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IN THE UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

STATE OF CALIFORNIA, BY AND THROUGH ATTORNEY GENERAL XAVIER BECERRA; COUNTY OF LOS ANGELES; CITY OF LOS ANGELES; CITY OF FREMONT; CITY OF LONG BEACH; CITY OF OAKLAND; CITY OF STOCKTON, Plaintiffs, **v.** **WILBUR L. ROSS, JR., IN HIS OFFICIAL CAPACITY AS SECRETARY OF THE U.S. DEPARTMENT OF COMMERCE; U.S. DEPARTMENT OF COMMERCE; RON JARMIN, IN HIS OFFICIAL CAPACITY AS ACTING DIRECTOR OF THE U.S. CENSUS BUREAU; U.S. CENSUS BUREAU; DOES 1-100,** Defendants.	3:18-cv-01865 **DECLARATION OF BERNARD L. FRAGA, PhD IN SUPPORT OF PLAINTIFFS' OPPOSITION TO MOTION FOR SUMMARY JUDGMENT** Judge: The Honorable Richard G. Seeborg Trial Date: January 7, 2019 Action Filed: March 26, 2018

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1 Background and Qualifications

My name is Bernard L. Fraga. I am a political data analyst and researcher. I am also employed as an assistant professor of political science at Indiana University Bloomington, where I joined the faculty in 2013. I earned my Ph.D. in Government and Social Policy at Harvard University in 2013, where my graduate training included courses in political science, statistics, and election law. I also received my Master of Arts degree in Political Science from Harvard University in 2011, and my Bachelor of Arts degree in Political Science and Linguistics from Stanford University in 2008. My academic research focuses on American politics, with particular research interests in elections, representation, and the demographic composition of the population where I frequently analyze data provided by the U.S. Census Bureau. I have published peer-reviewed works on these topics in the *American Journal of Political Science*, the *Journal of Politics*, the *Journal of Race, Ethnicity, and Politics*, and the *Quarterly Journal of Political Science*. I have also published work in the *Stanford Law Review*, and have a forthcoming book published by Cambridge University Press. I have served as a peer reviewer for numerous academic journals and press outlets in political science, advised multiple Ph.D. dissertations, and have been invited to give many academic lectures regarding my work on elections, representation, and the demographic composition of the population. My academic research has appeared in outlets such as the *New York Times* and the *Washington Post*. I previously produced expert reports in *Perez v. Texas* (2017) and *Common Cause Indiana et al. v. Marion County Election Board et al.* (2018). My complete curriculum vitae is attached to this report.

I am being compensated at a rate of $250 per hour. The opinions in this report are my own, and do not represent the views of Indiana University.

2 Scope of Work

On March 26, 2018, United States Secretary of Commerce Wilbur Ross announced that he would direct the Census Bureau to place a question inquiring about the citizenship of the householder and all residents within the home ("citizenship question") on the 2020 U.S. Census. Plaintiffs in this action have asked me to assess the impact of the addition of a citizenship question on the 2020 Census population count for California, and California's congressional

apportionment which will be based on the enumeration conducted as part of the 2020 Census. Specifically, I was asked:

- To project the population of California and other states at the time of the 2020 Census enumeration;
- To estimate, based on survey and Census Bureau data, the proportion of California's and other states' residents who would not be counted due to the addition of a citizenship question on the 2020 Census under four scenarios of nonresponse and follow-up;
- To quantify the probability that an undercount of California residents attributable to the addition of a citizenship question on the 2020 Census would decrease California's congressional apportionment.

The opinions in this document are based on my existing knowledge, expertise, and experience, along with the statistical analysis of a series of relevant data sources. To complete these statistical analyses, I used publicly available data provided by the U.S. Census Bureau, documents produced by the defendants in the course of this litigation, and results from a nationally representative survey. Specifically, I analyzed the following data sources:

- U.S. Census Bureau Population Estimates Program (PEP) estimates of the population, by state;
- U.S. Census Bureau American Community Survey (ACS) estimates of the population, by state, race, ethnicity, nativity, and citizenship of household members;
- U.S. Census Bureau apportionment population data for the 1980, 1990, 2000, and 2010 Census;
- Responses to items in the *Census 2020 Survey*, fielded by Dr. Matt A. Barreto.

3 Summary of Opinions

1. Based on the survey and Census Bureau data provided, compared to other states, California has a disproportionately high share of the population that would not be enumerated in a 2020 Census that includes a citizenship question.

2. Using publicly available Census Bureau estimates, the best estimates for the projected population of each state on April 1, 2020 indicate that California would be apportioned 53 seats in the U.S. House of Representatives if the 2020 Census does not include a citizenship question.

3. The addition of a citizenship question to the 2020 Census is likely to reduce the congressional representation apportioned to California.

4. Under a broad range of potential April 1, 2020 population estimates for each of the states, and methods of quantifying the undercount, the addition of a citizenship question always increases the probability of California receiving fewer congressional seats than in a 2020 Census with no citizenship question.

5. The above findings persist even with uncertainty inherent in making population projections, uncertainty in the demographic composition of states, survey sampling error, and reasonable efforts to follow up with nonresponding households.

4 Projecting the 2020 Population

In order to understand the impact of the addition of a citizenship question to the 2020 Census, I first construct projections of the 2020 population by state. Such projections are important in order to provide a complete picture of the effect of the citizenship question on each state, particularly for congressional apportionment where population change between 2018 and 2020 will likely have an impact on how many seats in the U.S. House of Representatives each state is apportioned. The Census Bureau no longer provides projections of the population by state, but does provide publicly available estimates of each state's population every year through the Population Estimates Program (PEP). I use 2010-2017 PEP data to project the April 1, 2020 ("Census Day") population by state, after validating the projection model using 2000-2007 PEP estimates and the official 2010 count.

4.1 Population Estimates Program (PEP) Data

The Census Bureau publishes annual estimates of the population for various geographic levels as part of the Population Estimates Program (PEP).[1] These

[1] https://www.census.gov/programs-surveys/popest.html.

estimates "update the decennial census counts" and correspond to the July 1 population for each year after a decennial census, taking into account "births, deaths, Federal tax returns, medicare [*sic*] enrollment, and immigration."[2] The Census Bureau notes that these figures are used in "Federal funding allocations, in setting the levels of national surveys, and in monitoring recent demographic changes."[3] For this report, I use PEP estimates of the resident population for each state.

I use two sets of PEP estimates in my analysis. The first, more recent set is identified as "Vintage 2017" by the Census Bureau and was released in June 2018.[4] This dataset provides updated estimates of the annual population of each state from July 1, 2010 to July 1, 2017, along with the population count as enumerated in the 2010 Census. The second, older dataset is "Vintage 2007," which was released in 2008.[5] The older dataset provides estimates of the annual population of each state from July 1, 2000 to July 1, 2008. Unlike the Intercensal or Postcensal estimates for 2000-2010, which also provide annual estimates of the population before the 2010 Census, the Vintage 2007 PEP estimates are not adjusted to provide smoothed trends in the population between 2000 and 2010.[6] Thus, the Vintage 2007 PEP estimates are an analog to the Vintage 2017 PEP estimates calculated at roughly the same period of time prior to the decennial census that followed, and can be used to estimate how much error exists when comparing the projection to the true enumeration found in the Census.

4.2 Models for Projecting the Population

The goal of the population projections is to generate a baseline estimate of the population that would be enumerated by a 2020 Census that does not include a citizenship question. Census estimates are rooted to April 1 of the Census year ("Census Day"), in this case, April 1, 2020. Different modeling approaches may reach different conclusions regarding this population, but forecasting approaches generally consist of using trends in historical data to predict future trends as

[2] https://www.census.gov/programs-surveys/popest/about/faq.html
[3] Ibid.
[4] https://www.census.gov/data/datasets/2017/demo/popest/state-total.html
[5] https://www2.census.gov/programs-surveys/popest/datasets/2000-2008/state/asrh/
[6] https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/intercensal/2000-2010-intercensal-estimates-methodology.pdf.

accurately as possible.[7] Drawing on principles of forecasting and my knowledge of methods of extrapolating and interpolating Census data, I evaluated the accuracy of four forecasting models when using Vintage 2007 data to project the Census 2010 population:

1. **Linear model from 2000-2007.** In this model I project the population to April 1, 2010 assuming a linear trend in the population for each state from July 1, 2007 to April 1, 2010 that is equivalent to the linear trend witnessed from July 1, 2000 to July 1, 2007. The theoretical implications of this model are that prior trends in population change should continue at the same linear rate that was witnessed since the 2000 Census. These estimates were generated using a bivariate linear regression model with data from the Vintage 2007 PEP for each state via the statistical software program R.

2. **Weighted linear model from 2000-2007.** In the second model I project the population to April 1, 2010 assuming a linear trend in the population for each state from July 1, 2007 to April 1, 2010 that is equivalent to the weighted linear trend witnessed from July 1, 2000 to July 1, 2007. This model incorporates the longer-term data from the first model, but gives more weight to years that are closer to the end point of interest (2010). Weights are the inverse of the number of years prior to 2010. These estimates were generated using a weighted linear regression model with data from the Vintage 2007 PEP for each state via the statistical software program R.

3. **Change from 2006-2007.** The previous approaches average over multiple time points in order to project the population. Instead, in this model I isolate the difference between the July 1, 2007 population and the July 1, 2006 population for each state, and then project this change to April 1, 2010 assuming that the yearly change going forward will be equivalent to the most recent yearly change in population. Here I assume that the last year of data provides the best projection for the next three years of population change. These estimates were generated by multiplying this short term trend by 2.75 and adding the result to the July 1, 2007 population.

4. **Exponential smoothing.** Instead of relying on linear or weighted linear trends in the data, more complex forecasting methods are often used to

[7] See Hyndman, Rob J. and Athanasopoulos, George. 2018. *Forecasting: Principles and Practice.* https://otexts.org/fpp2/index.html.

predict future outcomes. Many of these use smoothing techniques that account for nonlinearities in the data and generally do not force the data to take a particular form. These models use the entire time period, but give more weight to observations that are closer to the target end point (in this case, 2010). Here I assume an additive trend in the data, and no seasonality in population totals. These estimates were generated using the *ets* function from the *forecast* package in the statistical software program R, again drawing on Vintage 2007 PEP data for each state.

