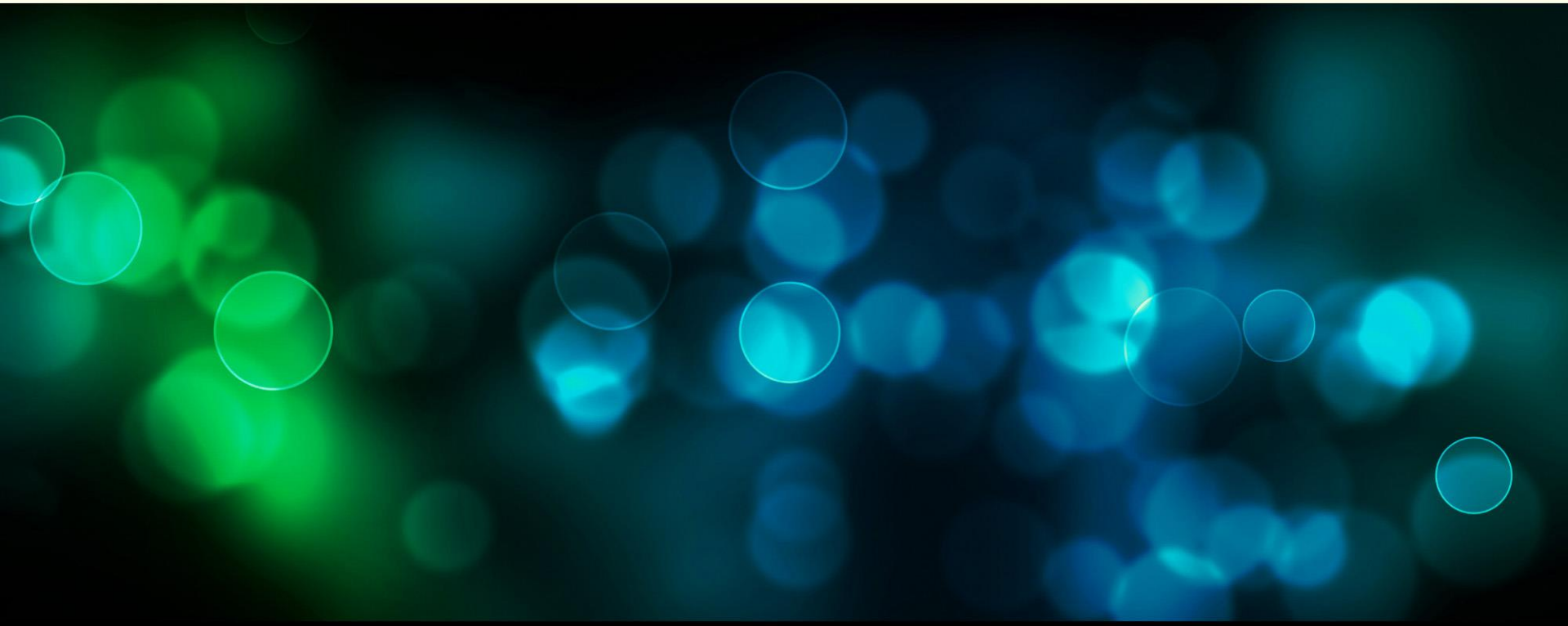
ACS Estimates and Data Aggregation Discussion



Presented to ACS Data Users Group

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Overview

- Review of Comparison Results
- Contributing Factors to Differences (i.e., limitations associated with aggregated 1-year estimates)
- New Supplemental Files
  - 2014 1-year Estimates for 20,000+ Populations
  - 2010-2014 Variance Replicate Estimates
- Micro-data Analysis System (MAS) Development
- Other potential approaches: Model-based Estimates

Review of Results: Tabulations

- For geographies of 65,000+, aggregated 3-year estimates and MOEs do a fairly reasonable job of representing corresponding 3-year period estimates and MOEs.
- This is generally as expected as the aggregation of 1-year estimates into multi-year estimates was the original plan for the ACS prior to development of period estimate approach.
- Processes are fairly straightforward, but possibly laborious.

Review of Results: Tabulations (2)

- Recall that one of the limitations of these “custom” MOEs is that the covariance between the 1-year estimates is not accounted for in the approximation formulas.
- Interestingly, the observed differences in the MOEs were both positive and negative.
- One implication is that the missing covariance did not result in the measures of reliability exhibiting large-scale systematic under- or over-estimation.
- However, it also means they are not consistently conservative.

