

More Hoosiers, Less Representation

The Census Bureau's December release of the first state numbers from Census 2000 generated much interest in the population counts for states, as well as in the resulting reapportionment of the seats in the next U.S. House of Representatives. The release also raised questions: how does the apportionment process work? How can it result in districts of such widely varying sizes among the states?

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By examining some of the details involved in the method of equal proportions, one can gain a better understanding of the apportionment process, how it works and how district size varies by state. In particular, the focus here is on Indiana and its widely publicized loss of a seat in the next House.

A Brief Overview

Apportionment is the process of dividing the 435 seats in the U.S. House of Representatives among the 50 states. After each decennial census, population counts for states are used to calculate the number of House seats each state is entitled to for the next decade.

The Results

The size of Indiana's delegation will drop from 10 to 9 in the 108th Congress, which begins in 2003. A total of twelve seats will change hands, with 10 states losing seats and 8 states gaining seats. **Figure 1** shows the seat changes resulting from the reapportionment.

Not surprisingly, states that have grown more slowly than the nation are among those losing seats: Pennsylvania and New York will each drop two seats; Connecticut, Illinois, Indiana, Michigan, Mississippi, Ohio, Oklahoma and Wisconsin will each lose one seat. The Great Lakes region will lose a total of nine House seats. Rapidly growing states in the south and west will gain seats. Arizona, Florida, Georgia and Texas will each pick up two seats, while California, Colorado, Nevada and North Carolina will each gain one seat.

The Method

Each state receives one seat in the House. The remaining 385 seats are distributed to the states based on the method of equal proportions, used after every census since 1940.

The method of equal proportions assigns seats according to priority values. The priority values are determined by multiplying the population of each state by a series of seat factors. The factor for seat n equals 1 divided by (the square root of (n times ($n-1$))). The resulting priority values are sorted in descending order, and the highest 385 priority values are assigned to seats 51 through 435.

For example the priority value for Indiana's 2nd seat following Census 2000 is:

$$6,090,782 * (1/\text{SQRT}(2*1))=6,090,782 * 0.7071067=4,306,833$$

Table 1 shows the assignment of Indiana's 2nd seat in the House, in seat number 80, the 30th seat assigned by the method (after each state receives one seat). Notice that California has received 8 seats before Indiana receives its 2nd seat.

