6%)	9,015 (2,685) 3.5% (0.5%)	68,435 (13,280) 26.4% (1.3%)
Total registrants	5,927,690	2,443,715 41.2%	2,159,265 36.4%	284,450 4.8%

Note: Standard errors in parentheses.

## 4 Results

We begin our analysis by examining the frequency with which a registrant who was identified as a mover by ERIC and failed to respond to a postcard subsequently went on to vote. We define a “mover voter” as someone who cast a ballot in at least one of the 2018 elections (April, August, or November) using the registration number contained in the movers poll books. The first row of Table 1 shows that there were 68,515 registrants in the movers poll books that we sampled. Of these 68,515 registrants, 19,315 voted in at least one of the 2018 elections using their original registration number. 1,895, or about 2.8 percent, of these registrants cast their ballots at the same address of registration flagged by ERIC, while 17,425, or about 25 percent, of these registrants cast a ballot at a new address of registration.

In the second row of Table 1 we use the data from our sample to extrapolate to the population of registrants in all movers poll books statewide. We estimate 9,015, or about 3.5 percent, of the 259,650 registrants in the movers poll books cast a ballot at the address of registration flagged by ERIC. This 3.5% figure is substantial, implying that for about every 29 registrations in the movers poll book, one registrant continued to reside at their address of registration and used that registration to cast a ballot. However, this only represents a lower bound on the false mover error rate. First, the number does not include any voters who



had their registration reactivated by the WEC before the movers poll books were created, including at least 12,133 removed registrations that the WEC proactively reactivated between January and March. Second, section 5 shows that some registrants flagged as movers by ERIC subsequently cast ballots using a new registration number but at the same address. Finally, some registrants in the movers poll book did not move, but also did not vote. The third row of Table 1 shows that about 41 percent of all registrants in the February 2018 voter file cast a ballot using the registration number contained in the February 2018 voter file. While this understates overall turnout because some of these registrants cast a ballot using a new voter registration number, it makes it clear that a non-trivial number of registrants who did not move also did not vote in these elections.

Table 2 shows that minorities in the movers poll books were more likely to vote at the address of registration flagged by ERIC than Whites in the movers poll books. The dependent variable in regressions reported in columns 1 through 4 is equal to 1 if a registrant in a movers poll book voted at the address flagged by ERIC, and 0 if a registrant in a movers poll book voted at a new address or did not vote. Column 1 presents the results of a regression in which this dependent variable is regressed on the predicted probability that the registrant is nonwhite. The interpretation of the constant is that our best estimate is that 2.7 percent of Whites in the movers poll books cast a ballot at the address of registration flagged by ERIC. The interpretation of the coefficient on the probability that the registrant is minority is that our best estimate is that minorities in the movers poll books were 3.8 percentage points more likely to vote at the address of registration flagged by ERIC than Whites in the movers poll books, meaning that about 6.5 percent of minorities in the movers poll books cast a ballot at the address of registration flagged by ERIC. Notably, this means that the lower bound on the false mover error rate is more than 100% larger for minorities than for Whites.

Column 2 of Table 2 shows the results of a regression that disaggregates minority movers poll book registrants by their probability of being of different races and ethnicities. The

Table 2: Racial and ethnic minorities in movers poll books are disproportionately likely to vote at the address flagged by ERIC

