Voting Patterns by Race/Ethnicity in Recent Congressional and State Legislative Elections in Arizona

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I. Scope of Project

I was retained by National Demographics Corporation (NDC) to direct an analysis of voting patterns by race/ethnicity in recent congressional and state legislative elections held in the State of Arizona. If I concluded voting in areas of the State was racially/ethnically polarized based on these elections, I was to assist in a district-specific, functional analysis to ascertain whether proposed congressional and legislative districts would provide minority voters with an opportunity to elect their candidates of choice. This analysis was undertaken to assist the Arizona Independent Redistricting Commission in its task of redrawing legislative and congressional district boundaries in compliance with the Voting Rights Act.

II. Professional Experience

I have over thirty-five years of experience as a voting rights and redistricting expert. I have advised scores of jurisdictions and other clients on minority voting rights and redistricting-related issues and have served as an expert in dozens of voting rights cases. My clients have included state and local jurisdictions, independent redistricting commissions, the U.S. Department of Justice, national civil rights organizations, and such international organizations as the United Nations.

I have been actively involved in researching, writing, and teaching on subjects relating to voting rights, including minority representation, electoral system design, and redistricting. I co-authored a book, *Minority Representation and the Quest for Voting Equality* (Cambridge University Press, 1992) and co-edited a volume, *Redistricting in Comparative Perspective* (Oxford University Press, 2008), on these subjects. In addition, my research on these topics has appeared in peer-reviewed journals such as *Journal of Politics*, *Legislative Studies Quarterly*, *American Politics Quarterly*, *Journal of Law and Politics*, and *Law and Policy*, as well as law reviews (e.g., *North Carolina Law Review*) and a number of edited books. I hold a Ph.D. in political science from The George Washington University.

I have been a principal of Frontier International Electoral Consulting since co-founding the company in 1998. Frontier IEC specializes in providing electoral assistance in transitional democracies and post-conflict countries. In addition, I am a Visiting Research Academic at Oxford Brookes University in Oxford, United Kingdom.

III. Analyzing Voting Patterns by Race/Ethnicity

An election is racially polarized if minorities and whites, considered separately, would have elected different candidates – this is referred to as the "separate electorates test" in the seminal Supreme Court decision *Thornburg v. Gingles*, 478 U.S. 30 (1986). An analysis of voting patterns by race/ethnicity serves as the foundation of two of the three elements of the "results test" as outlined in *Gingles*: a racial bloc voting analysis is needed to determine whether the minority group is politically cohesive; and the analysis is required to determine if whites are voting sufficiently as a bloc to usually defeat the candidates preferred by minority voters.[1]

The voting patterns of white and minority voters must be estimated using statistical techniques because direct information about how individuals have voted is simply not available. To carry out the analysis, an aggregate level database must be constructed, usually employing election precincts as the units of observation. Information relating to the demographic composition and election results in these precincts is collected, combined and statistically analyzed to determine if there is a relationship between the racial/ethnic composition of the precincts and support for specific candidates across the precincts.

Standard Statistical Techniques To estimate vote choices by race/ethnicity, three standard statistical techniques were used: homogeneous precinct analysis, ecological regression, and ecological inference.[2] Two of these analytic procedures – homogeneous precinct analysis

[1] The "results test" as interpreted by the Supreme Court in *Thornburg v. Gingles* requires plaintiffs to demonstrate three threshold factors to establish a §2 violation:

- The minority group must be sufficiently large and geographically compact to constitute a majority in a single member district;
- The minority group must be politically cohesive;
- The minority group must be able to demonstrate that the white majority votes sufficiently as a bloc to enable it – in the absence of special circumstances, such as the minority candidate running unopposed – usually to defeat the minority's preferred candidate.

[2] For a detailed explanation of homogenous precinct analysis and ecological regression see Bernard Grofman, Lisa Handley and Richard Niemi, *Minority Representation and the Quest for Voting Equality*

and ecological regression – were employed by the plaintiffs' expert in *Thornburg v. Gingles*, have the benefit of the Supreme Court's approval in that case, and have been used in most subsequent voting rights cases. The third technique, ecological inference, was developed after the *Gingles* decision and was designed, in part, to address the issue of out-of-bounds estimates (estimates that exceed 100 percent or are less than zero percent), which can arise in ecological regression analysis. Ecological inference analysis has been introduced and accepted in numerous district court proceedings.

Homogeneous precinct (HP) analysis is the simplest technique: it involves comparing the percentage of votes received by each of the candidates in precincts that are racially or ethnically homogeneous. The general practice is to label a precinct as homogeneous if at least 90 percent of the voting age population or, in the case of Arizona, voters or citizen voting age population, is composed of a single race/ethnicity. In fact, the homogeneous results reported are not estimates – they are the actual precinct results. However, most voters in Arizona do not reside in homogeneous precincts and voters who reside in homogeneous precincts may not be representative of voters who live in more integrated precincts. For this reason, I refer to these percentages as estimates.

The second statistical technique employed, ecological regression (ER), uses information from all precincts, not simply the homogeneous ones, to derive estimates of the voting behavior of minorities and whites. If there is a strong linear relationship across precincts between the percentage of Hispanics or Native Americans and the percentage of votes cast for a given candidate, this relationship can be used to estimate the percentage of Hispanics and non-Hispanics or Native Americans and non-Hispanic whites voting for each of the candidates in the election contest being examined.