Review of Results: PUMS

- The general consistency seen in tabular aggregation is equally true for estimates generated from concatenated 1-year PUMS files relative to 3- and 5-year period PUMS files.
- PUMS files concatenation is also fairly straightforward and not quite as laborious.
- Suggest that relative differences be included when making comparisons.
- Suggest looking at measures of reliability, as well.

But Why Are There Differences?

- Don’t the exact same set of interviews (and non-interviews) contribute to both sets of estimates.
- For period estimates, all processed together (at the same time)
- For aggregate estimates, processed separately (at different times) and then joined
- Of the sources of differences, can anything be done to mitigate?
  - Answer: No, Yes, and Maybe

What is it about Period Estimates that Contributes to Observed Differences?

- "Pooling" of data records allows for more refined non-response (NR) adjustment cells and corresponding NR factors.
- Current-Year "Vintage" applied along a few dimensions:
  - Population Controls - previous years adjusted to current year vintage (most sensitive when period crosses census year)
  - Geography - current definitions applied to all years in period
  - Variable Definitions - standardized across years
  - Inflation - previous years income and housing values adjusted to current year dollars (Compass Handbook - Appendix 5 provides guidance on use of "All Items CPI-U-RS Annual Averages" to adjust for this difference)

Other Factors beyond “Vintage”

- For multi-year period estimation only, a “model–assisted” weighting step to control to sub-county populations estimates is employed. 1-year estimates do not currently employ this step.
- For multi-year period variance estimation, a finite population correction factor (FPC) is applied to appropriately reduce estimates of variance to reflect the proportion of addresses in sample. Variances for 1-year estimates do not currently employ this adjustment.
- With this expanded usage of 1-year estimates, possibly these estimation differences should be revisited?

So, a Few Things to Note

- A more comprehensive assessment would come from aggregated 3-year estimates from geographic areas with 20,000-65,000 in population
  - Smaller sample sizes will contribute to greater deviations between 3-year period and aggregated estimates.
  - Differences from some of the contributing factors listed in the previous slides will be more sensitive within 20,000-65,000 population geographies relative to 65,000+ population geographies.
  - Especially, from the weighting and variance estimation differences related to sub-county estimates and high sampling rate geographies.

So, with that in mind…

- The first 1-year (2014) supplemental estimates have been released.
  - For geographies with 20,000+ population
  - Includes 23 geography levels: nation, state, county, place, metropolitan areas, congressional & school districts
  - Includes 58 high-level detailed tables
- A review of adequacy should be conducted

Great Start, But…

- Prior to waiting two more years
  - Generate & release corresponding 2012 and 2013 1-year supplemental estimates to avoid a two year gap in the 3-year series for 20,000-65,000 population geographies.
  - In fact, releasing 2011 1-year supplemental estimates would support repeating PRB's 3-year comparison efforts (period vs. aggregated), but now for the more directly relevant 20,000-65,000 population geographies.
  - Greater variation in estimates and MOEs likely to be observed in these smaller population geographies.

In Addition,…

- Spotted release of variance replicate estimates tables for 2010-2014 5-year estimates.
- Provided to allow users to calculate MOEs for their own aggregated estimates across geographies or categories within a table more accurately than from approximation methods in ACS documentation and employed in PRB report
- So, knowing the intended use is to aggregate, is there merit in supplying this kind of table package for the supplemental 1-year estimates?

Looking Ahead…

- Possibly, all these supplemental estimates and ad hoc aggregation efforts could be made moot by other approaches.
- In particular, the Micro-data Analysis System (MAS) comes to mind
  - Online remote access system to allow users to request custom tables from underlying micro-data
  - Possibly, expand to allow for aggregation over time in addition to geography and variable categories