For each of the four models, I evaluated their accuracy by comparing the predicted April 1, 2010 population to the 2010 Census population. I use three metrics to make my determination of accuracy: the mean difference between the projection and the actual count across states ("Mean Error"), the mean absolute value of the difference between the projection and the actual count ("Mean Absolute Error"), and the mean absolute error rescaled to be proportional to each state's 2010 Census count.

Table 1: Validation of Population Projection Models from 2000-2007 PEP Data

	Mean Error	**Mean Absolute Error**	**Mean Absolute Proportional Error**
Linear Model	6,429	82,730	0.016
Weighted Linear Model	7,315	77,682	0.015
Change from 2006-2007	14,864	58,796	0.012
Exponential Smoothing	1,526	60,047	0.011

Note: Based on projections to the April 1, 2010 population made from Vintage 2007 Population Estimates Program (PEP) estimates. Analysis conducted by Bernard L. Fraga.

In Table 1, smaller values for the three evaluation metrics indicate less error in predictions. In examining the three metrics for each model, we see signs that the exponential smoothing model best predicts the 2010 Census population using Vintage 2007 data. The mean error is smallest, mean absolute error second smallest, and the mean absolute proportional error is smallest when using the exponential smoothing method. Differences between models are relatively small, indicating that model selection does not produce large differences in projections. However, for all of the models there is inaccuracy in the projection of the population based on estimates from three years prior to Census Day. This

inaccuracy may manifest for any number of reasons, including the possibility of rapid change in a state's population a short time before Census enumeration takes place that would not be possible to account for under any modeling scenario. I account for this uncertainty in my population projections by using the observed imprecision in the Vintage 2007-based modeling of the 2010 population. Specifically, the mean state 2010 projection was 0.3% lower than the Census 2010 enumeration, an exceptionally small difference. The standard deviation of this difference was 0.0161, which means that approximately 68% of states' projections of the 2010 population were within 1.6% of the observed Census 2010 enumeration. I use this measure of state-level projection uncertainty when calculating apportionment, but provide mean estimates of the population in the following section.

4.3 Projections of the 2020 Population by State

Here I use the Vintage 2017 PEP estimates of the population of each state from July 1, 2010 to July 1, 2017 to project the population in each state on April 1, 2020. Having established that the exponential smoothing technique is slightly more accurate than the other models, I rely on this technique and again assume an additive trend and no seasonality in the yearly population totals. The results of this estimation process may be found in the column labeled "2020 Projection" in Table 2. I also include the 2010 Census enumeration for each state, and the July 1, 2017 Population Estimates Program resident population.

California, like most other states, is projected to have a substantial increase in population between July 1, 2017 and April 1, 2020. Over three million more Californians should be enumerated in 2020 than were enumerated in 2010. These state-level 2020 population projections form my baseline estimate of how many individuals would be enumerated by the 2020 Census if it contains the same content as the 2010 Census.

Table 2: Population by State in 2010, 2017, and 2020

	2010 Census	2017 PEP	2020 Projection
Alabama	4,779,736	4,874,747	4,909,797
Alaska	710,231	739,795	742,898
Arizona	6,392,017	7,016,270	7,302,219
Arkansas	2,915,918	3,004,279	3,041,609
CALIFORNIA	**37,253,956**	**39,536,653**	**40,393,990**
Colorado	5,029,196	5,607,154	5,793,650
Connecticut	3,574,097	3,588,184	3,582,310
Delaware	897,934	961,939	984,226
District of Columbia	601,723	693,972	727,258
Florida	18,801,310	20,984,400	21,668,695
Georgia	9,687,653	10,429,379	10,696,376
Hawaii	1,360,301	1,427,538	1,434,604
Idaho	1,567,582	1,716,943	1,817,286
Illinois	12,830,632	12,802,023	12,710,600
Indiana	6,483,802	6,666,818	6,735,594
Iowa	3,046,355	3,145,711	3,182,422
Kansas	2,853,118	2,913,123	2,932,387
Kentucky	4,339,367	4,454,189	4,491,934
Louisiana	4,533,372	4,684,333	4,722,625
Maine	1,328,361	1,335,907	1,331,859
Maryland	5,773,552	6,052,177	6,136,606
Massachusetts	6,547,629	6,859,819	6,973,938
Michigan	9,883,640	9,962,311	10,041,036
Minnesota	5,303,925	5,576,606	5,672,759
Mississippi	2,967,297	2,984,100	2,981,765
Missouri	5,988,927	6,113,532	6,153,347
Montana	989,415	1,050,493	1,067,836
Nebraska	1,826,341	1,920,076	1,951,944
Nevada	2,700,551	2,998,039	3,158,362
New Hampshire	1,316,470	1,342,795	1,358,014
New Jersey	8,791,894	9,005,644	9,073,181
New Mexico	2,059,179	2,088,070	2,093,728
New York	19,378,102	19,849,399	19,917,386
North Carolina	9,535,483	10,273,419	10,515,309
North Dakota	672,591	755,393	783,517
Ohio	11,536,504	11,658,609	11,756,941
Oklahoma	3,751,351	3,930,864	4,000,423
Oregon	3,831,074	4,142,776	4,310,660
Pennsylvania	12,702,379	12,805,537	12,804,528
Rhode Island	1,052,567	1,059,639	1,064,874
South Carolina	4,625,364	5,024,369	5,201,635
South Dakota	814,180	869,666	889,060
Tennessee	6,346,105	6,715,984	6,826,163
Texas	25,145,561	28,304,596	29,403,076
Utah	2,763,885	3,101,833	3,211,388
Vermont	625,741	623,657	621,076
Virginia	8,001,024	8,470,020	8,629,657
Washington	6,724,540	7,405,743	7,617,840
West Virginia	1,852,994	1,815,857	1,781,002
Wisconsin	5,686,986	5,795,483	5,837,508
Wyoming	563,626	579,315	598,982

Note: 2020 Projection is population projection to April 1, 2020 conducted by Bernard L. Fraga.

5 Estimating Undercount in the 2020 Census Due to a Citizenship Question

In this section, based on survey and Census estimates provided to me, I calculate the undercount in the 2020 Census that would occur due to the addition of a citizenship question. To estimate the undercount, I seek to identify and isolate the undercount attributable only to the addition of a citizenship question, not the broader undercount of certain populations that has disproportionately lowered the population for certain states, including California, in previous censuses.[8]

Here, the undercount is conceptualized as the net population effect of households not responding to the Census as a result of the citizenship question. This corresponds to the household being the basic unit of the enumeration universe for the Census Bureau and the basic unit when determining initial nonresponse to the Census.[9]

5.1 Scenarios A and B: Estimating the Undercount Based on Survey Data

In order to estimate the effect of the addition of a citizenship question to the 2020 Census, I was asked by legal counsel to explore four different scenarios of nonresponse and nonresponse follow-up (NRFU). Two of the scenarios are based on nonresponse and follow-up as indicated by the *Census 2020 Survey*, fielded by Dr. Matt Barreto and detailed in his expert report.

5.1.1 Scenario A: Survey-based Nonresponse

The nationally-representative survey asked a series of questions providing measures of whether or not respondents would complete the Census for members

[8]See, for example, Mule, Thomas. "Census Coverage Measurement Estimation Report: Summary of Estimates of Coverage for Persons in the United States." *DSSD 2010 Census Coverage Measurement Memorandum Series*. 2010-G-01. May 22, 2012. p. 21-22.

[9]See, *e.g.*, *2020 Census Detailed Operational Plan for: 18. Nonresponse Followup Operation (NRFU)*, April 16, 2018, p. 4,72 ["The enumeration universe is the complete set of addresses for living quarters that will be enumerated for the 2020 Census. The NRFU Universe is a subset of that enumeration universe."], p.4, cont. ["It comprises the set of addresses for living quarters that are housing units...for which the Census Bureau has not yet received a response."]; Fontenot, Albert E., Jr. *2020 Census Program Memorandum Series: 2018.10*, April 16, 2018, ["The primary purpose of NRFU is to determine the housing unit status of a nonresponding address and to enumerate the households at nonresponding housing units."]

of their household.[10] Specifically, I relied on results related to the first non-demographic question of the survey, which was as follows:

> "The Census is an official population count that is conducted every 10 years by the federal government. It requires all households to list the name, age, and race or ethnicity of every person living in the home and provide that information to the Census Bureau either online, by mail, or in-person with a census taker. The Census is required to keep this information confidential, and every single household in the country is required to participate.
>
> In March 2020 you will receive an invitation from the U.S. Census to fill out the census form. Do you plan to participate and submit your household information?"

Response options for this question were "Yes, will participate" or "No, will NOT participate." The description of the Census provided in this question approximates the demographic information requested in the 2010 Census. The "Yes, will participate" response to this question indicates the population that would take the 2020 Census if a citizenship question was not included. All of my analyses based on survey data use this as the baseline responsive population; individuals who are unlikely to respond to a 2010-style Census are excluded from my analysis.

The second question in the *Census 2020 Survey* questionnaire asked the following:

> "In 2020, the federal government is adding a new question to require you to list whether you, and every person in your household is a U.S. citizen, or not a citizen. With the addition of a citizenship question, will you participate and submit your household information, or not?"

Response options for this question were the same as the first question: "Yes, will participate" or "No, will NOT participate." Using responses to this question, after isolating the population who initially responds "Yes, will participate" to the first question, allows me to isolate the effect of the addition of a citizenship

[10] I was provided with estimates on specific questions from the survey, which were used to generate the statistics in this report. These estimates are included in the appendix of Dr. Barreto's expert report.

question to the Census and its resultant effect on response rates. Specifically, I was provided with estimates of the percent of respondents (and accompanying uncertainty) who replied "No, will NOT participate" or refused to respond to the second question after initially stating "Yes, will participate" to the first question. Again, by removing from the analysis respondents who answered "No" or did not respond to the first question (indicating that they would not respond to a 2020 Census even without a citizenship question) I isolated the *specific* nonresponse attributable to the addition of a citizenship question. Scenario A is thus the projected population for each state, minus the mean rate of drop-off due to the citizenship question.