The third technique, ecological inference (EI), was developed by Professor Gary King. This approach also uses information from all precincts but, unlike ecological regression, it does not rely on an assumption of linearity. Instead, it incorporates maximum likelihood statistics to produce estimates of voting patterns by race. In addition, it utilizes the method of bounds, which uses more of the available information from the precinct returns as well as providing more

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(Cambridge University Press, 1992). See Gary King, *A Solution to the Ecological Inference Problem* (Princeton University Press, 1997) for a more detailed explanation of ecological inference.

information about the voting behavior being estimated.[3] Unlike ecological regression, which can produce percentage estimates of less than 0 or more than 100 percent, ecological inference was designed to produce only estimates that fall within the possible limits. However, unlike ecological regression, EI does not guarantee that the estimates for all of the candidates add to 100 percent for each of the racial groups examined.

In addition, a more recently developed version of ecological inference was utilized, which I have labeled "EI RxC" in the summary tables found in the Appendix at the end of the report. EI RxC expands the analysis so that more than two racial/ethnic groups can be considered simultaneously or so that differences in the relative rates of minority and white turnout can be taken into account in deriving the estimates of minority and white support for the candidates. This is relevant when relying on voting age or citizen voting age population rather than voters to conduct the analysis. It is therefore only used and reported in this instance when estimating the voting behavior of Native Americans and non-Hispanic whites in Apache and Navajo Counties.[4]

Database To analyze voting patterns by race/ethnicity using aggregate level information, a database that combines election results with demographic information is required. This database is almost always constructed using election precinct level data. The demographic composition of the precincts is based on voter registration or turnout by race/ethnicity if this information is available; if this is not available, then voting or citizen voting age population is used.

In Arizona, the demographic information relied upon depended on whether Hispanic or Native American voting patterns were being estimated. For Hispanic and non-Hispanic voters, the statewide voter list file was obtained from the Secretary of State (including voter history data), voters on list were geocoded and the Census Bureau's Spanish-Surname list was used to identify Hispanic voters. The Spanish-surnamed and non-Spanish-surnamed voters were all matched by a combination of geocoded locations and voter list precinct identifiers (depending on

[3] The following is an example of how the method of bounds works: if a given precinct has 100 voters, of whom 75 are Hispanic and 25 are white, and the Hispanic candidate received 80 votes, then at least 55 of the Hispanic voters voted for the Hispanic candidate and at most all 75 did. (The method of bounds is less useful for calculating estimates for white voters, as anywhere between none of the whites and all of the whites could have voted for the candidate.) These bounds are used when calculating EI estimates but not when using ecological regression.

[4] The analysis of Hispanic and non-Hispanic voting patterns relies on voters, not citizen voting age population, hence the analysis already takes into account different levels of turnout for Hispanic and non-Hispanic voters.

the county) to the appropriate precinct election results data. This produced a count of the number of Hispanic and non-Hispanic voters for each of the precincts. However, because there is no widely recognized surname list for Native Americans, voting age population by race had to be used as a substitute for voters by race/ethnicity when estimates of Native American voting behavior were derived. This population data was obtained from the 2020 census PL 94-171 redistricting database for Arizona, released in September 2021. There are advantages and disadvantages associated with each of these approaches.[5]

The election data was obtained from the Arizona Secretary of State website (https://azsos.gov/elections/voter-registration-historical-election-data). The downloaded county precinct election text files had to be processed and standardized into a usable format, then merged with the precinct demographic data. The merged data files were then organized for analyses using the python "pandas" data processing package. Fields such as the percentage of votes candidates received in each precinct were calculated in python, and then ER, EI, HP and voter turnout rates were estimated in R using the eiPack and eiCompare packages.

Elections Analyzed Using the database described in the preceding paragraphs, all 2018 and 2020 congressional and state senate elections were analyzed in five distinct areas of Arizona:[6] Apache and Navajo Counties, Yuma County, Pima County, Pinal County, and Maricopa County.[7] If a legislative or congressional district crossed county boundaries, the portion of the district that fell within each specific county of interest was analyzed separately. For example, Congressional District 3 includes voters from portions of three counties of interest: Maricopa, Pima, and Pinal Counties. Each of these portions was analyzed separately and included in the county summary tables in the Appendix.

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[5] Using the Spanish surname approach can lead to misidentification of voters as Hispanic when they are not or misses voters who are Hispanic but do not have Spanish surnames. Using voting age population rather than a list of voters, however, considers only potentially eligible voters and not those who actually turned out to vote.

[6] Because voters can cast two votes (or one or no votes at all) for representatives to the state house, these elections are quite complex to analyze, and the estimates produced are less likely to reflect reality. Therefore, only state senate contests, in which voters can only cast one vote, were analyzed in the legislative districts of interest.

[7] NDC identified these counties as the counties containing a sufficiently large and geographically concentrated minority population to satisfy the first precondition set out in *Thornburg v. Gingles*.

In addition to analyzing endogenous elections – that is, congressional and state legislative elections – two recent statewide elections were examined on a county-by-county basis: the 2018 election contests for Governor and Attorney General. These election contests were included in the analysis for two reasons. First, these elections included Hispanic candidates and, in the context of determining if voting is racially polarized, election contests in which the candidate is the same race as the minority population in question are more probative than contests in which all of the candidates are white.[8] Second, if voting in these elections is polarized and the Hispanic candidate is preferred by minority voters, these elections can serve as "bellwether elections" to assist in determining if a proposed district is likely to provide minority voters with an opportunity to elect their candidates of choice. In fact, both elections were racially/ethnically polarized and minority voters supported the Hispanic candidates, David Garcia for governor and January Contreras for attorney general, in both instances.[9] The role of "bellwether elections" in evaluating proposed minority opportunity districts is discussed below.

