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# A Study of Whether Census Adjustment is Worthwhile

by

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### 1. INTRODUCTION

Suppose that we have a set of N disjoint blocks, indexed $i=1,\ldots,N$. One might think of these blocks as being the 50 states plus DC, but they might also correspond to smaller areas. For block i we let $t_i$ denote true population, and $y_i$ denote population as officially obtained from the Census. Let $T = \sum t_i$ and $Y = \sum y_i$ . We assume knowledge of $y_i$ (and thus Y) and T, but not of $t_i$. Presumably the knowledge of T would come from an external source such as demographic methods.

Consider the ratio adjustment across the board:

$$a_i = y_i T/Y, \tag{1}$$

which removes the effects of overall (as opposed to differential) relative overcount or undercount. We want to examine whether $a_i$ is better than $y_i$: "better" in the sense that $a_i$ is closer to $t_i$ than is $y_i$. We will consider four criteria for closeness. These criteria are as follows.

Let $\underline{a}$ denote the vector $(a_1,\ldots,a_N)$, with $\underline{y}$ and $\underline{t}$ likewise; and let $\underline{x}$ denote the (arbitrary) vector $(x_1,\ldots,x_N)$. With $\underline{y}$ and $\underline{t}$ fixed, let

$$f_1(\underline{x}) = \sum_{i=1}^{N} (x_i - t_i)^2 \tag{2a}$$

$$f_2(\underline{x}) = \sum (x_i - t_i)^2 / y_i \tag{2b}$$

$$f_3(\underline{x}) = \sum (x_i - t_i)^2 / t_i \tag{2c}$$

$$f_4(\underline{x}) = \sum |x_i - t_i| \ . \tag{2d}$$

These are our four criteria, or loss functions. For $k = 1,2,3,4$, we want to compare $f_k(\underline{a})$ and $f_k(\underline{y})$. We will examine the extent to which it is the case that

$$f_k(\underline{a})<f_k(\underline{y}). \qquad (3)$$

We will consider two approaches: in Section 2 we deal with mathematical analysis, and in Section 3 we deal with empirical results which, possibly, are indicative of what happens in practice. Section 4 is a summary.

## 2. MATHEMATICAL ANALYSIS

There is no convenient characterization as to when the inequality in (3) holds for $k=4$. For $k=2$ it always holds: that is,

$$f_2(\underline{a})<f_2(\underline{y}) \qquad (4)$$

always.

We may easily demonstrate (4) by letting $\underline{x} = c\underline{y}$ for varying scalar $c$ and establishing that $f_2(\underline{x})$ attains a minimum uniquely for $c = T/Y$.

For $k=1$, let

$$R = T/Y \text{ and } B = (\sum t_i y_i)/(\sum y_i^2). \qquad (5)$$

Then, we have

$$f_1(\underline{a})<f_1(\underline{y}) \text{ if and only if } |R-B|<|1-B|. \qquad (6)$$

Proof of (6) may be based on, again, letting $\underline{x} = c\underline{y}$ for varying scalar $c$ and viewing $f_1$ as a quadratic function of $c$ which attains a minimum at $c=B$.

Here is a simple example where the inequalities in (6) do not hold, for 2 states:

$$t_1=2,\ t_2=8/3 = 2\ 2/3,\ y_1=1,\ y_2=3,\ B=1,\ R=7/6. \qquad (7)$$

Thus (3) does not always hold for $k=1$. It does not hold when $B=1$ and $R\neq1$. To have $B=1$ we must have a balancing between some $y_i$ overstating $t_i$ and some $y_i$ understating it. But when such balancing occurs, R will typically also be close to 1. In practice, one might guess that B will not be close to 1, however, largely because there has been a prevailing pattern of $y_i$ understating $t_i$.

For $k=3$ we set

$$B^* = Y/(\sum y_i^{\,2}/t_i) \qquad (8)$$

and obtain, in analogy with (6), the characterization

$$f_3(\underline{a})<f_3(\underline{y}) \text{ if and only if } |R-B^*|<|1-B^*|. \qquad (9)$$

## 3. EMPIRICAL RESULTS

We now examine empirically the extent to which the 4 inequalities in (3) are satisfied.