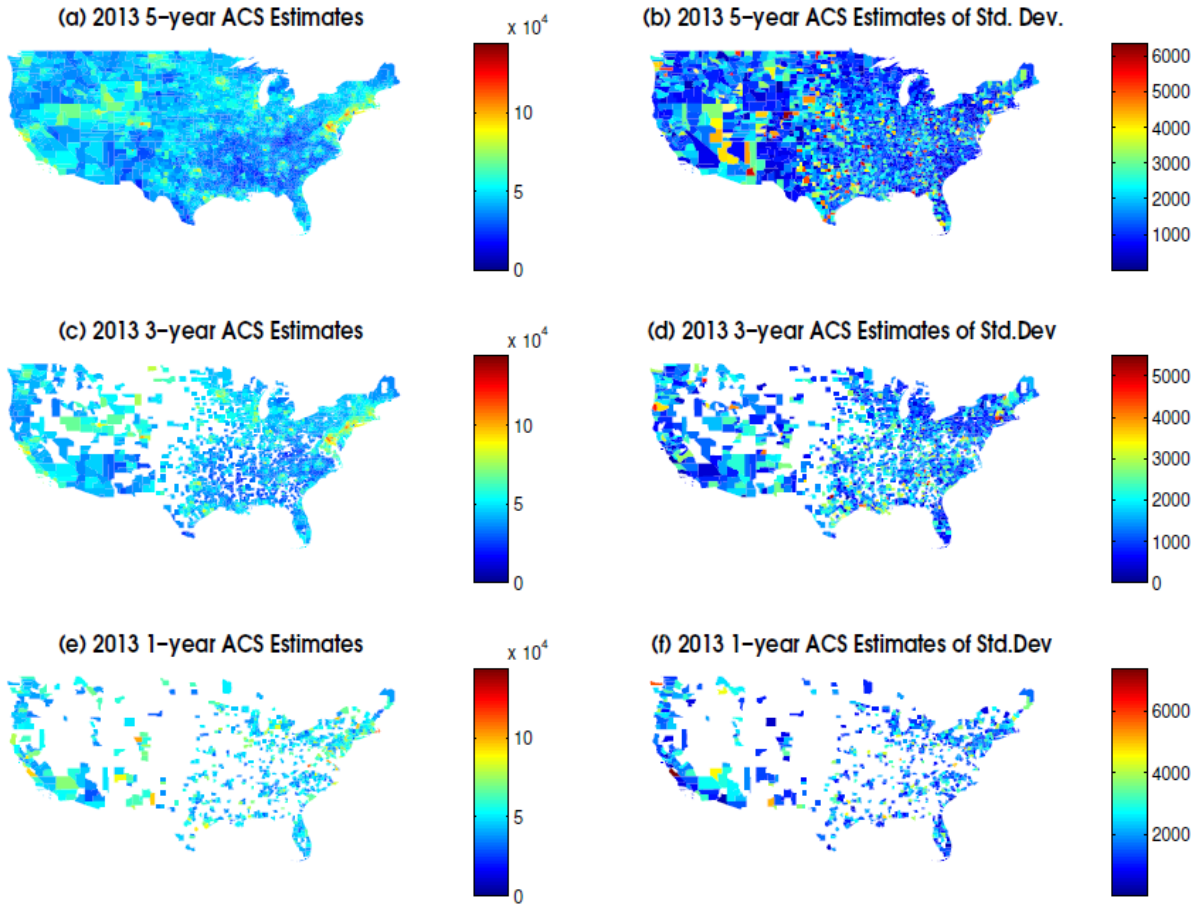
Micro-data Analysis System (MAS)

- However, the current MAS development is very much challenged by desire to maximize utility while simultaneously maintaining confidentiality standards
- Mostly driven by complexities associated with likely need to apply greater degree of data perturbation
- But I wonder if restricting use to “aggregation over time” with fixed tables (i.e., fixed geographies & categories) would overcome confidentiality concerns and expedite development/release, at least for this capability of aggregating over time?