IV. Results of Racial Bloc Voting Analysis

Apache and Navajo Counties These two counties fall entirely within Congressional District (CD)1, although CD extends well beyond the borders of these two counties. Both counties are also encompassed within Legislative District (LD)7.[10] The table in the Appendix labeled "Apache and Navajo Counties" provides the results of the racial bloc voting analysis for CD1 in 2018 and 2020 and LD7 in 2018. The state senate election for LD7 in 2020 was uncontested.

All three election contests were racially polarized, with a very large percentage of Native American voters supporting the Native American Democrat, Jamescita Peshlakai in LD7 in

[8] Election contests that include minority candidates are more probative because it is not sufficient for minority voters to be able to elect their candidates of choice only if these candidates are white. On the other hand, it is important to recognize that not all minority candidates are the preferred candidates of minority voters.

[9] The race for attorney general in 2018 may not have been polarized in Pima County.

[10] A small number of Navajo County election precincts are in LD6, but the number is insufficient for conducting a racial bloc voting analysis.

2018, and the non-Hispanic white Democrat, Tom O'Halleran, in CD1 in both 2018 and 2020.[11] Despite racially polarized voting, the Native American candidate won the state senate contest in 2018 with over 62% of the vote (and over 64% of the vote in Apache and Navajo Counties). This is because the district is over 67% Native American in citizen voting age population (CVAP).[12]

Yuma County Yuma County is split between CD3 and CD4, as well as between LD4 and LD13, and does not comprise the entirety of the population in any of these districts. Estimates of voting patterns by ethnicity for Yuma voters could only be produced for LD4, LD13 and CD3. The congressional contests in CD3 were polarized in 2018 and 2020, with an overwhelming majority of Hispanic voters supporting Hispanic Democrat, Raúl Grijalva, and non-Hispanic voters supporting his Republican opponent in both instances. The race for state senator from LD4 was unopposed in 2018 and polarized in 2020, with an overwhelming majority of Hispanic voters casting their votes for the Hispanic Democrat, Lisa Otondo. In LD13, the 2020 state senate election was uncontested, and the 2018 contest was polarized. The Hispanic-preferred state senate candidate lost in LD13 (26.4% Hispanic CVAP) but won in LD4 (52.4% Hispanic CVAP); the Hispanic-preferred candidate in CD3 won (53.4% Hispanic CVAP).

The two statewide elections examined were also polarized, with Hispanic voters in Yuma County heavily supporting the two Hispanic candidates and non-Hispanic voters strongly supporting their opponents in both cases. Neither Hispanic-preferred candidate carried the county despite a majority of the citizen voting age population being Hispanic (52.3% Hispanic CVAP).

Pinal County Estimates of Hispanic and non-Hispanic voting patterns in election contests in CD1 and CD4 and in LD8 and LD16 were reported in the table in the Appendix labeled "Pinal County."[13] None of these districts falls entirely within Pinal County. Six of the seven contested elections analyzed were polarized – only in the 2020 election in CD1 did the majority of both

[11] The statewide contests for Governor and Attorney General in 2018 were also racially polarized, with Native American voters supporting the Hispanic Democrat in both instances, and non-Hispanic white voters supporting the Republican candidates.

[12] The Native American-preferred candidate in CD1 also carried the two counties and won the district overall. CD1 is only 21.9% Native American in citizen voting age population, but the district also includes a substantial number of Hispanic voters who also supported the Democratic candidate.

[13] The number of Pinal precincts falling in LD12 is too small to conduct a racial bloc voting analysis. An analysis of LD11 was carried out but no reliable estimates could be produced.

Hispanic and non-Hispanic voters support the same candidate.[14] The 2018 contests for Governor and Attorney General were also polarized in Pinal County. The Hispanic-preferred candidates did not win the Pinal County portion of any of these polarized contests.

Pima County Portions of Pima County fall in CD2 and CD3; a very small portion – too small to analyze statistically – also falls within CD1. Seven legislative districts contain portions of Pima County, three of which are wholly contained within the county: LD3, LD9, and LD10. There were no contested state senate elections in LD3 in 2018 and 2020 – the incumbent Hispanic Democrat, Sally Ann Gonzales, faced no opposition in either election. Native American Democrat Victoria Steele won a polarized contest in 2018 with nearly 63% of the vote and was unopposed in 2020. Neither senate election in LD10 was polarized – the non-Hispanic Democrat received an overwhelming majority of the Hispanic vote and a clear majority of the non-Hispanic vote. Contested elections in LD2, LD4, and LD14 were polarized but the Hispanic-preferred candidate won the Pima portion of the LD2 and LD4 districts, as well as the districts as a whole. The congressional district elections in CD2 and CD3 were not particularly polarized in either year,[15] and the Hispanic-preferred candidates easily won both the Pima portion of the district and the district in its entirety. While the 2018 Governor's race was polarized, the Hispanic-preferred candidate carried the county. The 2018 election for Attorney General was most likely not polarized and Contreras carried the county with over 58% of the vote.

Maricopa County Voters in Maricopa County make up some or all of the voters in seven of the nine congressional districts in Arizona, and 20 of the 30 state legislative districts. As a consequence, the table summarizing voting patterns in this county includes about 40 elections. Most of these elections are polarized. The only consistent exceptions are CD7 and CD9 and state senate elections in LD24, LD26 and LD27. In CD7, a district that is nearly majority Hispanic in CVAP, Hispanic and non-Hispanic voters support Hispanic Democrat, Ruben Gallego. The candidate preferred by both Hispanic and non-Hispanic voters in CD9 is non-Hispanic white Democrat, Greg Stanton. In LD26, Hispanic and non-Hispanic voters both supported Hispanic

[14] The election for state senate in LD16 was uncontested in 2020.

[15] The ER and EI estimates point in slightly different directions in CD3 in 2018 and 2020, and in CD2 in 2020.