We consider results from the 1980 Decennial Census ($y_i$) and the Post-Enumeration Survey (PES) for that census. This followup coverage survey is carried out for a nationwide sample of persons, and produces estimators of the true but unknown $t_i$, with associated sampling variances which too have been estimated. Our approach, essentially, is (a) to act like these estimators are the true $t_i$, and (b) in the light of the sampling error that is indicated by our sampling variance, look at the statistical significance of these findings.

Thus, let $\hat{t}_i$ denote the estimator of $t_i$. We first form $\hat{T} = \sum \hat{t}_i$ and act as though $\hat{T}$ is the true T that would be obtained from external demographic methods. Thus we form $a_i$ based on ratio adjustment in (1). Then, to compute the loss functions $f_k$, we substitute $\hat{t}_i$ for $t_i$. Based on these substitutions, we set

$$\hat{E}_k = \hat{f}_k(\underline{a})/\hat{f}_k(\underline{y}) \qquad (10)$$

as indication of how much we gain, relatively, by using $a_i$ instead of $y_i$ as a proxy for $t_i$.

Under different assumptions, 12 sets of PEP estimators (with accompanying variances) were formed. Thus we obtain 12 sets of quantities $\hat{E}_k$ :

| set | $\hat{E}_1$ | $\hat{E}_2$ | $\hat{E}_3$ | $\hat{E}_4$ |
|---|---|---|---|---|
| 2-8 | .454 | .611 | .619 | .732 |
| 10-8 | .820 | .928 | .934 | .961 |
| 2-9 | .374 | .499 | .506 | .646 |
| 3-8 | .507 | .677 | .686 | .804 |
| 3-9 | .407 | .548 | .556 | .706 |
| 5-8 | .293 | .406 | .412 | .589 |
| 5-9 | .253 | .345 | .350 | .551 |
| 3-20 | .343 | .470 | .475 | .634 |
| 2-20 | .319 | .429 | .435 | .586 |
| 14-8 | .686 | .046 | .639 | .760 |
| 14-9 | .986 | .865 | .857 | .882 |
| 14-20 | 1.031 | .983 | .979 | .988 |

Thus only the last set, 14-20, for $f_1$ provides any indication that $a_i$ is not an improvement over $y_i$.

To assess the statistical significance of these results, we considered differences

$$\hat{D}_k = \hat{f}_k(\underline{y})-\hat{f}_k(\underline{a}). \qquad (11)$$

Corresponding to these differences there are, of course, underlying parameters $D_k$. We tested the null hypothesis $D_k = 0$ (no difference between $\underline{y}$ and $\underline{a}$) against the alternative $D_k>0$ ($\underline{a}$ is an improvement). These hypotheses correspond, of course, to $E_k = 1$ and $E_k<1$ respectively. For k=2 we already know $D_2>0$ as in (4); thus we consider the test only for k=1,3 and 4.

We may form an approximation to Var $(\hat{D}_k)$ based on a 1st-order Taylor linearization of $\hat{f}_k$ along with the aforementioned estimators of the quantities $\mathrm{Var}(\hat{t}_i)$. (In the case of Var $(\hat{D}_4)$ involving absolute values, this variance approximation is not completely conventional; but results for $\hat{D}_4$ , as we shall discuss, correspond to those for $\hat{D}_1$ and $\hat{D}_3$.) We divide $\hat{D}_k$ by its estimated standard deviation and compare the resulting test t-statistic against N(0,1) to test the null hypthesis. For 9 of the 12 sets of PEP estimators (all but sets 10-8, 14-9, and 14-20), the (positive) difference $\hat{D}_k$ was statistically significant at the 5% level. For set 14-20 and $D_3$, also, the difference was significant.

These, then, are the extent of the empirical findings to support the claim that a should be used in preference to y. For all four of the criterion $f_k$ in (2) this claim appears to hold up.

## 4. SUMMARY

We have shown that under a variety of standard loss functions, the simple ratio adjustment (1) moves the data closer to the truth. This result does not appear to be sensitive to the choice of loss function, thus confirming observations made in the CNSTAT final report.

The key assumption in the considered ratio adjustment is that the true total, T, is known and can be exploited in the ratio adjustment. Future reports will examine the extent to which the present findings hold true when the ratio adjustment is based upon an estimator $\hat{T}$ of T with known distributional properties.

