# Design and Methodology

*Current Population Survey—America's Source for Labor Force Data*

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# FOREWORD

The Current Population Survey (CPS) is one of the oldest, largest, and most well-recognized surveys in the United States. It is an important survey, providing information on many of the things that define us as a society—our work, our earnings, our education. It is also very complex. In this publication, the staff of the U.S. Census Bureau and the U.S. Bureau of Labor Statistics have attempted to provide data users with a thorough description of the design and methodology used to administer the CPS and create estimates. The preparation of this technical paper was a major undertaking, spanning several years and involving dozens of statisticians, economists, and others from the two agencies.

While the basic approach to collecting labor force and other data through the CPS has remained intact since this report was last updated, much has changed. In particular, since *CPS Design and Methodology Technical Paper 66* was issued in 2006, annual sampling replaced once-a-decade sampling to increase flexibility in design and operations. Another major difference from the previous design is the adoption of the master address file (MAF) to take advantage of the extensive and regularly-updated address information from the U.S. Postal Service. The MAF is now the primary source of frames and sample units for the CPS, as well as for many other demographic surveys the Census Bureau conducts. This change has allowed the Census Bureau to abandon costly address listing operations in the field.

In addition to this technical paper, please visit our CPS Web sites at <www.bls.gov/cps/> and <www.census.gov/programs-surveys/cps.html>, where additional information about CPS methodology and data is available. Also, we welcome comments from users about the value of this document and ways that it could be improved. To provide comments or submit a question, please refer to the CPS contact page at <www.bls.gov/cps/contact.htm>.

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October 2019

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# Chapter 1-1: Background and History

## BACKGROUND

The Current Population Survey (CPS) is a monthly survey sponsored jointly by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics (BLS). It is the source of the national unemployment rate, along with a wide range of information about employment, unemployment, and people not in the labor force. The CPS also collects extensive demographic data that complement and enhance our understanding of labor market conditions in the nation overall, among many different population groups and geographic areas.

The labor force concepts and definitions used in the CPS have undergone only slight modifications since the survey's inception in 1940. Those concepts and definitions are discussed in Chapter 1-2, Questionnaire Concepts and Definitions. Although labor market information is central to the CPS, the survey provides a wealth of other demographic and socioeconomic data that are widely used in both the public and private sectors. In addition, because of its long history and the quality of its data, the CPS has been a model for other household surveys, both in the United States and in other countries.

The CPS is a source of information not only for economic and social science research, but also for the study of survey methodology. This report focuses on labor force data because the timely and accurate collection and publication of these data remains the principal purpose of the survey.

The CPS is administered by the Census Bureau using a probability-selected sample of about 60,000 eligible households. Survey data generally are collected during the calendar week that includes the nineteenth of the month. The questions refer to activities during the prior week for those who are employed and the prior 4 weeks for those who are unemployed. Activities in the prior week generally refer to those done in the week that includes the twelfth of the month.[1] Sampled households from all 50 states and the District

of Columbia are in the survey for 4 consecutive months, are out for 8 months, and then return for another 4 consecutive months before leaving the sample permanently. This design ensures a high degree of continuity from one month to the next, as well as year to year. This 4-8-4 sampling scheme has the added benefit of allowing the constant replenishment of the sample without excessive burden to respondents. A new group of respondents starts its 4-8-4 rotation each calendar month, while at the same time another group completes its rotation.

The CPS is collected by Census Bureau field representatives (FR) across the country, through both personal and telephone interviews, using laptop computers. Additional telephone interviewing is conducted from the Census Bureau's two centralized contact centers in Jeffersonville, Indiana, and Tucson, Arizona.

To be eligible to participate in the CPS, individuals must be U.S. residents aged 15 or over who are not in the armed forces. People in institutions, such as prisons, long-term care facilities, and nursing homes, are ineligible for the CPS. In general, the BLS publishes labor force data only for people aged 16 and over, since those under the age of 16 are limited in their labor market activities by compulsory schooling and child labor laws. No upper age limit is used and students are treated the same as nonstudents. One person generally responds for all eligible members of the household.

Usually within 2 weeks of the completion of these interviews, the BLS publishes the Employment Situation news release. This release highlights monthly labor force statistics from the CPS, as well as data on employment, hours, and earnings from the Current Employment Statistics (CES) survey of establishments. This closely watched release provides some of the earliest economic indicators available each month and represents the nation's most comprehensive measures of national employment and unemployment. Dozens of data tables and thousands of time series estimates are also made available to the public at the time of the release.

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[1] In the month of December, the survey is often conducted 1 week earlier to avoid conflicting with the holiday season. Additionally, since 2006, the November collection may be moved 1 week earlier to avoid the holiday and/or to allow adequate processing time before the December collection. The reference week is then also moved 1 week earlier.

In addition to the regular labor force questions, the CPS often includes special supplementary questions on a variety of topics. The best known of the CPS supplements is the Annual Social and Economic Survey (ASEC), which is the source of the national poverty rate and is also used to measure income and health insurance coverage. Additional supplement topics include veterans, school enrollment, worker displacement, and job tenure. Because of the large sample size and broad population coverage of the CPS, a wide range of sponsors use supplements to collect data on topics that are not directly related to the labor market, such as participation in the arts, tobacco use, computer use, and voting patterns. The supplements are described in greater detail in Chapter 1-3, Supplements.

## HISTORY OF THE CURRENT POPULATION SURVEY

The CPS has its origin in a program established to provide direct measurement of national unemployment each month on a sample basis. Several earlier efforts attempted to estimate the number of unemployed using various devices ranging from guesses to enumerative counts. The problem of measuring unemployment became especially acute during the economic depression of the 1930s.

The Enumerative Check Census, taken as part of the 1937 unemployment registration, was the first attempt to estimate unemployment on a nation-wide basis using probability sampling. During the latter half of the 1930s, the Work Projects Administration (WPA) developed techniques for measuring unemployment, first on a local area basis and later on a national basis. This research by the WPA, combined with the experience from the Enumerative Check Census, led to a regular monthly sample survey of unemployment that provided an accurate and timely measurement of employment, unemployment, and the size of the labor force on a systematic basis. Early tests of this first national monthly sample survey were initiated in December 1939 and the survey officially began in March 1940 with the collection of data for the 1940 Census.

Over the years, survey questions have been expanded to capture additional labor market data. Since the survey's inception, there have been numerous modifications to the definitions, sample design, and data collection methods to enhance the reliability of labor force statistics derived from the survey data. See the Appendix: History of the Current Population Survey for a list of important modifications to the CPS since 1940.

# Chapter 1-2: Questionnaire Concepts and Definitions

## INTRODUCTION

An important component of the CPS is the questionnaire, also called the survey instrument. The survey instrument utilizes automated data collection methods: computer-assisted personal interviewing (CAPI) and computer-assisted telephone interviewing (CATI). This chapter explains the definitions embedded in the questionnaire and key survey questions. For details on data collection procedures and protocols, see Chapter 3-1, Instrument Design and Chapter 3-2, Conducting the Interviews.

## STRUCTURE OF THE SURVEY INSTRUMENT

The CPS interview questionnaire is divided into three basic parts: (1) household and demographic questions, (2) labor force questions, and (3) supplemental questions. Supplemental questions are added to the CPS nearly every month and cover a number of different topics. The order in which interviewers attempt to collect information is: (1) housing unit (HU) data, (2) demographic data, (3) labor force data, and (4) supplemental data. Supplemental data may include more demographic and household questions.

The definitions underlying the household, demographic, and labor force data are described below. For more information about supplements to the CPS, see Chapter 1-3, Supplements.

## CONCEPTS AND DEFINITIONS

### Household and Demographic Information

Upon contacting a household, interviewers proceed with the interview unless the case is a definite noninterview. (Chapter 3-2, Conducting the Interviews, discusses the interview process and explains refusals and other types of noninterviews.) When interviewing a household for the first time, interviewers collect information about the HU and all individuals who usually live at the address.

**Housing unit information**. Upon first contact with a HU, interviewers collect information on the HU physical address, its mailing address, the year it was constructed, the type of living quarters (e.g.,

a house, apartment, or mobile home), whether it is renter- or owner-occupied, and whether it has a telephone and, if so, the telephone number.

**Household roster**. After collecting or updating the HU data, the interviewer either creates or updates a list of all individuals living in the unit and determines whether they are members of the household. This list is referred to as the household roster.

**Household respondent**. One person may provide all of the CPS data for the entire sample unit, provided the person is a household member 15 years or older who is knowledgeable about the household. The person who responds for the household is called the household respondent. Information collected from the household respondent for other members of the household is referred to as proxy response.

**Reference person**. To create the household roster, the interviewer asks the household respondent to give "the names of all persons living or staying" in the HU, and to "start with the name of the person or one of the persons who owns or rents" the unit. The person whose name the interviewer enters first (presumably one of the individuals who owns or rents the unit) becomes the reference person. The household respondent and the reference person are not necessarily the same. For example, if you are the household respondent and you give your name first when asked to report the household roster, then you are also the reference person. If, on the other hand, you are the household respondent and you give your spouse's name first when asked to report the household roster, then your spouse is the reference person.

**Household**. A household is defined as all individuals (related family members and all unrelated individuals) whose usual place of residence at the time of the interview is the sample unit. Individuals who are temporarily absent and who have no other usual address are still classified as household members even though they are not present in the household during the survey week. College students compose the bulk of such absent household members, but people away on business or vacation are also included. (Not included are individuals in the military, individuals who

have usual residences elsewhere, and individuals in institutions such as prisons or nursing homes.) Once household or nonhousehold membership has been established for all people on the roster, the interviewer proceeds to collect all other demographic data, but only for household members.

**Relationship to reference person**. The interviewer will show a flash card with relationship categories (i.e., opposite-sex spouse, same-sex spouse, opposite-sex unmarried partner, same-sex unmarried partner, child, grandchild, parent, brother or sister, housemate or roommate) to the household respondent and ask them to report each household member's relationship to the reference person (the person listed on line one of the household roster). These relationships are used to define families, subfamilies, and unrelated individuals. A family is defined as a group of two or more individuals residing together who are related by birth, marriage, or adoption; all such individuals are considered members of one family. Families are further classified either as married-couple (spouse present) families or as families maintained by women or men without spouses present. Subfamilies are further classified as related subfamilies or unrelated subfamilies. A related subfamily is a married couple with or without children, or one parent with one or more own, single (never-married) children under 18 years old, living in a household, and related to, but not including, the householder or spouse. An unrelated subfamily is a family that lives in a HU where none of its members is related to the reference person. An unrelated individual(s) may be part of a household containing one or more families (like an unmarried partner, with or without children, or a housemate), or may reside in group quarters such as a rooming house.

**Additional demographic information**. In addition to asking for relationship data, the interviewer asks for other demographic data for each household member, including birth date, marital status, armed forces or veteran status, level of education, race, ethnicity, nativity, and disability status. Total family income is also collected.

The following terms define an individual's marital status at the time of the interview:

- Married, spouse present: applies to a married couple who both live at the same address, even though one may be temporarily absent due to business, vacation, a visit away from home, a hospital stay, etc.

- Married, spouse absent: refers to married people living apart because a spouse was employed and living at a considerable distance from home, was serving away from home in the armed forces, had moved to another area, or had a different place of residence for any other reason except separation as defined below.

- Separated: includes people with legal separations, those living apart with intentions of obtaining a divorce, and other people permanently or temporarily separated because of marital discord.

- Widowed.

- Divorced.

- Never married.

Educational attainment for each person in the household aged 15 or older is obtained through a question asking about the highest grade or degree completed. Beginning in 2015, additional questions about professional certifications and state or industry licenses used for getting or keeping a job were added to measure credentials granted outside of the regular education system.

Questions on race and Hispanic or Latino ethnicity comply with federal standards established by the Office of Management and Budget. Respondents are asked a question to determine if they are Hispanic, which is considered an ethnicity rather than a race. The question asks if the individual is of Hispanic, Latino, or Spanish origin, and appears before the question on race. Next, all respondents, including those who identify themselves as Hispanic, are asked to choose one or more of the following races they consider themselves to be: White, Black or African American, American Indian or Alaska Native, Asian, or Native Hawaiian or Other Pacific Islander. They are reminded that Hispanic origin is not a race. Although not indicated to the respondent, responses of "other" are accepted and allocated among the race categories. Respondents may choose more than one race, so data may be tabulated for many different combinations of race and Hispanic ethnicity.