Democrat Juan Mendez. In LD27, Hispanic Democrat Rebecca Rios was unopposed in 2018 and re-elected with very strong support from both Hispanic and non-Hispanic voters in 2020.[16]

There are three legislative districts that are majority Hispanic in CVAP located wholly or partially in Maricopa County: LD4, LD19, and LD29. Lisa Otondo was elected in a polarized contest within Maricopa County in 2018 and was unopposed for re-election in 2020. Lupe Chavira Contreras was unopposed in LD19 in both 2018 and 2020. In LD29, Martin Quezada was unopposed in 2018 and won re-election in what was probably a polarized contest in 2020.

Conclusion Voting in most of the areas of the State I examined is racially/ethnically polarized. As a result, districts that provide minority voters with an opportunity to elect their candidates of choice must be created or, if they already exist, must be maintained so that minority voters continue to have the opportunity to elect their preferred candidates to congress and the state legislature. A district-specific, functional analysis is required to ascertain whether a proposed congressional or state legislative districts offers this opportunity.

V. Conducting a District-Specific, Functional Analysis

An analysis must be conducted to ascertain whether a proposed district is likely to provide minority voters with an opportunity to elect their preferred candidates to office. The analysis must be district-specific – that is, must recognize there a likely to be differences in participation rates and voting patterns in districts across the state – and it must be functional – that is, it must be based on actual voting behavior of whites and minorities. There are two related approaches to conducting a district-specific, functional analysis, both of which take into account the relative turnout rates and voting patterns of minorities and whites. The first approach uses estimates derived from racial bloc voting analysis to calculate the percent minority population needed in a specific area for minority-preferred candidates to win a district in that area. The second approach relies on election results from previous contests that included minority-preferred minority candidates (as identified by racial bloc voting analysis) to determine if these candidates would win election in the proposed districts. The election results for these "bellwether elections" are disaggregated down from the precinct to the census block level and then recompiled to reflect the boundaries of the proposed district. If the minority-preferred candidates in these

[16] Hispanic and non-Hispanic voters supported non-Hispanic white Democrat Lela Alston in LD24, who won with over 70% of the vote in both 2018 and 2020.

racially/ethnically polarized elections win in the proposed district, this district is likely to provide minority voters with an opportunity to elect their candidates of choice. This latter approach can be used only if proposed district boundaries have been drawn. The former approach can be carried out before any new boundaries are drafted.

VI. Calculating the Minority CVAP Needed to Elect Minority-Preferred Candidates

The percentage of minority citizen voting age population needed in a district to provide minority voters with the opportunity to elect minority-preferred candidates to congress or to the state legislature varies. There is no single universal or statewide demographic target that can be applied for Native American or Hispanic voters to elect their candidates of choice. Using the estimates produced from the racial bloc voting analysis, I calculated the Native American and Hispanic CVAP percentages needed to elect minority-preferred candidates in each of the elections included in the summary tables in the Appendix. This calculation takes into account the relative participation rates of minorities and whites, as well as the level of minority support for the minority-preferred candidate (the "cohesiveness" of minority voters), and the level of non-Hispanic whites "crossing over" to vote for the minority-preferred candidate.

Equalizing minority and white turnout Because Native Americans and Hispanics who are eligible to vote often turn out to vote at lower rates than non-Hispanic white voters in Arizona, the minority CVAP needed to ensure that minority voters comprise at least half of the voters in an election is often higher than 50%. Using Hispanic and non-Hispanic voters as an example, once the respective turnout rates of Hispanic and non-Hispanic voters have been estimated using the statistical techniques described above, the percentage needed to equalize Hispanic and non-Hispanic voters can be calculated mathematically.[17] But equalizing turnout is

[17] The equalizing percentage is calculated mathematically by solving the following equation:

Let
M = the proportion of the district's voting age population that is Hispanic
W = 1-M = the proportion of the district's voting age population that is white
A = the proportion of the Hispanic voting age population that turned out to vote
B = the proportion of the white voting age population that turned out to vote

Therefore,
M(A) = the proportion of the population that is Hispanic and turned out to vote (1)
(1-M)B = the proportion of total population that is white and turned out to vote (2)

only the first step in the process – it does not take into account the voting patterns of Hispanic and non-Hispanic voters. If voting is racially polarized but a significant number of non-Hispanic voters typically "crossover" to vote for Hispanic voters' preferred candidate, it may be the case that crossover voting can more than compensate for depressed Hispanic turnout.

Incorporating Minority Cohesion and White Crossover Voting Even if Hispanic citizens are turning out at lower rates than non-Hispanics, and voting is racially polarized, if a relatively consistent percentage of non-Hispanic voters support Hispanic-preferred candidates, the candidates preferred by Hispanic voters can be elected even in districts that are less than majority Hispanic. On the other hand, if voting is starkly polarized, with few or no non-Hispanics crossing over to vote for the candidates supported by Hispanic voters, it may be the case that a district that is more than 50% Hispanic CVAP is needed to elect Hispanic-preferred candidates. A district-specific, functional analysis should take into account not only differences in turnout rates, but also the voting patterns of Hispanic and non-Hispanic voters.[18]

To illustrate this mathematically, consider a district that has 1000 citizens of voting age, 50% of whom are Hispanic and 50% of whom are non-Hispanic. Let us begin by assuming that Hispanic turnout is lower than non-Hispanic turnout in a two-candidate general election. In our hypothetical election example, 50% of the Hispanic CVAP turn out to vote and 60% of the non-Hispanic CVAP vote. This means that, for our illustrative election, there are 250 Hispanic voters and 300 non-Hispanic voters. Further suppose that 96% of the Hispanic voters supported their