1980 CENSUS COUNTS

| ST_60 | ST_NAME | CEN_CT |
|---|---|---|
| 11 | MAINE | 1124660 |
| 12 | NEW HAMPSHIRE | 920610 |
| 13 | VERMONT | 511456 |
| 14 | MASSACHUSETTS | 5737037 |
| 15 | RHODE ISLAND | 947154 |
| 16 | CONNECTICUT | 3107576 |
| 21 | NEW YORK | 17558072 |
| 22 | NEW JERSEY | 7364823 |
| 23 | PENNSYLVANIA | 11863895 |
| 31 | OHIO | 10797630 |
| 32 | INDIANA | 5490224 |
| 33 | ILLINOIS | 11426518 |
| 34 | MICHIGAN | 9262078 |
| 35 | WISCONSIN | 4705767 |
| 41 | MINNESOTA | 4075970 |
| 42 | IOWA | 2913808 |
| 43 | MISSOURI | 4916686 |
| 44 | NORTH DAKOTA | 652717 |
| 45 | SOUTH DAKOTA | 690768 |
| 46 | NEBRASKA | 1569825 |
| 47 | KANSAS | 2363679 |
| 51 | DELAWARE | 594338 |
| 52 | MARYLAND | 4216975 |
| 53 | DISTRICT OF COL. | 638333 |
| 54 | VIRGINIA | 5346818 |
| 55 | WEST VIRGINIA | 1949644 |
| 56 | NORTH CAROLINA | 5881766 |
| 57 | SOUTH CAROLINA | 3121820 |
| 58 | GEORGIA | 5463105 |
| 59 | FLORIDA | 9746324 |
| 61 | KENTUCKY | 3660777 |
| 62 | TENNESSEE | 4591120 |
| 63 | ALABAMA | 3893888 |
| 64 | MISSISSIPPI | 2520638 |
| 71 | ARKANSAS | 2286435 |
| 72 | LOUISIANA | 4205900 |
| 73 | OKLAHOMA | 3025290 |
| 74 | TEXAS | 14229191 |
| 81 | MONTANA | 786690 |
| 82 | IDAHO | 943935 |
| 83 | WYOMING | 469557 |
| 84 | COLORADO | 2889964 |
| 85 | NEW MEXICO | 1302894 |
| 86 | ARIZONA | 2718215 |
| 87 | UTAH | 1461037 |
| 88 | NEVADA | 800493 |
| 91 | WASHINGTON | 4132156 |
| 92 | OREGON | 2633105 |
| 93 | CALIFORNIA | 23667902 |
| 94 | ALASKA | 401851 |
| 95 | HAWAII | 964691 |

From PC80-1-1A, U. S. Summary, Table 8, p. 43.