Sample	<i>Dependent variable: Voted at address flagged by ERIC</i>							
	All registrants in movers poll books				Voters in movers poll books			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
pr(Minority)	0.038*** (0.002)		0.037*** (0.002)		0.096*** (0.008)		0.087*** (0.008)	
pr(Black)		0.053*** (0.003)		0.051*** (0.003)		0.117*** (0.009)		0.105*** (0.009)
pr(Hispanic)		0.027*** (0.005)		0.025*** (0.005)		0.085*** (0.015)		0.073*** (0.015)
pr(Asian)		-0.002 (0.006)		-0.001 (0.006)		0.014 (0.022)		0.018 (0.021)
pr(Other)		0.018 (0.015)		0.023 (0.015)		-0.004 (0.042)		0.009 (0.042)
Multi-unit			-0.005*** (0.002)	-0.004** (0.002)			-0.019*** (0.006)	-0.017*** (0.006)
Multi-registrant			-0.019*** (0.002)	-0.018*** (0.002)			-0.067*** (0.007)	-0.066*** (0.007)
Multi-family			-0.006** (0.002)	-0.006** (0.002)			-0.032*** (0.008)	-0.032*** (0.008)
Constant	0.027*** (0.001)	0.028*** (0.001)	0.038*** (0.001)	0.038*** (0.001)	0.095*** (0.003)	0.098*** (0.003)	0.142*** (0.004)	0.143*** (0.004)
Observations	66,749	66,749	66,749	66,749	18,762	18,762	18,762	18,762

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

results suggest that voters who are Black and, to a lesser extent, Hispanic are significantly more likely to have voted at the address flagged by ERIC than removed voters who are White. Mover voters predicted to be Asian or of another race did not appear to vote at their listed addresses at rates significantly different from White removed voters.

Columns 3 and 4 of Table 2 repeats the analysis from columns 1 and 2 while including some measures that we expect to account for some of the racial differences in the likelihood of casting a ballot at the address flagged by ERIC. Specifically, we control for whether a registrant lives at a residence with multiple units, in a household with at least one other registered voter, and in a household with at least one other registered voter who has the same last name.<sup>4</sup> Including these controls only slightly changes the estimated racial differences. Interestingly, the coefficients on these controls do not align with our expectations. While we expected that registrants who lived in multi-unit residences would be more likely to be wrongly identified as a mover than removed voters who lived in single-unit residences, they actually appear slightly less likely. One reason might be that the Wisconsin Election Commission proactively “identified several. . . situations where voters appeared to have moved but did not,” including “cases where the voter registration address. . . contained a unit number but their DMV record did not, or vice versa” (Wisconsin Elections Commission, 2019). Further, also contrary to our expectations, removed voters who lived in a household with another registrant are less likely to vote at the address flagged by ERIC than removed voters who lived in a household with no other registrant, particularly when that registrant has the same last name as them.

One potential explanation for why certain registrants were more likely to vote at the address flagged by ERIC is that they were more likely to vote in general. To investigate this possibility, the analysis reported in columns 5 through 8 restricts our sample only to flagged registrants who voted in at least one of the 2018 elections using their original registration number. This changes the interpretation of the coefficient to represent the probability that a

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<sup>4</sup>Section 7.3 in the Appendix details how we construct these variables.

flagged registrant who voted cast their ballot at the address flagged by ERIC. This analysis shows that more than 21 and 17 percent of Black and Hispanic registrants who voted using their original registration number did so at the address flagged by ERIC, as opposed to about 10 percent of White registrants. Thus, differential turnout does not explain why Black and Hispanic removed registrants were disproportionately likely to vote at the address flagged by ERIC.

## 5 Robustness

In this section we describe the robustness of our findings when we account for possible reasons why voters suspected of having moved would be missing from the regressions presented in the previous section. First, some municipalities only provided us copies of movers poll books for one or two of the three elections that we requested. This may cause us to miss some movers poll book voters, particularly when we are missing the April movers poll book. Second, some of the registrations flagged by ERIC may have been assigned a new voter registration number between the February 2018 and January 2019 statewide voter files, causing us to miss their vote record in at least one of the April, August, and November elections.

In Section 7.4 of the Appendix we conclude that our results would not change much if we had access to all three movers poll books in the 47 municipalities that sent us one or two movers poll books. We reach this conclusion by looking at how our results would change if we only observed a subset of the movers poll books in the 75 municipalities that sent us all three movers poll books.

In Section 7.5 of the Appendix we conclude that a significant number of movers poll book registrants voted using a new voter registration number. Using data from the subset of mover registrants with rare names, we estimate that about 730 and 29,200 movers poll books registrants in the population voted using a new voter registration number at the address flagged by ERIC and at a new address, respectively. This implies that the lower

bound on the false mover error rate is about four percent, while the share of movers voters who cast a ballot at the address flagged by ERIC is about nine percent. Section 7.5 presents no evidence that the racial differences we observe in Table 2 are an artifact of minority ERIC registrants being more likely to vote using a new voter registration number than white ERIC registrants.