5.1.2 Scenario B: Survey-based Nonresponse with Follow-up

Scenario B builds on Scenario A, by accounting for Census nonrespondents who may later respond as a result of the Census Bureau's follow-up efforts. This is done using Question 8 on Dr. Barreto's survey:

> "Now that you've heard a little bit about the 2020 Census let me ask you one final question about how likely you are to participate. If the government decides in 2020 to include a question about citizenship status, and asks you to report the race, ethnicity, age, gender and citizenship status of people living in your household, and the government provides assurances that your information will be kept confidential and ONLY used for purposes of counting the total population and nothing more, would you participate and fill out the 2020 Census form, or not?"

Dr. Barreto's report states that this question may be considered a "Simulated Follow Up" as it may "mimic an attempt a re-contact in the real world in a condensed telephone interview setting, by allowing some time to pass, and then asking the same subjects their willingness to participate a second or third time."[11] Again, response options were "Yes, will participate" or "No, will NOT participate."

Dr. Barreto reports that respondents who were considered drop-off respondents due to the citizenship question in Scenario A, but then responded "Yes, will participate" to this follow-up question may be considered a proxy for

[11] Expert report of Dr. Matt Barreto.

individuals who would be responsive to reasonable follow-up efforts conducted by the Census and thus would be enumerated. Scenario B thus removes the mean share of individuals who changed their mind and decided to reply to the Census after the follow-up from the drop-off respondents identified in Scenario A, reducing the size of the drop-off population.

5.1.3 Race, Ethnicity, and Nativity in the *Census 2020 Survey*

In addition to these questions, I use demographic information provided in the survey to estimate differential nonresponse by racial/ethnic group and nativity. The first question, regarding racial/ethnic group, asks "What do you consider your race or ethnicity to be?" with response options that can be translated into the racial and ethnic categories used by the Census Bureau.[12] The second question asks "Were you born in the United States, [if Latino "on the island of Puerto Rico,"] or in another country?" Hispanic and Asian survey respondents were separated into U.S.-born or Foreign (including Puerto Rico) born based on this question. I was provided with the mean rate of nonresponse under Scenario A and the mean rate of follow-up response under Scenario B for non-Hispanic Whites, non-Hispanic Blacks, native born Hispanics, foreign born Hispanics, native born Asians, foreign born Asians, and non-Hispanic Other Race individuals, along with associated measures of uncertainty in these estimates for each group.

5.2 Scenarios C and D: Estimating the Undercount Based on Census Analyses

The third and fourth scenarios make use of recent Census Bureau estimates of nonresponse and data related to nonresponse follow-up (NRFU) success.

5.2.1 Scenario C: Census Analysis-based Nonresponse

Specifically, Scenario C makes use of estimates contained in an August 6, 2018 report produced by the Census Bureau, hereafter referred to as the "Brown

[12] For the purposes of this analysis, individuals identifying as "Hispanic/Latino" were classified as "Hispanic," even if choosing an additional racial/ethnic group. Individuals marking multiple categories other than Hispanic, or the categories of "Middle Eastern or Arab," "American Indian/Native American," or "Other" were classified as "Other."

report."[13] The Brown report includes an analysis of housing unit self-response rates to the 2016 American Community Survey (ACS) questionnaire and the 2010 Census. The 2016 ACS is a Census Bureau product that includes 75 questions, including a citizenship question. The 2010 Census was substantially shorter (10 questions) and did not include a citizenship question. In this Census Bureau report, the authors are able to observe which housing units replied to the 2010 Census but not the 2016 ACS on the first mailing, providing an opportunity to observe the rate of drop-off for a Census product with a citizenship question.

The authors of the Brown report construct a statistical model that seeks to isolate the specific impact of having at least one non-citizen in the household ("noncitizen household") on a household's drop-off rate, removing the effect of "race/ethnicity, age, educational attainment, household income, working in the last week, job search in the last four weeks, and English language ability" on drop-off rates, and comparing drop-off for noncitizen households to households where all enumerated persons have been identified as citizens ("citizen households").[14] They estimate a 5.8 percentage point difference in modeled (not actual) rates of initial non-response for non-citizen households versus citizen households.[15] Notably, this estimate only captures part of the drop-off experienced by non-citizen households, and is not an estimate of the overall rate of drop-off for non-citizen households which is likely higher. The authors of the Brown report indicate a number of reasons suggesting why this "estimated effect on self response...is conservative."[16] I use this 5.8 percent estimate of drop-off for non-citizen households from the Brown report in Scenario C.

5.2.2 Scenario D: Census Analysis-based Nonresponse with Follow-up

For Scenario D, I use the 5.8% drop-off estimate for non-citizen households from Scenario C, but reduce this figure by an estimate of NRFU success based on Census data and analyses. The NRFU enumeration success rate I was provided with was 86.63%, and thus the multiplication of the drop-off estimate by the NRFU

[13] Brown, David J., Misty L. Heggeness, Suzanne M. Dorinski, Lawrence Warren, and Moises Yi. *Understanding the Quality of Alternative Citizenship Data Sources for the 2020 Census.* August 8, 2018, at AR COM_DIS00009833

[14] Ibid. p. 36-37

[15] Ibid. p. 39.

[16] Ibid.

enumeration success rate constitutes Scenario D.

5.3 American Community Survey (ACS) Data

In order to produce measures of the undercount under Scenario A, B, C, and D, I use state-level Census bureau estimates of the population by the race, ethnicity, and nativity of the householder[17] or the presence of at least one non-citizen in the household. The most recent Census product containing the requisite household-level measures is the American Community Survey (ACS) 2016 1-Year Public Use Microdata Sample (PUMS), which contains "a sample of actual responses to the American Community Survey" and the survey weights necessary to make the sample representative of the national population.[18]

To produce estimates under Scenario A and B, I extract information about the race of the householder, ethnicity of the householder, and for Asian and Hispanic householders, status as either foreign born or native born. I then map these householder characteristics onto the person-level ACS PUMS estimates to determine how many individuals live in households where the householder has said characteristics, aggregate to the state level using appropriate person-level weights, and derive the proportion of each state's total population whose householder falls into the following categories:

- non-Hispanic White
- non-Hispanic Black
- Foreign-born Hispanic
- Native-born Hispanic
- Foreign-born Asian
- Native-born Asian
- All other individuals ("Other")

The decision to use householder characteristics to estimate the population undercount is driven by Census practices for estimating non-response to the Census. Individuals receive the Census in the mail in a manner similar to receipt of the ACS, with a survey addressed "TO THE RESIDENT OF:" followed by the address of the respondent. For each household, the individual responding

[17] Also called the "head of household."

[18] https://www.census.gov/programs-surveys/acs/technical-documentation/pums.html

to the ACS is likely to be the individual who would have a major impact on the decision to have any individuals in the household enumerated via the 2020 Census.[19] Thus responses to the ACS regarding race or origins of the householder likely reflect the race or origins of the person who would be instrumental in the decision to participate in the Census, aligning well with the question wording and demographic characteristics available in the *Census 2020 Survey* used for Scenarios A and B.

For Scenarios C and D, I instead use ACS PUMS measures of whether or not there is at least one non-citizen in the household each person resides in.[20] Specifically, I separate households into two groups:

- Households with at least one non-citizen ("Non-citizen households")
- All other households ("Citizen households")

This aligns with the method of distinguishing populations sensitive versus not sensitive to the addition of a citizenship question for the Brown report[21] Again, I map these household characteristics onto the person-level ACS PUMS estimates to determine how many individuals live in non-citizen versus citizen households, aggregate to the state level using appropriate person-level weights, and derive the proportion of each state's total population whose household falls into the above categories. In the Brown report, they "assume AR [Administrative Record] and ACS all-citizen households are less sensitive to a citizenship question" and that "if some of the reluctance by AR and ACS all-citizens households to self-respond is due to the citizenship question on the ACS, then our analysis will underestimate the citizenship question unit self-response effect."[22] Self-responses to the ACS citizenship question also skew in the direction of underreporting the presence of a noncitizen in the household,[23] meaning that again Scenarios C and D are a highly conservative estimates even when isolating non-citizen household nonresponse only.

[19] Individuals living in group quarters, constituting less than 10% of the U.S. resident population, were designated as the individuals responsible for deciding whether or not to respond to the Census.

[20] For individuals living in group quarters, constituting less than 10% of the U.S. resident population, the citizenship status of the individual was used instead.

[21] Brown, David J., Misty L. Heggeness, Suzanne M. Dorinski, Lawrence Warren, and Moises Yi. *Understanding the Quality of Alternative Citizenship Data Sources for the 2020 Census.* August 8, 2018.

[22] Ibid. p. 34.

[23] Ibid. p. 20.

Associated measures of uncertainty for these proportions are also included in my estimates of apportionment, ensuring that even for states with small populations of particular racial/ethnic groups we may estimate the net undercount due to the addition of a citizenship question. Finally, as the number of individuals in households with racial/ethnic, nativity, and citizenship characteristics associated with sensitivity to the citizenship question is based on the 2016 ACS, and will likely grow by April 2020, the estimates I produce generate less of an undercount than would be observed with population estimates more proximate to 2020.

5.4 State-level Estimates of the Population Not Counted Due to a Citizenship Question

I combine the projections of the 2020 population by state in Table 2 of this report with the ACS PUMS estimates of the proportion of the population living in households with the characteristics outlined in the previous section. The result is a 2020 estimate of the number of individuals in each household type, by state. I then subtract a percentage of the population in each household type that would be undercounted in Scenarios A, B, C, and D. Finally, I re-aggregate these revised estimates of the population by household type back to state-level totals. In Table 3, I provide these estimates as the percent deviation from the 2020 Projection in Table 2 (here labeled "2020 Baseline") for each undercount scenario.