The CPS uses a set of six questions to identify persons with disabilities. People are classified as having a disability if there is a response of "yes" to any of these questions. Each of the questions asks the respondent whether anyone in the household (civilian, aged 15 and older) has the condition described, and if the respondent replies "yes," they are then asked to identify everyone in the household who has the condition. A brief description of the six conditions are: (1) deaf or serious difficulty hearing; (2) blind or serious difficulty seeing; (3) serious difficulty concentrating, remembering, or making decisions; (4) serious difficulty walking or climbing stairs; (5) difficulty dressing or bathing; and (6) difficulty doing errands.

## Labor Force Information

The CPS provides a measure of monthly employment—not jobs. An employed person, as measured in the CPS, may have more than one job. Labor force information is obtained after most household and demographic information has been collected. Besides determining labor force status, information is also collected on hours worked, occupation, industry, self-employment, earnings, duration of job search, and other labor force characteristics.

The primary purpose of the labor force questions is to classify all individuals as employed, unemployed, or not in the labor force. The major labor force categories are defined hierarchically and, thus, are mutually exclusive. Employed supersedes unemployed, which supersedes not in the labor force. For example, individuals who are classified as employed, no matter how many hours they worked, are not asked the questions about having looked for work and cannot be classified as unemployed. Survey respondents are never asked specifically if they are unemployed, nor are they given an opportunity to decide their own labor force status. Similarly, an individual's personal activities or characteristics, like going to school, taking care of a family member, or the presence of a disability or long-term illness, do not determine how labor force status is measured. Their status will be determined based on how they respond to a specific set of questions about their recent labor market activities. For example, someone who "retired" from one job may be working at another job and, thus, is classified as employed.

The current concepts and definitions underlying the collection and estimation of labor force data are presented below. A more expanded, nontechnical discussion of the various labor force categories is available in the BLS publication "How the Government Measures Unemployment," online at <www.bls.gov/cps/cps_htgm.htm>.

**Reference week**. The CPS labor force questions ask about labor market activities for 1 week each month. This week is referred to as the "reference week." The reference week is defined as the 7-day period, Sunday through Saturday, that typically includes the twelfth of the month. (For November and December, the reference week and survey collection period may be moved 1 week earlier to avoid the Thanksgiving and Christmas holidays and allow enough time for processing between data collection.)

**Civilian noninstitutional population**. In the CPS, labor force data are restricted to people who currently reside in one of the 50 states or the District of Columbia, who do not reside in institutions (such as a correctional institution or a residential nursing or mental health care facility), and who are not on active duty in the armed forces. Although data are collected from household members 15 years and over, official labor force estimates refer to people 16 years and over.

**Employed people**. Employed people are those who, during the reference week, (1) did any work at all (for at least 1 hour) as paid employees; (2) worked for profit in their own business, profession, or farm; (3) worked 15 hours or more as unpaid workers in an enterprise operated by a family member they lived with; or (4) were temporarily absent from their jobs because of illness, bad weather, vacation, labor dispute, or another reason (whether or not they were paid for the time off or were seeking other jobs). Each employed person is counted only once, even if he or she holds more than one job. (See the discussion of multiple jobholders below.)

Citizens of foreign countries who are working in the United States, not living on the premises of an embassy, and not simply visiting or traveling, are included in the number of employed people. People whose only activity consisted of work around their own house (painting, repairing, cleaning, or other home-related housework) or

unpaid volunteer work for religious, charitable, or other organizations are excluded.

The key questions used to determine whether an individual is employed or not are presented at the end of this unit.

**Multiple jobholders**. These are employed people who, during the reference week, had two or more jobs as wage and salary workers; were self-employed and also held one or more wage and salary jobs; or worked as unpaid family workers and also held one or more wage and salary jobs. A person employed only in private households (cleaner, gardener, babysitter, etc.) who worked for two or more employers during the reference week is not counted as a multiple jobholder since working for several employers is considered an inherent characteristic of private household work. Self-employed people with multiple unincorporated businesses and people with multiple jobs as unpaid family workers are excluded.

CPS respondents are asked questions each month to identify multiple jobholders. First, all employed people are asked "Last week, did you have more than one job (or business, if one exists), including part-time, evening, or weekend work?" Those who answer "yes" are then asked, "Altogether, how many jobs (or businesses) did you have?"

**Hours of work**. Information on both actual and usual hours of work is collected. Published data on hours of work generally relate to the actual number of hours spent "at work" during the reference week. For example, people who normally work 40 hours a week but were off on the Labor Day holiday would be reported as working 32 hours, even though they were paid for the holiday. For people working more than one job, the published figures relate to the number of hours worked at all jobs during the week. Data on people "at work" exclude employed people who were absent from their jobs during the entire reference week for reasons such as vacation, illness, or industrial dispute.

Data are also available on usual hours worked by all employed people, including those who were absent from their jobs during the reference week.

**Usual full- or part-time status**. In order to differentiate a person's normal schedule from his or her activity during the reference week, people are also classified according to their usual full- or part-time status. In this context, full-time workers are defined as those who usually work 35 hours or more (at all jobs combined). This group includes some individuals who worked fewer than 35 hours in the reference week—for either economic or noneconomic reasons—as well as those who are temporarily absent from work. Similarly, part-time workers are those who usually work fewer than 35 hours per week (at all jobs combined), regardless of the number of hours worked in the reference week. This may include some individuals who actually worked more than 34 hours in the reference week, as well as those who were temporarily absent from work. The full-time labor force includes all employed people who usually work full-time and unemployed people who are looking for full-time work or are on layoff from full-time jobs. The part-time labor force consists of employed people who usually work part-time and unemployed people who are seeking or are on layoff from part-time jobs.

**At work part-time for economic reasons**. Sometimes referred to as involuntary part-time, this category refers to individuals who gave an economic reason for working 1 to 34 hours during the reference week. (This includes both those who usually work part-time and those who worked part-time in the reference week, but usually work full-time.) Economic reasons include slack work or unfavorable business conditions, inability to find full-time work, and seasonal declines in demand. Those who usually work part-time also must indicate that they want and are available to work full-time to be classified as being part-time for economic reasons.

**At work part-time for noneconomic reasons**. This group includes people who usually work part-time and were at work 1 to 34 hours during the reference week for a noneconomic reason. Noneconomic reasons include illness or other medical limitation, childcare problems or other family or personal obligations, school or training, retirement or social security limits on earnings, and being in a job where full-time work is less than 35 hours. The group also includes those who gave an economic reason for usually working 1 to 34 hours but said they do not want to work full-time or were unavailable for such work.

**Occupation, industry, and class of worker**. For the employed, this information applies to the job held

in the reference week. A person with two or more jobs is classified according to their main job—the job at which they usually worked the greatest number of hours. The unemployed are classified according to their last job, if any. CPS data use the census occupational and industry classification systems, which are based on the Standard Occupational Classification (SOC) and the North American Industry Classification System (NAICS). A list of these census codes can be found in the Alphabetical Index of Industries and Occupations at <www.census.gov/topics/employment/industry -occupation/guidance/indexes.html>.

The class-of-worker designation assigns workers to one of the following categories: wage and salary workers, self-employed workers, and unpaid family workers. Wage and salary workers are those who receive wages, salary, commissions, tips, or pay-in-kind from a private employer or from a government unit. The class-of-worker question also includes separate response categories for government, private for-profit company, and non-profit organization to further classify wage and salary workers. The self-employed are those who work for profit or fees in their own businesses, professions, trades, or farms. Self-employed individuals are identified as those whose businesses are either incorporated or unincorporated. Typically, self-employment refers to only the unincorporated self-employed category since those whose businesses are incorporated are technically wage and salary employees of the corporation. However, BLS publishes some data separately for the unincorporated self-employed and the incorporated self-employed. Unpaid family workers are individuals working without pay for 15 hours a week or more on a farm or in a business operated by a member of the household to whom they are related by birth, marriage, or adoption.

**Occupation, industry, and class of worker on second job**. The occupation, industry, and class-of-worker information for individuals' second jobs is collected in order to obtain a more accurate measure of multiple jobholders and to obtain more detailed information about their employment characteristics. For the majority of multiple jobholders, occupation, industry, and class-of-worker data for their second jobs are collected only from one-fourth of the sample—those in their fourth or eighth monthly interview. However, for those who say they are "self-employed, unincorporated" on

their main jobs, class of worker of the second job is collected each month. This is done because, according to the official definition, individuals who are "self-employed, unincorporated" on both of their jobs are not considered multiple jobholders.

**Earnings**. Information on what people earn at their main job is collected only for those who are receiving their fourth or eighth monthly interviews. This means that earnings questions are asked of only one-fourth of the survey respondents each month. Employed respondents are asked to report their usual earnings before taxes and other deductions and to include any overtime pay, commissions, or tips usually received. The term "usual" is as perceived by the respondent. If the respondent asks for a definition of usual, interviewers are instructed to define the term as more than half the weeks worked during the past four or five months. Respondents may report earnings in the period of time they prefer—for example, hourly, weekly, biweekly, monthly, or annually. (Allowing respondents to report in a periodicity with which they are most comfortable was a feature added in the 1994 redesign.) Based on additional information collected during the interview, earnings reported on a basis other than weekly are converted to a weekly amount in later processing. Data are collected for wage and salary workers, and for self-employed people whose businesses are incorporated; earnings data are not collected for self-employed people whose businesses are unincorporated. (Earnings data are not edited and are not released to the public for the "self-employed whose businesses are incorporated.") These earnings data are used to construct estimates of the distribution of usual weekly earnings and median earnings. Individuals who do not report their earnings on an hourly basis are asked if they are, in fact, paid at an hourly rate and if so, what the hourly rate is. The earnings of those who reported hourly and those who are paid at an hourly rate are used to analyze the characteristics of hourly paid workers such as those who are paid the minimum wage.

**Unemployed people**. All people who were not employed during the reference week but were available for work (excluding temporary illness) and had made specific efforts to find employment some time during the 4-week period ending with the reference week are classified as unemployed. Individuals who were waiting to be recalled to a

job from which they had been laid off need not have been looking for work to be classified as unemployed.

People waiting to start a new job must have actively looked for a job within the last 4 weeks in order to be counted as unemployed. Otherwise, they are classified as not in the labor force.

As the definition indicates, there are two ways people may be classified as unemployed. They are either looking for work (job seekers) or they have been temporarily separated from a job (people on layoff). Job seekers must have engaged in an active job search during the above-mentioned 4-week period in order to be classified as unemployed. Active methods are defined as job search methods that have the potential to result in a job offer without any further action on the part of the job seeker. Examples of active job search methods include contacting an employer directly, using a public or private employment agency, seeking assistance from friends or relatives, placing or answering ads, or using some other active method. Examples of the "other active" category include auditioning for a part in a play, bidding on a contract, or waiting at a designated labor pickup point. Passive methods, which do not qualify as job search, include simply reading "help wanted" ads, researching companies as places to work, and taking a job training course, as opposed to actually answering "help wanted" ads or posting a resume online. The response categories for active and passive methods are clearly delineated in separately labeled columns on the interviewers' computer screens. Job search methods are identified by the following questions: "Have you been doing anything to find work during the last 4 weeks?" and "What are all of the things you have done to find work during the last 4 weeks?" To ensure that respondents report all of the methods of job search used, interviewers ask "Anything else?" after the initial or a subsequent job search method is reported.

Persons "on layoff" are defined as those who have been separated from a job to which they are waiting to be recalled (i.e., their layoff status is temporary). In order to measure layoffs accurately, the questionnaire determines whether people reported to be on layoff did in fact have an expectation of recall; that is, whether they had been given a specific date to return to work or, at least, had been given an indication that they would be recalled within the next 6 months. As previously mentioned, people on layoff need not be actively seeking work to be classified as unemployed.