Figure 1
Changes in U.S. House Seats Resulting from Reapportionment

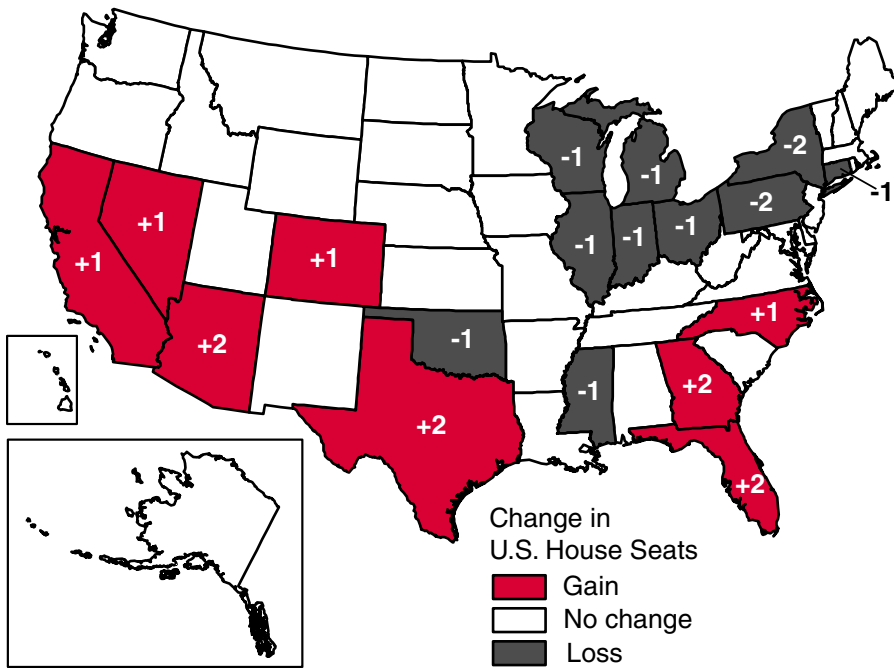


Table 1
Assignment of Seats 51 Through 80 in the U.S. House of Representatives

State	State's Seat	Priority Value	House Seat
California	2	23,992,697	51
Texas	2	14,781,356	52
California	3	13,852,190	53
New York	2	13,438,545	54
Florida	2	11,334,137	55
California	4	9,794,978	56
Illinois	2	8,795,731	57
Pennsylvania	2	8,697,887	58
Texas	3	8,534,020	59
Ohio	2	8,043,014	60
New York	3	7,758,748	61
California	5	7,587,157	62
Michigan	2	7,039,834	63
Florida	3	6,543,767	64
California	6	6,194,888	65
Texas	4	6,034,463	66
New Jersey	2	5,956,918	67
Georgia	2	5,803,208	68
North Carolina	2	5,704,706	69
New York	4	5,486,263	70
California	7	5,235,636	71
Illinois	3	5,078,218	72
Pennsylvania	3	5,021,727	73
Virginia	2	5,020,955	74
Texas	5	4,674,275	75
Ohio	3	4,643,637	76
Florida	4	4,627,142	77
California	8	4,534,194	78
Massachusetts	2	4,494,065	79
Indiana	2	4,306,833	80

How close was Indiana to retaining its 10th seat? Indiana would have needed a 10th seat priority value exceeding 645,931 in order to take North Carolina's 13th seat. This translates to needing more than 37,000 additional Hoosiers counted in Census 2000.

Ideal District Size

In 1990, the nation's apportionment population, which includes overseas federal employees, was 249,022,783. Dividing by 435, the number of seats in the House, results in an ideal district size of 572,000 people per representative. Indiana's 1990 apportionment population of 5,564,228 divided by 10 representatives yields an average of 556,000 people per representative. For Indiana's average district size to equal the ideal district size after the census in 1990, Indiana would have deserved 9.7 seats.

In 2000, the nation's apportionment population had grown to 281,424,177. With the number of seats fixed at 435, the ideal district size grew to 647,000. Indiana's 2000 apportionment population of 6,090,782 divided by 9 representatives yields an average of 677,000 people per representative. For Indiana's average district size to equal the ideal district size after Census 2000, Indiana would deserve 9.4 seats.

Figure 2 illustrates the growing ideal size of congressional districts between 1900 and 2000, along with Indiana's average district sizes. Several observations can be made:

- As long as the population of the nation grows and the number of seats in the House remains fixed at 435, the ideal district size will continue to grow.

- As long as fractional seats are not allowed in the House and as long as House districts cannot cross state boundaries, states will not be represented equally in the House. In the 1990s, Indiana was somewhat over-represented, and in the next decade, the state will be somewhat under-represented.

- Indiana is now facing the same situation that it experienced following the loss of a seat in 1980. The combination of a growing population and the loss of a seat result in a large increase in the state's average population per representative.