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To find the value of M that is needed for (1) and (2) to be equal, (1) and (2) are set as equal and we solve for M algebraically:

M(A)	= (1 – M) B
M(A)	= B – M(B)
M(A) + M(B)	= B
M(A + B)	= B
M	= B/ (A+B)

Thus, for example, if 39.3% of the Hispanic population turned out and 48.3% of the white population turned out, B= .483 and A = .393, and M = .483/ (.393+.483) = .483/.876 = .5513, therefore a Hispanic VAP of 55.1% would produce an equal number of Hispanic and white voters. (For a more in-depth discussion of equalizing turnout see Kimball Brace, Bernard Grofman, Lisa Handley and Richard Niemi, "Minority Voting Equality: The 65 Percent Rule in Theory and Practice," *Law and Policy*, 10 (1), January 1988.)

[18] For an in-depth discussion of this approach to creating effective minority districts, see Bernard Grofman, Lisa Handley and David Lublin, "Drawing Effective Minority Districts: A Conceptual Framework and Some Empirical Evidence," *North Carolina Law Review*, volume 79 (5), June 2001.

candidate of choice and 30% of the non-Hispanic voters cast their votes for this candidate (with the other 70% supporting her opponent in the election contest). Thus, in our example, Hispanic voters cast 240 of their 250 votes for the Hispanic-preferred candidate and their other 10 votes for her opponent; non-Hispanic voters cast 90 of their 300 votes for the Hispanic-preferred candidate and 210 votes for their preferred candidate. The two candidates in our example will receive the following number of votes under these conditions:

	Voters	**Votes for Hispanic Preferred Candidate**	**Votes for non-Hispanic Preferred Candidate**
Hispanic	500 x .50 = 250	250 x .96 = 240	250 x .04 = 10
Non-Hispanic	500 x .60 = 300	300 x .30 = 90	300 x .70 = 210
Votes	550	330	220

The candidate of choice of Hispanic voters received a total of 330 votes (240 from Hispanic voters and 90 from non-Hispanic voters), while the candidate preferred by non-Hispanic voters received only 220 votes (10 from Hispanic voters and 210 from non-Hispanic voters). The Hispanic-preferred candidate won the election with 60% (330/550) of the vote in this hypothetical 50% Hispanic CVAP district. And the Hispanic-preferred candidate won the election despite the fact that the election was racially/ethnically polarized and Hispanics turned out to vote at a lower rate than non-Hispanics.[19] In a district that is 45% Hispanic CVAP rather than 50% Hispanic CVAP, the Hispanic-preferred candidate would still win the election with 56.8% (315/555) of the vote.

The tables that follow incorporate the estimates of turnout and votes by race/ethnicity (based on the EI estimates) listed in the summary tables in the Appendix and calculates the percentage Hispanic or Native American CVAP, depending on the county, needed for the Native American or Hispanic-preferred candidates to win each of the elections examined. However, if voting is not polarized, no Hispanic percentage is calculated because the non-Hispanic voters would have elected the Hispanic-preferred candidate regardless of the Hispanic CVAP. (All

[19] In the illustrative example, VAP and voting patterns are known and the equation solves for percentage of votes received by the Hispanic-preferred candidate. In determining the percentage of Hispanic CVAP needed to provide Hispanic voters with an opportunity to elect their candidates of choice, voting patterns

election contests for which Native American and non-Native American estimates were derived were racially polarized hence this table does not include any blanks.)

Table 1 reports the Native American CVAP needed for the Native American-preferred candidates to win the five contests analyzed. All of the contests examined were polarized and crossover voting was never higher than about 24%, and usually considerably lower than this. The percentage Native American CVAP needed is less than 50% for three of the five contests but is over 60% for the 2018 race for governor in which the minority-preferred candidate garnered little support from non-Native voters. A district that is over 60% Native American in CVAP is required before the candidate preferred by Native American voters wins all five elections examined.

Table 2 indicates that the percentage of Hispanic citizens of voting age required to elect Hispanic-preferred candidates in the contests examined is over 50% in all six contests, and in two contests is over 60%. These contests were all polarized and on average slightly less than 25% of the non-Hispanic voters voted for the Hispanic-preferred candidate. Even a district that is 60% Hispanic CVAP will not produce a win for the Hispanic-preferred candidates in all six contests. (At 55% Hispanic CVAP, the Hispanic candidate of choice wins half of the elections analyzed.)

As Table 3 shows, eight of the nine contests analyzed in Pinal County were racially/ethnically polarized. The percent Hispanic CVAP required for the Hispanic-preferred candidate to win election in these contests varied widely, from as little as 30.3% needed for the 2018 election in Congressional District 1 to as high as 75.8% for the 2018 election for state senator in LD16. In a district that is 50% Hispanic CVAP, the Hispanic-preferred candidate wins four of the eight polarized elections. But the percent needed to win varies dramatically – recompiled election results for the two bellwether elections will be very important in making assessments about whether proposed districts in Pinal County offer Hispanic candidates an opportunity to elect their candidates of choice.

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and the percentage of votes are known and we are solving for the VAP needed to produce at least 50 percent of the votes for the Hispanic-preferred candidate.