Table 3 indicates how much of each state's population would not be counted in the 2020 Census due solely to the addition of a citizenship question. As we can see the impacts are large for California, where 12.51% of the population would not be counted when using the survey-based estimates of nonresponse in Scenario A. This reduction is cut somewhat when the "Simulated Follow Up" is added, as we see that in Scenario B the California undercount is 8.48%. In Scenario C, which is based on a Census analysis that only examines part of the total nonresponse for households with at least one noncitizen, the reduction in California's population is 1.68%. Scenario D, which builds on Scenario C by assuming a highly successful nonresponse follow-up operation for nonresponding households, California's population count is reduced by 0.22%.

Table 3: Percent of Population Not Counted Due to a Citizenship Question

	2020 Baseline	Scenario A	Scenario B	Scenario C	Scenario D
Alabama	4,909,797	-6.19%	-2.73%	-0.24%	-0.03%
Alaska	742,898	-5.94%	-2.75%	-0.37%	-0.05%
Arizona	7,302,219	-7.44%	-3.94%	-0.96%	-0.13%
Arkansas	3,041,609	-6.11%	-2.80%	-0.37%	-0.05%
CALIFORNIA	**40,393,990**	**-12.51%**	**-8.48%**	**-1.68%**	**-0.22%**
Colorado	5,793,650	-6.77%	-3.53%	-0.70%	-0.09%
Connecticut	3,582,310	-6.56%	-3.31%	-0.72%	-0.10%
Delaware	984,226	-6.44%	-3.04%	-0.54%	-0.07%
District of Columbia	727,258	-7.22%	-3.29%	-0.72%	-0.10%
Florida	21,668,695	-7.27%	-3.61%	-0.99%	-0.13%
Georgia	10,696,376	-6.70%	-3.10%	-0.65%	-0.09%
Hawaii	1,434,604	-7.00%	-4.61%	-1.03%	-0.14%
Idaho	1,817,286	-5.99%	-2.92%	-0.44%	-0.06%
Illinois	12,710,600	-6.76%	-3.42%	-0.81%	-0.11%
Indiana	6,735,594	-5.90%	-2.79%	-0.35%	-0.05%
Iowa	3,182,422	-5.69%	-2.71%	-0.34%	-0.05%
Kansas	2,932,387	-6.16%	-3.01%	-0.52%	-0.07%
Kentucky	4,491,934	-5.65%	-2.60%	-0.22%	-0.03%
Louisiana	4,722,625	-6.40%	-2.82%	-0.24%	-0.03%
Maine	1,331,859	-5.36%	-2.46%	-0.19%	-0.03%
Maryland	6,136,606	-6.72%	-3.20%	-0.83%	-0.11%
Massachusetts	6,973,938	-6.25%	-3.17%	-0.81%	-0.11%
Michigan	10,041,036	-5.95%	-2.78%	-0.36%	-0.05%
Minnesota	5,672,759	-5.77%	-2.80%	-0.44%	-0.06%
Mississippi	2,981,765	-6.41%	-2.74%	-0.14%	-0.02%
Missouri	6,153,347	-5.80%	-2.67%	-0.24%	-0.03%
Montana	1,067,836	-5.46%	-2.45%	-0.14%	-0.02%
Nebraska	1,951,944	-6.07%	-2.95%	-0.52%	-0.07%
Nevada	3,158,362	-7.47%	-4.03%	-1.30%	-0.17%
New Hampshire	1,358,014	-5.50%	-2.61%	-0.28%	-0.04%
New Jersey	9,073,181	-7.02%	-3.73%	-1.11%	-0.15%
New Mexico	2,093,728	-8.78%	-5.01%	-0.69%	-0.09%
New York	19,917,386	-6.98%	-3.65%	-1.16%	-0.16%
North Carolina	10,515,309	-6.39%	-2.96%	-0.52%	-0.07%
North Dakota	783,517	-5.55%	-2.49%	-0.21%	-0.03%
Ohio	11,756,941	-5.79%	-2.66%	-0.21%	-0.03%
Oklahoma	4,000,423	-6.19%	-2.83%	-0.43%	-0.06%
Oregon	4,310,660	-6.13%	-3.06%	-0.65%	-0.09%
Pennsylvania	12,804,528	-6.00%	-2.87%	-0.34%	-0.05%
Rhode Island	1,064,874	-6.40%	-3.19%	-0.76%	-0.10%
South Carolina	5,201,635	-6.28%	-2.80%	-0.32%	-0.04%
South Dakota	889,060	-5.56%	-2.49%	-0.26%	-0.04%
Tennessee	6,826,163	-6.00%	-2.73%	-0.34%	-0.05%
Texas	29,403,076	-8.23%	-4.53%	-1.26%	-0.17%
Utah	3,211,388	-6.16%	-3.05%	-0.61%	-0.08%
Vermont	621,076	-5.38%	-2.51%	-0.17%	-0.02%
Virginia	8,629,657	-6.39%	-3.11%	-0.65%	-0.09%
Washington	7,617,840	-6.27%	-3.26%	-0.84%	-0.11%
West Virginia	1,781,002	-5.42%	-2.48%	-0.10%	-0.01%
Wisconsin	5,837,508	-5.83%	-2.79%	-0.33%	-0.04%
Wyoming	598,982	-5.86%	-2.83%	-0.23%	-0.03%

Note: 2020 Baseline is population projection to April 1, 2020 conducted by Bernard L. Fraga. For details regarding assumptions in Scenarios A, B, C, and D, see sections 5.1 and 5.2 of this report.

Across all of the four scenarios, California loses a greater share of their population than any other state when a citizenship question is placed on the 2020 Census. However, Scenarios A and B show a greater decline than Scenarios C and D that are based on the Census analysis contained in the Brown report.[24] According to Census Bureau Chief Scientist Dr. John Abowd, the 5.8 percentage point figure featured in the Brown report is "probably an underestimate" of the magnitude of nonresponse due to the addition of a citizenship question on the 2020 Census.[25] Indeed, Dr. Abowd goes on to state that it is likely that changes in response rates would occur for "all citizen households" as well: "If you ask us collectively do we think that the self-response of all citizen households is going to stay [un]changed in an environment where a controversial citizen question is on the census, we would say no."[26] Measures of nonresponse including "all citizen households" likely do a better job of capturing the full effect of the citizenship question on 2020 Census counts.

6 Quantifying the Apportionment Impact of a Citizenship Question

In this section I quantify the impact of the addition of a citizenship question to the 2020 Census on congressional apportionment. Using the population projections and measures of uncertainty in the projections discussed in section 4 of this document, and the scenarios of nonresponse and follow-up outlined in section 5, I seek to quantify the probability that an undercount of California residents attributable to the addition of a citizenship question to the 2020 Census would impact California's congressional apportionment.

6.1 Estimating 2020 Apportionment

Apportionment is mandated by the Constitution, and determined based on the total population of each state. Since 1941, the formula used to determine how many congressional seats are apportioned to each state uses the "Method of

[24] Brown, David J., Misty L. Heggeness, Suzanne M. Dorinski, Lawrence Warren, and Moises Yi. *Understanding the Quality of Alternative Citizenship Data Sources for the 2020 Census.* August 8, 2018.

[25] Deposition of Dr. John Abowd, August 29, 2018. p. 242-243.

[26] Ibid.

Equal Proportions."[27] To compute apportionment using this method, each state is first apportioned a single, constitutionally-mandated seat, and then additional seats are distributed to each state in order of "priority." Priority is calculated as the state's population multiplied by the reciprocal of the geometric mean for each seat the state could receive, or $1/\sqrt{n(n-1)}$ (also called a "multiplier") for all n seats that could be assigned to a state. The resultant 385 highest "priority values" are apportioned seats.[28] The total number of seats assigned to each state constitutes apportionment. California currently has the largest number of seats, with 53. What this means is that the multiplier for a 53rd seat, or $1/\sqrt{53(53-1)}$ (0.0190484829) times the apportionment population of California (the "priority value") in 2010 was higher than all of the other states' priority values that had not yet been used to assign a seat.

The process of apportioning seats is somewhat complex and relatively small differences in state populations can be the difference between one state receiving a seat and another state receiving a seat. Thus, I developed an apportionment formula and tested this formula to ensure that it always provided precisely correct multipliers, priority values, state apportionment, and order of seats apportioned to states. I used apportionment population data for the 1980, 1990, 2000, and 2010 Censuses to conduct this validation. In each case, the statistical formula successfully replicated the exact apportionment circumstances for each year. Thus, the model will accurately predict 2020 apportionment based on the input of apportionment populations for each state.

The apportionment population is based on the resident population as enumerated by the decennial census, but also includes the nonresident population of federal employees stationed overseas as assigned to states. This includes overseas military and other governmental personnel, is also included in apportionment totals. The estimates in section 4 of this report do not include the overseas resident population, which is allocated to states for apportionment purposes, but is not included in the population count made by the Census as the Census only counts U.S. residents. The PEP estimates and ACS estimates also do not seek to estimate this population. Therefore, I estimate the overseas U.S. military, federal civilian employees, and dependents living with these groups based on change in this population from 2000-2010 and information about

[27] https://www.census.gov/population/apportionment/about/computing.html

[28] 435-50, because 50 seats are automatically assigned with the one seat minimum per state.

military personnel stationed in foreign countries as reported by the Department of Defense (DoD).

The DoD estimates that in FY2010 there were 293,600 active duty, reserve, and civilian personnel required to be stationed in foreign countries across the Army, Navy, Marine Corps, and Air Force.[29] The DoD estimates that in FY2018 there were 198,700 active duty, reserve, and civilian personnel required to be stationed in foreign countries across the Army, Navy, Marine Corps, and Air Force, a number which has remained relatively stable over the last three fiscal years.[30] The apportionment figures provided by the Census Bureau indicate 1,042,523 federal employees, including military and non-military personnel, residing overseas. Thus in 2010 military personnel made up approximately 28% of the overseas population counted for apportionment, a population that declined by 32.3% from FY2010 to FY2018. Using the 2010 estimate of the overseas population as a baseline, I reduce this figure by 18.96% due to the decline in military stationed overseas. This revised estimate is then allocated to each state based on the average of the Census 2000 and Census 2010 shares of the overseas population allocated to each state, assuming some reversion to the mean given changes in state population shares over the preceding 18 years and declines in the overseas military population since 2010.