PEP ESTIMATES AND THEIR STANDARD ERRORS

| ST_NAME | P_14_8 | SE_14_8 | P_14_9 | SE_14_9 | P_14_20 | SE_14_20 |
|---|---|---|---|---|---|---|
| MAINE | 1133442 | 11779 | 1133819 | 11686 | 1136592 | 11526 |
| NEW HAMPSHIRE | 900058 | 9212 | 901668 | 9173 | 905632 | 9593 |
| VERMONT | 504598 | 2607 | 503889 | 2825 | 507410 | 2947 |
| MASSACHUSETTS | 5610009 | 33607 | 5659372 | 31177 | 5675444 | 31965 |
| RHODE ISLAND | 940363 | 5830 | 939383 | 5611 | 943048 | 5065 |
| CONNECTICUT | 3046416 | 35128 | 3057298 | 34143 | 3071513 | 27244 |
| NEW YORK | 17383935 | 79571 | 17468341 | 82674 | 17510441 | 83021 |
| NEW JERSEY | 7349244 | 49201 | 7348474 | 49534 | 7376830 | 51949 |
| PENNSYLVANIA | 11733989 | 55687 | 11763321 | 56751 | 11789261 | 56369 |
| OHIO | 10750393 | 57420 | 10761895 | 58527 | 10781745 | 56147 |
| INDIANA | 5385405 | 38088 | 5389839 | 37434 | 5397001 | 36246 |
| ILLINOIS | 11327722 | 55281 | 11407278 | 58554 | 11423435 | 57569 |
| MICHIGAN | 9217382 | 41963 | 9250276 | 40324 | 9270978 | 41627 |
| WISCONSIN | 4739499 | 21763 | 4739499 | 21763 | 4740968 | 22426 |
| MINNESOTA | 4083163 | 22629 | 4098277 | 23621 | 4102679 | 21977 |
| IOWA | 2875557 | 31942 | 2875557 | 31942 | 2876769 | 33202 |
| MISSOURI | 4911352 | 32186 | 4916254 | 31629 | 4928215 | 30591 |
| NORTH DAKOTA | 647731 | 2390 | 649538 | 2308 | 649691 | 2323 |
| SOUTH DAKOTA | 685668 | 2748 | 686531 | 2461 | 687216 | 2541 |
| NEBRASKA | 1557977 | 7354 | 1561192 | 7194 | 1564690 | 6476 |
| KANSAS | 2343775 | 16682 | 2347907 | 16171 | 2356056 | 14618 |
| DELAWARE | 583846 | 6031 | 585168 | 5631 | 587416 | 5421 |
| MARYLAND | 4254937 | 42689 | 4265835 | 41272 | 4276896 | 40938 |
| DISTRICT OF COL. | 647834 | 10791 | 661198 | 10317 | 669127 | 9577 |
| VIRGINIA | 5300229 | 43167 | 5323099 | 42628 | 5334276 | 43337 |
| WEST VIRGINIA | 1912683 | 27574 | 1912188 | 27343 | 1918131 | 26380 |
| NORTH CAROLINA | 5864556 | 65152 | 5877425 | 60004 | 5899525 | 57015 |
| SOUTH CAROLINA | 3234299 | 76660 | 3246235 | 76095 | 3281862 | 74909 |
| GEORGIA | 5346937 | 34325 | 5370092 | 34716 | 5388033 | 39923 |
| FLORIDA | 9647620 | 71854 | 9702921 | 74012 | 9746240 | 68120 |
| KENTUCKY | 3567481 | 28063 | 3567659 | 30468 | 3587015 | 28216 |
| TENNESSEE | 4410031 | 55286 | 4434256 | 55235 | 4431468 | 55573 |
| ALABAMA | 3807843 | 32152 | 3820235 | 30687 | 3843447 | 32968 |
| MISSISSIPPI | 2498395 | 28288 | 2512079 | 25706 | 2516300 | 27645 |
| ARKANSAS | 2234157 | 31747 | 2239942 | 30547 | 2254683 | 30982 |
| LOUISIANA | 4185817 | 90828 | 4196851 | 81061 | 4228070 | 81332 |
| OKLAHOMA | 2946071 | 20237 | 2946844 | 19648 | 2958441 | 20276 |
| TEXAS | 13778895 | 101087 | 13890195 | 97672 | 13958898 | 99513 |
| MONTANA | 785850 | 6550 | 788038 | 6310 | 791057 | 7056 |
| IDAHO | 946492 | 6060 | 947605 | 5858 | 950557 | 5058 |
| WYOMING | 477834 | 4666 | 479803 | 5210 | 479958 | 5176 |
| COLORADO | 2842810 | 22065 | 2861295 | 24070 | 2869023 | 24890 |
| NEW MEXICO | 1287808 | 11085 | 1291059 | 11246 | 1295591 | 11518 |
| ARIZONA | 2716403 | 35819 | 2738359 | 33943 | 2752653 | 29879 |
| UTAH | 1459520 | 9701 | 1469576 | 9265 | 1470772 | 9727 |
| NEVADA | 799035 | 10117 | 816468 | 9694 | 821234 | 9543 |
| WASHINGTON | 4112177 | 29036 | 4110050 | 29282 | 4132475 | 25471 |
| OREGON | 2602181 | 15713 | 2614882 | 14213 | 2624861 | 12502 |
| CALIFORNIA | 23747738 | 100346 | 23935428 | 96609 | 24018862 | 93470 |
| ALASKA | 406537 | 4784 | 408387 | 4871 | 409122 | 4821 |
| HAWAII | 955198 | 8986 | 956720 | 9017 | 962707 | 8191 |