Table 1: Apache and Navajo Counties

Apache and Navajo Counties Percent Native American CVAP needed to win	race of NA-P candidate	turnout rate and percent vote for Native American-preferred candidates						percent of vote NA-P cand would have received if district was 60% Native American CVAP	percent of vote NA-P cand would have received if district was 55% Native American CVAP	percent of vote NA-P cand would have received if district was 50% Native American CVAP	percent of vote NA-P cand would have received if district was 45% Native American CVAP	percent of vote NA-P cand would have received if district was 40% Native American CVAP	percent Native American CVAP must exceed for NA-P candidate to win	comments
		Native American votes			NonNative American votes									
		votes cast for office	NA-P	all others	votes cast for office	NA-P	all others							
2018 Governor	H	46.2	76.9	23.1	54.3	13.0	87.0	48.8	45.6	42.4	39.2	36.1	61.8	polarized
2018 Attorney General	H	45.5	85.6	14.4	53.1	18.0	82.0	56.0	52.6	49.2	45.9	42.6	51.2	polarized
2018 Cong District 1	W	46.2	87.0	13.0	53.9	23.8	76.2	59.4	56.1	53.0	49.9	46.8	45.2	polarized
2018 St Sen District 7	NA	46.4	92.3	7.7	50.9	19.5	80.5	61.5	57.9	54.2	50.6	47.0	44.2	polarized
2020 Cong District 1	W	66.3	86.9	13.1	71.2	20.5	79.5	59.2	55.8	52.5	49.2	45.9	46.2	polarized

Table 2: Yuma County

Yuma County Percent Hispanic CVAP needed to win	race of H-P candidate	turnout rate and percent vote for Hispanic-preferred candidates						percent of vote H-P cand would have received if district was 60% Hispanic CVAP	percent of vote H-P cand would have received if district was 55% Hispanic CVAP	percent of vote H-P cand would have received if district was 50% Hispanic CVAP	percent of vote H-P cand would have received if district was 45% Hispanic CVAP	percent of vote H-P cand would have received if district was 40% Hispanic CVAP	percent Hispanic CVAP must exceed for H-P candidate to win	comments
		Hispanic votes			NonHispanic votes									
		votes cast for office	H-P	all others	votes cast for office	H-P	all others							
2018 Governor	H	21.3	95.7	4.3	49.2	18.7	81.3	49.0	45.3	42.0	38.8	35.9	61.3	polarized
2018 Attorney General	H	21.3	95.3	4.7	47.6	25.1	74.9	53.3	49.9	46.8	43.9	41.2	55.1	polarized
2018 Cong District 3	H	21.7	94.5	5.5	57.2	32.1	67.9	54.7	51.9	49.3	46.9	44.7	51.5	polarized
2018 St Senate District 13	W	21.3	83.1	16.9	44.5	21.6	78.4	47.3	44.3	41.5	38.9	36.5	64.2	polarized
2020 Cong District 3	H	40.1	93.8	6.2	83.2	26.3	73.7	54.6	51.3	48.3	45.4	42.7	52.9	polarized
2020 St Senate District 4	H	39.4	95.1	4.9	84.2	25.4	74.6	54.1	50.8	47.6	44.7	42.0	53.8	polarized

Table 3: Pinal County

Pinal County Percent Hispanic CVAP needed to win	race of H-P candidate	turnout rate and percent vote for Hispanic-preferred candidates						percent of vote H-P cand would have received if district was 60% Hispanic CVAP	percent of vote H-P cand would have received if district was 55% Hispanic CVAP	percent of vote H-P cand would have received if district was 50% Hispanic CVAP	percent of vote H-P cand would have received if district was 45% Hispanic CVAP	percent of vote H-P cand would have received if district was 40% Hispanic CVAP	percent Hispanic CVAP must exceed for H-P candidate to win	comments
		Hispanic votes			NonHispanic votes									
		votes cast for office	H-P	all others	votes cast for office	H-P	all others							
2018 Governor	H	20.7	89.2	10.8	43.6	24.7	75.3	51.5	48.4	45.5	42.7	40.2	57.6	polarized
2018 Attorney General	H	20.7	95.6	4.4	43.1	32.2	67.8	58.7	55.7	52.8	50.1	47.6	44.8	polarized
2018 Cong District 1	W	22.0	99.3	0.7	46.6	39.9	60.1	64.5	61.6	58.9	56.5	54.1	30.3	polarized
2018 Cong District 4	W	18.2	94.3	5.7	37.5	29.6	70.4	56.9	53.7	50.7	48.0	45.4	48.7	polarized
2018 St Senate District 8	W	19.3	100.0	0.0	72.6	31.1	68.9	50.7	48.0	45.6	43.4	41.5	58.7	polarized
2018 St Senate District 16	W	20.4	59.4	40.6	41.1	35.4	64.6	45.6	44.5	43.4	42.3	41.4	75.8	polarized
2020 Cong District 1	W	3.9	97.8	2.2	5.8	65.9	34.1	81.9	80.3	78.7	77.2	75.8		not polarized
2020 Cong District 4	H	17.2	77.9	22.1	22.5	29.8	70.2	55.5	53.0	50.6	48.3	46.0	48.6	polarized
2020 St Sen District 8	W	3.5	98.7	1.3	8.4	27.8	72.2	55.1	51.7	48.7	45.8	43.2	52.2	polarized

