Refocusing on What We Don’t Know: A Sample Redesign to Leverage Administrative Data

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The Census Bureau has reviewed this data product to ensure appropriate access, use, and disclosure avoidance protection of the confidential source data (Project No. P-7504866, Disclosure Review Board (DRB) approval number: CBDRB-FY24-ESMD013-001).

All estimates are subject to sampling error, and all comparison statements made during this presentation are significant at the 90% confidence level.

Annual Business Survey (ABS)

Annual survey of nonfarm, for-profit employer firms collecting data on:

- Business owner demographics
- Business and business owner characteristics
- Innovation activities
- Research and Development (R&D) expenditures
- Rotating content on financing, management practices, globalization, design, or climate and sustainability

ABS Sample Design

- Sample 300,000 firms each year, including 45,000 certainty firms due to large size or known R&D
- Universe stratified by expected owner demographics, state, and primary industry
- Oversample small demographic groups and high-R&D industry strata
- Select at least 5 noncertainty firms per stratum

Motivation for Sample Redesign

- Administrative data available for owner demographics
    - No longer need sample to measure demographics, so sample should be designed to measure other characteristics

- Uneven respondent burden
    - Small firms with rare combinations of characteristics have been selected in most (sometimes all) years of ABS

Simulation Research Plan

- Create 2 populations for consecutive years with fabricated "true" characteristics for all firms
- Use historical ABS responses and improved administrative data sources and methods to determine known demographics
- Evaluate 4 different sampling methods based on:
  - Stratum-level sampling rates
  - Noncertainty sample overlap from first to second year
  - Estimate bias and variance

Simulation Samples

Sample Name	Stratification	Sample Parameters	Controlled Nonselection
Original	Current	Current	No
Alternate 1 (Collapse)	Collapsed	Current	No
Alternate 2 (New Params)	Collapsed	Updated	No
Alternate 3 (Nonselection)	Collapsed	Updated	Yes

Current Stratification Cells

- Expected owner demographics (7 categories)
  - Native Hawaiian or Other Pacific Islander (NHOPI)
  - American Indian or Alaska Native (AIAN)
  - Black or African American
  - Asian
  - Hispanic
  - White female
  - White male or unclassifiable
- State (52 categories)
  - Includes DC and a category for multi-unit firms operating in multiple states
- Primary industry groups most relevant to NCSES publications (35 categories)
  - All other industries combined into one large industry group

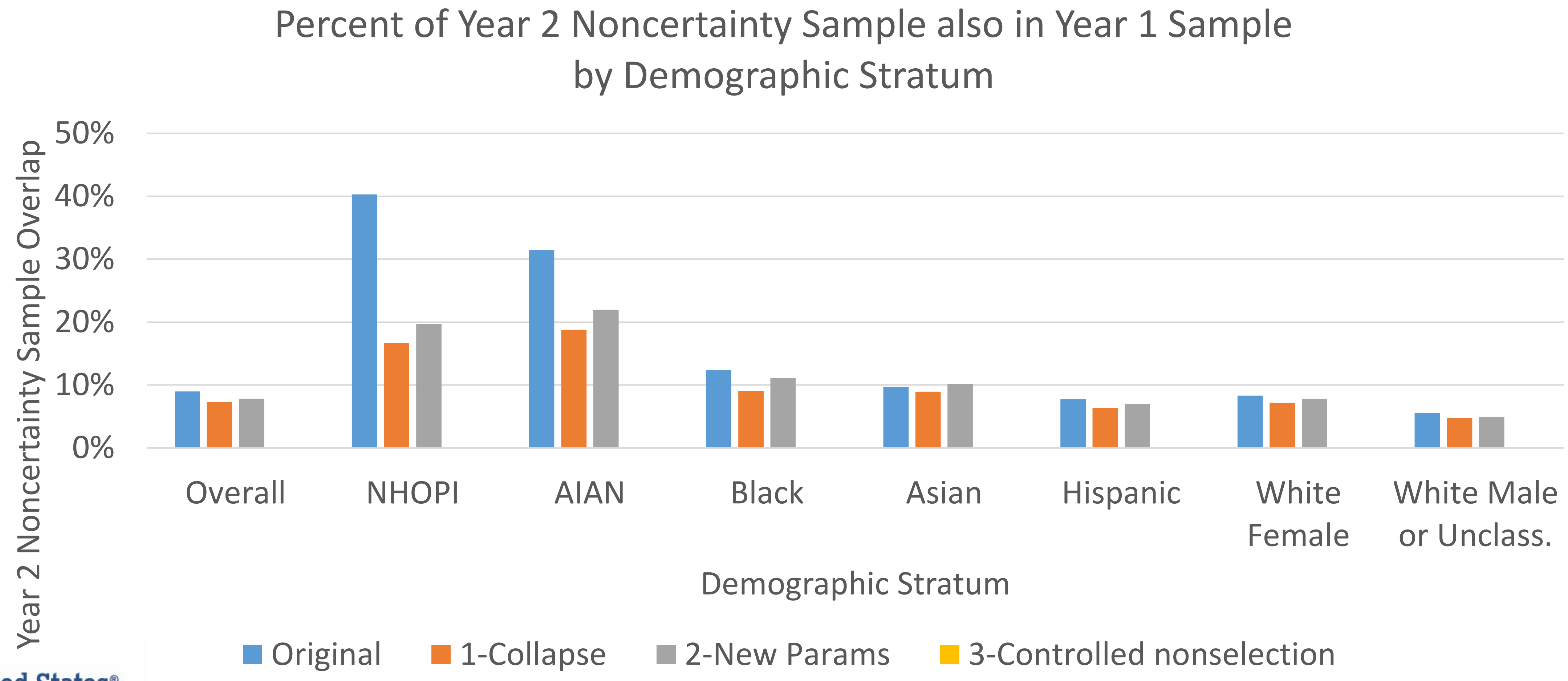
Proposed Stratification Collapsing Method