The key questions used to classify an individual as unemployed are presented at the end of this unit.

**Reason for unemployment**. Unemployed individuals are categorized according to their status at the time they became unemployed. The categories are:

- Job losers and people who completed temporary jobs: a group composed of (1) people on temporary layoff from a job to which they expect to be recalled, (2) permanent job losers, whose employment ended involuntarily and who began looking for work, and (3) people who completed temporary jobs—that is, individuals who began looking for work after their jobs ended.

- Job leavers: people who quit or otherwise terminated their employment voluntarily and began looking for work.

- Reentrants: unemployed people who previously worked but were out of the labor force prior to beginning their job search.

- New entrants: unemployed individuals who never worked before and who were entering the labor force for the first time.

**Duration of unemployment**. The duration of unemployment is typically expressed in weeks, although the survey collects information in weeks, months, or years. For individuals classified as unemployed because they are looking for work, the duration of unemployment is the length of time (through the current reference week) that they have been looking for work. For people on layoff, the duration of unemployment is the number of weeks (through the reference week) they have been on layoff.

**Not in the labor force**. Included in this group are all members of the civilian noninstitutional population who are neither employed nor unemployed. Information is collected on their desire for and availability to take a job at the time of the CPS interview, job search activity in the prior year, and

reason for not looking in the 4-week period prior to the survey week. Responses to the question "Do you currently want a job, either full- or part-time?" are used in determining desire for work.

The not-in-labor-force group includes a subset of individuals marginally attached to the labor force, defined as people not working who want and are available for a job and who have looked for work sometime in the past 12 months (or since the end of their last job if they held one within the past 12 months). They are not counted as unemployed because they had not actively searched for work in the prior 4 weeks. Within the marginally attached group are discouraged workers—people who are not currently looking for work because they believe there are no jobs available or there are none for which they would qualify. Reasons identified by discouraged workers for not recently looking for work are:

- Belief that no work is available in line of work or area.

- Inability to find any work.

- Lack of necessary schooling, training, skills, or experience.

- Belief that employers have age bias.

- Belief that there are other types of discrimination.

The other persons marginally attached to the labor force group includes persons who want a job but had not looked for work in the past 4 weeks for reasons such as family responsibilities, being in school or training, ill health or disability, or transportation problems.

Estimates of the number of employed and unemployed are used to construct a variety of measures. These measures include:

- Labor force. The labor force consists of all people aged 16 and older in the civilian non-institutional population classified as employed or unemployed according to the criteria described above. In other words, the labor force level is the number of people who are either working or actively seeking work.

- Unemployment rate. The unemployment rate represents the number of unemployed as a percentage of the labor force.

- Labor force participation rate. The labor force participation rate is the proportion of the age-eligible, civilian, noninstitutional population that is in the labor force. For the CPS, the age-eligible population consists of people aged 16 and older. It represents the proportion of the population that is either working or unemployed and actively seeking work or are temporarily laid off from a job to which they expect to be recalled.

- Employment-population ratio. The employment population ratio is the number of employed people aged 16 and older as a percentage of the civilian noninstitutional population. It represents the proportion of the population that is working.

## KEY QUESTIONS FOR EMPLOYED AND UNEMPLOYED

1. Does anyone in this household have a business or a farm?
   *This question is asked once for each household. A series of questions is then asked for each household member. The parentheticals below are filled if there is a business or farm in the household.*

2. LAST WEEK, did you do ANY work for (either) pay (or profit)?

3. LAST WEEK, did you do any unpaid work in the family business or farm?

4. LAST WEEK, (in addition to the business) did you have a job, either full- or part-time? Include any job from which you were temporarily absent.

5. LAST WEEK, were you on layoff from a job?

6. Has your employer given you a date to return to work?

7. Have you been given any indication that you will be recalled to work within the next 6 months?

8. Have you been doing anything to find work during the last 4 weeks?

9. What are all of the things you have done to find work during the last 4 weeks?
   *Interviewers ask "Anything else?" until all of the methods of job search used by the individual are reported.*

10. LAST WEEK, could you have started a job if one had been offered?

*Individuals are classified as employed if they say "yes" to questions 2, 3 (and work 15 hours or more in the reference week or receive profits from the business or farm), or 4.*

*Individuals who are available to work ("yes" to 10) are classified as unemployed if they say "yes" to 5 and either 6 or 7 (on temporary layoff), or if they say "yes" to 8 and provide an active job search method (one that could potentially result in a job offer) in 9.*

For a complete version of the questionnaire, see the CPS Web site at <www.census.gov/programs-surveys/cps/technical-documentation/questionnaires.html>.

## REFERENCES

U.S. Department of Commerce, U.S. Census Bureau, Alphabetical Index of Industries and Occupations, 2014, retrieved from <www.census.gov/topics/employment/industry-occupation/guidance/indexes.html>.

U.S. Department of Labor, U.S. Bureau of Labor Statistics, How the Government Measures Unemployment, 2015, retrieved from <www.bls.gov/cps/cps_htgm.htm>.

## FURTHER READING

U.S. Bureau of Labor Statistics definitions related to Current Population Survey concepts retrieved from <www.bls.gov/cps/definitions.htm>.

U.S. Census Bureau definitions related to Current Population Survey concepts retrieved from <www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html>.

# Chapter 1-3: Supplements

## INTRODUCTION

In addition to providing data on the labor force status of the population, the CPS supports a variety of supplemental studies on the entire U.S. population and specific population subsets. Upon completing the basic CPS interview, some respondents are requested to answer a series of supplemental questions. These questions provide information on the economic and social well-being of the nation. Federal agencies and federal independent organizations sponsor these supplemental data collections. Supplemental inquiries take advantage of several special features of the CPS such as large sample size; general-purpose design; highly skilled, experienced interviewing and field staff; and generalized processing systems that can easily accommodate the inclusion of additional questions.

Some CPS supplemental inquiries are conducted annually, others are every other year, and still other inquiries are on a one-time basis. The frequency and recurrence of a supplement depend on what best meets the needs of the supplement's sponsor. In addition, any supplemental inquiry must meet the strict criteria discussed in the next section.

Producing supplemental data from the CPS involves more than including additional questions. Separate data processing is required to edit responses for consistency and sometimes to impute missing values. Additional weighting methods are often necessary because the supplement targets a different universe from that of the basic CPS. A supplement can also engender a different level of response or cooperation from respondents.

With the many different subject matters that the supplements address, the level of data (data about household versus data about individuals), target populations, contact strategies, and weighting procedures, etc., may differ from that of the CPS.

## CRITERIA FOR CURRENT POPULATION SURVEY SUPPLEMENTS

Over the years, the Census Bureau, in consultation with BLS, has developed and refined a number of criteria to determine the acceptability of undertaking supplements for federal agencies or federal independent organizations.

Working with the sponsors, the staff of the Census Bureau develop the survey design including the methodologies, questionnaires, pretesting options, interviewer instructions, and processing requirements. The Census Bureau provides a written description of the statistical properties associated with each supplement. The same standards of quality that apply to the basic CPS also apply to the supplements.

The Census Bureau considers the following criteria before undertaking a supplement:

- The subject matter of the inquiry must be in the public interest and must be appropriate for inclusion in a government-run survey. The questions should be of a factual nature rather than gathering opinions.

- The inquiry must not have an adverse effect on the CPS or on the image of BLS or the Census Bureau. Specifically, the questions must not be so far removed from the subject and tenor of the basic CPS or from the missions of BLS and the Census Bureau that they damage survey or institutional legitimacy. They must not cause respondents to question the importance of the survey or result in significantly decreased response rates or data quality. BLS and the Census Bureau must not be affected in terms of congressional acceptance and approval of their programs.

- The subject matter must be compatible with the basic CPS survey and not introduce a concept that could affect the accuracy of responses to the basic CPS information. For example, a series of questions incorporating a revised labor force concept could

inadvertently affect responses to the standard labor force items and would not be allowed.

- The subject matter must not be sensitive. This criterion is imprecise, and its interpretation has changed over time. For example, the subject of birth expectations, once considered sensitive, has been included as a CPS supplemental inquiry. Religious affiliation and activity are examples of subjects currently considered sensitive.

- The inquiry must not slow down the work of the basic survey or impose a response burden that may affect future participation in the basic CPS. In general, the supplemental inquiry must not add more than 10 minutes of interview time per household. Competing requirements for the use of BLS and Census Bureau staff or facilities that arise in dealing with a supplemental inquiry are resolved by giving the basic CPS first priority. BLS and the Census Bureau will not jeopardize the schedule for completing the basic CPS or other work to favor completing a supplemental inquiry within a specified time frame.

- It must be possible to meet the objectives of the inquiry through survey methods. That is, it must be possible to translate the supplemental survey's objectives into meaningful questions, and the respondent must be able to supply the information required to answer the questions.

- If the Census Bureau is to collect the supplemental information during the CPS interview, the inquiry must be suitable for the personal visit and telephone procedures used in the CPS.

- All supplements must abide by the Census Bureau's enabling legislation, which, in part, ensures that the Census Bureau will not release information that can identify any individual. Requests for a person's name, address, social security number, or other information that can directly identify an individual will not be included in the dataset. In addition, information that could be used to indirectly identify an individual with a high probability of success (e.g., small geographic areas in conjunction with income or age) will be suppressed.

- The cost of supplements must be borne by the sponsor, regardless of the nature of the request or the relationship of the sponsor to the ongoing CPS. The questionnaires developed for the supplement are subject to BLS' and the Census Bureau's pretesting policies. These policies encourage questionnaire research aimed at improving data quality. While BLS and the Census Bureau may reject proposed supplement questions and topics, they cannot give final approval of questions or supplements. The Office of Management and Budget (OMB), through its Statistical Policy Division, reviews the proposed supplement to make certain it meets government-wide standards regarding the need for the data and the appropriateness of the design and ensures that the survey instruments, strategy, and response burden are acceptable. They may not allow some questions, or even whole supplements, that had been approved by the BLS and Census Bureau. The risk of this occurring is minimized by consulting with OMB early in the development process if there is some question about the appropriateness or validity of the proposed questions.

## RECENT CURRENT POPULATION SURVEY SUPPLEMENTS

The scope and type of CPS supplements vary considerably from month to month and from year to year. Generally, the interviewers ask the selected respondent(s) the additional questions that are included in the supplemental survey after completing the basic CPS. Table 1-3.1 summarizes CPS supplements that were conducted between January 2004 and December 2017.