Table 4: Pima County

Pima County Percent Hispanic CVAP needed to win	race of H-P candidate	turnout rate and percent vote for Hispanic-preferred candidates						percent of vote H-P cand would have received if district was 60% Hispanic CVAP	percent of vote H-P cand would have received if district was 55% Hispanic CVAP	percent of vote H-P cand would have received if district was 50% Hispanic CVAP	percent of vote H-P cand would have received if district was 45% Hispanic CVAP	percent of vote H-P cand would have received if district was 40% Hispanic CVAP	percent Hispanic CVAP must exceed for H-P candidate to win	comments
		Hispanic votes			NonHispanic votes									
		votes cast for office	H-P	all others	votes cast for office	H-P	all others							
2018 Governor	H	29.8	91.3	8.7	61.7	41.9	58.1	62.7	60.2	58.0	55.9	53.9	28.9	polarized
2018 Attorney General	H	29.8	99.2	0.8	60.3	49.9	50.1	70.9	68.5	66.2	64.1	62.1	0.4	
2018 Cong District 2	W	37.9	85.6	14.4	68.8	53.4	46.6	68.0	66.4	64.8	63.4	62.0		not polarized
2018 Cong District 3	H	29.1	97.4	2.6	48.9	49.9	50.1	72.3	69.9	67.6	65.5	63.4	0.4	
2018 St Senate District 2	W	26.7	99.7	0.3	55.2	42.2	57.8	66.4	63.6	60.9	58.5	56.2	24.5	polarized
2018 St Senate District 9	NA	27.4	64.4	35.6	64.6	33.7	66.3	45.6	44.2	42.8	41.6	40.5	72.7	polarized
2018 St Senate District 10	W	31.0	93.9	6.1	62.3	53.1	46.9	70.5	68.5	66.7	64.9	63.3		not polarized
2018 St Senate District 14	H	39.0	52.8	47.2	66.4	37.6	62.4	44.7	44.0	43.2	42.5	41.9	88.3	polarized
2020 Cong District 2	W	37.9	89.3	10.7	68.8	52.1	47.9	68.9	67.1	65.3	63.7	62.1		not polarized
2020 Cong District 3	H	26.6	98.1	1.9	41.0	47.5	52.5	72.5	69.9	67.4	65.0	62.8	7.4	polarized
2020 St Senate District 2	H	31.8	98.8	1.2	69.5	41.0	59.0	64.5	61.7	59.1	56.7	54.5	28.7	polarized
2020 St Senate District 4	H	7.5	98.5	1.5	10.8	42.8	57.2	71.2	68.4	65.6	63.0	60.4	17.6	polarized
2020 St Senate District 10	W	48.6	96.9	3.1	81.1	52.6	47.4	73.6	71.3	69.2	67.2	65.2		not polarized
2020 St Senate District 14	W	13.5	60.8	39.2	32.1	37.4	62.6	46.5	45.3	44.3	43.4	42.5	73.5	polarized

Table 5: Maricopa County

Maricopa County Percent Hispanic CVAP needed to win	race of H-P candidate	turnout rate and percent vote for Hispanic-preferred candidates						percent of vote H-P cand would have received if district was 60% Hispanic CVAP	percent of vote H-P cand would have received if district was 55% Hispanic CVAP	percent of vote H-P cand would have received if district was 50% Hispanic CVAP	percent of vote H-P cand would have received if district was 45% Hispanic CVAP	percent of vote H-P cand would have received if district was 40% Hispanic CVAP	percent Hispanic CVAP must exceed for H-P candidate to win	comments
		Hispanic votes			NonHispanic votes									
		votes cast for office	H-P	all others	votes cast for office	H-P	all others							
2018 Governor	H	27.4	97.8	2.2	55.7	34.4	65.6	61.3	58.2	55.3	52.6	50.1	39.9	polarized
2018 Attorney General	H	27.4	99.1	0.9	54.6	40.8	59.2	65.8	63.0	60.3	57.8	55.4	27.2	polarized
2018 Cong District 4	W	39.0	60.3	39.7	64.6	23.9	76.1	41.2	39.4	37.6	35.9	34.3	80.8	polarized
2018 Cong District 5	W	33.6	98.4	1.6	60.1	35.1	64.9	64.0	60.8	57.8	55.0	52.3	35.5	polarized
2018 Cong District 6	A	27.6	99.6	0.4	58.0	41.5	58.5	65.7	62.9	60.2	57.8	55.5	26.5	polarized
2018 Cong District 7	H	23.4	92.5	7.5	40.6	80.2	19.8	85.9	85.3	84.7	84.1	83.6		not polarized
2018 Cong District 8	A	32.4	100.0	0.0	56.6	39.6	60.4	67.5	64.5	61.6	58.9	56.3	26.7	polarized
2018 Cong District 9	W	26.6	88.4	11.6	52.5	57.7	42.3	71.0	69.4	68.0	66.7	65.5		not polarized
2018 St Sen District 12	W	35.9	98.4	1.6	63.9	36.6	63.4	64.9	61.8	58.8	56.1	53.4	33.0	polarized
2018 St Sen District 13	W	32.8	100.0	0.0	57.8	21.9	78.1	57.8	53.9	50.2	46.7	43.3	49.8	polarized
2018 St Sen District 16	W	31.1	78.9	21.1	54.9	38.1	61.9	56.8	54.8	52.9	51.0	49.3	42.1	polarized
2018 St Sen District 17	W	37.3	99.5	0.5	62.6	43.5	56.5	69.9	67.1	64.4	61.9	59.4	18.1	polarized
2018 St Sen District 18	W	36.0	97.1	2.9	61.9	52.8	47.2	73.4	71.2	69.1	67.1	65.2		not polarized
2018 St Sen District 20	W	26.2	70.6	29.4	46.8	41.1	58.9	54.6	53.1	51.7	50.4	49.1	43.6	polarized
2018 St Sen District 24	W	24.4	100.0	0.0	49.0	67.0	33.0	81.1	79.5	78.0	76.6	75.2		not polarized
2018 St Sen District 25	W	27.0	96.2	3.8	52.1	33.0	67.0	60.6	57.5	54.6	51.8	49.2	41.5	polarized
2018 St Sen District 28	W	27.2	97.2	2.8	62.0	46.1	53.9	66.4	63.9	61.7	59.6	57.7	15.8	polarized

Table 5 (continued)

