Attachment I

U.S. Census Bureau Report "Evaluating Nonresponse Bias in the 2022 Food Security Supplement to the Current Population Survey"

October 18, 2023

MEMORANDUM FOR	Michelle Ver Ploeg Chief, Food Assistance Branch U.S. Department of Agriculture Economic Research Service
Through:	Kyra M. Linse Survey Director, Current Population & American Time-Use Surveys Associate Directorate for Demographic Programs
From:	Anthony G. Tersine, Jr. *Anthony G. Tersine, Jr.* Chief, Demographic Statistical Methods Division
Subject:	Evaluating Nonresponse Bias in the 2022 Food Security Supplement to the Current Population Survey

The purpose of this memorandum is to report on analysis of various nonresponse estimates computed for the 2022 Food Security Supplement to the Current Population Survey and to provide nonresponse bias analysis tables for those estimates.

If you should have any questions about this document, please contact Emily Hood at 301-763-0284 or Emily.Hood@census.gov or David Hornick at 301-763-4183 or David.V.Hornick@census.gov.

The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0145.

Attachment: Evaluating Nonresponse Bias in the 2022 Food Security Supplement to the Current Population Survey

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Evaluating Nonresponse Bias in the 2022 Food Security Supplement to the Current Population Survey

October 18, 2023

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Executive Summary

This report presents results of an analysis of various nonresponse estimates computed for the 2022 Food Security Supplement (FSS) to the Current Population Survey (CPS). The sample included all households who completed a CPS interview. A nonresponse bias analysis was conducted to determine whether nonresponse among different demographic groups may have biased estimates. We investigated overall response rates, demographic subgroup response rates, and demographic respondent and nonrespondent distributions.

Our key findings for the 2022 FSS are:

- The CPS household weighted response rate was 70.91 percent. The FSS household weighted response rate was 76.27 percent. Thus, the overall weighted response rate for the FSS sample was 54.08 percent.

- For the CPS household estimates, excluding blanks (no responses), there are significant differences in the response rates for each of the variables that we investigated except gender of reference person. Excluding the blanks and missing values, one of the largest differences in response rates is seen for the age of reference person. Excluding blanks, each of the variables we investigated, except type of living quarters, principal city status, and urban/rural status, have significant differences in the respondent distributions. The largest differences between respondent and nonrespondent distributions are within race, gender, Hispanic origin, and age of reference person.

- For the FSS household estimates, excluding blanks, there are significant differences in the response rates and respondent distributions for each of the variables that we investigated except for type of living quarters, principal city status, and urban/rural status. Region had one of the largest differences in response rates.[1] The largest difference between respondent and nonrespondent distributions is within age of reference person.

- For FSS household estimates for characteristics only available for CPS respondents, there are significant differences in the response rates for each of the variables that we investigated except family income and child(ren) present. There are significant differences in the respondent distributions for each of the variables that we investigated except child(ren) present. The largest difference in respondent and nonrespondent distributions is seen within family income.

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[1] The largest difference in response rates for region is not significantly different than the largest difference in response rates for race of reference person.

1.   Introduction

The Office of Management and Budget (OMB) provides guidelines for conducting a nonresponse bias study when the expected unit response rate of a survey is below 80 percent (OMB, 2006). The Current Population Survey (CPS) household response rates have historically been above 80 percent,[2] but the overall supplement response rates (which are the product of the CPS household and Food Security Supplement (FSS) household response rates) are below this threshold.

This document provides results from our evaluation of nonresponse in the 2022 FSS to the CPS. Its purpose is to determine the existence of potential nonresponse bias in the 2022 FSS.

1.1   Overview of the CPS

The monthly CPS collects primarily labor force data about the civilian noninstitutional population living in the United States. The institutional population, which is excluded from the population universe, is composed primarily of the population in correctional institutions and nursing homes (98 percent of the 4.0 million institutionalized people in Census 2010). Interviewers ask questions concerning labor force participation about each member 15 years old and over in sample households. For December 2022, the week containing the twelfth of the month is the interview week. The week containing the fifth is the reference week (i.e., the week about which the labor force questions are asked).

The CPS uses a multistage probability sample based on the results of the decennial census, with coverage in all 50 states and the District of Columbia. The sample is continually updated to account for new residential construction. When files from the most recent decennial census become available, the Census Bureau gradually introduces a new sample design for the CPS.

Every ten years, the CPS first-stage sample is redesigned[3] reflecting changes based on the most recent decennial census. In the first stage of the sampling process, primary sampling units (PSUs)[4] were selected for sample. In the 2010 sample design, the United States was divided into 1,987 PSUs. These PSUs were then grouped into 852 strata. Within each stratum, a single PSU was chosen for the sample, with its probability of selection proportional to its population as of

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[2]   During the COVID-19 pandemic, data collection faced extraordinary circumstances that impacted response rates.

[3]   For detailed information on the 2010 sample redesign, please reference Bureau of Labor Statistics (2014).

[4]   The PSUs correspond to substate areas (i.e., counties or groups of counties) that are geographically contiguous.

the most recent decennial census. In the case of strata consisting of only one PSU, the PSU was chosen with certainty.