Table 1-3.1.
## Current Population Survey Supplements, January 2004–December 2017

| Title | Month and year(s) | Purpose | Recent sponsor |
|---|---|---|---|
| Annual Social and Economic Supplement | February, March, April 2004–2017 | Provide data concerning family characteristics, household composition, marital status, educational attainment, health insurance coverage, foreign-born population, prior year's income from all sources, work experience, receipt of noncash benefit, poverty, program participation, and geographic mobility. | Census Bureau/ Bureau of Labor Statistics (BLS) |
| Child Support | April 2004, 2006, 2008, 2010, 2012, 2014, 2016 | Identify households with absent parents and provide data on child support arrangements, visitation rights of absent parent, amount and frequency of actual versus awarded child support, and health insurance coverage. Also provide data on why child support was not received or awarded. | Office of Child Support Enforcement |
| Civic Engagement | November 2008, 2009, 2010, 2011, 2013 | Provide information on the extent to which our nation's communities are places where individuals are civically active. | Corporation for National and Community Service (CNCS) |
| Computer Use/ Internet Use | October 2007, July 2011, July 2013, July 2015, November 2017 | Provide information about household access to computers and the use of the Internet. | National Telecommunications and Information Administration |
| Contingent Workers | February 2005, May 2017 | Provide information on the type of employment arrangement workers have on their current job and other characteristics of the current job, e.g., earnings, benefits, longevity, along with their satisfaction with and expectations for their current jobs. | Department of Labor |
| Disability | May 2012 | Provide information on labor market challenges facing people with a disability. | Office of Disability Employment Policy |
| Displaced Workers | January 2004, 2006, 2008, 2010, 2012, 2014, 2016 | Provide data on workers who lost a job in the last 5 years because of plant closing, shift elimination, or other work-related reason. | Department of Labor |
| Fertility | June 2004, 2006, 2008, 2010, 2012, 2014, 2016 | Provide data on the number of children that women aged 15 through 44 have ever had and the children's characteristics. | Census Bureau |
| Food Security | December 2004–2017 | Provide data that will measure hunger and food security such as food expenditure, access to food, and food quality and safety. | Food and Nutrition Service |
| Housing Vacancy | Monthly | Provide quarterly data on vacancy rates and characteristics of vacant units. | Census Bureau |
| International Migration | August 2008 | Provide information on how migration patterns have changed, as well as how migrants adapt to living in the United States. | Census Bureau |
| Participation in the Arts (PPA)/ Annual Arts Benchmark Survey (AABS) | PPA: February 2008, February 2012<br><br>AABS: February 2013, 2014, 2015, 2016 | PPA provides data on the type and frequency of adult participation in the arts; training and exposure (particularly while young); and their musical artistic activity preferences.<br><br>AABS collects a subset of the same information from PPA. | National Endowment for the Arts |

U.S. Bureau of Labor Statistics and U.S. Census Bureau

Table 1-3.1.
**Current Population Survey Supplements, January 2004–December 2017**—Con.

| Title | Month and year(s) | Purpose | Recent sponsor |
|---|---|---|---|
| School Enrollment | October 2004–2017 | Provide information on the population 3 years and older on school enrollment, junior or regular college attendance, and high school graduation. | BLS/Census Bureau/ National Center for Education Statistics |
| Tobacco Use | May 2006, August 2006, January 2007, May 2010, August 2010, January 2011, July 2014, January 2015, May 2015 | Provide data for population 15 years and older on current and former use of tobacco products; restrictions of smoking in workplace for employed persons; and personal attitudes toward smoking. | National Cancer Institute/Food and Drug Administration |
| Unbanked and Underbanked | June 2009, 2011, 2013, 2015, 2017 | Provide data on unbanked and underbanked households, their demographic characteristics, and their reasons for being unbanked and underbanked. | Federal Deposit Insurance Corporation |
| Unemployment Insurance Nonfiler | January, May, July, November 2005 | Provide data on individuals who do apply for unemployment insurance and the reasons they do not apply. | Department of Labor |
| Veterans | August 2005, 2007, 2009, July 2010, August 2011–2017 | Provide data for veterans of the Unites States on Vietnam-theater and Persian Gulf-theater status, service-connected income, effect of a service-connected disability on current labor force participation, and participation in veterans' programs. | Veterans' Employment and Training Service and Department of Veterans Affairs |
| Volunteers | September 2004–2015 | Provide a measurement of participation in volunteer service, specifically about the frequency of volunteer activity, the kinds of organizations volunteered with, and types of activities chosen. Among nonvolunteers, questions identify what barriers were experienced in volunteering, or what encouragement is needed to increase participation. | CNCS |
| Voting and Registration | November 2004, 2006, 2008, 2010, 2012, 2014, 2016 | Provide demographic information on persons who did and did not register to vote. Also measures number of persons who voted and reasons for not registering. | Census Bureau |

A widely used supplement is the ASEC that the Census Bureau conducts every February, March, and April. This supplement collects data on work experience, several sources of income, poverty, migration, household composition, health insurance coverage, and receipt of noncash benefits.

The Housing Vacancy Survey (HVS) is unusual in that it is conducted every month. The HVS collects additional information (e.g., number of rooms, plumbing, and rental or sales price) on HUs identified as vacant in the basic CPS.

The basic CPS weighting is not always appropriate for supplements, since supplements tend to have higher response rates. In general, only CPS respondents are requested to participate in supplements. So, response to supplements is conditional on CPS response. In addition, supplement universes may be different from the basic CPS universe. Thus, some supplements require weighting procedures that are different from those of the basic CPS.

Although it is not a supplement, there is one survey that uses the CPS as its sampling frame: the American Time Use Survey (ATUS). The ATUS draws sample households from households that have completed their final CPS interview. The ATUS, which is conducted 2 to 5 months after the final CPS interview, collects information about how people spend their time. More information about the ATUS, including sampling and weighting procedures, can be found in the American Time Use Survey User's Guide, at <www.bls.gov/tus/atususersguide.pdf>.

## HOUSING VACANCY SURVEY

### Description of supplement

The Housing Vacancy Survey (HVS) is a monthly supplement to the CPS. The Census Bureau administers this supplement when the CPS interviewers encounter a sample unit that is intended for year-round or seasonal occupancy and is currently vacant or occupied by people with a usual residence elsewhere. The interviewer asks a reliable respondent (e.g., the owner, a rental agent, or a knowledgeable neighbor) questions on year built; number of rooms, bedrooms, and bathrooms; how long the HU has been vacant; the vacancy status (for rent, for sale, etc.); and when applicable, the selling price or rent amount.

The purpose of the HVS is to provide current information on the rental and homeowner vacancy rates, home ownership rates, and characteristics of units available for occupancy. The rental vacancy rate is a component of the index of leading economic indicators, which is used to gauge the current economic climate. Although the Census Bureau performs this survey monthly, data for the nation and for the Northeast, South, Midwest, and West regions are released quarterly and annually. The data released annually include information for states and large metropolitan areas.

### Calculation of vacancy rates

The HVS collects data on year-round and seasonal vacant units. Vacant year-round units are those intended for occupancy at any time of the year, even though they may not be in use year-round. In resort areas, a HU that is intended for occupancy on a year-round basis is considered a year-round unit; those intended for occupancy only during certain seasons of the year are considered seasonal. In addition, vacant HUs held for occupancy by migratory workers employed in farm work during the crop season are classified as seasonal.

The rental and homeowner vacancy rates are the most prominent HVS statistics. The vacancy rates are determined using information collected by the HVS and CPS, since the rates are calculated using both vacant and occupied HUs.

The rental vacancy rate is the ratio of vacant year-round units for rent to the sum of renter-occupied units, vacant year-round units rented but awaiting occupancy, and vacant year-round units for rent.

The homeowner vacancy rate is the ratio of vacant year-round units for sale to the sum of owner-occupied units, vacant year-round units sold but awaiting occupancy, and vacant year-round units for sale.

### Weighting procedure

Since the HVS universe differs from the CPS universe, the HVS records require a different weighting procedure from the CPS records. The HVS records are weighted by the CPS basic weight, the CPS special weighting factor, two HVS adjustments, and a regional HU adjustment. (Refer to Chapter 2-3, Weighting and Estimation, for a

description of the CPS weighting adjustments.) The two HVS adjustments are referred to as the HVS first-stage weighting adjustment factor and the HVS second-stage weighting adjustment factor.

The HVS first-stage adjustment factor is comparable to the CPS first-stage adjustment factor in that it reduces the contribution to variance from the sampling of Primary Sampling Units (PSUs). The adjustment factors are based on 2010 Census data. There are separate first-stage factors for year-round and seasonal HUs. For each state, they are calculated as the ratio of the state-level census count of vacant year-round or seasonal HUs in all non-self-representing (NSR) PSUs to the corresponding state-level estimate of vacant year-round or seasonal HUs from the sample NSR PSUs. The appropriate first-stage adjustment factor is applied to every vacant year-round and seasonal HU in the NSR PSUs. The following formula is used to compute the first-stage adjustment factors for each state for the year-round and seasonal HUs:

$$FS_s = \frac{\sum_{i=1}^{n} C_{s,i}}{\sum_{k=1}^{m} \left(\frac{1}{\pi_{sk}}\right)(C_{s,k})}$$

where

$FS_s$ = The first-stage ratio adjustment factor for state $s$.

$C_{S,i}$ = The number of seasonal or year-round vacancies based on 2010 census data for all NSR PSU $i$ (sample and nonsample) in state $s$.

$C_{S,k}$ = The number of seasonal or year-round vacancies based on 2010 census data for only sampled NSR PSU $k$ in state $s$.

$\pi_{S,k}$ = The probability of selection for sample PSU in state $s$.

$n$ = The number of NSR PSUs (sample and nonsample) in state $s$.

$m$ = The number of NSR sample PSUs in state $s$.

The HVS second-stage adjustment, which applies to vacant year-round and seasonal HUs in self-representing and NSR PSUs, is calculated as the ratio

of the weighted CPS interviewed HUs after CPS second-stage adjustment to the weighted CPS interviewed HUs after CPS first-stage adjustment. The cells for the HVS second-stage adjustment are calculated within each month-in-sample (MIS) by census region and type of area (metropolitan or nonmetropolitan, central city or balance of Core Based Statistical Area, and urban or rural). This adjustment is made to all eligible HVS records.

The regional HU adjustment is the final stage in the HVS weighting procedure. The factor is calculated as the ratio of the HU control estimates (including occupied and vacant HUs) by the four major geographic regions of the United States (Northeast, South, Midwest, and West) supplied by the Population Division, to the sum of estimated occupied (from the CPS) plus vacant HUs, through the HVS second-stage adjustment. This factor is applied to both occupied and vacant HUs.

The final weight for each HVS record is determined by calculating the product of the CPS basic weight, the HVS first-stage adjustment, and the HVS second-stage adjustment, that is,

Final weight = (baseweight)
x (HVS first-stage adjustment)
x (HVS second-stage adjustment).

The occupied units in the denominator of the vacancy rate formulas use a different final weight since the data come from the CPS. The final weight applied to the renter-occupied and owner-occupied units is the CPS household weight. (Refer to Chapter 2-3, Weighting and Estimation, for a description of the CPS household weight.)

## ANNUAL SOCIAL AND ECONOMIC SUPPLEMENT

### Description of supplement

The Census Bureau and BLS sponsor the ASEC. The Census Bureau has collected ASEC data since 1947. From 1947 to 1955, the ASEC interviews took place in April; from 1956 to 2001, the ASEC interviews took place in March; and from 2002 to the present, the ASEC interviews take place in February, March, and April, with most interviews in March.

Prior to 2003, the ASEC was known as the Annual Demographic Supplement (ADS) or the March Supplement. In 2001,[2] a sample increase was implemented that required more time for data collection. Thus, additional ASEC interviews now take place in February through April.

The supplement collects data on health insurance coverage, work experience, and income from all sources, receipt of noncash benefits, poverty, program participation, and geographic mobility. A major reason for conducting the ASEC in the month of March is to obtain better income data, given proximity to tax season. The universe of the ASEC is slightly different from that of the basic CPS—it includes certain members of the armed forces. This difference requires some minor changes to the weighting methodology.

## Sample

The ASEC sample consists of the March CPS sample, plus additional CPS households identified in prior CPS samples and the following April CPS sample. Table 1-3.2 shows the months when the eligible sample is identified for years 2001 through 2017. Starting in 2004, the eligible ASEC sample households are:

- The entire March CPS sample—8 MIS groups.

- Hispanic households—identified in November (from all eight MIS groups)

- Hispanic households—identified in April (from MIS 1 and 5 groups)—a total of two additional MIS groups.

- Non-Hispanic, non-White households—identified in August (MIS 8), September (MIS 8),

October (MIS 8), November (MIS 1 and 5), and April (MIS 1 and 5)—a total of seven additional MIS groups.

- Non-Hispanic White households with children 18 years or younger—identified in August (MIS 8), September (MIS 8), October (MIS 8), November (MIS 1 and 5), and April (MIS 1 and 5)—a total of seven additional MIS groups.

Prior to 1976, no additional sample households were added. From 1976 to 2001, only the November CPS households containing at least one person of Hispanic origin (item 2 above) were added to the ASEC. The rest of the households (items 3, 4, and 5 above) were added in 2001, along with a general sample increase in selected states, and are collectively known as the Children's Health Insurance Program (CHIP) sample expansion.[3] The added households improve the precision of the ASEC estimates for the Hispanic households; non-Hispanic, non-White households; and non-Hispanic White households with children 18 years or younger.