Another Consideration…

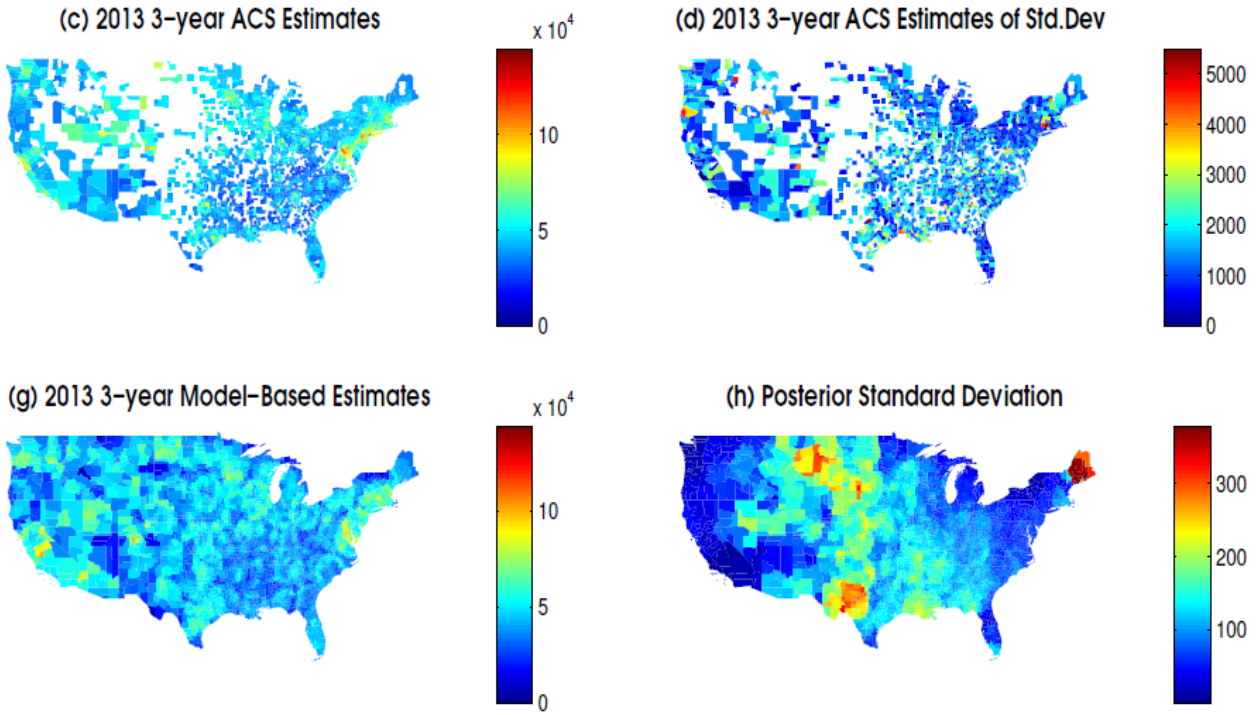
- Model-Based Estimates
- Bradley, Wikle, and Holan (2015), “Spatio-temporal change of support with application to American Community Survey multi-year period estimates”
- Used 1-year and 5-year period estimates to model 3-year estimates for every county in the US

5-, 3-, and 1-Year Period Estimates of Median Household Income (2013)



Each period estimate has a relatively large measure of uncertainty.

Estimating 3-Year Period Estimates of Median Household Income



(Bayesian) Model-based based estimates (g) and (h) use the 1-year period estimates and the 5-year period estimates from the previous slide, but do not use the 3-year period estimates.

Going further…

- Might be interesting to compare modeled results for counties with 20,000-65,000 populations with corresponding 3-year period published estimates
- Also wonder about how the modeling would be “improved” with inclusion of the new supplemental 1-year estimates for these 20,000-65,000 population counties being made available

Some Resources: Census Bureau

- ACS General Compass Handbook
  - https://www.census.gov/content/dam/Census/library/publications/2008/acs/ACSGeneralHandbook.pdf
- Design & Methodology Report - 2014
  - https://www.census.gov/programs-surveys/acs/methodology/design-and-methodology.html
- Accuracy of the Data – PUMS 2010-2014
  - http://www2.census.gov/programs-surveys/acs/tech_docs/pums/accuracy/2010_2014AccuracyPUMS.pdf

Some Resources: Census Bureau (2)

- Table and Geography Changes
  - http://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes.2014.html
- Supplemental Materials
  - https://www.census.gov/programs-surveys/acs/news/data-releases/2014/release.html

Additional Resources…

- Schar, Freiman, and Lauger (2015), “Developing and Testing the Microdata Analysis System at the U.S. Census Bureau”
  - https://fcsm.sites.usa.gov/files/2016/03/J3_Schar_2015FCSM.pdf
- Bradley, Wikle, and Holan (2015), “Spatio-temporal change of support with application to American Community Survey multi-year period estimates”
  - https://arxiv.org/pdf/1508.01451v2.pdf

Thanks for the opportunity.

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