1.2   Overview of the 2022 Food Security Supplement to the Current Population Survey

In December 2022, in addition to the basic CPS questions, interviewers asked supplementary questions of how much households spent for food, their use of Federal and community food assistance programs, and whether they were able to afford enough food. The universe for this supplement is households eligible for the basic CPS. This supplement allows for proxy response. However, if at all possible, interviewers should interview the person within the household who is responsible for buying or preparing food for the household. Households with incomes below 185 percent of the poverty threshold are asked all supplement questions, whereas households with incomes over 185 percent of the poverty threshold are asked only a few questions, unless their answers identify them as "food insufficient or experiencing some degree of food hardship" and make them eligible for the entire supplement (U.S. Census Bureau, 2019 or U.S. Census Bureau, 2022a).

The key estimates include:
- Concern about food adequacy
- Money for food
- Access to food
- Use of emergency food
- Food assistance program participation
- Food intake reductions or hunger

Key domains, or characteristics for which the key estimates are created, include:
- Households
- Families
- Household Composition
- Unrelated Individuals
- Family Income

1.3   Discussion of Nonresponse in the 2022 Food Security Supplement to the Current Population Survey

Some degree of nonresponse bias and variance is a normal feature of almost all statistical surveys. The FSS produces food security estimates using the answers from responding households and persons. These food security estimates will be biased if answers from respondents differ from the potential answers of

nonrespondents. The magnitude of the bias is a function of the response rate and differences between respondents and nonrespondents.

There were two ways that a household could be a nonrespondent to the FSS:
- The entire household did not respond to CPS (the occupants were not found at home after repeated calls or are unavailable for some other reason).
- The household responded to CPS but did not respond to the FSS interview.

Because the FSS is directly linked to the CPS response rate, the CPS and FSS attempt to minimize nonresponse bias by increasing response rates and adjusting weights for potential differences between respondents and nonrespondents. We try to increase response rates within CPS by conducting personal visit interviews for new and returning sample units, mailing advance letters for all sample units, providing a Spanish language questionnaire for potential respondents who do not speak English, allowing interpreters for potential respondents who do not speak English or Spanish, training field representatives to gain respondent cooperation, allowing proxy respondents in special circumstances, and mailing follow-up letters to nonresponding households. We also help minimize nonresponse bias by reducing respondent burden for the FSS by limiting the length of the survey.

We reduce the effects of respondent/nonrespondent differences through noninterview weighting adjustments. These adjustments group respondents and nonrespondents into adjustment cells, and the weights of the nonrespondents are reallocated to the respondents within the adjustment cells.

CPS noninterview adjustment cells are formed by noninterview cluster (NICL) and central city status. The NICLs are created based on sample PSUs that are similar in metropolitan status and population size within the same state (U.S. Census Bureau, 2006). Metropolitan status is defined as metropolitan or nonmetropolitan. Within metropolitan PSUs, a further breakdown into "central city" and "not central city" is defined. This results in 127 NICLs and 214 adjustment cells. These variables were chosen for the noninterview adjustment cells because they are thought to be correlated with the CPS variables of interest.

FSS noninterview adjustment cells are defined to be the same as the CPS noninterview adjustment cells.

Despite the measures taken to reduce nonresponse bias, there is likely still some amount of nonresponse bias that we cannot correct without knowing the food security of the nonrespondents.

2.   Methodology

2.1   Data

The data for this nonresponse bias analysis are from the December 2022 FSS to the CPS and the December 2022 CPS. The U.S. Census Bureau conducts the CPS every month, although this file has only December data. The December survey uses two sets of questions, the basic CPS and a set of supplemental questions. The CPS, sponsored jointly by the Census Bureau and the U.S. Bureau of Labor Statistics, is the country's primary source of labor force statistics for the entire population. The U.S. Department of Agriculture, Economic Research Service sponsors the supplemental questions for December.

For a small number of variables, we had complete household information for all sample households, including respondents and nonrespondents. These variables were primarily limited to geographic and sampling data. There are also some variables with partial information for the nonrespondents. Normal CPS processing uses previous responses to demographic questions (when available) and does not re-ask those that are unlikely to change from interview to interview. Any variables that have never been answered are imputed using the hot deck imputation method. Hot deck imputation assigns a value collected for a person with similar characteristics to the missing value. Where possible, nonrespondent actual values were used as opposed to edited or imputed values in the comparison to respondents. The two exceptions are for tenure and presence of children, because these characteristics were only available for CPS respondents.

2.2   Weights

In the detailed weighting process for the CPS, base weights were adjusted with the weighting control factor, which accounts for subsampling in the field but does not include any nonresponse/noninterview or population coverage adjustments. This subsampling-adjusted base weight is the weight used throughout this report for household calculations for CPS.

When computing rates and distributions for FSS households, the FSS base weights, which are the noninterview-adjusted weights from CPS, were used. Note that FSS base weights are higher than CPS base weights because they include the CPS noninterview adjustment, which inflates weights back up to the eligible weighted CPS household sample.

All numbers presented in the report are weighted unless otherwise noted. All estimates in this report are rounded according to Census Bureau Disclosure Review Board policies.

2.3   Universe for the Estimates

We analyzed nonresponse for households. Since one person in each household responded for the entire household, our analysis focused on household nonresponse within reference person demographics, housing unit (HU) characteristics, and geography.

3.   Limitations

There are some limitations to this analysis which may affect the results. In particular:

1. Using past data to assign subgroup variables to nonrespondents is not necessarily accurate for households. Due to inmovers and outmovers, it is possible for demographic variables that we get from past data to be out of date. However, we do not believe our results need to be 100 percent accurate to show major differences between respondents and nonrespondents. This assumes that the demographics of neighborhoods do not change much in one and a half years.