Because of the characteristics of CPS sample rotation (see Chapter 2-2, Sample Design), the additional cases from the August, September, October, November, and April CPS do not overlap with those in the March CPS. The March CPS sample alone consists of eight MIS groups. The additional sample cases in the ASEC increase its effective sample size in comparison. The ASEC sample includes 18 MIS groups for Hispanic households, 15 MIS groups for non-Hispanic, non-White households, 15 MIS groups for non-Hispanic White households with children 18 years or younger, and 8 MIS groups for all other households.

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[2] The Census Bureau first used the expanded sample in 2001 for testing and was not included in the official ADS statistics for 2001. The statistics from 2002 are the first official set of statistics published by the Census Bureau using the expanded sample. The 2001 expanded sample statistics were released and are used for comparing the 2001 data to the official 2002 statistics.

[3] The CHIP was formerly known as the State Children's Health Insurance Program. For additional information about CHIP, see Unit 2-2, Sample Design.

Table 1-3.2
## Month-In-Sample Groups Included in the Annual Social and Economic Supplement Sample for Years 2001 to 2017[1]

| Current Population Survey month/Hispanic status | | Month-in-sample | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| August | Hispanic[2] | NI | | | | | | | |
| | Non-Hispanic[3] | NI | | | | | | | 2004–2017[1] |
| September | Hispanic[2] | NI | | | | | | | |
| | Non-Hispanic[3] | NI | | | | | | | 2004–2017[1] |
| October | Hispanic[2] | NI | | | | | | | |
| | Non-Hispanic[3] | NI | | | | | | | 2003–2017[1] |
| November | Hispanic[2] | 2001–2017[1] | | | | | | | |
| | Non-Hispanic[3] | 2001–2017[1] | NI | | | 2001–2017[1] | 2001–2002 | 2001–2003 | 2001–2003 |
| March | Hispanic[2] | 2001–2017[1] | | | | | | | |
| | Non-Hispanic[3] | 2001–2017[1] | | | | | | | |
| April | Hispanic[2] | 2001–2017[1] | NI | | | 2001–2017[1] | NI | | |
| | Non-Hispanic[3] | 2001–2017[1] | NI | | | 2001–2017[1] | NI | | |

NI Not interviewed for the Annual Social and Economic Supplement.

[1] The 2010 sample design was phased-in in 2014. The month-in-sample groups for 2014 continue in subsequent years.

[2] Hispanics may be any race.

[3] The non-Hispanic group includes both non-Hispanic, non-Whites, and non-Hispanic Whites with children 18 years or younger.

Prior to 2004, non-Hispanic, non-White and non-Hispanic White with children-under-18 households were selected from different months-in-sample. This table shows the sample selection as of 2004.

The March and April ASEC eligible cases are given the ASEC questionnaire in those respective months (see Table 1-3.3). The November eligible Hispanic households are administered the ASEC questionnaire in February for November MIS groups 1 and 5, during their regular CPS interviewing time, and the remaining MIS groups (MIS 2 to 4 and 6 to 8) receive the ASEC interview in March. November MIS 6 to 8 households have already completed all 8 months of interviewing for the CPS before March, and the November MIS 2 to 4 households have an extra contact scheduled for the ASEC before the fifth interview of the CPS later in the year.

The August, September, October, and November eligible non-Hispanic households are given the ASEC questionnaire in either February or April.

November ASEC-eligible cases in MIS 1 and 5 are interviewed for the CPS in February (in MIS 4 and 8, respectively), so the ASEC questionnaire is given in February. The August, September, and October MIS 8 eligible cases are split between the February and April CPS interviewing months. The households in other rotation groups in February and April receive the corresponding CPS non-ASEC supplement for that month.

Mover households are defined at the time of the ASEC interview as households with a different reference person when compared to the previous CPS interview or the person causing the household to be eligible has moved out (i.e., the Hispanic person or other race minority moved out or a single child aged the household out of eligibility). Mover households identified from the August, September, October, and November eligible sample are removed from the ASEC sample. Mover households identified in the March and April eligible sample receive the ASEC questionnaire.

Table 1-3.3.
## Summary of the Annual Social and Economic Supplement Interview Months

| Current Population Survey month/Hispanic status | | Month-in-sample | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mover | | | | | | | | Nonmover | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| August | Hispanic[1] | NI | | | | | | | | NI | | | | | | | |
| | Non-Hispanic[2] | NI | | | | | | | | NI | | | | | | | Feb |
| September | Hispanic[1] | NI | | | | | | | | NI | | | | | | | |
| | Non-Hispanic[2] | NI | | | | | | | | NI | | | | | | | Feb |
| October | Hispanic[1] | NI | | | | | | | | NI | | | | | | | |
| | Non-Hispanic[2] | NI | | | | | | | | NI | | | | | | | Apr |
| November | Hispanic[1] | NI | | | | | | | | Feb | | March | | Feb | | March | |
| | Non-Hispanic[2] | NI | | | | | | | | Feb | | NI | | Feb | | NI | |
| March | Hispanic[1] | March | | | | | | | | March | | | | | | | |
| | Non-Hispanic[2] | | | | | | | | | | | | | | | | |
| April | Hispanic[1] | Apr | NI | | | Apr | NI | | | Apr | NI | | | Apr | NI | | |
| | Non-Hispanic[2] | | | | | | | | | | | | | | | | |

NI Not interviewed for the Annual Social and Economic Supplement.

[1] Hispanics may be any race.

[2] The non-Hispanic group includes both non-Hispanic, non-Whites, and non-Hispanic Whites with children 18 years or younger.

## Weighting procedure

Prior to weighting, missing supplement items are assigned values based on hot deck imputation, a method in which each missing value is replaced with an observed response from a "similar" unit. Values are imputed even if all of the supplement data are missing; thus, there is no separate adjustment for households that respond to the basic CPS survey but not to the supplement. The ASEC records are weighted by the CPS base weight, the CPS special weighting factor,[4] the CPS noninterview adjustment, the CPS first-stage adjustment, and the CPS second-stage adjustment procedure. (Chapter 2-3, Weighting and Estimation, contains a description of these adjustments.) The ASEC also receives an additional noninterview adjustment for the August, September, October, and November ASEC sample, a CHIP Adjustment Factor, a family equalization adjustment, and weights applied to armed forces members.

The August, September, October, and November eligible samples are each weighted through the CPS noninterview adjustment and then combined. A noninterview adjustment for the combined samples and the CPS first-stage adjustments are applied before the CHIP adjustment is applied.

The March eligible sample and the April eligible sample are also weighted separately before the second-stage weighting adjustment. All of the samples are then combined so that one second-stage adjustment procedure is performed. The flowchart in Figure 1-3.1 illustrates the weighting process for the ASEC sample.

**Households from August, September, October, and November eligible samples**: The households from the August, September, October, and November eligible samples start with their base CPS weight as calculated in the appropriate month, modified by the appropriate CPS special weighting factor and appropriate CPS noninterview adjustment in the August, September, October, or November interviews. Next, a second noninterview adjustment is made for eligible households that are still occupied but for which an interview could not be obtained to account for the nonrespondent households in the February, March, or April interviews. Then, the ASEC sample weights for the prior sample are adjusted by the CPS first-stage adjustment and the CHIP Adjustment Factor.

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[4] For the 2010 Sample Design, the CPS special weighting factor applies only to group quarters frame units.

Figure 1-3.1.
**Diagram of the Annual Social and Economic Supplement Weighting Scheme**
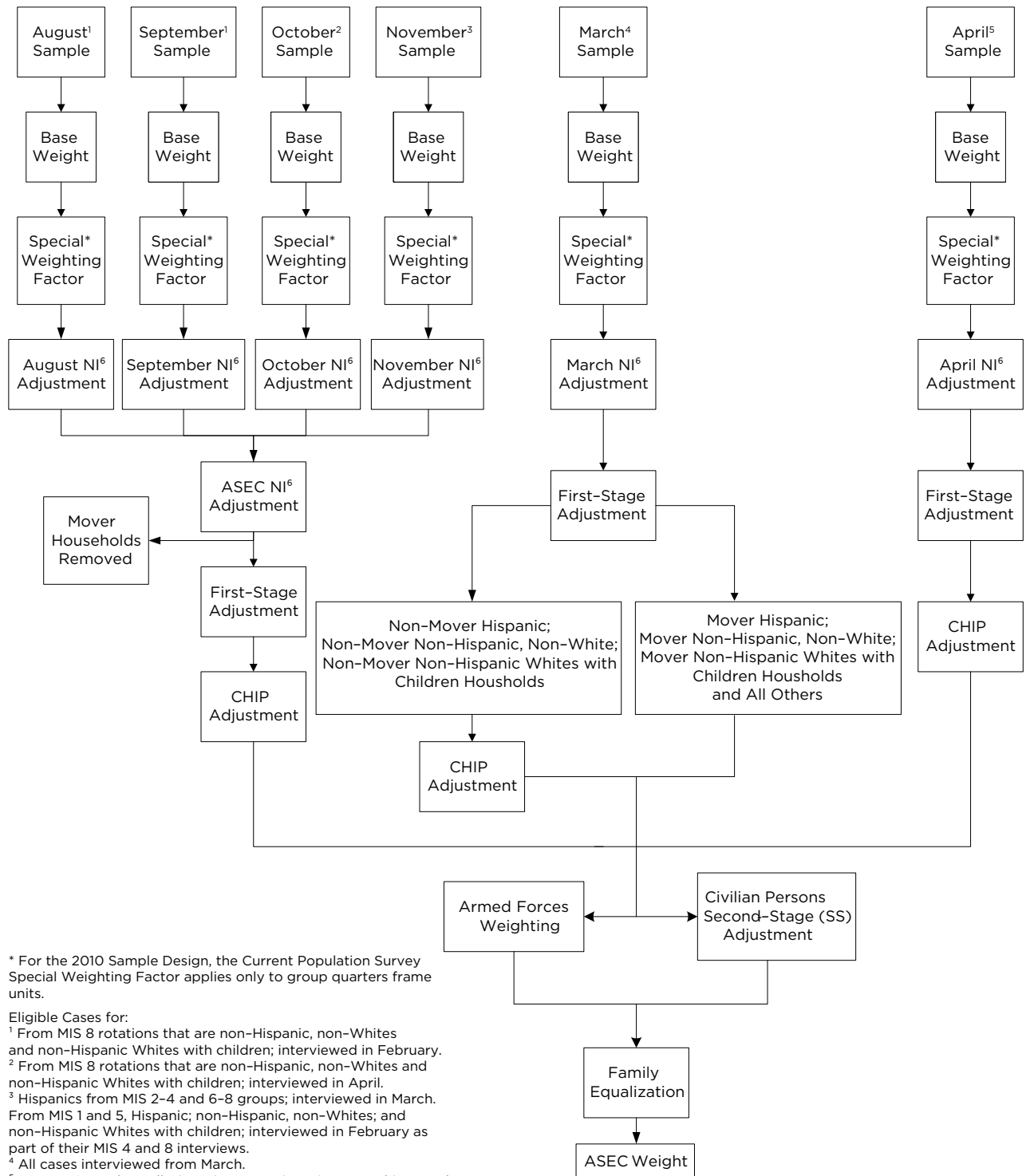


* For the 2010 Sample Design, the Current Population Survey Special Weighting Factor applies only to group quarters frame units.

Eligible Cases for:
[1] From MIS 8 rotations that are non–Hispanic, non–Whites and non–Hispanic Whites with children; interviewed in February.
[2] From MIS 8 rotations that are non–Hispanic, non–Whites and non–Hispanic Whites with children; interviewed in April.
[3] Hispanics from MIS 2–4 and 6–8 groups; interviewed in March. From MIS 1 and 5, Hispanic; non–Hispanic, non–Whites; and non–Hispanic Whites with children; interviewed in February as part of their MIS 4 and 8 interviews.
[4] All cases interviewed from March.
[5] From MIS 1 and 5, all Hispanics; non–Hispanic, non–Whites; and non–Hispanic Whites with children; all interviewed in April.
[6] NI (Not interviewed for the Annual Social and Economic Supplement.)