- As needed, combine strata together until all strata have at least 15 firms
  - Never combine strata from different states
  - Combine demographic groups within oversampled R&D industry
  - For all other industries, combine industries within demographic group

Stratification Collapsing Results

Stratum Size	Original Strata (and sampling rate)	Collapsed Strata (and sampling rate)
1-5 firms	3,091 (100%)	0
6-14 firms	1,520 (69%)	0
15-30 firms	1,198 (30%)	1,270 (32%)
31-50 firms	811 (26%)	1,024 (31%)
51-100 firms	829 (17%)	936 (20%)
101 or more firms	2,141 (4%)	2,162 (4%)
Total	**9,590 (4%)**	**5,392 (4%)**

Sample Overlap



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Mean Relative Standard Error (RSE)

ABS uses extended delete-a-group jackknife variance estimation with 10 random groups and a finite-population-correction.

$$RSE\left(\hat{Y}\right) = 100 * \frac{\sigma_{\hat{Y}}}{\hat{Y}}$$

For statistical comparison between sample types, we calculate the simple mean and variance of RSE across 11 different samples:

$$var\left(RSE\left(\hat{Y}\right)\right) = \frac{1}{11}\sum\left(RSE\left(\hat{Y}\right) - \overline{RSE\left(\hat{Y}\right)}\right)^2$$

Mean Relative Standard Error (RSE)

Number of estimates where alternate sample types produced a higher Mean RSE than the original estimate.

	Total Estimates	1-Collapsed Higher RSE	2-New Parameter Higher RSE	3-Nonselection Higher RSE
0 or 1 characteristic	468	0	0	0
2 chars excl NAICS 3 & 4	1,585	22	20	22
3 chars excl NAICS 3 & 4	2,043	12	24	23
2 chars incl NAICS 3 & 4	18,946	377	433	435
3 chars incl NAICS 3 & 4	17,362	244	421	439
Overall	**40,404**	**655**	**898**	**919**

Mean Relative Standard Error (RSE)

Number of estimates where alternate sample types produced a lower Mean RSE than the original estimate.

	Total Estimates	1-Collapsed Lower RSE	2-New Parameter Lower RSE	3-Nonselection Lower RSE
0 or 1 characteristic	468	0	10	7
2 chars excl NAICS 3 & 4	1,585	1	7	9
3 chars excl NAICS 3 & 4	2,043	6	9	9
2 chars incl NAICS 3 & 4	18,946	107	206	185
3 chars incl NAICS 3 & 4	17,362	89	145	140
Overall	**40,404**	**203**	**377**	**350**

Mean Percent Bias

Percent bias for each estimate compares the true sum to the estimated sum and divides by the true sum to standardize across estimates.

$$B = \frac{\hat{Y} - Y}{Y}$$

For statistical comparison between sample types, we calculate the simple mean and variance of the Percent Bias across 11 different samples:

$$var(B) = \frac{1}{11}\sum(B - \bar{B})^2$$

Mean Percent Bias

Estimates with significant bias by sample type

	Total Estimates	Original Estimates with Bias	1- Collapse Estimates with Bias	2-New Parameter Estimates with Bias	3-Nonselection Estimates with Bias
0 or 1 characteristic	468	2	2	3	1
2 chars excl NAICS 3 & 4	1,585	21	23	25	27
3 chars excl NAICS 3 & 4	2,043	51	41	63	59
2 chars incl NAICS 3 & 4	18,946	1,162	1,165	1,037	1,033
3 chars incl NAICS 3 & 4	17,362	1,136	1,161	1,107	1,143
Overall	**40,404**	**2,372**	**2,392**	**2,235**	**2,263**

Conclusions

- New administrative data sources provide more accurate and comprehensive demographic ownership data than before
- Collapsing strata and new sampling parameters reduce respondent burden for small firms with rare characteristics
- Preliminary analysis shows minimal impacts to estimate quality using collapsed strata and new sampling parameters

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