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Supplementary Materials for

The racial burden of voter list maintenance errors: Evidence from Wisconsin's supplemental movers poll books

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Supplementary Materials

Municipalities included in our analysis

Table S1 shows each of the sampled municipalities for which we attempted 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 whether 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. We also note the seven municipalities for which we were not able to collect any poll books.

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.

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 our process 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.

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 geocoded the address in both voter files using the Geocodio API to obtain the Census block of residence. As part of this geocode 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 (*22*).

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

Missing movers poll books

There are two types of missing data in our sample. First, Table S1 shows a seven municipalities did not respond to our request for copies of poll books. We also could only get poll books for the portion of the City of Watertown located in Jefferson County. Given that only about 4.6 percent of weighted registrations were from municipalities that did not provide us data, omitted their movers only can have minimal consequences on the conclusions we draw from our data.

Table S1 in the Appendix also 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 movers 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 exampled 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. We computed the weighted number of ERIC voters we would have detected in each of the 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 S2 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 we had access to all three polls books that 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 the share of ERIC voters who cast a ballot at the address flagged by ERIC.

Registrants in movers poll books who vote using new voter registration numbers

In this section we describe how we attempted to estimate how often registrants with a 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 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. The estimated share of White registrants was nearly identical In the subset with unique first and last name (79.2%) as in the broader population (80%).

Table S3 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 S3 shows that among the cases we identify with a consistent middle name, we estimate about 2.6% 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%among people who voted using the same voter registration number as the flagged ERIC registration. If we assume based on the data in Table S3 that 0.4%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 S2 and Table S3, we conclude that Table 1 understates the lower bound on the false mover error rate and overstates the share of mover voters who cast a ballot at the address flagged by ERIC. Table 1 shows that about 3.5% of registrants in the movers poll books cast a ballot at their address of registration and 13% 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 S3 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 S3 show that registrants who are 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.

Municipality fixed effects

Table S4 replicates Table 2 while also including municipality fixed effects. We do this because we hypothesize that one of the reasons why racial and ethnic minorities are more likely vote at the address flagged by ERIC is that they live in places where people are at a greater risk of being inaccurately identified as a mover. For example, registrants living in urban areas may be more likely to be incorrectly identified as a mover than registrants living in rural areas. The results in Table S4 suggest that this is the case. In Column 1 of Table 2, we estimated that a minority mover registrant was about 3.8 percentage points more likely to cast a ballot at the addressed flagged by ERIC than a White mover registrant. When we conduct the same analysis while including municipality fixed effects in Table S4, this difference drops to about 2.6 percentage points. Thus, about one-third of the estimated difference between minorities and Whites in the likelihood of voting at the address flagged by ERIC can be explained by differences in the types of municipalities that minorities and Whites live in.

Supplemental tables

Table S1: Sampled municipalities included in our analysis

Municipality	Which Pollbooks April	August	November	Weighted Registrations	Data Received
City of Appleton - Multiple Counties	1	1	1	3,782	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	27,365	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	40,410	sample
City of Muskego - Waukesha County	1	1	1	840	sample
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	3,402	census
City of Rice Lake - Barron County	1	0	0	1,772	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 Tomahawk - Lincoln County	0	0	0	NA	missing
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 Albion - Trempealeau County	0	0	0	NA	missing
Town of Algoma - Winnebago County	0	0	1	596	census
Town of Almond - Portage County	0	0	0	0	no reg.
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

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Municipality	Which Pollbooks April	August	November	Weighted Registrations	Data Received
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
Town of Chilton - Calumet County	1	1	1	620	census
Town of Cleveland - Chippewa County	1	0	1	640	census
Town of Cloverland - Vilas County,	0	0	0	NA	missing
Town of Colburn - Adams County	0	1	1	40	census
Town of Dallas - Barron County	0	0	0	0	no reg.
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 Eau Pleine - Portage County	0	0	0	NA	missing
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	1	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	no reg.
Town of Leon - Monroe County	1	1	0	580	census
Town of Leroy - Dodge County	1	1	1	440	census
Town of Lincoln - Monroe County,	0	0	0	NA	missing
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 Long Lake - Washburn County	0	0	0	NA	missing
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
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	no reg.
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

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Municipality	Which Pollbooks April	August	November	Weighted Registrations	Data Received
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	380	census
Village of Bell Center - Crawford County	0	0	0	0	no reg.
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 Marshall - Dane County	0	0	0	NA	missing
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	no reg.
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

Table S2: Accounting for missing movers 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
Total			9,000	68,095	NA%	NA%	9,155	69,940

Table S3: Some registrants in movers poll books 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

Table S4: Municipality of residence explains some of the relationship between racial and ethnic minority status and likelihood that a registrant in movers poll book votes at the address flagged by ERIC

	Dependent variable:							
	Voted at Address Flagged by ERIC							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
pr(Minority)	0.026***		0.025***		0.080***		0.072***	
	(0.003)		(0.003)		(0.010)		(0.010)	
pr(Black)		0.037***		0.034***		0.094***		0.084***
		(0.004)		(0.004)		(0.012)		(0.012)
pr(Hispanic)		0.024***		0.021***		0.085***		0.074***
		(0.005)		(0.005)		(0.016)		(0.015)
pr(Asian)		0.005		0.006		0.028		0.030
		(0.006)		(0.006)		(0.022)		(0.022)
pr(Other)		0.029*		0.032**		0.029		0.036
		(0.015)		(0.015)		(0.043)		(0.043)
Multi-unit			−0.004**	−0.004**			−0.013**	−0.012**
			(0.002)	(0.002)			(0.006)	(0.006)
Multi-ppl			−0.016***	−0.016***			−0.058***	−0.057***
			(0.002)	(0.002)			(0.007)	(0.007)
Multi-family			−0.008***	−0.008***			−0.038***	−0.038***
			(0.003)	(0.003)			(0.008)	(0.008)
Observations	58,492	58,492	58,492	58,492	16,524	16,524	16,524	16,524

Note: Regressions also include unreported municipality fixed effects. *p<0.1; **p<0.05; ***p<0.01