2. Nonrespondents for CPS are never given the opportunity to respond to the FSS.

4.   Response Rates

The response rates tell us the percentage of eligible sample cases that responded to the CPS and the FSS. It is useful to compare response rates for different subgroups to understand the magnitude of potential biases.

We produced weighted and unweighted response rates for the 2022 FSS by key domains and variables. The overall FSS response rate is the product of CPS household response and FSS household response rate.

Response rates are defined as:

$$RR = \frac{\sum_{i \in s} w_i R_i D_i}{\sum_{i \in s} w_i D_i}$$

where:
w_i = the appropriate weight (1 if unweighted) for the response rate calculation
R_i = the response indicator (1 for respondents, 0 for nonrespondents)
D_i = the domain indicator (1 if within domain of interest, 0 otherwise)
s = the set of all eligible households

Eligible households are all sample housing units (HUs) that did not receive Type B or Type C (out-of-scope) outcome codes. Persons within group quarters (GQs) are treated as individual HUs. The CPS interview data contains all eligible and non-eligible HUs, and the FSS interview data contains only eligible HUs to the CPS.

For the December 2022 CPS, there were approximately 59,500 occupied HUs eligible for the household analysis. Of the 59,500 occupied households, 42,000 were interviewed. Of the 42,000 households that were interviewed for CPS, 32,000 also responded to the FSS.

Table 1 shows that the weighted percentage of households where at least one person responded to CPS is 70.91 percent. From those responding households, 76.27 percent of the weighted households responded to FSS. This results in an overall weighted FSS response rate of 54.08 percent.

Table 1: 2022 Food Security Unit Response Rates

Response Category	Count	Weighted Sum*	Unweighted Response Rates	Weighted Response Rates
Sampled CPS[A] Households	68,500	141,700,000		
Eligible CPS[A] Households	59,500	123,900,000		
CPS[A] Household Response	42,000	87,850,000	70.43%	70.91%
Food Security Households	42,000	123,900,000		
Food Security Household Response	32,000	94,480,000	76.42%	76.27%
Overall Food Security Response			53.82%	54.08%

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

[A] CPS: Current Population Survey

* May not sum to totals due to rounding. For Current Population Survey (CPS) households, CPS household weights prior to noninterview adjustments were used. For Food Security Supplement (FSS) households, the FSS base weights, which are the noninterview-adjusted weights from CPS, were used. Note that FSS base weights are higher than CPS base weights because they include the CPS noninterview adjustment, which inflates weights back up to the eligible weighted CPS household sample. The CPS Household Response row and Food Security Households row are the same set of households but are presented twice to show the difference in weights used.

Table 2 shows weighted response rates for all CPS households by domain. The standard error column shows the standard error of the response rate. Standard errors are conditional on the sample and represent expected variability in the response process, rather than traditional sampling error. Replicate weights were used to calculate the standard errors to account for the sample design. The CPS uses the successive difference replication method to calculate replicate weights. For detailed information on variance estimation, please reference U.S. Census Bureau (2019).

Table 2: Response Rates for December 2022 Current Population Survey Households

Characteristic	Unweighted Households*	Weighted Households*	Weighted Response Rate (%)	Standard Error (%)	Significance Grouping[x]
Type of Living Quarters					
Housing Unit	56,500	118,700,000	70.85%	0.2641%	B
Non-Housing Unit[A]	2,600	4,924,000	75.66%	1.024%	A
Blank[B]	100	225,500	1.347%	1.336%	C
Principal City Status					
Principal City within CBSA/MSA[C]	19,000	40,170,000	67.77%	0.4505%	C
Residual within CBSA/MSA[C]	29,000	66,520,000	71.52%	0.3036%	B
Outside of a CBSA/MSA[C]	11,500	17,190,000	75.92%	0.8058%	A
Region					
Northeast	10,000	21,530,000	67.12%	0.5963%	C
Midwest	11,500	27,080,000	73.04%	0.5554%	A
South	22,500	47,730,000	69.84%	0.4543%	B
West	15,000	27,550,000	73.64%	0.4591%	A
Urban/Rural Status					
Urban	45,000	98,160,000	69.98%	0.2834%	B
Rural	13,500	23,900,000	75.36%	0.5492%	A
Missing	850	1,826,000	63.13%	1.992%	C
Race of Reference Person					
White Only	36,500	75,280,000	88.74%	0.1915%	A
Black Only	5,300	11,770,000	83.40%	0.5677%	C
Asian Only	2,300	5,320,000	87.22%	0.7687%	AB
Other Race/Two or More Races	1,400	2,328,000	85.18%	1.149%	BC
Blank	14,000	29,190,000	15.79%	0.4162%	D
Gender of Reference Person					
Male	24,000	50,080,000	86.85%	0.2553%	A
Female	24,500	51,040,000	86.89%	0.2605%	A
Blank	11,000	22,770,000	0.071%	0.0277%	B
Hispanic Origin of Reference Person					
Hispanic	5,900	14,410,000	84.51%	0.5435%	B
Non-Hispanic	41,500	85,120,000	88.19%	0.1893%	A
Blank	12,000	24,360,000	2.525%	0.2018%	C
Age of Reference Person					
15-29	4,900	10,240,000	81.83%	0.5959%	E
30-39	7,500	15,840,000	84.90%	0.4904%	D
40-49	7,400	15,780,000	85.54%	0.4462%	D
50-59	7,800	16,590,000	87.51%	0.4153%	C
60-69	8,800	18,060,000	90.18%	0.3996%	B
70+	9,700	19,900,000	93.46%	0.3052%	A
Blank or Less than 15	13,000	27,480,000	11.37%	0.3581%	F
Overall	59,500	123,900,000	70.91%	0.2567%	

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

[A] Non-Housing Units include quarters within rooming or boarding homes; non-permanent units in transient hotels, motels, etc.; unoccupied sites for mobile homes, trailers, or tents; group quarters in school dormitories; and other units that are not defined to be housing units.