6.2 Estimating 2020 Apportionment with a Citizenship Question

Here, I examine five apportionment scenarios in the same manner as section 5 of this report: a baseline scenario with no citizenship question, and Scenarios A, B, C, and D which use different assumptions and data sources to quantify the impact of a citizenship question on nonresponse and nonresponse follow-up in the 2020 Census. To review, Scenarios A and B use estimates of nonresponse due to the presence of a citizenship question and follow-up success by race, ethnicity, and nativity of the householder, as provided by the *Census 2020 Survey*. Scenarios C and D use an estimate of the nonresponse of households with at least one noncitizen attributable to the presence of a citizenship question, as calculated in a Census Bureau report.

The first column of Table 4 provides the baseline apportionment estimates for each state, using the statistical formula discussed above and the 2020 population

[29] *Defense Manpower Requirements Report, Fiscal Year 2011.* February 2011. p. 16
[30] *Defense Manpower Requirements Report, Fiscal Year 2018.* December 2017. p. 16

projections from Table 3. In this baseline scenario, there are changes from 2010 apportionment due to growth of the population in some states and decline in other states. Notably, California's apportionment is unchanged from 2010 in this baseline 2020 Census scenario with no citizenship question: 53 congressional seats.

The estimates of the undercount in Table 3 indicated that a citizenship question on the 2020 Census would have a disproportionate, negative impact on California's population enumeration. We see similar disproportionate, negative impacts for California's congressional apportionment. Using Scenario A, which accounts for rates of Census nonresponse due to the citizenship question by race, ethnicity, and nativity of the householder, California loses three seats versus the baseline 2020 scenario (and 2010 apportionment), dropping from 53 to 50 seats. No other state experiences more than a one seat decline under this scenario. Scenario B, which includes estimates of the success of a targeted nonresponse follow-up effort, California still loses three congressional seats versus the 2020 baseline. Again, no other state experiences more than a one seat decline under this scenario. For Scenarios C and D, where Table 3 indicated population declines were smaller, on average California continues to hold 53 seats. However, as the next section shows, the *probability* of losing at least one seat still increases substantially even with these more limited estimates of nonresponse.

Table 4: Change in Apportionment Due to a Citizenship Question

	2020 Baseline	Scenario A	Scenario B	Scenario C	Scenario D
Alabama	6	7	7	7	6
Alaska	1	1	1	1	1
Arizona	10	10	10	10	10
Arkansas	4	4	4	4	4
CALIFORNIA	**53**	**50**	**50**	**53**	**53**
Colorado	8	8	8	8	8
Connecticut	5	5	5	5	5
Delaware	1	1	1	1	1
Florida	28	28	29	28	28
Georgia	14	14	14	14	14
Hawaii	2	2	2	2	2
Idaho	2	2	2	2	2
Illinois	17	17	17	17	17
Indiana	9	9	9	9	9
Iowa	4	4	4	4	4
Kansas	4	4	4	4	4
Kentucky	6	6	6	6	6
Louisiana	6	6	6	6	6
Maine	2	2	2	2	2
Maryland	8	8	8	8	8
Massachusetts	9	9	9	9	9
Michigan	13	13	13	13	13
Minnesota	7	8	8	7	7
Mississippi	4	4	4	4	4
Missouri	8	8	8	8	8
Montana	1	2	2	1	1
Nebraska	3	3	3	3	3
Nevada	4	4	4	4	4
New Hampshire	2	2	2	2	2
New Jersey	12	12	12	12	12
New Mexico	3	3	3	3	3
New York	26	26	26	26	26
North Carolina	14	14	14	14	14
North Dakota	1	1	1	1	1
Ohio	15	16	16	16	15
Oklahoma	5	5	5	5	5
Oregon	6	6	6	6	6
Pennsylvania	17	17	17	17	17
Rhode Island	1	1	1	1	1
South Carolina	7	7	7	7	7
South Dakota	1	1	1	1	1
Tennessee	9	9	9	9	9
Texas	39	38	38	38	39
Utah	4	4	4	4	4
Vermont	1	1	1	1	1
Virginia	11	11	11	11	11
Washington	10	10	10	10	10
West Virginia	2	2	2	2	2
Wisconsin	8	8	8	8	8
Wyoming	1	1	1	1	1

6.3 Probability that a Citizenship Question Will Reduce California's Congressional Apportionment

The apportionment formula, 2020 projections of the population, and estimates of the overseas population can be used to calculate the apportionment provided to each state. In addition, using the scenarios of nonresponse and follow-up from section 5, we can observe apportionment under each scenario and determine how the number of seats apportioned to each state would change if a citizenship question was added to the 2020 Census. However, because small differences in the apportionment population for each state may make a large difference in apportionment, estimates of the *average* apportionment population may not provide a complete picture of how much more *likely* certain apportionment outcomes are.

I therefore account for uncertainty in the population projections, demographic composition of each state, rate of nonresponse, and rate of follow-up to nonresponse when calculating apportionment. This is achieved through the generation of 10,000 simulated datasets where, for each state, each of these quantities is estimated via a draw from a normal distribution with a standard deviation equal to the observed variation we see in these measures for each state. Simulation is a technique useful when the underlying probability is unknown or complex, as is the case with the multiple inputs to the apportionment formula and apportionment itself where outcomes for each state are dependent on outcomes for other states. I conduct 10,000 simulations for each of the five scenarios, reporting the mean result of these simulations where appropriate and using the distribution of results to define the probability of particular events occurring.

6.3.1 Change in Probability of Seat Loss

Table 5 is similar to Table 4, but instead of providing the mean number of seats each state is apportioned, I provide the probability that each state will lose at least one seat for the baseline and four undercount scenarios. In Table 5 we see that the probability of California losing at least one congressional seat after the 2020 Census goes from moderately rare (26.14%) with no citizenship question to a rounded 100% probability under Scenario A. After an attempt at following up with voters, as in Scenario B, California still loses at least one seat 99% of the time. Scenarios C and D, which are based on Census analyses accounting for only a

part of nonresponse in households with at least one noncitizen, still show that the probability of California losing one or more congressional seats nearly doubles to become a 50-50 chance under Scenario C and increases 15% under Scenario D. For no other state do we see changes in the probability of losing at least one seat shift nearly as much due to the addition of a citizenship question. This indicates that the addition of a citizenship question, under any scenario, will make it more likely that California will lose at least one congressional seat after the 2020 Census.

Table 5: Probability of Losing One or More Congressional Seats

	2010 Seats	2020 Baseline	Scenario A	Scenario B	Scenario C	Scenario D
Alabama	7	65.13%	31.93%	32.89%	48.36%	60.77%
CALIFORNIA	**53**	**26.14%**	**99.72%**	**98.69%**	**49.86%**	**29.96%**
Connecticut	5	0.11%	0.07%	0.06%	0.16%	0.15%
Georgia	14	0.91%	0.67%	0.40%	0.64%	0.77%
Illinois	18	99.89%	99.18%	99.49%	99.82%	99.82%
Indiana	9	0.65%	0.06%	0.26%	0.41%	0.70%
Michigan	14	92.97%	69.74%	76.41%	89.16%	92.93%
Minnesota	8	64.34%	27.07%	37.22%	57.50%	65.39%
Nebraska	3	0.48%	0.07%	0.09%	0.22%	0.40%
New Jersey	12	1.66%	1.83%	1.72%	2.75%	1.89%
New York	27	80.77%	74.04%	74.54%	87.79%	83.40%
Ohio	16	61.70%	22.46%	30.71%	47.46%	60.27%
Pennsylvania	18	99.41%	93.96%	96.39%	98.92%	99.50%
Rhode Island	2	78.40%	56.66%	61.71%	78.36%	79.02%
South Carolina	7	0.14%	0.02%	0.01%	0.06%	0.13%
Tennessee	9	0.07%	0.00%	0.00%	0.00%	0.05%
Washington	10	0.12%	0.03%	0.03%	0.09%	0.05%
West Virginia	3	99.79%	93.12%	97.23%	99.30%	99.79%
Wisconsin	8	8.00%	1.17%	2.40%	4.88%	7.97%

Note: Only shows states where at least one seat was lost relative to 2010 apportionment in any of the 10,000 simulations.

Table 6 shows the probability of each state losing two or more seats in 2020. Examining results for California, we see that the chance of California losing two or more congressional seats after the 2020 Census goes from exceptionally rare (2.6%) in the baseline scenario with no citizenship question to almost guaranteed when a citizenship question is added under Scenario A (95.2%), or even after a reasonable attempt at following up with voters in Scenario B (87.2%). Scenarios C and D, which account for a portion of overall nonresponse attributable to a citizenship question, still indicate that the probability of California losing two or more congressional seats nearly triples under Scenario C and increases 33% under Scenario D *despite high rates of nonresponse follow-up success*. California is the only

state to be virtually guaranteed of losing two or more seats due to the addition of a citizenship question when using any of the undercount scenarios, and in addition to New York, is one of only two states to have a substantively significant increase in the probability of losing two or more seats under any of the undercount scenarios.

Table 6: Probability of Losing Two or More Congressional Seats

	2010 Seats	2020 Baseline	Scenario A	Scenario B	Scenario C	Scenario D
CALIFORNIA	**53**	**2.59%**	**95.20%**	**87.20%**	**9.92%**	**3.44%**
Illinois	18	24.20%	16.52%	16.63%	24.66%	24.64%
Michigan	14	0.10%	0.00%	0.01%	0.01%	0.07%
New York	27	6.13%	5.11%	5.31%	10.17%	7.02%
Ohio	16	0.01%	0.00%	0.00%	0.00%	0.00%
Pennsylvania	18	12.69%	3.03%	4.60%	8.49%	12.90%

Note: Only shows states where at least two seats were lost relative to 2010 apportionment in any of the 10,000 simulations.