*The ASEC noninterview adjustment for the August, September, October, and November eligible sample*. The second noninterview adjustment is applied to the August, September, October, and November eligible sample households to reflect nonresponse of occupied HUs that occur in the February, March, or April interviews. If a nonresponding household is actually a mover household, it would not be eligible for interview. Since the mover status of nonresponding households is not known, we assume that the proportion of mover households is the same for interviewed and nonresponding households. This is reflected in the noninterview adjustment. With this exception, the noninterview adjustment procedure is the same as described in Chapter 2-3, Weighting and Estimation. At this point, the nonresponding households and those mover households receive no further ASEC weighting. The weights of nonresponding, occupied, nonmover households from August, September, October, and November are transferred to the ASEC respondents from August, September, October, and November so that the ASEC respondents represent all eligible persons. The noninterview adjustment factor, $F_{ij}$, is computed as follows:

$$F_{ij} = \frac{Z_{ij} + N_{ij} + B_{ij}}{Z_{ij} + B_{ij}}$$

where

$Z_{ij}$ = The weighted number of August, September, October, and November eligible sample households interviewed in the February, March, or April CPS in cell *j* of cluster *i.*

$N_{ij}$ = The weighted number of August, September, October, and November eligible sample occupied, nonresponding HUs in the February, March, or April CPS in cell *j* of cluster *i.*

$B_{ij}$ = The weighted number of August, September, October, and November eligible sample mover households identified in the February, March, or April CPS in cell *j* of cluster *i.*

The weighted counts used in this formula are those after the CPS noninterview adjustment is applied. The clusters i refer to the noninterview clusters (NICL), which are groups of PSUs.

NICL boundaries do not cross the census regions (Northeast, Midwest, South, and West). Within each of these clusters, the cell j could be (1) Central City, (2) Balance of Metropolitan Statistical Area, or (3) Nonmetropolitan, depending on the type of cluster, with each cluster having either cells (1) and (2), or only cell (3).

**CHIP adjustment factor for the August, September, October, and November eligible sample.** The CHIP adjustment factor is applied to nonmover eligible households that contain residents who are Hispanic; non-Hispanic, non-White; and non-Hispanic Whites with children 18 years or younger to compensate for the increased sample in these demographic categories. Hispanic households receive a CHIP adjustment factor of 8/18 and non-Hispanic, non-White households and non-Hispanic White households with children 18 years or younger receive a CHIP adjustment factor of 8/15 (see Table 1-3.4). After this adjustment is applied, the August, September, October, and November eligible sample households are ready to be combined with the March and April eligible samples for the application of the second-stage adjustment.

**Eligible households from the March sample**: The March eligible sample households start with their CPS base weight, modified by the CPS special weighting factor, the March CPS noninterview adjustment, the March CPS first-stage adjustment (as described in Chapter 2-3, Weighting and Estimation), and the CHIP adjustment factor. After the CHIP adjustment factor is applied, the March eligible sample is ready to be combined with the August, September, October, November, and April eligible samples for the application of the second-stage adjustment.

*CHIP adjustment factor for the March eligible sample.* The CHIP adjustment factor is applied to the March eligible nonmover households that contain residents who are Hispanic; non-Hispanic, non-White; and non-Hispanic Whites with children 18 years or younger to compensate for the increased sample size in these demographic categories. Hispanic households receive a CHIP adjustment factor of 8/18 and non-Hispanic, non-White households and non-Hispanic White resident households with children 18 years or younger receive a CHIP adjustment factor of 8/15. Mover households, households with newborns, and all other

households receive a CHIP adjustment of one. Table 1-3.4 summarizes these weight adjustments.

**Eligible households from the April sample**: The households in the April eligible sample start with their CPS base weight as calculated in April, modified by the April CPS special weighting factor, the April CPS noninterview adjustment, the April CPS first-stage adjustment, and the CHIP adjustment factor. After the CHIP adjustment factor is applied, the April eligible sample is ready to be combined with the August, September, October, November, and March eligible samples for the application of the second-stage adjustment.

*CHIP adjustment factor for the April eligible sample*. The CHIP adjustment factor is applied to April-eligible households that contain residents who are Hispanic; non-Hispanic, non-Whites; or non-Hispanic Whites with children 18 years or younger to compensate for the increased sample size in these demographic categories regardless of mover status. Hispanic households receive a CHIP adjustment factor of 8/18 and non-Hispanic, non-White households and non-Hispanic White households with children 18 years or younger receive a CHIP adjustment factor of 8/15. Table 1-3.4 summarizes these weight adjustments.

Combined sample of eligible households from the August, September, October, November, March, and April CPS: At this point, the eligible samples from August, September, October, November, March, and April are combined. The remaining adjustments are applied to this combined sample file.

**ASEC second-stage adjustment**: The second-stage adjustment adjusts the ASEC estimates, so that they agree with independent age, sex, race, and Hispanic-origin population controls as described in Chapter 2-3, Weighting and Estimation. The same procedure used for CPS is used for the ASEC.

**Additional ASEC weighting**: After the ASEC weight through the second-stage procedure is determined, the next step is to determine the final ASEC weight. There are two more weighting adjustments applied to the ASEC sample cases. The first is applied to the armed forces members.

The armed forces adjustment assigns weights to the eligible armed forces members so they are included in the ASEC estimates. The second adjustment is for family equalization. Without this adjustment, the estimates of men in partnerships would be more than the number of women in partnerships. Weights are adjusted to give a married partners and unmarried partners the same weight, while maintaining the overall age and race and sex and Hispanic origin control totals.

Armed forces: Male and female members of the armed forces living off post or living with their families on post are included in the ASEC as long as at least one civilian adult lives in the same household, whereas the CPS excludes all armed forces members. Households with no civilian adults in the household, i.e., households with only armed forces members, are excluded from the ASEC. Control totals, used in the second-stage factor, do not include armed forces members; thus, armed forces members do not go through the second-stage adjustment. During family equalization, the weight of an armed forces member with a spouse or partner is assigned to the weight of their spouse or partner.

Family equalization: The family equalization procedure equalizes the estimates of the number of people in partnerships, both married and unmarried, while maintaining the overall civilian age/race/sex/ethnicity control totals. Seven categories of adults (at least 16 years old) based on sex and household composition are formed:

- Female partners in female/female married or unmarried partner households.

- All other civilian females.

- Married males, spouse present.

- Male partners in male/female unmarried partner households.

- Other civilian male heads of households.

- Male partners in male/male married or unmarried partner households.

- All other civilian males.

Table 1-3.4.

## Summary of the Annual Social and Economic Supplement Children's Health Insurance Program Adjustment Factor

| Current Population Survey month/Hispanic status | | Month-in-sample | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mover | | | | | | | | Nonmover | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| August | Hispanic[1] | $0^2$ | | | | | | | | $0^2$ | | | | | | | |
| | Non-Hispanic[3] | $0^2$ | | | | | | | | $0^2$ | | | | | | | |
| September | Hispanic[1] | $0^2$ | | | | | | | | $0^2$ | | | | | | | |
| | Non-Hispanic[3] | $0^2$ | | | | | | | | $0^2$ | | | | | | | |
| October | Hispanic[1] | $0^2$ | | | | | | | | $0^2$ | | | | | | | |
| | Non-Hispanic[3] | $0^2$ | | | | | | | | $0^2$ | | | | | | | |
| November | Hispanic[1] | $0^2$ | | | | | | | | 8/18 | | | | | | | |
| | Non-Hispanic[3] | $0^2$ | | | | | | | | 8/15 | $0^2$ | | 8/15 | | $0^2$ | | |
| March | Hispanic[1] | 1 | | | | | | | | 8/18 | | | | | | | |
| | Non-Hispanic[3,4] | | | | | | | | | 8/15 | | | | | | | |
| April | Hispanic[1] | 8/18 | $0^2$ | | | 8/18 | $0^2$ | | | 8/18 | $0^2$ | | | 8/18 | $0^2$ | | |
| | Non-Hispanic[3] | 8/15 | | | | 8/15 | | | | 8/15 | | | | 8/15 | | | |

[1] Hispanics may be any race.

[2] Zero weight indicates the cases are ineligible for the Annual Social and Economic Supplement.

[3] The non-Hispanic group includes both non-Hispanic, non-Whites, and non-Hispanic Whites with children 18 years or younger.

[4] Nonmover non-Hispanic Whites without children 18 years or younger get a Children's Health Insurance Program Adjustment Factor.

Three different methods, depending on the household composition, are used to assign the ASEC weight to other members of the household. The methods are (1) assigning the weight of the householder to the spouse or partner, (2) averaging the weights of the householder and partner, or (3) computing a ratio adjustment factor and multiplying the factor by the ASEC weight.

## SUMMARY

Although this discussion focuses on only two CPS supplements (the HVS and the ASEC), every supplement has its own unique objectives. The Census Bureau tailors the particular questions, edits, and imputations to each supplement's data needs. For many supplements, this also means altering the weighting procedure to reflect a different universe, account for a modified sample, or adjust for a higher rate of nonresponse. The weighting revisions discussed here for HVS and ASEC indicate only the types of modifications that the Census Bureau might use for a supplement. Technical documentation for the CPS supplements can be found at <www.census.gov/programs-surveys/cps/technical-documentation.html>.

## REFERENCES

U.S. Bureau of Labor Statistics, American Time Use Survey User's Guide retrieved from <www.bls.gov/tus/atususersguide.pdf>.

U.S. Census Bureau, Current Population Survey Questionnaires retrieved from <www.census.gov/programs-surveys/cps/technical-documentation.html>.

# Chapter 1-4: Data Products

## INTRODUCTION

Information collected in the CPS is made available by both the BLS and the Census Bureau through broad publication programs that include news releases, reports, charts, data tables, time series, and other formats. In addition to tabulated data, public-use microdata files are also available. Some of the major products are identified below. This section is not intended to be an exhaustive reference for all information available from the CPS.

## BUREAU OF LABOR STATISTICS PRODUCTS

Each month, employment and unemployment data are published initially in The Employment Situation news release about 2 weeks after data collection is completed. The release includes a narrative summary and analysis of the major employment and unemployment developments together with tables containing statistics for the principal data series. The news release can be accessed at <www.bls.gov/news.release/empsit.toc.htm>.

In addition to the news release, detailed tables provide information on the labor force, employment, and unemployment by a number of characteristics such as age, sex, race, Hispanic and Latino ethnicity, educational attainment, industry, and occupation. Tables may contain monthly, quarterly, or annual average data. Annual average tables typically show more detail than tables published on a monthly or quarterly basis. See <www.bls.gov/cps/tables.htm>.

The BLS LABSTAT database system contains four separate databases with CPS time series data. (They can be accessed from <www.bls.gov/cps/data.htm>). The largest database contains the main labor force statistics, and others contain earnings, union, and marital and family statistics. About 15,000 labor force series are updated each month, including a few hundred time series that go back to the 1940s. In total, there are over 100,000 monthly, quarterly, or annual-only time series available from the CPS.

Some of the tables and time series contain seasonally adjusted monthly or quarterly data. These estimates, useful for month-to-month analysis, undergo a process that removes predictable seasonal patterns in the data and makes it easier to see the underlying trends. However, only a small portion of estimates are available on a seasonally adjusted basis. The majority of the data are not seasonally adjusted. An over-the-year comparison of unadjusted data is recommended rather than a month-to-month analysis. (Note that annual averages do not exhibit seasonality.) A discussion of seasonal adjustment is available in Chapter 2-5, Seasonal Adjustment.

BLS publishes CPS data in annual news releases on a wide variety of subjects including union membership, veterans, people with disabilities, families, the foreign-born, and summer employment of youth. BLS also publishes several large reports on minimum wage workers, labor force characteristics by race and ethnicity, women in the labor force, and earnings of men and women. All of these publications include both analytical content and data tables. They also include a Technical Note describing the source of the data and key concepts or issues in interpreting the information presented. Reports and news releases are available at <www.bls.gov/cps/news.htm>.

BLS also sponsors (or co-sponsors) many of the supplemental surveys described in Chapter 1-3, Supplements. BLS news releases and reports from the CPS supplements include work experience over the calendar year (annual), a profile of the working poor (annual), characteristics of veterans (annual), college enrollment and work activity of recent high school graduates (annual), worker displacement (biennial), and employee tenure (biennial). Other topics have also periodically been addressed, like barriers to employment and labor-related issues for people with disabilities, workers on flexible and shift schedules, work at home, and contingent and alternative employment arrangements.