## 6 Discussion

Our analysis of the list maintenance procedure used by Wisconsin reveals that it initially removed a substantial number of registrants who resided at their address of registration. These registrants were identified by ERIC as movers by matching administrative records. All registrants flagged as movers were then sent postcards in the mail that, in theory, gave those registrants who had not in fact moved the opportunity to confirm their address of registration. Yet, we find at least 10,000 registrants, or about 4 percent of all flagged registrants who did not respond to this postcard, went out to vote in 2018 at the address of registration flagged by ERIC. This represents a lower bound on the false mover error rate because there were additional registrants who had their registration reactivated before we could observe them or continued to reside at their address of registration but did not vote in 2018.

Additionally, we find the burden of incorrect removal falls more heavily on minority registrants. Our analysis shows that the lower bound on the false mover error rate is more than twice as large for Blacks registrants as White registrants. This finding is consistent with claims made by groups like U.S. Commission on Civil Rights (2018) that the more frequent movements of registrants of color may make it harder to determine their current residence, and hence put registrants of color at a heightened risk of having their valid registrations removed.

Our analysis exploits the decision by the WEC to restore the registrations of registrants

flagged as movers using the movers poll books. Because these registrants were restored into separate movers poll books, and because poll books are by state law available for public inspection in Wisconsin, we can observe nearly the entire universe of registrants removed through this list maintenance procedure and the registration and voting behavior of these registrants. However, had Wisconsin not taken these unusual steps, the process used by the state would have otherwise been obscured because of the state’s participation in the ERIC consortium. ERIC prohibits states from disclosing to third parties the list of voters flagged as movers, which has heretofore made it impossible for researchers to assess its error rate. As we show, this lack of transparency may be consequential—incorrect removals are both large in number and display a disturbing pattern of racial bias. More creativity is needed to find ways to allow evaluation that are consistent with the Driver’s Protection Policy Act. More generally, both the public and policymakers need to be able to observe enough details about how algorithms work in practice to evaluate their fairness.

Beyond these broader issues, we also believe that our findings also point to policy changes that can mitigate the potential disenfranchising effects of errors in voter list maintenance procedures. First, given that a substantial number of registrants fail to respond to a postcard seeking to validate their address, states should consider revising the process of address verification. Only about 6,000 people responded to the postcard sent by WEC asking the registrant to confirm their address of registration if they wished to remain registered to vote. Subsequently, the WEC proactively reactivated about 12,000 of the registrations in which the registrant didn’t respond to the postcard, and we identified at least an additional 10,000 registrations in which the registrant did not respond to the postcard despite remaining eligible to vote at their address of registration. Given that a majority of the registrants who remain eligible to vote at their address of registration are not responding to a postcard, it may be that state communication should include multiple efforts at contact, clearer communication, or contact through means other than the USPS.

Second, in states where failure to respond to a validation postcard leads to either re-

removal or placing a voter on an inactive list, more effort should be made to cure errors. While the protections of the NVRA and Election Day registration reduce the costs of falsely flagging movers, they do not eliminate them. While inactive registrants are always eligible to vote, they may not be sent official mailings from election administrators and face a more burdensome process to verify their identify before they can cast a ballot. Likewise, forcing someone to reregister to vote on Election Day is likely to increase the time it takes someone to vote. Wisconsin's movers poll books are an example of a clear intervention that avoided the disenfranchising effects of their list maintenance procedure, as is Election Day registration, although both processes will be more efficacious when those who are removed continue to receive notices about upcoming elections. Our results show why it is essential to make registrants aware if their registration is being moved to inactive status and continue to alert these registrants to upcoming elections so that they know of when and where to vote if they still reside at their address of registration.