PEP ESTIMATES AND THEIR STANDARD ERRORS

| ST_NAME | P_5_9 | SE_5_9 | P_3_20 | SE_3_20 | P_2_20 | SE_2_20 |
|---|---|---|---|---|---|---|
| MAINE | 1147827 | 9672 | 1151422 | 10263 | 1152058 | 10127 |
| NEW HAMPSHIRE | 932986 | 12344 | 912601 | 11325 | 912068 | 11080 |
| VERMONT | 510112 | 3876 | 509164 | 2892 | 509899 | 3208 |
| MASSACHUSETTS | 5760173 | 50760 | 5744186 | 35216 | 5744774 | 34312 |
| RHODE ISLAND | 958391 | 8389 | 959387 | 8473 | 958985 | 8478 |
| CONNECTICUT | 3136759 | 36073 | 3103238 | 30933 | 3118575 | 33470 |
| NEW YORK | 17958646 | 120366 | 18001262 | 110647 | 18031802 | 108927 |
| NEW JERSEY | 7479318 | 64765 | 7497216 | 68247 | 7509603 | 68687 |
| PENNSYLVANIA | 11877050 | 78827 | 11902607 | 63505 | 11943069 | 66392 |
| OHIO | 10923983 | 53363 | 10946193 | 65204 | 10948088 | 65093 |
| INDIANA | 5625813 | 50314 | 5467317 | 42094 | 5467819 | 42557 |
| ILLINOIS | 11639057 | 84989 | 11766850 | 70260 | 11758411 | 67853 |
| MICHIGAN | 9407742 | 39569 | 9391797 | 54750 | 9410438 | 56899 |
| WISCONSIN | 4721516 | 16949 | 4786560 | 26549 | 4785651 | 27184 |
| MINNESOTA | 4134647 | 19323 | 4138130 | 22531 | 4142497 | 24089 |
| IOWA | 2933860 | 24101 | 2894572 | 32219 | 2897219 | 33413 |
| MISSOURI | 4948854 | 34852 | 4972828 | 35803 | 4981497 | 34831 |
| NORTH DAKOTA | 657974 | 3704 | 654538 | 2050 | 654649 | 2013 |
| SOUTH DAKOTA | 705992 | 7697 | 691991 | 3475 | 693427 | 3783 |
| NEBRASKA | 1593988 | 15170 | 1577211 | 8702 | 1578417 | 7740 |
| KANSAS | 2411717 | 20325 | 2388642 | 21119 | 2393672 | 22649 |
| DELAWARE | 602116 | 6859 | 594523 | 5938 | 595915 | 5301 |
| MARYLAND | 4349139 | 33640 | 4341398 | 55187 | 4350610 | 55976 |
| DISTRICT OF COL. | 655310 | 14006 | 684647 | 10264 | 687044 | 9864 |
| VIRGINIA | 5463288 | 39469 | 5387357 | 36819 | 5419582 | 48845 |
| WEST VIRGINIA | 1929721 | 24188 | 1943662 | 24935 | 1942108 | 24187 |
| NORTH CAROLINA | 6019022 | 72405 | 5987293 | 58600 | 5985507 | 61982 |
| SOUTH CAROLINA | 3265538 | 93135 | 3366650 | 90400 | 3362934 | 89108 |
| GEORGIA | 5561556 | 43948 | 5482471 | 45529 | 5503578 | 44857 |
| FLORIDA | 10226444 | 160251 | 9985520 | 78117 | 10006779 | 74771 |
| KENTUCKY | 3667009 | 39447 | 3623860 | 34627 | 3629793 | 34145 |
| TENNESSEE | 4511838 | 68109 | 4484931 | 57244 | 4485744 | 56168 |
| ALABAMA | 3892997 | 32017 | 3917646 | 40584 | 3917039 | 39660 |
| MISSISSIPPI | 2611013 | 43295 | 2563415 | 30642 | 2563906 | 31345 |
| ARKANSAS | 2324880 | 36342 | 2283101 | 27728 | 2284426 | 27433 |
| LOUISIANA | 4296275 | 88040 | 4348857 | 85508 | 4344365 | 84488 |
| OKLAHOMA | 3050086 | 41578 | 3027835 | 29481 | 3030504 | 29654 |
| TEXAS | 14759062 | 158065 | 14459291 | 126928 | 14499190 | 127876 |
| MONTANA | 809072 | 8134 | 803893 | 9269 | 804796 | 8747 |
| IDAHO | 989582 | 10876 | 960694 | 5709 | 962329 | 6418 |
| WYOMING | 493962 | 6840 | 489130 | 6900 | 489794 | 6683 |
| COLORADO | 3018413 | 35212 | 2928879 | 28342 | 2939314 | 30726 |
| NEW MEXICO | 1355898 | 19082 | 1340313 | 13047 | 1341986 | 13527 |
| ARIZONA | 2880359 | 34317 | 2811024 | 39522 | 2802321 | 35798 |
| UTAH | 1500886 | 10484 | 1479094 | 11227 | 1479989 | 11143 |
| NEVADA | 859325 | 15313 | 845656 | 10289 | 848574 | 10570 |
| WASHINGTON | 4281463 | 55524 | 4216774 | 36531 | 4222592 | 34746 |
| OREGON | 2707216 | 25585 | 2668734 | 17082 | 2671585 | 17659 |
| CALIFORNIA | 24568211 | 133003 | 24687815 | 126695 | 24760391 | 127307 |
| ALASKA | 435264 | 11910 | 415678 | 5071 | 416155 | 5063 |
| HAWAII | 986124 | 9925 | 980799 | 11648 | 982873 | 10894 |