6.3.2 Change in Distribution of Potential Apportionment Outcomes

To fully visualize the range of possible apportionment outcomes for California, I provide charts showing the probability of each apportionment outcome. This constitutes a summary of 10,000 simulated apportionment outcomes for each scenario, again allowing me to account for multiple forms of uncertainty in the population, demographic, and nonresponse estimates. Most of the variation is due to uncertainty in the true population of California in 2020; substantial change in population trends could take place over the next three years, based on what was observed from 2007-2010. Thus, simulated outcomes of the 2020 apportionment range from 46 seats to 57 seats, but 95% of the estimates under either scenario apportion California between 48 seats and 54 seats.

For Figure 1, these apportionment simulations were conducted under two conditions: a *Baseline* condition (depicted with gray bars) with no citizenship question on the 2020 Census, and an *Add Citizenship Question*, *Scenario A* condition (depicted with black bars) where a citizenship is incorporated into the 2020 Census under the assumptions of Scenario A and therefore the undercount increases substantially. In Figure 1, we see that for every potential apportionment outcome, the percent of simulations where California receives fewer seats than it currently has is greater in Scenario A than for the 2020 baseline. Furthermore, the percent of simulations where California receives more seats than it currently has

is *smaller* in Scenario A than in the baseline estimate with no citizenship question. The percent of simulations where California's apportionment is 53 seats, the status quo after the 2010 Census, is virtually zero (0.3%) under Scenario A, while the probability of California having at least 53 seats in the baseline scenario is nearly 75%. Conversely, the probability of California losing $\underline{4}$ seats (thus dropping to 49 seats) seats under Scenario A is 24.1%, despite the fact that this never occurs in the baseline scenario.

Figure 1: Simulated Apportionment, Baseline vs. Scenario A

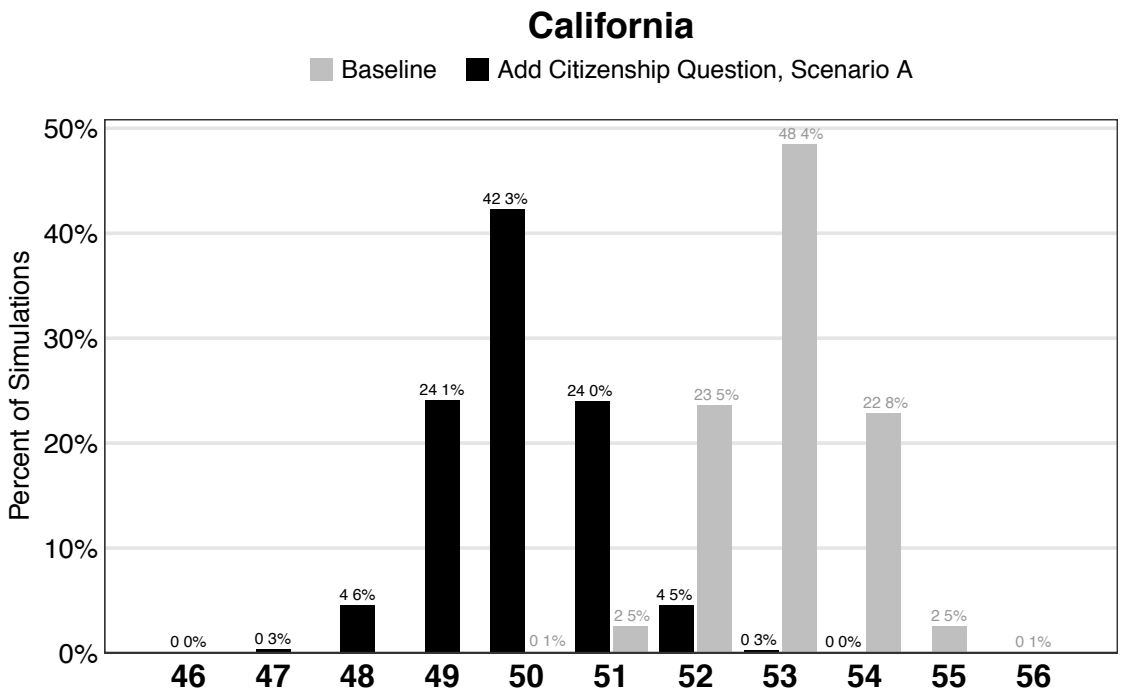
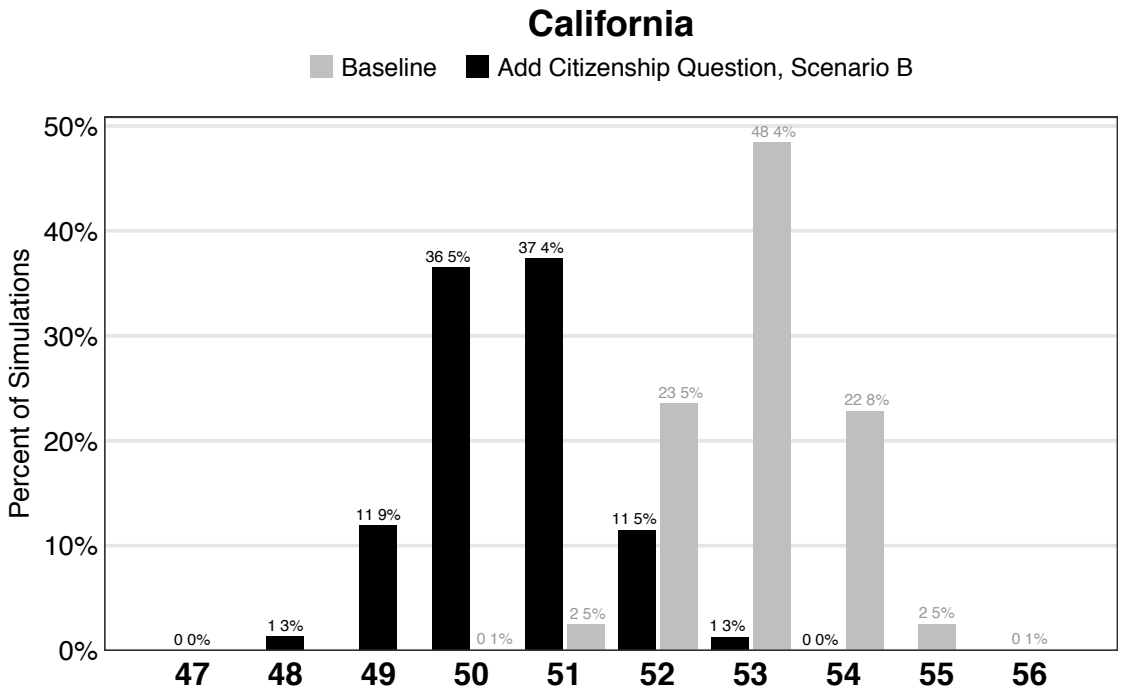


Figure 2 again presents the baseline scenario with no citizenship question (gray bars), but now compares this baseline to Scenario B where a citizenship question is on the 2020 Census, some individuals do not respond, but then an attempt at follow-up was estimated via the *Census 2020 Survey* (black bars). As indicted in Tables 4, 5, and 6, the likelihood of California losing a large number of seats is reduced when accounting for follow-up. However, we still see that in only a very small number of scenarios (1.3%) California is apportioned the same number of seats in 2020 that it received in 2010. The probability of losing three or more seats is far higher (13.2%) and, again, for every potential apportionment outcome the percent of simulations where California receives fewer seats than it currently has

is greater in Scenario A than for the 2020 baseline.

Figure 2: Simulated Apportionment, Baseline vs. Scenario B



7 Conclusion

In this report I conducted a statistical analysis of a series of relevant data sources in order to determine the impact of the addition of a citizenship question to the 2020 Census on population counts and congressional apportionment. Focusing on California, I found that the addition of a citizenship question to the 2020 Census would lead to a disproportionate reduction in California's population relative to other states. This disproportionate reduction means that the addition of a citizenship question would substantially increase the probability of a reduction of the number of congressional seats apportioned to California as part of the 2020 Census.

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Academic Affiliations

Indiana University, Bloomington, IN

Assistant Professor, Department of Political Science (2013 -)

Faculty Affiliate, Center for Research on Race and Ethnicity in Society (2013 -)

Faculty Affiliate, Latino Studies Program (2013 -)

Education

Harvard University, Cambridge, MA

Ph.D., Government and Social Policy (2013)

A.M., Political Science (2011)

Stanford University, Stanford, CA

B.A., Political Science and Linguistics (2008)

Degree Conferred with Distinction and Departmental Honors

Research Interests

Electoral Politics, Institutions, and Policy - Race, Ethnicity, and Politics - Political Participation - Representation, Parties, and Partisanship - Campaigns - Political Geography

Book

Fraga, Bernard L. (2018) *The Turnout Gap: Race, Ethnicity, and Political Inequality in a Diversifying America.* New York: Cambridge University Press.

Journal Articles

Fraga, Bernard L. and Eitan D. Hersh. (2018) "Are Americans Stuck in Uncompetitive Enclaves? An Appraisal of U.S. Electoral Competition." *Quarterly Journal of Political Science* 13 (3): 291-311.

Fraga, Bernard L. (2016) "Candidates or Districts? Reevaluating the Role of Race in Voter Turnout." *American Journal of Political Science.* 60 (1): 97-122.

Fraga, Bernard L. (2016) "Redistricting and the Causal Impact of Race on Voter Turnout." *Journal of Politics* 78 (1): 19-34.

Ansolabehere, Stephen and Bernard L. Fraga. (2016) "Do Americans Prefer Co-Ethnic Representation? The Impact of Race on House Incumbent Evaluations." *Stanford Law Review* 68 (6): 1553-1594.

Fraga, Bernard L. and Julie Lee Merseth. (2016) "Examining the Causal Impact of the Voting Rights Act Language Minority Provisions." *Journal of Race, Ethnicity, and Politics* 1 (1): 31-59.