[B] Blank indicates that the living quarters type was either not identified or was identified with an invalid code.

[C] CBSA/MSA: Core-Based Statistical Area/Metropolitan Statistical Area

* May not sum to totals due to rounding. For weighted percent of total sample, reference Table 5.

[x] Within each characteristic, response rates identified with the same letter are not significantly different at the α=0.10 level. A indicates the highest response rates, B indicates the next highest rates, etc. P-values were adjusted for multiple comparisons within each demographic characteristic using the Tukey-Kramer method (NIST/SEMATECH, 2013).

Excluding the blanks and missing values, one of the largest differences in response rates for the CPS subgroups is 11.64 percent, seen for the age of reference person, where age group 70+ has a response rate of 93.46 percent versus 81.83 percent for age group 15-29. Additionally, households in living quarters that are non-HUs have a higher response rate than households in HU living quarters. Households outside of a core-based statistical area/metropolitan statistical area (CBSA/MSA) have the highest response rate within principal city status, west has one of the highest response rates among the regions,[5] rural has a higher response rate than urban, White only has a higher response rate than Black only and other race/two or more races,[6] non-Hispanic has a higher response rate than Hispanic, and households with reference person aged 70+ has the highest response rate among the age groups.

The response rate for blanks within the demographic subgroups is low because these demographic items are collected during the interview, resulting in a large portion of the household nonrespondents falling within these blank categories instead of the categories where they belong. Any household with a blank value within the demographic subgroups above indicates that the household has not previously responded to the CPS or never provided responses to those demographic questions in previous interviews. The nonresponse in the non-blank demographic categories is from households which had previously responded to the CPS and provided a valid response (non-blank) within the demographic category.

Table 2 shows standard errors which facilitate hypothesis testing of differential response rates. However, the practical significance of response rate differences is usually driven more by the magnitude of the difference. Therefore, excluding blanks, if the nonrespondents are different from respondents, age of reference person has the most potential for bias.

Table 3 shows weighted response rates for all FSS households by domain.

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[5] The response rate for west is not significantly different than the response rate for midwest.
[6] The response rate for White only is not significantly different than the response rate for Asian only.

Table 3: Response Rates for 2022 Food Security Supplement Households

Characteristic	Unweighted Households*	Weighted Households*	Weighted Response Rate (%)	Standard Error (%)	Significance Grouping[x]
Type of Living Quarters					
Housing Unit	40,000	118,900,000	76.30%	0.2928%	A
Non-Housing Unit[A]	1,900	5,032,000	75.44%	1.216%	A
Blank[B]	<15	S	S	S	–
Principal City Status					
Principal City within CBSA/MSA[C]	13,000	40,000,000	75.91%	0.4966%	A
Residual within CBSA/MSA[C]	20,500	66,660,000	76.33%	0.4257%	A
Outside of a CBSA/MSA[C]	8,500	17,220,000	76.86%	1.062%	A
Region					
Northeast	6,800	21,550,000	76.70%	0.6502%	B
Midwest	8,400	27,080,000	79.70%	0.6298%	A
South	15,500	47,710,000	71.83%	0.5459%	C
West	11,000	27,550,000	80.25%	0.5249%	A
Urban/Rural Status					
Urban	31,500	97,960,000	76.60%	0.3134%	A
Rural	9,900	24,320,000	75.08%	0.7257%	A
Missing	550	1,605,000	74.25%	2.249%	A
Race of Reference Person					
White Only	32,500	93,600,000	77.73%	0.3389%	A
Black Only	4,400	14,350,000	71.07%	0.8129%	B
Asian Only	2,000	6,646,000	75.50%	1.043%	A
Other Race/Two or More Races	1,200	2,780,000	77.65%	1.481%	A
Blank	1,900	6,514,000	66.95%	1.143%	C
Gender of Reference Person					
Male	20,500	61,300,000	75.82%	0.3474%	B
Female	21,000	62,570,000	76.72%	0.3700%	A
Blank	<15	22,580	29.99%	17.77%	C[+]
Hispanic Origin of Reference Person					
Hispanic	4,900	17,460,000	74.63%	0.5733%	B
Non-Hispanic	36,500	105,600,000	77.02%	0.3206%	A
Blank	250	833,600	15.87%	2.286%	C
Age of Reference Person					
15-29	4,000	11,880,000	77.08%	0.7438%	A, B
30-39	6,300	19,130,000	77.46%	0.5924%	A, B
40-49	6,300	19,070,000	76.11%	0.7014%	B
50-59	6,800	20,470,000	77.84%	0.5813%	A, B
60-69	7,900	22,920,000	78.70%	0.5847%	A
70+	9,100	26,050,000	77.74%	0.5692%	A, B
Blank or Less than 15	1,400	4,367,000	40.61%	1.628%	C
Overall	42,000	123,900,000	76.27%	0.2916%	

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

[A] Non-Housing Units include quarters within rooming or boarding homes; non-permanent units in transient hotels, motels, etc.; unoccupied sites for mobile homes, trailers, or tents; group quarters in school dormitories; and other units that are not defined to be housing units.