## PEP ESTIMATES AND THEIR STANDARD ERRORS

| ST_NAME | P_2_8 | SE_2_8 | P_10_8 | SE_10_8 | P_2_9 | SE_2_9 |
|---|---|---|---|---|---|---|
| MAINE | 1148857 | 10381 | 1138585 | 10386 | 1149257 | 10427 |
| NEW HAMPSHIRE | 906427 | 10716 | 913701 | 13818 | 908053 | 10716 |
| VERMONT | 507065 | 2840 | 503948 | 2558 | 506353 | 3120 |
| MASSACHUSETTS | 5677995 | 36522 | 5665354 | 50929 | 5728378 | 33614 |
| RHODE ISLAND | 956158 | 8782 | 939519 | 7170 | 955215 | 8723 |
| CONNECTICUT | 3092482 | 41701 | 3066917 | 32045 | 3103845 | 40463 |
| NEW YORK | 17896310 | 106844 | 17649139 | 116359 | 17986995 | 109157 |
| NEW JERSEY | 7480686 | 66647 | 7376197 | 50172 | 7480049 | 66737 |
| PENNSYLVANIA | 11886284 | 66475 | 11728624 | 71873 | 11916546 | 66299 |
| OHIO | 10915915 | 64874 | 10803257 | 48353 | 10928111 | 66213 |
| INDIANA | 5456021 | 44338 | 5573542 | 56715 | 5460497 | 44011 |
| ILLINOIS | 11658112 | 67217 | 11426594 | 74179 | 11741166 | 68136 |
| MICHIGAN | 9354474 | 54896 | 9252240 | 36172 | 9389139 | 54405 |
| WISCONSIN | 4784191 | 26437 | 4703058 | 18116 | 4784191 | 26437 |
| MINNESOTA | 4122914 | 25671 | 4092346 | 17679 | 4138069 | 25781 |
| IOWA | 2896006 | 32207 | 2903087 | 22340 | 2896006 | 32207 |
| MISSOURI | 4964266 | 36444 | 4890199 | 31127 | 4969316 | 35812 |
| NORTH DAKOTA | 652652 | 2056 | 654444 | 3323 | 654487 | 2020 |
| SOUTH DAKOTA | 691857 | 3946 | 696137 | 5994 | 692730 | 3729 |
| NEBRASKA | 1571571 | 8312 | 1576922 | 13337 | 1574864 | 8311 |
| KANSAS | 2381114 | 23562 | 2384627 | 23737 | 2385339 | 23300 |
| DELAWARE | 592297 | 5796 | 595941 | 7303 | 593623 | 5488 |
| MARYLAND | 4328315 | 57282 | 4291222 | 38343 | 4339304 | 56077 |
| DISTRICT OF COL. | 665112 | 11290 | 633892 | 11858 | 678912 | 10457 |