Because the CPS provides information on such a wide variety of topics, the best way to explore data from the BLS is using the subject matter summaries of available data on the labor force, employment, unemployment, persons not in the labor force, hours of work, earnings, and other demographic and labor force characteristics. The CPS topics A to Z list is often a good place to start: <www.bls.gov/cps/cpsaz.htm>. Each subject overview presents relevant news releases, tables, database series, charts, and analytical articles authored by BLS staff.

Information about the CPS itself, including concepts, measurement, and changes to the program over time, is available at <www.bls.gov/cps/documentation.htm>.

Most of the CPS data available from BLS are estimates for the United States as a whole, but some information is available for states and other geographic areas. The BLS Local Area Unemployment Statistics (LAUS) program publishes monthly estimates of employment and unemployment for all states, counties, metropolitan areas, cities of 25,000 population or more, and New England cities and towns of 1,000 population or more, by place of residence. Labor force data from the LAUS program follow the same CPS concepts and definitions used for the national labor force data. However, because the CPS sample is insufficient for creating reliable monthly estimates for statewide and substate areas, LAUS uses different estimating procedures for different levels of geography. In general, monthly estimates for the states, such as the official state unemployment rates, are developed using statistical models that incorporate current and historical data from the CPS, the monthly CES establishment survey, and regular state unemployment insurance systems. The annual subnational demographic labor force data published in the Geographical Profile of Employment and Unemployment are derived

solely from the CPS. For more information about these estimates, see <www.bls.gov/lau/>.

## CENSUS BUREAU PRODUCTS

The Census Bureau has been analyzing data from the CPS and reporting the results to the public for over five decades. The reports provide information on a recurring basis about a wide variety of social, demographic, and economic topics. Most of these reports appear in one of the following series issued by the Census Bureau: P-20, Population Characteristics; P-23, Special Studies; and P-60, Consumer Income. Many of the reports are based on data collected by the ASEC, which is a CPS supplement. However, other reports use data from various CPS supplements. Generally, reports are announced by news release and are released to the public via <www.census.gov>.

### Census Bureau Report Series

**P-20, Population Characteristics.** Regularly recurring reports in this series include topics such as geographic mobility, educational attainment, school enrollment, marital status, households and families, Hispanic origin, fertility, voter registration and participation, and the foreign-born population.

**P-23, Special Studies.** Information pertaining to methods, concepts, or specialized data is furnished in these publications. Also included are occasional reports on the Black population, metropolitan-nonmetropolitan population, youth, women, the older population, and other topics.

**P-60, Consumer Income.** Information concerning families, individuals, and households at various income levels is presented in this group of reports. Data are also presented on noncash benefits and relationship of income to age, sex, race, family size, education, occupation, work experience, and other characteristics.

## Public-Use Microdata Files

In addition to the regularly tabulated statistics described above, special data can be generated through the use of the CPS individual record (microdata) files. These files contain records of the responses to the survey questionnaire for all respondents in the survey and can be used to create additional cross-sectional detail. The actual identities of the individuals are protected on all versions of the files made available to users outside of the Census Bureau.

Access to CPS raw microdata, that is, the untabulated data from survey items, is available through an FTP site <https://thedataweb.rm.census.gov/ftp/cps_ftp.html?#>. This site provides the microdata files for the basic monthly labor force survey from 1994 forward, along with record layouts (data dictionaries). It also includes files for selected CPS supplements.

# Appendix: History of the Current Population Survey

- **March 1940**. WPA compiles the first official monthly figures on unemployment; estimates are released in an internal memorandum in April 1940 with the title "Monthly Report of Unemployment." The reference week for the survey was March 24–30; data were collected the following week. (This is generally thought of as the survey's first collection date.) March was chosen since it closely matched the reference period for the 1940 decennial census.

- **August 1942**. The Census Bureau assumes responsibility for the survey, and the program is renamed the Monthly Report on the Labor Force.

- **October 1943**. Following the 1940 decennial census, the sample for the survey is revised to make full use of probability sampling principles. PSUs of one or more counties were defined covering the entire United States. Sixty-eight PSUs were selected, and about 26,000 HUs were designated for the sample, of which about 22,500 were eligible for interview.

- **March 1945**. The monthly sample is reduced to about 25,000 designated households (21,500 eligible for interview) without affecting the reliability of the estimates.

- **July 1945**. The CPS questionnaire is revised. The revision consisted of the introduction of four basic employment status questions. Methodological studies showed that the previous questionnaire produced results that misclassified large numbers of part-time and intermittent workers such as students, housewives, and unpaid family workers on farms. These groups were erroneously reported as not active in the labor force.

- **August 1947**. The sample selection method is revised. The method of selecting sample units within a sample area was changed so that each unit selected would have the same chance of selection. This change simplified estimation procedures.

- **July 1949**. Previously excluded dwelling places are now covered. The sample was extended to cover special dwelling places—hotels, motels, trailer camps, etc. This led to improvements in the statistics (i.e., reduced bias), since residents of these places often have characteristics that are different from the rest of the population.

- **February 1952**. Document-sensing procedures are introduced into the survey process. The CPS questionnaire was printed on a document-sensing card. In this procedure, responses were recorded by drawing a line through the oval representing the correct answer using an electrographic lead pencil. Punch cards were automatically prepared from the questionnaire by document-sensing equipment.

- **January 1953**. Ratio estimates begin to use data from the 1950 population census. Prior to January 1953, the ratio estimates had been based on 1940 census relationships for the first-stage ratio estimate, and 1940 population data were used to adjust for births, deaths, etc., for the second-stage ratio estimate.

- **July 1953**. The 4-8-4 rotation system is introduced. This sample rotation system was adopted to improve measurement of changes over time. In this system, households are interviewed for 4 consecutive months, leave the sample for 8 months, and then return for the same period of 4 months the following year. In the previous system, households were interviewed for 6 consecutive months and then replaced. The 4-8-4 system provides some year-to-year overlap (50 percent), thus improving estimates of change on a year-to-year basis (while largely preserving the degree of month-to-month overlap).

- **September 1953**. In second-stage ratio estimation, information on "color" (the race terminology used at that time) is added and information on "veteran status" is omitted. This change made it feasible to publish separate, absolute numbers for individuals by race, whereas previously only the percent distributions had been published.

High-speed electronic equipment is introduced for tabulations. The introduction of electronic calculation greatly increased data timeliness and led to other improvements in

estimation methods. Other benefits included the substantial expansion of the scope and content of the tabulations and the computation of sampling variability. (The shift to modern computers was made in 1959.)

- **February 1954**. For the redesign following the 1950 Census, a new sample is phased in from February 1954 to May 1955. The number of PSUs was increased from 68 to 230 while retaining the overall sample size of 25,000 designated HUs (21,500 eligible for interview).

  At the same time, a substantially improved estimation procedure is introduced, referred to as composite estimation. This procedure took advantage of the large overlap in the sample from month to month. These two changes improved the reliability of most of the major statistics by a magnitude that could otherwise be achieved only by doubling the sample size.

  Major reliance on telephone interviewing begins, though personal interviews are preferred for MIS 1, 2, and 5. A regular reinterview program was initiated as a quality control measure.

- **May 1955**. Monthly questions exploring the reasons for part-time work were added to the standard set of employment status questions. In the past, this information had been collected quarterly or less frequently and was found to be valuable in studying labor market trends.

- **July 1955**. The survey reference week is moved to the calendar week containing the twelfth day of the month to align the CPS time reference with that of other employment statistics. Previously, the survey reference week had been the calendar week containing the eighth day of the month.

- **May 1956**. The number of PSUs is expanded from 230 to 330. All of the former 230 PSUs were also included in the expanded sample. The overall sample size also increased by roughly two-thirds to a total of about 40,000 households (about 35,000 eligible units). The expansion improved the reliability of the major statistics by around 20 percent and made it possible to publish more detailed statistics.

- **January 1957**. In response to recommendations from an interagency committee tasked with reviewing conceptual and methodological issues in the measurement of employment and unemployment, two relatively small groups of people, both formerly classified as employed ''with a job but not at work,'' are assigned to new classifications. The reassigned groups were (1) people on layoff with definite instructions to return to work within 30 days of the layoff date, and (2) people waiting to start new wage and salary jobs within 30 days of the interview. Most of the people in these two groups were shifted to the unemployed classification. The only exception was the small subgroup in school during the survey week who were waiting to start new jobs; these were transferred to ''not in labor force.'' This change in definition did not affect the basic labor force questions or the enumeration procedures.

- **June 1957**. A seasonally adjusted unemployment rate is introduced reflecting ongoing advances in electronic computers. A further extension of the data—using more refined seasonal adjustment methods—was introduced in July 1957. (Some seasonally adjusted unemployment data were introduced early in 1955 in index form.) The new data included a seasonally adjusted rate of unemployment and trends in seasonally adjusted levels for total employment and unemployment. Significant improvements in methodology emerged from research conducted at the BLS and the Census Bureau in the following years.

- **July 1959**. Responsibility for the planning, analysis, seasonal adjustment, and publication of the labor force statistics from the CPS is transferred to BLS as part of a large exchange of statistical functions between the Department of Commerce and Department of Labor. The Census Bureau continued to have (and still has) responsibility for the collection and computer processing of these statistics, for maintenance of the CPS sample, and for related methodological research. Interagency review of CPS policy and technical issues continues to be the responsibility of the Bureau of the Budget (now the Statistical Policy Division, OMB).

- **January 1960**. Upon achieving statehood, Alaska and Hawaii are included in the independent population estimates and in the sample survey. This increased the number of sample PSUs from 330 to 333. The addition of these two states affected the comparability of population and labor force data with previous years. There was an increase of about 500,000 in the noninstitutional population aged 16 and over and about 300,000 in the labor force, four-fifths of this in nonagricultural employment. The levels of other labor force categories were not appreciably changed.

- **October 1961**. The CPS questionnaire is converted to the Film Optical Sensing Device for Input to the Computer system (the system used in the 1960 Census). Entries were made by filling in small circles with an ordinary lead pencil. The questionnaires were photographed to microfilm. The microfilms were then scanned by a reading device that transferred the information directly to computer tape. This system permitted a larger form and a more flexible arrangement of items than the previous document-sensing procedure and did not require the preparation of punch cards. This data entry system was used through December 1993.

- **December 1961**. For the redesign following the 1960 decennial census, new sample is phased in from December 1961 to March 1963. There were 357 PSUs; 35,000 households were eligible for interview. In a major improvement, most of the sample is drawn from household lists prepared during the decennial census. Starting February 1962, population controls from the decennial census were used in weighting.

- **January 1963**. In response to recommendations from the President's Committee to Appraise Employment and Unemployment Statistics (also referred to as the "Gordon Committee"), two new items are added to the monthly questionnaire. The first was a question, formerly asked only intermittently, on whether the unemployed were seeking full- or part-time work. The second was an expanded item on household relationships, formerly included only annually, to provide greater detail on the marital status and household relationships of unemployed people.

- **January 1967**. The CPS sample is expanded from 357 to 449 PSUs. An increase in total budget allowed the overall sample size to increase by roughly 50 percent to a total of about 60,000 HUs (50,000 eligible units). This expansion improved the reliability of the major statistics by about 20 percent and made it possible to publish more detailed statistics.

  The definitions of employment and unemployment are modified. In line with the basic recommendations of the President's Committee to Appraise Employment and Unemployment Statistics (U.S. Department of Commerce, 1962), a several-year study was conducted to develop and test proposed changes in the labor force concepts. The principal research results were implemented in January 1967. The changes included a revised lower age limit in defining the labor force (from age 14 to age 16) and new questions to improve the information on hours of work, the duration of unemployment, and the self-employed. The definition of unemployment was also revised slightly. A 4-week job search period was specified, and new questions on job search methods and current availability for work were added. The refined definition of unemployment led to small differences in the estimates of levels and month-to-month change. Collection of additional information on those not in the labor force began.