[B] Blank indicates that the living quarters type was either not identified or was identified with an invalid code.

[C] CBSA/MSA: Core-Based Statistical Area/Metropolitan Statistical Area

* May not sum to totals due to rounding. For weighted percent of total sample, reference Table 6.

[+] Exercise caution: The sample size is extremely small, leading to unreliable estimates.

[x] Within each characteristic, response rates identified with the same letter are not significantly different at the α=0.10 level. A indicates the highest response rates, B indicates the next highest rates, etc. P-values

were adjusted for multiple comparisons within each demographic characteristic using the Tukey-Kramer method (NIST/SEMATECH, 2013).

S   The estimate is withheld because estimate did not meet publication standards. Significance grouping is not applicable for these cases.

For the FSS household estimates, excluding the blanks, there were no significant differences among the type of living quarters, principal city status, or urban/rural status response rates. Excluding the blanks and missing values, one of the largest differences in response rates for the FSS subgroups is 8.42 percent,[7] seen for region, where the west has a response rate of 80.25[8] percent versus 71.83 percent for the south. Additionally, households with a female reference person have a higher response rate than households with a male reference person, and households with a non-Hispanic reference person have a higher response rate than households with a Hispanic reference person.

Again, although Table 3 shows standard errors which facilitate hypothesis testing, the practical significance of response rate differences is driven more by the magnitude of the difference than the sample size. Therefore, excluding blanks, if the nonrespondents are different from respondents, region and race of reference person has the most potential for bias.

Table 4 shows weighted response rates for all FSS households by domain for characteristics that were only available for CPS respondents.

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[7]   The largest difference in response rates for region is not significantly different than the largest difference in response rates for race of reference person.

[8]   The response rate for the west is not significantly different than the response rate for the midwest.

Table 4: Response Rates for 2022 Food Security Supplement Households for Characteristics Only Available for Responding Current Population Survey Households

Characteristic	Unweighted Households*	Weighted Households*	Weighted Response Rate (%)	Standard Error (%)	Significance Grouping[x]
Tenure (Edited)					
Owned or Mortgage	29,000	83,910,000	77.07%	0.3391%	A
Rented for Cash	12,500	38,670,000	74.46%	0.4805%	B
No Cash Rent	450	1,307,000	78.01%	2.251%	A, B
Family Income					
Less than $10,000	1,400	4,174,000	79.71%	1.347%	A
$10,000-$19,999.99	2,600	7,502,000	82.79%	0.9227%	A
$20,000-$29,999.99	2,800	8,093,000	81.49%	0.8902%	A
$30,000-$39,999.99	3,200	9,301,000	82.96%	0.8203%	A
$40,000-$49,999.99	2,500	7,128,000	84.70%	0.8346%	A
$50,000-$59,999.99	2,600	7,458,000	82.67%	0.8948%	A
$60,000-$74,999.99	3,400	96,910,000	83.49%	0.7827%	A
$75,000-$99,999.99	4,200	12,120,000	83.38%	0.7016%	A
$100,000-$149,999.99	4,800	14,320,000	83.83%	0.6580%	A
$150,000+	5,500	17,120,000	83.35%	0.6057%	A
Blank or Don't Know	1,800	5,253,000	51.96%	1.444%	B
Refused	7,200	21,730,000	51.72%	0.7109%	B
Household Type					
Husband/Wife Primary Family	20,000	58,550,000	76.71%	0.3702%	A
Unmarried Householder Primary Family	6,600	20,170,000	74.55%	0.6054%	B
Primary Individual	15,500	45,030,000	76.55%	0.4703%	A
Group Quarters with Family	<15	24,400	87.62%	12.20%	A, B[+]
Group Quarters without Family	30	112,400	38.33%	14.93%	B
Child(ren) Present (Edited)					
No	32,500	95,660,000	76.38%	0.3381%	A
Yes	9,400	28,230,000	75.90%	0.5117%	A
Measure of Labor Force Participation Status of Reference Person					
Employed	24,500	72,750,000	76.60%	0.3578%	B
Unemployed	700	2,090,000	80.66%	1.714%	A
Not in Labor Force	16,500	48,440,000	75.89%	0.4461%	B
Blank	250	599,100	50.90%	4.588%	C
Overall	42,000	123,900,000	76.27%	0.2916%	

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

* May not sum to totals due to rounding. For weighted percent of total sample, reference Table 7.

[+] Exercise caution: The sample size is small, leading to unreliable estimates.

[x] Within each characteristic, response rates identified with the same letter are not significantly different at the α=0.10 level. A indicates the highest response rates, B indicates the next highest rates, etc. P-values were adjusted for multiple comparisons within each demographic characteristic using the Tukey-Kramer method (NIST/SEMATECH, 2013).

