Adjusting Census Figures
Why consider adjusting census figures?

- Errors may be substantial and the validity of the census counts is 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

Implications of census adjustment for geographic distribution of population

States that would have gained and lost 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


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What to adjust?

- Census results
  - Total population, population by administrative area (state, region, ...)?
  - Main distributions (by state, sex, age...)?
  - All the database, in order to adjust all potential distribution?
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.


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How to adjust? (2)

- There are several techniques to adjust census figures
  - Coverage rate can be directly used to adjust population size
  - Synthetic estimation and regression model permit modeling the distribution of the undercount at the geographic level appropriate to the measurement technique
    - The model obtained is used to allocate the undercount to lower levels of geography or to areas

How to adjust? (2)

- **Synthetic estimation** - estimates persons missed as a percent of total estimated population for various demographic subgroups – example for age and sex – at a specified geographic level

- The method takes the undercount at high levels of geography and distributes it proportionally at lower levels of geography


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How to adjust? (2)

\[ \hat{U}_{ijk} = \frac{x_{ijk} U_{ij}}{\sum_{k} x_{ijk}} \]

| \( U_{ij} \) | Undercount for age \( i \) and sex \( j \) at the national level |
| \( \hat{U}_{ijk} \) | Estimated undercount for age \( i \) and sex \( j \) for area \( k \) |
| \( x_{ijk} \) | Enumerated persons for age \( i \) and sex \( j \) for area \( k \) |

Guarantees that undercount at lower levels will sum to undercount at more aggregated levels


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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

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.
Adjustment for the purpose of population estimates/projections

- Distribution of population by age can be adjusted to take into account age misreporting

\[ \text{PAS} = \text{AGESMTH} \]

- Demographic estimates such as the level of fertility and mortality can be adjusted for coverage and distribution errors of births and deaths
1. Male Population by Age
2. Female Population by Age
Adjusting census figures- some considerations

- Consequences of making adjustment for population size 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