Fraga, Bernard L. and Eitan D. Hersh. (2011) "Voting Costs and Voter Turnout in Competitive Elections." *Quarterly Journal of Political Science* 5 (4): 339-356.

Other Publications

McElwee, Sean, Jesse H. Rhodes, Brian F. Schaffner, and Bernard L. Fraga. (2018) "The Missing Obama Millions." *New York Times.* March 10.

Fraga, Bernard L., Sean McElwee, Jesse Rhodes, and Brian Schaffner. (2017) "Why did Trump win? More whites—and fewer blacks—actually voted." *Washington Post, Monkey Cage Blog.* May 8.

Fraga, Bernard L. and Brian Schaffner. (2016) "Who's voting early? Latino turnout is surging, but white turnout is, too." *Washington Post, Monkey Cage Blog.* Nov 4.

Fraga, Bernard L. (2016) Review of *American Identity and the Politics of Multiculturalism* by Jack Citrin and David O. Sears. *Perspectives on Politics* 14 (2): 562-564.

Fraga, Bernard L. (2015) "The Voting Rights Act turns 50 today. Here are three trends in minority voting you should know about." *Washington Post, Monkey Cage Blog.* Aug 6.

Fraga, Bernard L. (2013) "The SCOTUS Majority Is Missing Exactly What the VRA Sought to Remedy." *Monkey Cage Blog.* Jun 27.

Working Papers

"One Run Leads to Another: Minority Incumbents and the Emergence of Lower Ticket Minority Candidates" *with Eric Gonzalez Juenke and Paru Shah*

"Are Minority Candidates Penalized by Party Politics? Race, Gender, and Access to Party Support and Donor Networks" *with Hans J.G. Hassell*

"Who Does Voter ID Keep from Voting?" *with Michael G. Miller*

"Using Nationwide Voter Files to Study the Effects of Election Laws" *with John B. Holbein and Christopher Skovron*

"Measuring College Student Voter Turnout" *with John B. Holbein*

"Evaluating Patterns in Women's Turnout at the State and District Level: Evidence from 2006-2016" *with Katelyn Stauffer*

"Race, Party, and Candidate Prospects in the Multiple Stages of Congressional Elections"

"How the Interplay between Individual and District Partisanship Affects Turnout" *with Daniel Moskowitz and Benjamin Schneer*

"Abandoning (Partisan)ship? Dynamics of Latino Party Identification, 1989-2017" *with Colin Fisk*

"Testing the 'Two Sides of Racialization"' *with Christopher DeSante and Matthew Hayes*

"Panel Attrition in Voter Files: An Argument for Keeping Dropped Voters" *with Bradley Spahn and Alan N. Yan*

"Winning the Race, Losing the Base? Minority Candidates and Electoral Competition"

Teaching

Indiana University, Bloomington, IN

Voting, Elections, and Public Opinion *(Undergraduate)*

Racial and Ethnic Politics in the U.S. *(Undergraduate)*

Election Law and Voting Rights *(Undergraduate)*

Analyzing Politics *(Undergraduate)*

Electoral Politics and Political Participation *(Graduate)*

The Politics of Race, Ethnicity, Gender, and Identity *(Graduate)*

American Politics Workshop *(Graduate)*

Harvard University, Cambridge, MA

Teaching Fellow/Tutor, Sophomore Tutorial on Democracy *(Undergraduate)*

Teaching Fellow, American Government *(Undergraduate)*

Grants, Awards, & Fellowships

Midwest Political Science Association Latino Caucus Early Career Award (2018)

Visiting Scholar *(non-residential)* (2017-2019)
Institute for Democracy & Higher Education, Tufts University

Indiana University Summer Instructional Development Fellowship (2017)

New Initiatives Grant (2017)
Massachusetts Institute of Technology Election Data and Science Lab

Indiana University Latino Faculty and Staff Council Emerging Scholar Award (2017)

Indiana University Trustees Teaching Award (2015)

Midwest Political Science Association Lucius Barker Award (2015)

Best Dissertation Award Honorable Mention (2014)
American Political Science Association Race, Ethnicity, and Politics Section

Harvard Graduate Prize Dissertation Completion Fellowship (2012-2013)

Harvard University Center for American Politics Travel Grant (2012)

Harvard University Certificate of Distinction in Teaching (2011, 2012)

SSRC Graduate Studies Enhancement Grant (2010, 2011, 2012)

NSF-IGERT Doctoral Fellow (2009-2011)
Multidisciplinary Program in Inequality & Social Policy, Harvard University

American Political Science Association Minority Fellow (2008-2010)

Mellon Mays Undergraduate Fellowship (2006-2008)

Conference & Workshop Presentations

Invited Talk: University of Pittsburgh Seminar in Representation and Identity Politics. (Scheduled) "Separating Race and Party in Congressional Elections"

Invited Talk: Princeton Conference on Identity and Inequality. (Scheduled) "The Turnout Gap: Causes and Consequences of Racial/Ethnic Disparities in Voter Turnout"

American Political Science Association Annual Meeting, August 31, 2018. "Measuring College Student Voter Turnout" *(with John B. Holbein)*

Invited Talk: Spring Conference on American Politics, University of California San Diego Center for American Politics, May 24, 2018. "Who Does Voter ID Keep from Voting?"

Invited Talk: Race, Ethnicity, and Politics Workshop, Northwestern University, February 23, 2018. "The Turnout Gap: Causes and Consequences of Racial/Ethnic Disparities in Voter Turnout."

Invited: Symposium Rapporteur for *The New American Electorate Beyond the Voting Booth: Building an Inclusive Democracy*, The Ohio State University, November 30 - December 1, 2017.

American Political Science Association Annual Meeting, September 1, 2017. "Are Minority Candidates Penalized by Party Politics? Race, Gender, and Access to Party Support and Donor Networks" *(with Hans J.G. Hassell)*

American Political Science Association Annual Meeting, September 1, 2017. "Mobilizing College Students through Peer-based Voter Registration Reminders." *(with Katherine Hitchcock and Nina Wornhoff)*

Election Sciences, Reform, and Administration Summer Conference, July 27, 2017. "Panel Attrition in Voter Files: An Argument for Keeping Dropped Voters." *(with Bradley Spahn and Alan Yan)*

Invited Talk: American Politics Workshop, Columbia University, April 25, 2017. "The Turnout Gap: Exploring the Causes and Consequences of Racial/Ethnic Differences in Voter Turnout."

Midwest Political Science Association Annual Meeting, April 6, 2017. "Let's Party: How the Interplay between Individual and District Partisanship Affects Turnout" *(with Daniel Moskowitz and Benjamin Schneer)*

Invited Talk: Research on Individuals, Politics, and Society Speaker Series, Vanderbilt University, February 27, 2017. "The Turnout Gap: Exploring the Causes and Consequences of Racial/Ethnic Differences in Voter Turnout."

Invited Talk: Speaker Series, Rice University, January 27, 2017. "The Turnout Gap: Examining the Causes and Consequences of Racial/Ethnic Differences in Voter Turnout."

American Politics Workshop, Indiana University, January 20, 2017. "The Turnout Gap: Race, Ethnicity, and Political Inequality in a Diversifying America."

Invited Talk: ICPSR Summer Institute Blalock Lecture, August 4, 2016. "Using Big Data to Measure, Map, and Explain Racial Differences in Voter Turnout."

Midwest Political Science Association Annual Meeting, April 10, 2016. "Racial Coattails: How Top-Ticket Minority Candidates Affect the Emergence and Success of Lower Ticket Minority Candidates." *(with Eric Juenke and Paru Shah)*

Midwest Political Science Association Annual Meeting, April 10, 2016. "Robust Competition: The American Voter's Experience with Close Elections." *(with Eitan Hersh)*

Midwest Political Science Association Annual Meeting, April 8, 2016. "How Demographics and Geography Shape Minority Turnout Rates."

Workshop on Race, Ethnicity, and Migration, Indiana University, February 4, 2016. "How Age Shapes Minority Turnout Rates."

Invited Talk: American Politics Workshop, University of Chicago, Nov 9, 2015. "Changing Districts, Changing Turnout: Redistricting and Minority Political Participation."

American Politics Workshop, Indiana University, October 30, 2015. "Changing Districts, Changing Turnout: Redistricting and Minority Political Participation."

Midwest Political Science Association Annual Meeting, April 16, 2015. "Turning Sour Grapes into Wine: Voter Mobilization after Divisive Primaries."

Western Political Science Association Meeting, April 2, 2015. "Turning Sour Grapes into Wine: Voter Mobilization after Divisive Primaries."

Invited: Workshop Participant and Panelist, Harvard Kennedy School Ash Center for Democratic Governance and Innovation, March 26, 2015. "How Data is Helping Us Understand Voting Rights After *Shelby County v. Holder*."

Invited: Panelist, Neal-Marshall Black Culture Center, November 10, 2014. "Rights and Retrospectives: The Civil Rights Act at 50."

American Political Science Association Annual Meeting, Aug 30, 2014. "Examining the Causal Impact of the Voting Rights Act Language Minority Provisions." *(with Julie Lee Merseth)*

American Political Science Association Annual Meeting, Aug 29, 2014. "A Misreported Registration Gap? Race and Survey Misreporting of Voter Registration Status."

Midwest Political Science Association Annual National Conference, Apr 4, 2014. "Assessing the Causal Impact of Race-Based Districting on Voter Turnout." *Winner, Lucius Barker Award for best paper on a topic investigating race or ethnicity and politics and honoring the spirit and work of Professor Barker.*

Invited Talk: Social Science Research Commons Workshop in Methods, Indiana Uni-

versity, Dec 3, 2013. "Using the Catalist Database to Study Political Participation."

Politics of Race, Immigration, and Ethnicity Consortium Meeting, UC-Riverside, Sep 27, 2013. "Assessing the Causal Impact of Race-Based Districting on Voter Turnout."