Finally, we do not think our results should be used to claim that states should not use ERIC to help with list maintenance. List maintenance is essential, and our data shows that a large majority of the registrations ERIC flags as potential movers are for registrants who no longer reside at their address of registration. There is unlikely to be methods of conducting list maintenance that avoid incorrect removals without leaving a large number of ineligible registrations on the rolls. That said, we hope that this evaluation causes ERIC and its member states to further assess its practices and work towards reducing differences in the frequency of the incorrect flagging of White registrants and registrants of color. We also hope it highlights to policymakers and the public the importance of treating the information from ERIC as evidence that registrants *might* have moved, rather than evidence that they *did* move, and to use it accordingly.

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## 7 Appendix

### 7.1 Municipalities included in our analysis

Table A.1 shows each of the sampled municipalities for which we were able to collect copies of their movers poll books. Each row shows which poll books we collected from the sampled municipality, our estimate of the number of ERIC registrations contained in the poll books we collected, and this estimate is based on a census or sample of the precincts in the municipality. Municipalities with an estimate of zero ERIC registrations based on a census of precincts are municipalities that communicated to us that they had no ERIC registrations.

Table A.1: Sampled municipalities included in our analysis

Municipality	Which Pollbooks			Weighted Registrations	Data Received
	April	August	November		
City of Appleton - Multiple Counties	1	1	1	3,783	census
City of Ashland - Multiple Counties	1	1	1	1,764	census
City of Beloit - Rock County	1	1	1	2,170	sample
City of Brookfield - Waukesha County	1	1	1	1,712	census
City of Clintonville - Waupaca County	1	1	1	724	census
City of Eau Claire - Multiple Counties	1	1	1	8,320	sample
City of Evansville - Rock County	1	1	0	1,840	sample
City of Fond Du Lac - Fond Du Lac County	1	1	1	1,030	sample
City of Franklin - Milwaukee County	1	1	1	3,680	sample
City of Green Bay - Brown County	1	1	0	4,020	sample
City of Greenfield - Milwaukee County	1	1	1	2,060	sample
City of Hartford - Multiple Counties	0	1	1	3,560	sample
City of Hillsboro - Vernon County	1	1	1	1,100	census
City of Janesville - Rock County	1	1	1	1,530	sample
City of Kenosha - Kenosha County	1	1	1	3,570	sample
City of La Crosse - La Crosse County	1	1	1	3,480	sample
City of Madison - Dane County	1	1	1	27,367	census
City of Marshfield - Multiple Counties	1	1	1	3,280	sample
City of Mellen - Ashland County	1	0	1	260	census
City of Menasha - Multiple Counties	1	1	0	2,480	sample
City of Milwaukee - Multiple Counties	1	1	0	40,420	sample
City of Muskego - Waukesha County	1	1	1	840	sample

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Municipality	Which Pollbooks			Weighted Registrations	Data Received
	April	August	November		
City of Neenah - Winnebago County	1	1	1	4,904	census
City of New Berlin - Waukesha County	1	1	1	1,190	sample
City of Oak Creek - Milwaukee County	1	1	1	7,388	census
City of Onalaska - La Crosse County	1	0	0	6,560	sample
City of Oshkosh - Winnebago County	1	1	1	3,980	sample
City of Peshtigo - Marinette County	1	1	1	2,900	census
City of Racine - Racine County	1	1	1	3,403	census
City of Rice Lake - Barron County	1	0	0	1,776	census
City of Richland Center - Richland County	0	0	1	944	census
City of Sheboygan - Sheboygan County	1	1	1	3,400	sample
City of Spooner - Washburn County	1	1	1	1,920	census
City of Watertown - Multiple Counties	1	1	1	3,480	sample
City of Waukesha - Waukesha County	1	1	1	2,300	sample
City of Waupun - Multiple Counties	1	1	0	2,160	sample
City of Wausau - Marathon County	1	1	1	2,260	sample
City of Wauwatosa - Milwaukee County	1	1	1	2,330	sample
City of West Allis - Milwaukee County	1	1	1	3,355	census
City of Wisconsin Dells - Multiple Counties	1	0	0	0	sample
City of Wisconsin Rapids - Wood County	1	1	0	2,988	census
Town of Akan - Richland County	1	1	0	260	census
Town of Algoma - Winnebago County	0	0	1	596	census
Town of Almond - Portage County	0	0	0	0	census
Town of Aniwa - Shawano County	0	1	1	180	census
Town of Atlanta - Rusk County	1	1	1	380	census
Town of Barre - La Crosse County	1	1	1	820	census
Town of Bashaw - Washburn County	1	1	1	640	census
Town of Beaver Dam - Dodge County	0	0	0	436	census
Town of Bevent - Marathon County	1	0	1	640	census
Town of Birch Creek - Chippewa County	1	0	1	20	census
Town of Black Creek - Outagamie County	1	1	1	220	census
Town of Breed - Oconto County	0	1	1	520	census
Town of Brighton - Kenosha County	0	1	0	1,000	census
Town of Burnside - Trempealeau County	0	1	1	120	census
Town of Cady - St. Croix County	1	0	1	520	census
Town of Carey - Iron County	0	1	0	80	census
Town of Charlestown - Calumet County	1	1	1	340	census

