Adjusting Census Figures

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Why consider adjusting census figures ?

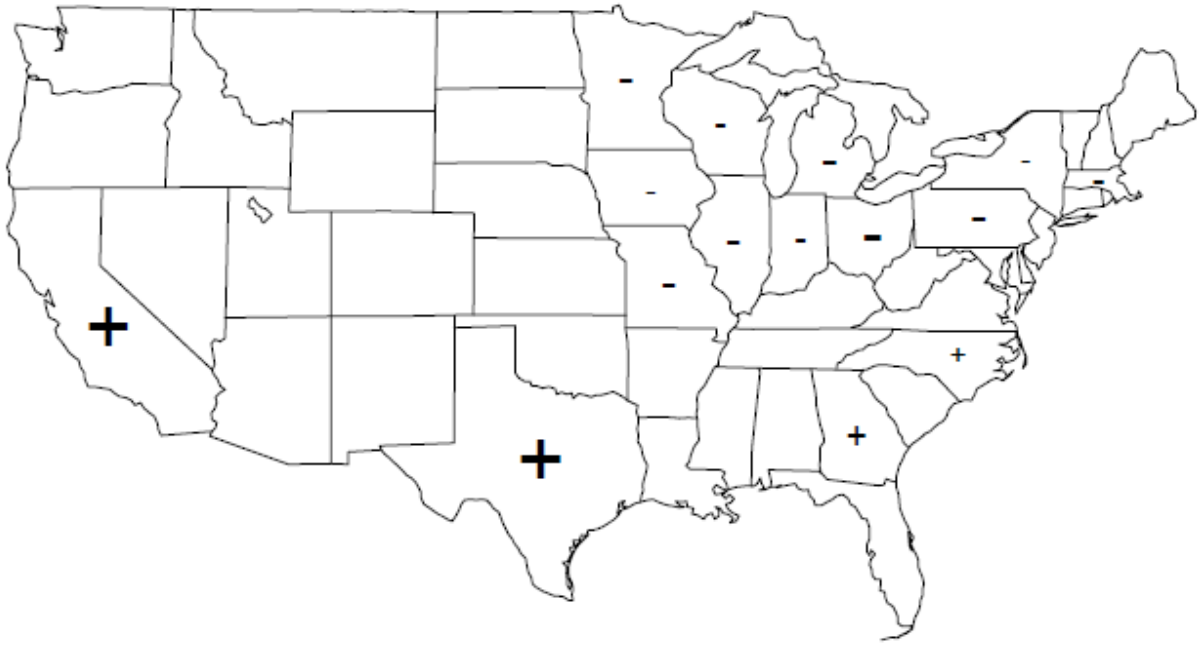
- Errors may be substantial, placing the validity of the census counts in question
- Coverage of certain population groups or geographic areas may be particularly deficient
  - Where census counts are used to determine the allocation of services, funds, political representation etc., such errors can have an effect on resource distribution
  - For allocation purposes, the distribution of the population matters more than absolute numbers
    - *So, if undercoverage is uniform across demographic and geographic groups, there are no consequences in terms of equity*
- To have a correct estimate of the population as a basis for future intercensal estimates and projections

Source: US Census Bureau, 1985. *Evaluating Censuses of Population and Housing*

Implications of census adjustment for geographic distribution of population

- States that would have gained and lost most population if 2000 US census had been adjusted based on the results of the PES

Figure 1. ACE Adjustment: State Share Changes Exceeding 50 Parts Per Million[5]



Source: David Freedman and Ken Wachter. 2002. *On the likelihood of improving the accuracy of the census through statistical adjustment.*

The decision to adjust census figures

- Adjusting a census brings with it many technical considerations, but census adjustment is also a sensitive political issue
  - Decision of whether or not to adjust should be made during the census planning phase, not after evaluation, so that appropriate resources can be allocated
  - Criteria for if and how to adjust should be set before data analysis, so that an objective function is chosen, a "decision rule"

Source: US Census Bureau, 1985. *Evaluating Censuses of Population and Housing*

The decision to adjust census figures

- There is no way to know the true population count with absolute certainty, no matter what the census evaluation method
  - The relevant question is how confident analysts are that adjusting the census will bring the results closer to the true population count

Different methods of census analysis may suggest different counts, or even net errors with opposite signs (over- vs. under- counts):

Table 2. The population of the United States

Demographic analysis	279.6 million
Census 2000	281.4 million
ACE	284.7 million

Source: US Census Bureau, 1985. *Evaluating Censuses of Population and Housing*, table from David Freedman and Ken Wachter. 2002. *On the likelihood of improving the accuracy of the census through statistical adjustment.*

What to adjust?

- Minimize average census error across administrative units? Or maximum error for any particular unit?
- Census results
  - Total population, population by administrative area (state, region, …)??
  - Main distributions (by state, sex, age…)??
  - Effect on common ratio measure (e.g. average persons per household) should be considered

How to adjust? (1)

- Depending on the range of the evaluation programme associated with the census, NSO may carry out more than one type of study to evaluate the census
- Combining the estimates has the advantage of taking the best characteristics to counterbalance weaknesses in the evaluation methods
  - For example, estimates from demographic analysis may only provide national totals, but those may be considered better estimates than those estimated from PES
  - PES may provide more geographical detail than demographic methods

Source: US Census Bureau, 1985. *Evaluating Censuses of Population and Housing*

How to adjust? (2)

- There are several techniques to adjust census figures
  - Coverage rate can be directly used to adjust population size
  - Methods of synthetic estimation and regression model the distribution of the undercount at the geographic level appropriate to the measurement technique
- Synthetic estimation - estimates persons missed as a percent of total estimated population (mean undercount rate) for different demographic subgroups at a specified geographic level.
  - Takes undercount at high levels of geography and distributes it proportionally at lower levels of geography.
  - Guarantees that undercount at lower levels will sum to undercount at more aggregated levels

Source: US Census Bureau, 1985. *Evaluating Censuses of Population and Housing*

How to adjust? (3)

- Regression techniques – fit a regression model to the undercount estimates at a set geographic level. The estimates are generated in a way similar to that used for synthetic estimation, applying the coefficients estimated at higher geographic levels to characteristics and variables observed in lower geographical levels.
  - Counts at lower levels are not guaranteed to sum to the counts at higher levels – will sum to the predicted values from the regression at the higher geographical level

Source: US Census Bureau, 1985. *Evaluating Censuses of Population and Housing*

Adjustment for the purpose of population estimates/projections

- If estimates of census error are made available, census results can be adjusted for specific analyses at the discretion of the analyst, such as for population estimates and projections
  - Based on the result of census evaluation, population size can be adjusted to take into account under- or over-coverage
  - Distribution of population by age can be adjusted to take into account age misreporting
  - Demographic estimates such as the level of fertility and mortality can be adjusted for coverage and distribution errors

Adjusting census figures- some considerations

- Consequences of making adjustment might be substantial and sensitive
- Adjustments have an effect on geographic and demographic distributions of population
- Adjustment may be costly (*in doing and in explaining*)
- Adjustment may be complex and time consuming
- Adjustment requires careful communication