Figure 2
Average Population Per Congressional District, 1900-2000

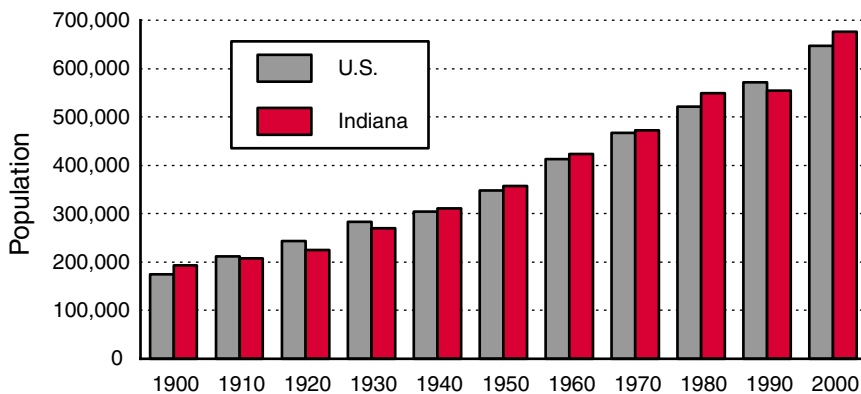


Table 2
Average Congressional District Sizes Following Census 2000

Rank	Apportionment Population	Number of Seats After	People Per Representative	With One More Seat	With One Less Seat
		2000 Census			
	United States	281,424,177	435	646,952	
1	Montana	905,316	1	905,316	452,658
2	Delaware	785,068	1	785,068	392,534
3	South Dakota	756,874	1	756,874	378,437
4	Utah	2,236,714	3	745,571	559,179
5	Mississippi	2,852,927	4	713,232	570,585
6	Oklahoma	3,458,819	5	691,764	576,470
7	Oregon	3,428,543	5	685,709	571,424
8	Connecticut	3,409,535	5	681,907	568,256
9	Indiana	6,090,782	9	676,754	609,078
10	Kentucky	4,049,431	6	674,905	578,490
11	Kansas	2,693,824	4	673,456	538,765
12	Wisconsin	5,371,210	8	671,401	596,801
13	S. Carolina	4,025,061	6	670,844	575,009
14	Arkansas	2,679,733	4	669,933	535,947
15	Nevada	2,002,032	3	667,344	500,508
16	Michigan	9,955,829	15	663,722	622,239
17	Maryland	5,307,886	8	663,486	589,765
18	Washington	5,908,684	9	656,520	590,868
19	New York	19,004,973	29	655,344	633,499
20	Illinois	12,429,042	19	654,686	621,952
21	Texas	20,903,994	32	653,250	633,454
22	Idaho	1,297,274	2	648,637	432,425
23	New Jersey	8,424,354	13	648,027	601,740
24	Pennsylvania	12,300,670	19	647,404	615,034
25	Virginia	7,100,702	11	645,518	591,725
26	North Dakota	643,756	1	643,756	321,878
27	Arizona	5,140,683	8	642,585	571,187
28	Florida	16,028,890	25	641,156	616,496
29	California	33,930,798	53	640,204	628,348
30	Louisiana	4,480,271	7	640,039	560,034
31	Maine	1,277,731	2	638,866	425,910
32	Alabama	4,461,130	7	637,304	557,641
33	Massachusetts	6,355,568	10	635,557	577,779
34	Tennessee	5,700,037	9	633,337	570,004
35	Ohio	11,374,540	18	631,919	598,660
36	Georgia	8,206,975	13	631,306	586,213
37	Alaska	628,933	1	628,933	314,467
38	Missouri	5,606,260	9	622,918	560,626
39	N. Carolina	8,067,673	13	620,590	576,262
40	New Hampshire	1,238,415	2	619,208	412,805
41	Colorado	4,311,882	7	615,983	538,985
42	Minnesota	4,925,670	8	615,709	547,297
43	Vermont	609,890	1	609,890	304,945
44	Hawaii	1,216,642	2	608,321	405,547
45	New Mexico	1,823,821	3	607,940	455,955
46	West Virginia	1,813,077	3	604,359	453,269
47	Iowa	2,931,923	5	586,385	488,654
48	Nebraska	1,715,369	3	571,790	428,842
49	Rhode Island	1,049,662	2	524,831	349,887
50	Wyoming	495,304	1	495,304	247,652

District Sizes for States

Table 2 illustrates that average district sizes for states will range from a high of 905,000 in Montana to a low of 495,000 in Wyoming. Indiana will have the 9th largest average district size in the nation, at 677,000. The table also shows the average district sizes that would result if each state had one more or one less seat in the House. These numbers can help illustrate that the method of equal proportions minimizes the relative differences between levels of representation (or average district sizes) for the states.

For example, what would happen if Montana received a second seat? With an additional seat, Montana would have 453,000 persons per representative, making the state's average district size the smallest in the nation, instead of the largest. Which state should contribute a seat to Montana? One might think that California could most afford to give up one of its 53 seats. The result would be 653,000 persons per representative in California instead of 640,000. California's average district size would rank 22nd in the nation, instead of 29th.

This might appear reasonable to many people, especially to those in Montana. However, the result would be a larger relative difference between district sizes in these two states. To calculate relative difference between two values, subtract the smaller value from the larger one; then divide the difference by the smaller value.

Using the post-2000 district sizes for Montana and California, one obtains a relative difference of $(905,316 - 640,204) / 640,204 = 0.414$. With an additional seat for Montana and one fewer for California, the relative difference between district sizes for these two states would be $(652,515 - 452,658) / 452,658 = 0.442$ which is larger than the relative difference calculated above.