Symposium on the Politics of Immigration, Race, and Ethnicity, Yale University, Oct 12, 2012. "Candidates or Influence? Reevaluating the Role of Race in Voter Turnout."

American Politics Research Workshop, Harvard University, Sep 18, 2012. "Candidates or Influence? Reevaluating the Role of Race in Voter Turnout."

Midwest Political Science Association Annual National Conference, Apr 13, 2012. "Candidates or Context? Evaluating the Determinants of Minority Voter Turnout."

American Politics Research Workshop, Harvard University, Oct 25, 2011. "Partisan Influence and Race in Congressional Elections."

American Political Science Association Annual Meeting, Sep 1, 2011. "Where's the Party? Partisan Influence and Race in Congressional Elections."

Political Psychology and Behavior Workshop, Harvard University, Mar 11, 2011. "Party Coalitions and Minority Candidate Emergence."

American Politics Research Workshop, Harvard University, Feb 24, 2011. "Group-Level Political Incorporation into Partisan Coalitions."

American Political Science Association Annual Meeting, Sep 3, 2010. "The (Surprising) Short-Term Impact of the Language Provisions of the VRA."

Political Psychology and Behavior Workshop, Institute for Quantitative Social Science, Harvard University, Mar 5, 2010. "Randomly Assigned Voting Costs in Competitive Elections." *(with Eitan Hersh)*

Advising & Service

Ph.D. Dissertation Committee Chair and Member, *Indiana University* (2013 -)

Master's Thesis Examiner in Political Science, *Freie Universität Berlin* (2017-2018)

Faculty Mentor, Center for Research on Race and Ethnicity in Society Postdoctoral Scholar, *Indiana University* (2017 -)

Faculty Mentor, Center for Research on Race and Ethnicity in Society Undergraduate Research Program, *Indiana University* (2017 - 2018)

Honors Thesis Mentor, Department of Political Science, *Indiana University* (2014-2016, 2018 -)

Faculty Mentor, Cox Research Scholars Program, *Indiana University* (2013 -)

Member, Diversity and Affirmative Action Committee, Bloomington Faculty Council,

Indiana University (2016-2017)

Board Member, All In Campus Democracy Project and Big 10 Voting Challenge, *Indiana University* (2016, 2018)

Coordinator, Department of Political Science American Politics Subfield, *Indiana University* (2018 -)

Co-coordinator, Department of Political Science Political Analytics Program, *Indiana University* (2018 -)

Member, Department of Political Science Development Committee, *Indiana University* (2018-2019)

Member, Department of Political Science Personnel Committee, *Indiana University* (2017-2018)

Member, Department of Political Science Graduate Program and Admissions Committee, *Indiana University* (2013-2017)

Member, Department of Political Science Undergraduate Program Committee, *Indiana University* (2015-2016)

Member, Department of Political Science Graduate Awards Committee, *Indiana University* (2014-2015)

Member, Center for Research on Race and Ethnicity in Society Postdoctoral Fellowship Selection Committee, *Indiana University* (2014)

Professional Activities & Affiliations

Reviewer: *American Political Science Review*; *American Journal of Political Science*; *Journal of Politics*; *Journal of Race, Ethnicity, and Politics*; *Cambridge University Press*; *Oxford University Press*; *W.W. Norton & Co.*; *British Journal of Political Science*; *Political Analysis*; *Political Research Quarterly*; *Political Psychology*; *Public Opinion Quarterly*; *Legislative Studies Quarterly*; *Political Behavior*; *American Politics Research*; *Politics, Groups, and Identities*

Member, Western Political Science Association Committee on the Status of Latinos/as in the Profession (2017-2019, Chair 2018-2019)

Member, Executive Committee, Section on Race, Ethnicity, and Politics, American Political Science Association (2019-2021)

Member, Nominations Committee, Section on Race, Ethnicity, and Politics, American Political Science Association (2017-2019)

Research Affiliate, Democracy Fund Voter Study Group (2018 -)

Co-Organizer, Symposium on the Politics of Immigration, Race, and Ethnicity (SPIRE) (2016 -), Institution Host (2014)

Program Co-Chair, Election Sciences, Reform, and Administration (ESRA) Summer Conference (2017)

Chair, Lucius Barker Award Selection Committee, Midwest Political Science Association (2017-2018)

Member: *American Political Science Association*; *Midwest Political Science Association*; *Western Political Science Association*

Supplement to Expert Report and Declaration of Bernard L. Fraga, Ph.D.

Like Table 4, Table 4A shows the average apportionment outcomes witnessed under the baseline scenario with no citizenship question (2020 Baseline), followed by four scenarios of nonresponse and follow-up (Scenario A, Scenario B, Scenario C, or Scenario D), but without rounding the average apportionment to the nearest whole seat. In each of the four scenarios the average congressional apportionment for California decreases.

Table 4A: Change in Apportionment Due to a Citizenship Question, unrounded average outcomes

	2020 Baseline	Scenario A	Scenario B	Scenario C	Scenario D
Alabama	6.3487	6.6807	6.6711	6.5164	6.3923
Alaska	1.0000	1.0000	1.0000	1.0000	1.0000
Arizona	9.7249	9.6856	9.7081	9.6838	9.7148
Arkansas	4.0000	4.0000	4.0000	4.0000	4.0000
California	52.9925	49.9972	50.4965	52.5004	52.9011
Colorado	7.8316	7.8984	7.8705	7.8437	7.8306
Connecticut	4.9989	4.9993	4.9994	4.9984	4.9985
Delaware	1.0000	1.0000	1.0000	1.0000	1.0000
Florida	28.4291	28.4863	28.5563	28.4052	28.4498
Georgia	14.0111	14.0712	14.0867	14.0222	14.0159
Hawaii	2.0000	2.0000	2.0000	2.0000	2.0000
Idaho	2.0445	2.2328	2.1617	2.0757	2.0518
Illinois	16.7591	16.8430	16.8388	16.7552	16.7554
Indiana	8.9935	9.0002	8.9977	8.9959	8.9930
Iowa	4.0001	4.0025	4.0002	4.0001	4.0000
Kansas	4.0000	4.0000	4.0000	4.0000	4.0000
Kentucky	6.0000	6.0000	6.0000	6.0000	6.0000
Louisiana	6.0027	6.0324	6.0310	6.0068	6.0029
Maine	2.0000	2.0000	2.0000	2.0000	2.0000
Maryland	8.0011	8.0060	8.0052	8.0003	8.0004
Massachusetts	9.0108	9.0649	9.0374	9.0091	9.0096
Michigan	13.0693	13.3026	13.2358	13.1083	13.0700
Minnesota	7.3566	7.7293	7.6278	7.4250	7.3461
Mississippi	4.0000	4.0000	4.0000	4.0000	4.0000
Missouri	8.0012	8.0257	8.0150	8.0029	8.0010
Montana	1.2741	1.7637	1.6606	1.4704	1.3256
Nebraska	2.9952	2.9993	2.9991	2.9978	2.9960
Nevada	4.0000	4.0000	4.0000	4.0000	4.0000
New Hampshire	2.0000	2.0000	2.0000	2.0000	2.0000
New Jersey	11.9849	11.9862	11.9862	11.9732	11.9823
New Mexico	3.0000	3.0000	3.0000	3.0000	3.0000
New York	26.1316	26.2109	26.2029	26.0207	26.0964
North Carolina	13.9151	13.9791	13.9784	13.9391	13.9176
North Dakota	1.0000	1.0000	1.0000	1.0000	1.0000
Ohio	15.3829	15.7760	15.6936	15.5255	15.3974
Oklahoma	5.0051	5.0401	5.0289	5.0072	5.0035
Oregon	5.9729	5.9940	5.9907	5.9811	5.9767
Pennsylvania	16.8790	17.0301	16.9901	16.9259	16.8760
Rhode Island	1.2160	1.4334	1.3829	1.2164	1.2098
South Carolina	6.9986	6.9998	6.9999	6.9994	6.9987
South Dakota	1.0000	1.0000	1.0000	1.0000	1.0000
Tennessee	8.9998	9.0063	9.0034	9.0002	8.9995
Texas	38.5737	38.2290	38.3584	38.4143	38.5653
Utah	4.0001	4.0027	4.0014	4.0001	4.0001
Vermont	1.0000	1.0000	1.0000	1.0000	1.0000
Virginia	11.1733	11.4185	11.3735	11.2207	11.1983
Washington	9.9999	10.0157	10.0071	10.0004	10.0012
West Virginia	2.0021	2.0688	2.0277	2.0070	2.0021
Wisconsin	7.9200	7.9883	7.9760	7.9512	7.9203
Wyoming	1.0000	1.0000	1.0000	1.0000	1.0000
TOTAL	435	435	435	435	435

Errata to Expert Report and Declaration of Bernard L. Fraga, Ph.D.

1. On Page 21 of my declaration, to estimate the total population of overseas federal employees (military and non-military) in 2020, I use Department of Defense estimates of the overseas military population in FY2010 and FY2018. These estimates indicate a decline of 94,900 individuals during that period. Since Census Bureau figures indicate that the total overseas population in 2010 was 1,042,523, this equals a 9.1% (94,900/1,042,523) decline in the total overseas population.

2. Page 21 of my report should therefore state, "Using the 2010 estimate of the overseas population as a baseline, I reduce this figure by 9.1% due to the decline in military stationed overseas," instead of "Using the 2010 estimate of the overseas population as a baseline, I reduce this figure by 18.96% due to the decline in military stationed overseas."

3. This revised estimate of the 2020 overseas population results in a slightly larger overseas population to be allocated to states. However, since the percent of the overseas population allocated to each state does not change, each state's proportion of the estimated 2020 overseas population is unaffected. Therefore, the conclusions of my report as outlined in section 3 and section 7 do not change when using the revised figures. This concurs with findings by Dr. Stuart D. Gurrea, who states "the use of a marginally different (higher) Baseline apportionment population is immaterial."[1]

[1] Expert Report and Declaration of Stuart D. Gurrea, Ph.D. October 3, 2018, p. 21.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on November 15, 2018.

Bernard L. Fraga