For the FSS household estimates of characteristics only available for CPS respondents, excluding the blanks, refusals, and GQ groups, there were no significant differences in response rates within the family income and child(ren) present categories. For the

tenure category, owned or mortgage has a higher response rate than rented for cash, but neither are significantly different from the response rate for no cash rent. Husband/wife primary family households and primary individual households have response rates that are not significantly different, but both are higher than the response rate for unmarried householder primary family households. For the measure of labor force participation category, unemployed had a higher response rate than either employed or not in the labor force.[9]

Again, although Table 4 shows standard errors which facilitate hypothesis testing, the practical significance of response rate differences is driven more by the magnitude of the difference than the sample size. However, among the categories in Table 4, the magnitudes of the differences are not statistically different. Therefore, it is difficult to identify which category has the most potential for bias. The measure of labor force participation category has a difference in response rates of 4.77[10] percent, where unemployed has a response rate of 80.66 percent versus 75.89 percent for not in the labor force.[11]

5.   Respondent Distributions

Respondent and nonrespondent distributions show the relative percent of members of a domain subset within respondents and nonrespondents separately. This is different than the response rates, which are the relative percent of respondents within the different domain subsets. We used chi-square tests to determine if the respondent and nonrespondent distributions differed.

Respondent distributions are defined as:

$$RD = \frac{\sum_{i \in s} w_i R_i D_i}{\sum_{i \in s} w_i R_i}$$

This definition assumes the same eligibility criteria, weights, and indicators as the response rate calculations in the previous section. Nonrespondent distributions use the same formula, but with the R_i variable indicating nonrespondents instead of respondents. The chi-square test statistics were calculated using replicate weights to account for the sample design.

Table 5 shows the percent of total sample distribution as well as comparisons of respondent and nonrespondent distributions for CPS households within the different domain subgroups.

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[9]   The response rates for employed and not in the labor force are not significantly different.
[10]   The largest difference of 4.77 percent for measure of labor force participation was not significantly different from the largest differences for family income, tenure, or household type.
[11]   The response rate for not in the labor force is not significantly different than the response rate for employed.

**Table 5: Respondent and Nonrespondent Distributions for December 2022
Current Population Survey Households**

Characteristic	Percentage of Total Sample*	Household Respondent Percentage*	Household Nonrespondent Percentage*	Chi-Square Statistic (df)	P-value
Type of Living Quarters					
Housing Unit	95.84%	95.76%	96.06%	198.3 (2)	< 0.0001
Non-Housing Unit[A]	3.975%	4.240%	3.326%	[18.48(1)	< 0.0001]
Blank[B]	0.1821%	0.003459%	0.6175%		
Principal City Status					
Principal City within CBSA/MSA[C]	32.43%	30.99%	35.93%		
Residual within CBSA/MSA[C]	53.70%	54.15%	52.58%	92.97 (2)	< 0.0001
Outside of a CBSA/MSA[C]	13.88%	14.86%	11.49%		
Region					
Northeast	17.38%	16.45%	19.64%		
Midwest	21.86%	22.51%	20.26%	88.16 (3)	< 0.0001
South	38.53%	37.94%	39.94%		
West	22.24%	23.10%	20.16%		
Urban/Rural Status					
Urban	79.24%	78.19%	81.79%	96.29(2)	< 0.0001
Rural	19.29%	20.50%	16.34%	[74.47(1)]	< 0.0001]
Missing	1.474%	1.312%	1.868%		
Race of Reference Person					
White Only	60.77%	76.04%	23.52%		
Black Only	9.500%	11.17%	5.423%	21,300 (4)	< 0.0001
Asian Only	4.294%	5.281%	1.888%	[114.9 (3)	< 0.0001]
Other Race/Two or More Races	1.879%	2.257%	0.9576%		
Blank	23.56%	5.245%	68.21%		
Gender of Reference Person					
Male	40.42%	49.50%	18.28%	30,780 (2)	< 0.0001
Female	41.20%	50.48%	18.57%	[0.0135 (1)	0.9074]
Blank	18.38%	0.01841%	63.14%		
Hispanic Origin of Reference Person					
Hispanic	11.63%	13.86%	6.192%	21,980 (2)	< 0.0001
Non-Hispanic	68.71%	85.44%	27.90%	[49.37 (1)	< 0.0001]
Blank	19.67%	0.7002%	65.91%		
Age of Reference Person					
15-29	8.266%	9.538%	5.165%		
30-39	12.79%	15.31%	6.638%		
40-49	12.73%	15.36%	6.332%		
50-59	13.39%	16.52%	5.748%	22,460 (6)	< 0.0001
60-69	14.58%	18.54%	4.921%	[455.0 (5)]	< 0.0001]
70+	16.06%	21.17%	3.611%		
Blank or Less than 15	22.18%	3.557%	67.59%		
Overall	100%	100%	100%		

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

[A] Non-Housing Units include quarters within rooming or boarding homes; non-permanent units in transient hotels, motels, etc.; unoccupied sites for mobile homes, trailers, or tents; group quarters in school dormitories; and other units that are not defined to be housing units.

[B] Blank indicates that the living quarters type was either not identified or was identified with an invalid code.

[C] CBSA/MSA: Core-Based Statistical Area/Metropolitan Statistical Area

* May not sum to totals due to rounding.

[] The values within brackets are the chi-square statistic, df, and p-value when the blanks/missings are excluded from the chi-square test.