| VIRGINIA | 5384287 | 49025 | 5392551 | 38061 | 5407359 | 47894 |
| WEST VIRGINIA | 1936644 | 24993 | 1908116 | 24119 | 1936108 | 24764 |
| NORTH CAROLINA | 5949657 | 68494 | 5951662 | 71751 | 5962736 | 64359 |
| SOUTH CAROLINA | 3314170 | 89094 | 3191081 | 82711 | 3326403 | 89255 |
| GEORGIA | 5461848 | 40043 | 5413506 | 42547 | 5485548 | 39993 |
| FLORIDA | 9905683 | 78574 | 9876934 | 142058 | 9962705 | 80150 |
| KENTUCKY | 3610017 | 33671 | 3633443 | 46685 | 3610074 | 36183 |
| TENNESSEE | 4463364 | 56031 | 4444731 | 65572 | 4488596 | 55749 |
| ALABAMA | 3880007 | 36012 | 3844577 | 33718 | 3892815 | 35031 |
| MISSISSIPPI | 2545731 | 32163 | 2545183 | 37082 | 2559566 | 29542 |
| ARKANSAS | 2263733 | 28114 | 2285270 | 41867 | 2269627 | 26818 |
| LOUISIANA | 4300078 | 94091 | 4215907 | 84803 | 4312276 | 82796 |
| OKLAHOMA | 3017843 | 29738 | 3003971 | 30937 | 3018609 | 29470 |
| TEXAS | 14309405 | 127810 | 14257990 | 138549 | 14427264 | 125196 |
| MONTANA | 799391 | 8091 | 803923 | 8015 | 801662 | 8006 |
| IDAHO | 958180 | 7354 | 971455 | 8145 | 959307 | 7141 |
| WYOMING | 487629 | 6273 | 480384 | 4684 | 489633 | 6706 |
| COLORADO | 2912128 | 27870 | 2935075 | 31971 | 2931335 | 29258 |
| NEW MEXICO | 1333681 | 12906 | 1333274 | 16547 | 1337235 | 13250 |
| ARIZONA | 2765268 | 40617 | 2790879 | 35949 | 2787619 | 39204 |
| UTAH | 1468643 | 11285 | 1466806 | 9573 | 1478797 | 10715 |
| NEVADA | 825059 | 10851 | 808559 | 8405 | 843642 | 10635 |
| WASHINGTON | 4201690 | 38090 | 4204009 | 41839 | 4199458 | 38472 |
| OREGON | 2646687 | 20366 | 2657919 | 23235 | 2661388 | 19288 |
| CALIFORNIA | 24476807 | 137350 | 23975957 | 98559 | 24673911 | 131605 |
| ALASKA | 413497 | 5018 | 420221 | 12231 | 415397 | 5066 |
| HAWAII | 975149 | 11522 | 974713 | 9114 | 976712 | 11697 |