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Municipality	Which Pollbooks			Weighted Registrations	Data Received
	April	August	November		
Town of Chilton - Calumet County	1	1	1	620	census
Town of Cleveland - Chippewa County	1	0	1	640	census
Town of Colburn - Adams County	0	1	1	40	census
Town of Dallas - Barron County	0	0	0	0	census
Town of Delafield - Waukesha County	1	1	1	1,440	sample
Town of Delavan - Walworth County	1	1	1	248	census
Town of Dunkirk - Dane County	1	1	1	1,120	census
Town of Dunn - Dane County	1	1	1	3,280	census
Town of Eisenstein - Price County	1	1	1	320	census
Town of Ellington - Outagamie County	1	1	1	1,760	census
Town of Fairbanks - Shawano County	1	1	1	500	census
Town of Forest - St. Croix County	1	1	1	540	census
Town of Frankfort - Marathon County	1	1	1	160	census
Town of Greenwood - Taylor County	0	1	0	60	census
Town of Hansen - Wood County	0	0	0	500	census
Town of Harmony - Rock County	1	0	1	1,500	census
Town of Herman - Dodge County	0	1	0	600	census
Town of Hixton - Jackson County	1	1	1	600	census
Town of Isabelle - Pierce County	1	1	1	140	census
Town of Lake - Price County	1	1	1	620	census
Town of Ledgeview - Brown County	0	0	0	0	census
Town of Leon - Monroe County	1	1	0	580	census
Town of Leroy - Dodge County	1	1	1	440	census
Town of Little Falls - Monroe County	1	1	1	800	census
Town of Little Grant - Grant County	0	1	1	40	census
Town of Lomira - Dodge County	1	1	1	640	census
Town of Magnolia - Rock County	1	1	1	460	census
Town of Merton - Waukesha County	1	1	1	1,640	sample
Town of Minong - Washburn County	1	0	0	880	census
Town of Mitchell - Sheboygan County	0	1	0	660	census
Town of Nekimi - Winnebago County	1	1	1	620	census
Town of Neva - Langlade County	1	1	1	700	census
Town of New Diggings - Lafayette County	0	1	0	140	census
Town of Oakland - Jefferson County	1	1	0	2,120	census
Town of Pella - Shawano County	0	1	1	380	census
Town of Pleasant Valley - Eau Claire County	1	1	1	2,640	census