The chi-square tests for CPS households showed significant differences (at the α=0.10 level) between respondent and nonrespondent distributions for all variables. Simply looking at the distributions for the race, gender, Hispanic origin, and age of reference person, you can tell that there are large differences between the respondent and nonrespondent distributions, which corresponds to the magnitude of the chi-square test statistics (21,300, 30,780, 21,980, and 22,460, respectively). However, when you exclude the blanks from the chi-square test, the gender of the reference person no longer has a significant difference between the two distributions. Note: The chi-square tests only indicate that the distributions of respondents and nonrespondents differ but do not necessarily indicate a nonresponse bias problem. These differences will only cause bias if the respondents and nonrespondents report differing rates of food security.

Even though there are significant differences between the respondents and nonrespondents, the differences might not be large enough to cause meaningful differences in estimates. Furthermore, weighting adjustments might also minimize the impact of some differences. Because the CPS noninterview adjustments take NICL and central city status into account, the principal city status and region differences may be reduced within those adjustments.

Table 6 shows the percent of total sample distribution as well as comparisons of respondent and nonrespondent distributions for FSS households within the different domain subgroups.

Table 6: Respondent and Nonrespondent Distributions for 2022 Food Security Supplement Households

Characteristic	Percentage of Total Sample*	Household Respondent Percentage*	Household Nonrespondent Percentage*	Chi-Square Statistic (df)	P-value
Type of Living Quarters					
Housing Unit	95.94%	95.98%	95.78%	N (2)	N
Non-Housing Unit[A]	4.062%	4.018%	4.203%	[0.5148 (1)	0.4731]
Blank[B]	0.002948%	0.000%	0.01242%		
Principal City Status					
Principal City within CBSA/MSA[C]	32.29%	32.14%	32.77%		
Residual within CBSA/MSA[C]	53.81%	53.85%	53.67%	0.7262 (2)	0.6955
Outside of a CBSA/MSA[C]	13.90%	14.01%	13.55%		
Region					
Northeast	17.39%	17.49%	17.07%		
Midwest	21.86%	22.84%	18.69%	159.0 (3)	< 0.0001
South	38.51%	36.27%	45.72%		
West	22.24%	23.40%	18.51%		
Urban/Rural Status					
Urban	79.07%	79.41%	77.98%	5.382 (2)	0.0678
Rural	19.63%	19.33%	20.62%	[3.871 (1)	0.0491]
Missing	1.296%	1.261%	1.406%		
Race of Reference Person					
White Only	75.55%	77.00%	70.91%		
Black Only	11.58%	10.79%	14.12%	158.2(4)	< 0.0001
Asian Only	5.365%	5.311%	5.538%	[77.59 (3)	< 0.0001
Other Race/Two or More Races	2.244%	2.285%	2.113%		
Blank	5.258%	4.615%	7.322%		
Gender of Reference Person					
Male	49.48%	49.19%	50.41%	13.19 (2)	0.0014
Female	50.50%	50.80%	49.54%	[4.564 (1)	0.0326]
Blank	0.01822%	0.007167%	0.05376%		
Hispanic Origin of Reference Person					
Hispanic	14.10%	13.79%	15.07%	528.7 (2)	< 0.0001
Non-Hispanic	85.23%	86.07%	82.54%	[14.35 (1)	0.0002]
Blank	0.6729%	0.1400%	2.385%		
Age of Reference Person					
15-29	9.591%	9.693%	9.261%		
30-39	15.44%	15.68%	14.66%		
40-49	15.39%	15.36%	15.49%		
50-59	16.52%	16.86%	15.43%	765.9 (6)	< 0.0001
60-69	18.50%	19.09%	16.61%	[10.54 (5)	0.0613]
70+	21.03%	21.43%	19.72%		
Blank or Less than 15	3.525%	1.877%	8.823%		
Overall	100%	100%	100%		

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

[A] Non-Housing Units include quarters within rooming or boarding homes; non-permanent units in transient hotels, motels, etc.; unoccupied sites for mobile homes, trailers, or tents; group quarters in school dormitories; and other units that are not defined to be housing units.

[B] Blank indicates that the living quarters type was either not identified or was identified with an invalid code.

[C] CBSA/MSA: Core-Based Statistical Area/Metropolitan Statistical Area

* May not sum to totals due to rounding.

N Estimate is not available.

[] The values within brackets are the chi-square statistic, df, and p-value when the blanks/missings are excluded from the chi-square test.

The chi-square tests for FSS households showed significant differences (at the α=0.10 level) for the distributions of all variables except type of living quarters, principal city status, and urban/rural status. Simply looking at the distributions for age of the reference person, you can tell that there are large differences between the respondent and nonrespondent distributions, which correspond to the magnitude of the chi-square test statistic (765.9).

As mentioned for CPS household respondent distributions, the chi-square tests only indicate that the distributions of respondents and nonrespondents differ but do not necessarily indicate a nonresponse bias problem. Furthermore, weighting adjustments might minimize the impact of some differences. Because the FSS noninterview adjustments take NICL and central city status into account, the principal city status and region differences may be reduced within those adjustments.

Table 7 shows the percent of total sample distribution as well as comparisons of respondent and nonrespondent distributions for FSS households within the different domain subgroups for characteristics that were only available for CPS respondents.