PEP ESTIMATES AND THEIR STANDARD ERRORS

| ST_NAME | P_3_8 | SE_3_8 | P_3_9 | SE_3_9 | P_5_8 | SE_5_8 |
|---|---|---|---|---|---|---|
| MAINE | 1148216 | 10520 | 1148618 | 10571 | 1147413 | 9489 |
| NEW HAMPSHIRE | 906955 | 10954 | 908581 | 10960 | 931344 | 12401 |
| VERMONT | 506337 | 2544 | 505627 | 2828 | 510857 | 3781 |
| MASSACHUSETTS | 5677298 | 36982 | 5727773 | 34516 | 5708805 | 51516 |
| RHODE ISLAND | 956563 | 8742 | 955619 | 8681 | 959338 | 8362 |
| CONNECTICUT | 3076773 | 39515 | 3088168 | 38013 | 3124597 | 36053 |
| NEW YORK | 17866180 | 108180 | 17956517 | 110879 | 17870500 | 121754 |
| NEW JERSEY | 7468431 | 66195 | 7467772 | 66281 | 7480190 | 64326 |
| PENNSYLVANIA | 11846230 | 62738 | 11876188 | 63048 | 11847508 | 79294 |
| OHIO | 10914072 | 64921 | 10926238 | 66165 | 10911827 | 51266 |
| INDIANA | 5455524 | 43752 | 5459995 | 43420 | 5621245 | 50727 |
| ILLINOIS | 11665181 | 70695 | 11749424 | 71247 | 11553854 | 82670 |
| MICHIGAN | 9335928 | 53063 | 9370570 | 52449 | 9373506 | 41255 |
| WISCONSIN | 4785099 | 25802 | 4785099 | 25802 | 4721516 | 16949 |
| MINNESOTA | 4118554 | 24481 | 4133699 | 24046 | 4119626 | 17918 |
| IOWA | 2893358 | 30967 | 2893358 | 30967 | 2933860 | 24101 |
| MISSOURI | 4955711 | 37406 | 4960742 | 36845 | 4943710 | 35203 |
| NORTH DAKOTA | 652542 | 2094 | 654376 | 2054 | 656143 | 3687 |
| SOUTH DAKOTA | 690419 | 3632 | 691294 | 3415 | 705093 | 7696 |
| NEBRASKA | 1570371 | 9269 | 1573661 | 9298 | 1590660 | 15102 |
| KANSAS | 2376165 | 21878 | 2380331 | 21612 | 2407267 | 21016 |
| DELAWARE | 590896 | 6392 | 592224 | 6090 | 600709 | 7466 |
| MARYLAND | 4319123 | 56499 | 4330107 | 55276 | 4338196 | 34417 |
| DISTRICT OF COL. | 662779 | 11490 | 676546 | 10762 | 642265 | 13887 |
| VIRGINIA | 5352941 | 38036 | 5376010 | 36109 | 5439742 | 38168 |
| WEST VIRGINIA | 1938186 | 25743 | 1937652 | 25518 | 1930327 | 24370 |
| NORTH CAROLINA | 5951617 | 65091 | 5964746 | 61120 | 6005549 | 72485 |
| SOUTH CAROLINA | 3317900 | 90296 | 3330163 | 90492 | 3253625 | 93790 |
| GEORGIA | 5440800 | 39961 | 5464384 | 40696 | 5537553 | 44147 |
| FLORIDA | 9884595 | 81449 | 9941468 | 82707 | 10166367 | 152275 |
| KENTUCKY | 3604103 | 34242 | 3604170 | 36794 | 3667319 | 38668 |
| TENNESSEE | 4462549 | 57078 | 4487767 | 56819 | 4485907 | 68145 |
| ALABAMA | 3880560 | 36878 | 3893386 | 35922 | 3879983 | 33336 |
| MISSISSIPPI | 2545228 | 31466 | 2559065 | 28843 | 2596972 | 42867 |
| ARKANSAS | 2262397 | 28578 | 2268294 | 27199 | 2318834 | 36328 |
| LOUISIANA | 4304462 | 95032 | 4316711 | 83583 | 4286482 | 96208 |
| OKLAHOMA | 3015205 | 29947 | 3015969 | 29645 | 3049244 | 41975 |
| TEXAS | 14270589 | 127313 | 14387681 | 124183 | 14639509 | 159466 |
| MONTANA | 798487 | 8677 | 800740 | 8487 | 806774 | 7886 |
| IDAHO | 956553 | 6531 | 957678 | 6343 | 988388 | 10608 |
| WYOMING | 486972 | 6410 | 488969 | 6932 | 491902 | 6849 |
| COLORADO | 2901640 | 26509 | 2920873 | 27758 | 2998616 | 33625 |
| NEW MEXICO | 1332019 | 12487 | 1335557 | 12727 | 1352069 | 18452 |
| ARIZONA | 2773884 | 44374 | 2796236 | 42887 | 2856920 | 36018 |
| UTAH | 1467747 | 11271 | 1477903 | 10805 | 1490449 | 10671 |
| NEVADA | 822213 | 10815 | 840745 | 10392 | 840821 | 15075 |
| WASHINGTON | 4195887 | 39938 | 4193657 | 40305 | 4283789 | 55210 |
| OREGON | 2643859 | 19620 | 2658535 | 18761 | 2693344 | 25410 |
| CALIFORNIA | 24405570 | 137305 | 24601506 | 131962 | 24373924 | 132392 |
| ALASKA | 413028 | 5042 | 414924 | 5064 | 433234 | 11984 |
| HAWAII | 973143 | 12109 | 974701 | 12345 | 984593 | 10280 |