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Municipality	Which Pollbooks			Weighted Registrations	Data Received
	April	August	November		
Town of Randolph - Columbia County	1	1	1	240	census
Town of Rock Elm - Pierce County	1	1	1	220	census
Town of Sheldon - Monroe County	1	1	1	260	census
Town of Sherman - Clark County	1	1	1	400	census
Town of Somers - Kenosha County	0	0	0	0	census
Town of Springfield - St. Croix County	1	1	1	240	census
Town of Stiles - Oconto County	1	0	0	580	census
Town of Strickland - Rusk County	1	1	1	200	census
Town of Trenton - Washington County	1	1	1	1,440	census
Town of Two Rivers - Manitowoc County	1	0	0	840	census
Town of Vilas - Langlade County	0	1	0	160	census
Town of Wheatland - Kenosha County	1	1	1	2,880	census
Town of Wood - Wood County	1	0	0	520	census
Village of Argyle - Lafayette County	0	1	0	400	census
Village of Bell Center - Crawford County	0	0	0	0	census
Village of Cambridge - Multiple Counties	1	1	1	1,140	census
Village of Dresser - Polk County	1	1	1	1,280	census
Village of Hewitt - Wood County	0	1	1	480	census
Village of Hortonville - Outagamie County	0	1	1	2,540	census
Village of Jackson - Washington County	1	0	0	1,472	census
Village of Kronenwetter - Marathon County	1	1	1	1,268	census
Village of Luck - Polk County	1	1	1	680	census
Village of Mcfarland - Dane County	0	1	1	1,368	census
Village of Menomonee Falls - Waukesha County	1	1	1	7,440	sample
Village of Mukwonago - Multiple Counties	1	1	1	1,640	census
Village of Oregon - Dane County	1	1	1	2,152	census
Village of Osceola - Polk County	0	1	1	2,460	census
Village of Oxford - Marquette County	0	0	0	0	census
Village of Randolph - Multiple Counties	1	1	1	1,060	census
Village of Ridgeway - Iowa County	1	1	0	540	census
Village of Saukville - Ozaukee County	1	0	0	4,580	census
Village of Scandinavia - Waupaca County	1	1	1	120	census
Village of Shorewood - Milwaukee County	1	1	1	3,480	sample
Village of Stockholm - Pepin County	1	1	1	80	census
Village of Union Grove - Racine County	1	0	0	4,400	census
Village of Waunakee - Dane County	1	1	1	2,660	census

## 7.2 Error checking our processing of ERIC poll books

We are worried about three different forms of measurement error that could cause us to inaccurately represent the data contained in the random sample of ERIC poll books that we collected. First, our processing of ERIC poll books could have represented voter registration numbers differently than they were presented in the poll book (e.g., we processed a voter registration number as 700110 that was actually 100110). Second, we may have failed to process some of the voter registration numbers contained in the ERIC poll books. Third, we could have correctly processed voter registration numbers contained in these poll books, but been unable to link these voter registration numbers to the correct registrants' records in the February 2018 Wisconsin voter file.

We instituted two flags to limit the amount of measurement error when processing the movers poll books. First, we flagged pages in which the number of voter registration numbers identified did not match the number we expected to find given auxiliary information available on the page. Second, we flagged cases in which a voter registration number only appeared in a single poll book. We then had a research assistant inspect almost every flagged case, and add, remove, or change voter registration records that they determined were erroneous.

We merged all of the voter registration numbers uncovered using this combination of automated and manual processing to a record in the February 2018 voter file with that voter registration number in that municipality. That is, we validated our merge by looking at “pre-removal” records. We located a few additional OCR errors when we found that a voter registration number did not match to a voter registration number in the municipality in this voter file. After fixing those errors and remerging the data to the February file,

To evaluate how much measurement error was present after putting in these checks, we identified 1,000 pages in these poll books at random and looked for these three different sources of error. The evaluation shows that the process described in Section 3.2 generated very little measurement error. There were at least 3,031 voter registration numbers pulled from these 1,000 pages in our data. We found zero cases in which a voter registration

number was collected from a page that wasn't found on the page. Note that this could either represent a case of the wrong voter registration number being pulled from that page or us incorrectly noting what page that this voter registration number was pulled from. We also found five voter registration numbers on these 1,000 pages that did not make it into our final dataset. Finally, we found one case in which a voter registration number identified an incorrect, extraneous registrant in the February 2018 Wisconsin voter file. However, we simultaneously identified the correct registrant in the voter file. The small number of errors relative to the total number of voter registration numbers pulled from these pages gives us confidence that we are accurately representing the data contained in the random sample of ERIC poll books that we collected.