Maricopa County Percent Hispanic CVAP needed to win	race of H-P candidate	turnout rate and percent vote for Hispanic-preferred candidates						percent of vote H-P cand would have received if district was 60% Hispanic CVAP	percent of vote H-P cand would have received if district was 55% Hispanic CVAP	percent of vote H-P cand would have received if district was 50% Hispanic CVAP	percent of vote H-P cand would have received if district was 45% Hispanic CVAP	percent of vote H-P cand would have received if district was 40% Hispanic CVAP	percent Hispanic CVAP must exceed for H-P candidate to win	comments
		Hispanic votes			NonHispanic votes									
		votes cast for office	H-P	all others	votes cast for office	H-P	all others							
2020 Cong District 3	H	47.2	100.0	0.0	70.6	21.4	78.6	60.8	56.7	52.9	49.2	45.6	46.1	polarized
2020 Cong District 5	W	57.1	100.0	0.0	86.5	35.5	64.5	67.6	64.3	61.1	58.1	55.2	30.5	polarized
2020 Cong District 6	A	46.0	99.3	0.7	78.6	43.9	56.1	69.8	67.0	64.4	61.8	59.4	17.5	polarized
2020 Cong District 7	H	39.1	92.5	7.5	65.1	63.2	36.8	77.1	75.6	74.2	72.9	71.6		not polarized
2020 Cong District 8	W	55.6	100.0	0.0	78.8	35.7	64.3	68.8	65.5	62.3	59.2	56.3	28.8	polarized
2020 Cong District 9	W	44.5	87.1	12.9	72.6	57.9	42.1	71.9	70.4	69.0	67.7	66.4		not polarized
2020 St Sen District 1	H	67.2	96.4	3.6	84.8	25.7	74.3	64.1	60.5	57.0	53.5	50.1	39.8	polarized
2020 St Sen District 4	H	50.5	100.0	0.0	73.9	25.1	74.9	63.0	59.2	55.5	52.0	48.5	42.2	polarized
2020 St Sen District 12	B	61.7	98.2	1.8	96.3	31.6	68.4	64.2	60.8	57.6	54.5	51.5	37.3	polarized
2020 St Sen District 17	W	62.7	99.9	0.1	88.0	40.5	59.5	71.2	68.1	65.2	62.4	59.6	21.1	polarized
2020 St Sen District 18	W	57.1	99.0	1.0	82.0	53.2	46.8	76.6	74.3	72.0	69.8	67.7		not polarized
2020 St Sen District 20	W	45.1	73.9	26.1	66.8	43.2	56.8	58.6	57.1	55.6	54.1	52.7	29.6	polarized
2020 St Sen District 24	W	39.5	97.9	2.1	71.1	65.5	34.5	80.2	78.6	77.1	75.6	74.3		not polarized
2020 St Sen District 25	W	46.0	97.6	2.4	73.0	32.5	67.5	64.1	60.8	57.7	54.6	51.8	36.8	polarized
2020 St Sen District 27	H	45.5	99.7	0.3	66.1	65.6	34.4	82.9	81.2	79.5	77.9	76.3		not polarized
2020 St Sen District 28	W	42.7	97.5	2.5	81.1	45.8	54.2	68.6	66.0	63.6	61.4	59.2	14.4	polarized
2020 St Sen District 29	H	38.9	100.0	0.0	61.6	42.4	57.6	70.4	67.5	64.7	62.0	59.5	19.4	polarized

Voting in eight of the 14 election contests analyzed in Pima County was racially/ethnically polarized. As Table 4 shows, crossover voting in five of these polarized contests was high enough to produce Hispanic CVAP percentages needed to win that are below 30%. However, the percentages in the other three polarized contests are remarkably high – in all instances because of the much lower than usual estimates of Hispanic cohesion. Because of these erratic percentages, recompiled election results are going to be important in determining whether a proposed district in Pima County offers Hispanic voters an opportunity to elect their candidates of choice. What is clear is that in many instances, the percentage Hispanic CVAP required is likely to be considerably less than 50%.

Table 5 lists the 34 contested elections examined in Maricopa County. Most of these contests (73.5%) were polarized. However, in nearly all of the 25 contests that were polarized, non-Hispanic crossover voting was quite high, producing estimates of the percent Hispanic CVAP needed to win often well below 50%. The only exception to this was a contest in which Hispanic voters were not strongly cohesive in support of their candidate of choice. As in Pinal and Pima Counties, recompiled election results for the two bellwether elections are going to be an important tool for ascertaining if a specific proposed district is likely to provide Hispanic voters with an opportunity to elect their candidates of choice.

VII. Conclusion

Voting in recent congressional and state legislative elections in the Arizona counties I examined is racially/ethnically polarized. Districts that provide minority voters with an opportunity to elect their candidates of choice will need to be created or maintained in all of these counties. However, the demographic composition of the districts drawn to provide minority voters with an opportunity to elect their candidates of choice should vary depending on where the district is located. It is clear that a district that offers Native American voters an opportunity in Apache and Navajo Counties should have a substantial majority Native American voting age population. The same is true of a Hispanic opportunity district in Yuma County – it will need to have a substantial majority Hispanic CVAP to provide Hispanic voters with an opportunity to elect their candidates of choice. This may be true in Pinal County as well, depending on where the district is located. Providing Hispanic voters with an opportunity to elect their candidates of choice in Pima and

Maricopa County, however, is unlikely to require a majority Hispanic CVAP district. Recompiled election results of the two bellwether elections will be important in determining if proposed districts in these two counties will provide Hispanic voters with an opportunity to elect their candidates of choice in congressional and state legislative elections.

APPENDIX