Table 7: Respondent and Nonrespondent Distributions for 2022 Food Security Supplement Households for Characteristics Only Available for Responding CPS Households

Characteristic	Percentage of Total Sample*	Household Respondent Percentage*	Household Nonrespondent Percentage*	Chi-Square Statistic (df)	P-value
Tenure (Edited)					
Owned or Mortgage	67.73%	68.45%	65.43%		
Rented for Cash	31.22%	30.47%	33.60%	25.03 (2)	< 0.0001
No Cash Rent	1.055%	1.079%	0.9773%		
Family Income					
Less than $10,000	3.369%	3.521%	2.881%		
$10,000-$19,999.99	6.055%	6.573%	4.391%		
$20,000-$29,999.99	6.533%	6.980%	5.094%		
$30,000-$39,999.99	7.507%	8.166%	5.391%		
$40,000-$49,999.99	5.754%	6.390%	3.709%		
$50,000-$59,999.99	6.020%	6.525%	4.396%	2,718 (11)	< 0.0001
$60,000-$74,999.99	7.823%	8.563%	5.443%	[17.02 (9)	0.0485]
$75,000-$99,999.99	9.780%	10.69%	6.850%		
$100,000-$149,999.99	11.56%	12.71%	7.878%		
$150,000+	13.82%	15.10%	9.695%		
Blank or Don't Know	4.240%	2.889%	8.584%		
Refused	17.54%	11.89%	35.69%		
Household Type					
Husband/Wife Primary Family	47.26%	47.54%	46.38%		
Unmarried Householder Primary Family	16.28%	15.91%	17.46%	25.05 (4)	< 0.0001
Primary Individual	36.35%	36.48%	35.92%	{18.58 (3)	0.0003}
Group Quarters with Family	0.01968%	0.002260%	0.01027%		
Group Quarters without Family	0.09077%	0.04561%	0.2359%		
Child(ren) Present (Edited)					
No	77.21%	77.32%	76.86%		
Yes	22.79%	22.68%	23.14%	0.6441 (1)	0.4222
Measure of Labor Force Participation Status of Reference Person					
Employed	58.73%	58.99%	57.90%		
Unemployed	1.687%	1.784%	1.375%	53.95 (3)	< 0.0001
Not in Labor Force	39.10%	38.91%	39.73%	[6.955 (2)	0.0309]
Blank	0.4836%	0.3228%	1.000%		
Overall	100%	100%	100%		

Source: U.S. Census Bureau internal data from December 2022 Current Population Survey.

Note: The chi-square test for household type could not be calculated due to a frequency of zero within the Group Quarters with Family cell.

* May not sum to totals due to rounding.

[] The values within brackets are the chi-square statistic, df, and p-value when the blanks and refusals are excluded from the chi-square test.

{} The values within braces are the chi-square statistic, df, and p-value when combining the groups, Group Quarters with Family, and Group Quarters without Family.

The chi-square tests for FSS household estimates of characteristics only available for CPS respondents showed significant differences (at the $\alpha=0.10$ level) for the distributions of all variables except child(ren) present. Simply looking at the distributions for family

income, you can tell that there are large differences between the respondent and nonrespondent distributions, which correspond to the magnitude of the chi-square test statistic (2,718). Even after excluding the blanks and refusals, there is still a significant difference between the respondent and nonrespondent distributions for family income.

As mentioned previously, the chi-square tests only indicate that the distributions of respondents and nonrespondents differ but do not necessarily indicate a nonresponse bias problem. Furthermore, weighting adjustments might minimize the impact of some differences.

6. Conclusions

This analysis found evidence of potential nonresponse bias for both CPS and FSS households. For CPS, there is potential nonresponse bias for all investigated characteristics except possibly for gender of reference person. For FSS, there is potential nonresponse bias for most investigated characteristics except type of living quarters, principal city status, or urban/rural status.

Excluding the blanks and missing values, one of the largest differences in response rates for the CPS subgroups is 11.64 percent, seen for the age of reference person, where age group 70+ has a response rate of 93.46 percent versus 81.83 percent for age group 15-29. For respondent and nonrespondent distributions within CPS households, the largest differences are seen within race, gender, Hispanic origin, and age of reference person.

Excluding the blanks and missing values, one of the largest differences in response rates for the FSS subgroups is 8.42 percent,[12] seen for region, where the west has a response rate of 80.25[13] percent versus 71.83 percent for the south. For respondent and nonrespondent distributions within FSS households, a large difference is seen within age of reference person.

Among the estimates for the FSS households for characteristics only available for CPS respondents, one of the largest differences between the respondent and nonrespondent distributions is seen within family income.

Using the information learned from this analysis, discussions should be had with the sponsor regarding enhancements to the weighting process. The findings suggest that research could be done into the possible inclusion of other geographic and demographic characteristics into the household noninterview adjustments for the FSS. Research could be conducted into whether the nonresponse adjustment should include the geographic and demographic characteristics that were investigated in this report to determine if

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[12] The largest difference in response rates for region is not significantly different than the largest difference in response rates for race of reference person.

[13] The response rate for the west is not significantly different than the response rate for the midwest.

they can help reduce the nonresponse bias. Some other potential characteristics that may be related to food security to consider including in the noninterview adjustment may be block and/or tract planning database variables, which would include geographic and demographic variables based on the location of the sampled household, such as percent of population that is Hispanic, percent of HUs where no one lives regularly (vacant HUs), percent of population that is below the poverty level. Note: planning database variables are estimates using American Community Survey or Census data. Please reference U.S. Census Bureau (2023) for additional information on the planning database.

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