As mentioned previously, no apportionment method will produce equal representation for all states. Congress has considered various apportionment methods over the years. Different methods minimize different measures of discrepancy between district sizes for pairs of states. Using a different apportionment method, for instance one that minimizes the absolute difference between district sizes would result in a different apportionment of the House seats.

FAQ

Questions and Answers About Indiana's Loss of a Seat in the U.S. House of Representatives

Q: Will Indiana lose a seat because of declining population?

A: No. Indiana's population grew 9.7% between 1990 and 2000.

Q: Then why will Indiana lose a seat?

A: **Figure 3** helps answer this question. The apportionment formula does not explicitly use "share of the nation's population" in determining the number of seats for each state. However, as long as the number of seats remains fixed at 435, those states with declining shares of the nation's population are candidates to lose seats, while states that are growing faster than the nation are candidates to gain seats.

Note that by inspecting **Figure 3**, Indiana's share of the nation's population continues to decline. This decline has been accompanied by the loss of a house seat in 1930, 1940, 1980 and 2000.

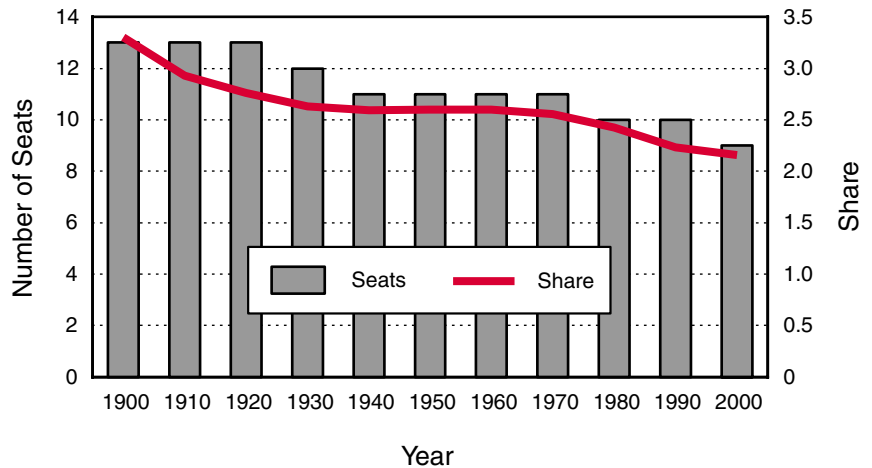
Q: Indiana barely grew in the 1980s and yet held onto 10 seats. Now with much more rapid growth in the 1990s, the state will lose a seat. How can this be?

A: It may take more than a decade for slower growth than the nation to result in the loss of a seat. Indiana's declining share of the nation's population "caught up with it" in 2000. To take it a step farther, one could argue that Indiana was slightly over-represented after the 1990 census, when the state deserved 9.7 seats but held onto 10. Now the Hoosier state will be slightly under-represented with 9 seats, when the state deserves 9.4 seats.

Q: Indiana and Kentucky both enjoyed the same population growth rate since 1990 (9.7%). Yet Indiana will lose a seat and Kentucky will not. Why is that?

A: The method of equal proportions used in apportioning the seats to the states does not use growth rates. Instead, the method minimizes the relative difference between the levels of representation for the states. Looking specifically at Indiana and Kentucky, the new apportionment results in approximately 677,000 persons per representative in Indiana and 675,000 people per representative in Kentucky. With one fewer representative, Kentucky's average district size would be 810,000.

Figure 3
Indiana's Declining Share of the Nation's Population and Number of Seats in the U.S. House of Representatives



What If?

What if the overseas population had not been included in the apportionment process? In other words, if the resident population counts had been used to apportion the House seats, would it have made a difference?

Table 3 illustrates the assignment of the last 5 seats in the House, seats 431 through 435, along with the first five states that would have just missed receiving an additional seat, if the overseas population had not been included. Utah would have gained a seat in the House, instead of North Carolina in this scenario. Indiana would have remained the 5th state in line for an additional seat.

Table 3
What If Overseas Population Had Not Been Included?
The Assignment of the Last Five Seats in the House

State	State's Seat	Priority Value	House Seat
Iowa	5	654,346	431
Florida	25	652,478	432
Ohio	18	649,016	433
California	53	645,204	434
Utah	4	644,660	435
North Carolina	13	644,461	436
New York	30	643,362	437
Texas	33	641,670	438
Michigan	16	641,524	439
Indiana	10	640,939	440