### **7.3 Coding variables**

Our dependent variable is whether a potential mover voted in 2018 at the address of registration flagged by ERIC. To identify whether someone voted at the address of registration flagged by ERIC, we look at whether someone with a record of voting in April, August, or November 2018 in the January 2019 voter file has an identical standardized address that they had in the February 2018 voter file. We geo coded the address in both voter files via Geocod.io API to obtain the Census block of residence. As part of this geo code the format of the address of registration is standardized. Comparing the standardized address prevents us from classifying a registrant as a mover because they live in "Apt. 2" in the February 2018 voter file and "Unit 2" in the January 2019 voter file.

Our key independent variables are the probability that a registrant is from five different racial and ethnic backgrounds. We used the R package `wru`, which takes as inputs both the registrant's last name and Census block of residence, to estimate the probability that each registrant was white, Black, Hispanic, Asian, or some other race Imai and Khanna (2016).

Some of our regressions also include control variables. We measure whether a registrant lives at a residence with multiple units by looking we look at whether there is any registrant



in the voter file at that address that includes a unit number or unit type. We measure a multi-registrant household based on whether two or more registrants report the same full address in the voter file, including unit number. Finally, we measure a multi-family household based on whether two or more registrants with the same last name report the same full address in the voter file, including unit number.

## 7.4 Missing ERIC poll books

In order to estimate the extent to which we undercounted ERIC voters in the 47 municipalities that provided us ERIC poll books for one or two elections, we examined how the combination of poll books used affected the number of ERIC voters we found in the 75 municipalities from which we received all three poll books (see Table A.1 in the Appendix for a table of which poll books we collect from each sampled municipality). We computed the weighted number of ERIC voters we would have detected in each of 75 municipalities if we only used voter registration numbers that were contained in each possible combination of poll books (i.e., only April, only August, only November, April and August, April and November, or August and November). Thus, we would not count an ERIC voter who was only listed in the April ERIC poll book when computing ERIC voters contained only in August, only in November, or in the August and November poll books). After performing these calculations for each municipality, we aggregated over all 75 municipalities and determined the percent of ERIC voters that were lost using each of the possible partial combinations of poll books relative to using all three poll books.

Table A.2 provides evidence that leads us to believe our results would not change much if we had access to all three poll books in the 47 municipalities that sent us incomplete data. We delineated between ERIC voters who voted at the registration address flagged by ERIC and those who voted at a different/new address in these estimations. As expected, we found that we underreported ERIC voters of both types at the highest rates when we did not have access to a municipality's April poll book. We expect that if always had access to all three

Table A.2: Accounting for Missing ERIC Poll Books

Which Poll Book			Observed Address		% Observed		Estimated Total	
April	August	November	Same	Different	Same	Different	Same	Different
Yes	No	No	435	5,985	90.9%	91.5%	480	6,540
No	Yes	No	100	760	80.8%	74.2%	125	1,025
No	No	Yes	5	150	66.9%	54.7%	5	280
Yes	Yes	No	3,380	17,375	99.4%	99.4%	3,400	17,475
Yes	No	Yes	40	760	96.7%	95.8%	40	795
No	Yes	Yes	345	2,630	84.4%	77.4%	410	3,395
Yes	Yes	Yes	4,695	40,435	100.0%	100.0%	4,695	40,435
<b>Total</b>			9,000	68,095	NA%	NA%	9,155	69,940

polls books we would have observed 155 additional ERIC voters who cast a ballot at the registration address flagged by ERIC and 1,845 additional ERIC voters who cast a ballot at a new address. Thus, we expect that observing all three poll books in the 47 municipalities which sent us incomplete data would cause a trivial reduction in our estimate of share of ERIC voters who cast a ballot at the address flagged by ERIC.

## 7.5 ERIC voters with new voter registration numbers

In this section we describe how we attempted to estimate how often registrants with registration flagged by ERIC showed up to vote using a new voter registration number. This is challenging because Wisconsin’s voter file does not include information on either date of birth or age, which leaves us only with names of registrants in movers poll books to link registrations over voter files. But many registered Wisconsin voters share the same names; David Johnson, the most common name in the January 2019 statewide voter file, appeared 323 times.

To make it easier to identify when someone reregistered to vote using a different voter registration number, we focus on uncommon names. First, we reduced our pool of registrants in movers poll books to only those whose combined first and last name was unique in the entire February 2018 (pre-removal) statewide voter file and who did not cast a vote in any of the three 2018 elections using the voter registration number flagged by ERIC. We then

Table A.3: Some ERIC registrants cast ballots using a new voter registration number

		Consistent	Unknown	Inconsistent	Consistent	Unknown	Inconsistent
		Same Address			Different Address		
	N	Middle	Middle	Middle	Middle	Middle	Middle
all registrants	103,248	401	10	20	15,159	1,339	1,136
p(white) >= 0.5	85,054	378	6	20	13,218	919	1,047
p(white) < 0.5	16,380	13	4	0	1,551	377	83
no p(white)	1,814	10	0	0	390	43	6

searched for registrants who had cast a vote in any of the three statewide 2018 elections using this exact first and last name as the identifier.

Table A.3 shows why we conclude that a substantial number of registrants in movers poll books vote using a new voter registration number. The first row shows that we estimate there were 103,250 registrants in movers poll books with unique names that did not have a vote record attached to the voter registration number that was contained in the movers poll books. We estimate that 18,065 of these registrants matched to at least one registrant with a different registration number, but the same first and last name and one or more recorded statewide 2018 votes in the 2019 voter file. We tried further to discern whether two voter registration numbers belonged to the same registrant by comparing the middle names/middle initials listed between the two voter files. We found that 86.1% percent of these registrants had consistent middle names, 6.4% percent of these registrations had inconsistent middle names, and 7.5% percent were missing at least one middle name. Thus, it appears that most, but not all, of the cases represent the registrant flagged by ERIC getting assigned a new voter registration number.

Registrants from movers poll books who voted under a new voter registration number are more likely to vote at a new address than registrants from movers poll books who voted under the same voter registration number. Table A.3 shows that among the cases we identify with a consistent middle name, we estimate about 2.6 percent of the people who reregister have the same address of registration as the registration address flagged by ERIC. In Table 1, we estimated that the same rate was about 11.6 percent among people who voted using

the same voter registration number as the flagged ERIC registration. If we assume based on the data in Table A.3 that 0.4 percent of registrants in movers poll books voted under a new voter registration number at the address flagged by ERIC and 16 percent of registrants in movers poll books voted under a new voter registration number at a new address, this would imply that Table 1 is missing about 730 registrants in movers poll books who voted at the address flagged by ERIC and 29,200 registrants in movers poll books who voted at a new address.

Based on the analysis in Table A.2 and Table A.3, we conclude that Table 1 understates the lower bound on the false mover error rate and overstates the share of mover poll book voters who cast a ballot at the address flagged by ERIC. Table 1 shows that about 3.5 percent of registrants in the movers poll books cast a ballot at their address of registration and 13 percent of mover voters who voted using the same voter registration number cast a ballot at the address flagged by ERIC. Our analysis in this section suggests that Table 1 is missing at least 885 mover voters who cast a ballot at the address flagged by ERIC and 31,045 mover voters who cast a ballot at a new address. If the estimates are correct, the lower bound on the false mover error rate would be  $\frac{9,015+885}{259,650} \approx 0.038$  and share of mover voters who cast a ballot at the address flagged by ERIC would be  $\frac{9,015+885}{68,435+31,045} \approx 0.091$ .

Table A.3 does not provide any evidence that the large racial differences we identified in Table 2 were an artifact of focusing only on voters from mover poll books who cast a vote using a registration with the same voter registration number. The second and third rows of Table A.3 show that registrants who more likely to be White appear slightly more likely than registrants who are less likely to be White to vote using a new voter registration number. However, the magnitudes of these differences are an order of magnitude smaller than the differences reported in Table 2.