- **March 1968**. Separate age and sex ratio estimation cells are introduced for Negro and Other races. (Negro was the race terminology used at that time. Other includes American Indian, Eskimo, Aleut, Asian, and Pacific Islander.) Previously, the second-stage ratio estimation used White and non-White race categories by age groups and sex. The revised procedures allowed separate ratio estimates for Negro and Other race categories. This change increased the number of ratio estimation cells from 68 to 116.

- **January 1970**. The detailed not in labor force questions are shifted from the incoming rotation groups (MIS 1 and 5) to the outgoing rotation groups (MIS 4 and 8).

- **January 1971**. The 1970 Census occupational classification system is introduced.

- **December 1971**. For the redesign following the 1970 decennial census, new sample is phased in from December 1971 to March 1973. There were 461 PSUs; 47,000 HUs were eligible for interview. Also, the cluster design was changed from six nearby households (but not contiguous) to four usually contiguous households. This change was undertaken after research found that smaller cluster sizes would increase sample efficiency. Even with the reduction in sample size, this change led to a small gain in reliability for most characteristics. Also, the questions on occupation were made more comparable to those used in the 1970 Census by adding a question on major activities or duties of current job.

- **January 1972**. The population estimates used in second-stage ratio estimation are updated to the 1970 Census base. Data tabulated using the 1970 Census occupation classification system were produced.

- **January 1973**. Seasonal adjustment converts to X-11 software, replacing the BLS Factor Method (which had been introduced in 1960). The X-11 software included several options for handling both additive and multiplicative series, diagnostics were improved, and variable trends and seasonals were allowed.

- **January 1974**. The inflation-deflation method is introduced for deriving independent estimates of the civilian noninstitutional population by age, race, and sex used in second-stage ratio estimation.

- **July 1975**. As a result of the large inflow of Vietnamese refugees to the United States, the total and Black-and-Other independent population controls for those 16 years and over are adjusted upward.

- **September 1975**. In order to obtain state estimates from the CPS, state supplementary samples are introduced; these samples were not used for national estimation. An additional sample consisting of about 14,000 interviews each month, was introduced in July 1975 to supplement the national sample in 26 states and the District of Columbia. In all, 165 new PSUs were involved. The supplemental sample was added to meet a specific reliability standard for estimates of the annual average number of unemployed people for each state.

- **January 1978**. State supplemental sample for 24 states and the District of Columbia are incorporated into national estimation. Also, a supplemental sample was introduced to improve coverage in "address list" enumeration districts.

- **October 1978**. Procedures for determining demographic characteristics are modified. At this time, changes were made in the collection methods for household relationship, race, and ethnicity data. Race is now determined by the respondent rather than by the interviewer. Other modifications included the introduction of earnings questions for the two outgoing rotations in the monthly survey (with regular collection of these data beginning in January 1979). New questions focused on usual hours worked, hourly wage rate, and usual weekly earnings. Earnings questions were asked of currently employed wage and salary workers. Previously, earnings data were collected in supplements.

- **January 1979**. A new two-level, first-stage ratio estimation procedure is introduced. This procedure was designed to improve the reliability of metropolitan and nonmetropolitan estimates. Also introduced were monthly tabulations of children's demographic data including relationship, age, sex, race, and origin.

- **September 1979**. The final report of the National Commission on Employment and Unemployment Statistics ("Levitan Commission") is issued (Executive Office of the President, 1979). This report shaped many of the future changes to the CPS.

- **January 1980**. To improve coverage, about 450 households are added to the sample, increasing the number of total PSUs to 629. Also, X-11 Auto-Regressive Integrated Moving Average (ARIMA) software was introduced for seasonal adjustment.

- **May 1981**. The sample is reduced by approximately 6,000 assigned households, bringing the total sample size to approximately 72,000 assigned households (with about 60,000 households eligible for interview).

- **January 1982**. The race categories in second-stage ratio estimation adjustment are changed from White and non-White to Black and non-Black. These changes were made to eliminate classification differences in race that existed between the 1980 Census and the CPS. The change did not result in notable differences in published CPS data. Nevertheless, it did result in more variability for certain "White," "Black," and "Other" characteristics. As is customary, the CPS uses ratio estimates from the most recent decennial census. Beginning in January 1982, current population estimates used in the second-stage estimation procedure were based on findings from the 1980 Census. The use of the 1980 Census-based population estimates, in conjunction with the revised second-stage adjustment, resulted in about a 2 percent increase in the estimates for total civilian noninstitutional population aged 16 and over, civilian labor force, and unemployed people. The magnitude of the differences between 1970 and 1980 Census-based ratio estimates affected the historical comparability and continuity of major labor force series; therefore, BLS revised approximately 30,000 series going back to 1970.

- **January 1983**. The occupational and industrial data are coded using the 1980 classification systems. While the effect on industry-related data was minor, the conversion was viewed as a major break in occupation-related data series. The census developed a "list of conversion factors" to translate occupation descriptions based on the 1970 census-coding classification system to their 1980 equivalents. Among the "Black and Other" race category, data for Blacks are broken out and tabulated separately going back to 1972. Data continued to be published for a number of "Black and Other" data series until 2003. Two questions on union membership and union coverage for the two outgoing rotations in the monthly survey are introduced. The questions were asked of currently employed wage and salary workers. Previously, union membership data were collected in supplements.

  Reflecting a recommendation from the Levitan Commission, selected series that included the resident armed forces among the employed

are introduced. This included an overall unemployment rate for the nation, which tended to be about 0.1 percentage point lower than the civilian unemployment rate.

- **October 1984**. School enrollment questions are added to the basic CPS for people 16 to 24 years of age.

- **April 1984.** The 1970 Census-based sample is phased out through a series of changes that were completed by July 1985. The redesigned sample used data from the 1980 Census to update the sampling frame, took advantage of recent research findings to improve the efficiency and quality of the survey, and used a state-based design to improve the estimates for the states without any change in sample size.

- **January 1985**. Estimation procedures are changed to use data from the 1980 Census and the new sample. The major changes were to the second-stage adjustment, which replaced population estimates for "Black" and "Non-Black" (by sex and age groups) with population estimates for "White," "Black," and "Other" population groups. In addition, a separate, intermediate step was added as a control to the Hispanic population. (Hispanics may be of any race.) The combined effect of these changes on labor force estimates and aggregates for most population groups was negligible; however, the Hispanic population and associated labor force estimates were dramatically affected, and revisions to the major Hispanic data series were made back to January 1980 to the extent possible.

- **June 1985**. The CPS CATI contact center is opened at Hagerstown, Maryland. A series of tests over the next few years were conducted to identify and resolve the operational issues associated with the use of CATI. Later tests focused on CATI-related issues, such as data quality, costs, and mode effects on labor force estimates. Samples used in these tests were not used in the official CPS estimates.

- **July 1985**. Response categories that obtain information on period of service for female veterans are added to the monthly CPS questionnaire. Estimates of the number of female

veterans based on these questions were first published in a 1986 Monthly Labor Review article.

- **January 1986**. For the first time, the population controls used in the second-stage ratio adjustment method are revised to reflect an explicit estimate of the number of undocumented immigrants (largely Hispanic) since 1980. In addition, the population controls included an improved estimate of emigration, or movement out of the United States, by legal residents. Taken together, the two changes had a comparatively small effect on the total population figure, but their effect on the Hispanic population was more pronounced. Because of the magnitude of the adjustments for Hispanics, many Hispanic data series were revised back to January 1980.

- **January 1989.** First CATI cases are used on a large scale in CPS monthly estimates. Initially, CATI started with several hundred cases each month. As operational issues were resolved and new contact centers were opened— Tucson, Arizona (May 1992) and Jeffersonville, Indiana (September 1994)—the CATI workload was gradually increased to about 10,000 cases a month.

- **June 1990**. The first of a series of experiments to test alternative labor force questionnaires is started at the Hagerstown Telephone Center. These tests used random-digit dialing and were conducted in 1990 and 1991.

- **January 1992**. Industry and occupation (I&O) codes from the 1990 Census are introduced. Population estimates were converted to the 1990 Census base for use in ratio estimation procedures.

- **July 1992**. The CATI and CAPI Overlap (CCO) experiments begins. CATI and automated laptop versions of the revised CPS questionnaire were used in a sample of about 12,000 households selected from the National Crime Victimization Survey sample.

  The CCO's main purpose was to gauge the combined effect of the new questionnaire and computer-assisted data collection. The initial CCO ran parallel to the official CPS from July 1992 to December 1993. An extended parallel survey with modifications ran from January

1994 to May 1994. Research indicated that the initial CCO parallel survey results provided misleading indications of the impact of the redesign on major CPS indicators. Additional research, using data collected from both parallel surveys, along with data collected from the official CPS both prior to and after January 1994 redesign, enabled a more accurate interpretation of the effects of the redesigned survey on CPS estimates.

- **January 1994**. A new questionnaire designed solely for use in computer-assisted interviewing is introduced in the official CPS. This allowed the use of a very complex questionnaire without increasing respondent burden, increased consistency by reducing interviewer error, permitted editing at time of interviewing, and allowed the use of dependent interviewing where information reported in 1 month (I&O, retired and disabled statuses, and duration of unemployment) was confirmed or updated in subsequent months. In developing the automated questionnaire, extensive use was made of cognitive testing techniques.

  It is estimated that the redesign had no statistically significant effect on the total unemployment rate, but it did affect statistics related to unemployment such as the reasons for unemployment, the duration of unemployment, and the I&O distribution of the unemployed with previous work experience. It is also estimated that the redesign significantly increased the employment-population ratio and the labor force participation rate for women, but significantly decreased the employment-population ratio for men. Along with the changes in employment data, the redesign significantly influenced the measurement of characteristics related to employment such as the proportion of the employed working part-time, the proportion working part-time for economic reasons, the number of individuals classified as self-employed, and the I&O distribution of the employed.

  The redesigned questionnaire collects some new data that sharpens labor force concepts and definitions and incorporates some of the recommendations from the Levitan Commission. For example, the definition of discouraged workers is tightened by requiring some evidence of attachment to the job

market, and it improves the measurement of involuntary part-time employment by explicitly asking about current availability for full-time work. Questions were added on citizenship, country of birth of a person's parents, and whether they were immigrants. These questions were phased into the sample.

CPS data used by BLS are adjusted to reflect an undercount in the 1990 decennial census. Quantitative measures of this undercount are derived from a post-enumeration survey. Because of reliability issues associated with the post-enumeration survey for small areas of geography (i.e., places with populations of less than 1,000,000), the undercount adjustment was made only to state and national level estimates. While the undercount varied by geography and demographic group, the overall undercount was estimated to be slightly more than 2 percent for the total aged 16 and over civilian noninstitutional population.

Most interviews are conducted by FRs in person or by telephone, but the transfer of workload to CATI contact centers continued.

- **April 1994**. For the redesign following the 1990 decennial census, new sample is phased in from April 1994 to July 1995. This resulted in a monthly overall sample size of 68,000, with about 58,000 eligible HUs in 792 PSUs.

- **December 1994**. Starting in December 1994, a new set of response categories are phased in for the relationship to reference person question. This modification was directed at individuals not formally related to the reference person to determine whether there were unmarried partners in a household. The old partner or roommate category was deleted and replaced with the following categories: unmarried partner, housemate or roommate, and roomer or boarder. This modification was phased in for two rotation groups at a time and was fully in place by March 1995. This change had no effect on the family statistics produced by CPS.

- **January 1996**. The 1990 CPS design is changed because of a funding reduction. The original reliability requirements of the sample were relaxed, allowing a reduction in the national sample size. The overall sample size decreased from 68,000 to 59,500 HUs, with a reduction of 56,000 eligible HUs to about 50,000 eligible HUs. The reduced CPS national sample contained 754 PSUs. As a result of the sample reduction, it was decided to use time series models to produce monthly employment and unemployment estimates for all states.

- **January 1998**. A new composite weighting methodology is implemented. The procedure starts with computed composite estimates for the main labor force categories, classified by key demographic characteristics. Then, the procedure adjusts person weights, through a series of ratio adjustments, to agree with the composite estimates—thus incorporating the effect of composite estimation into the person weights.

- **July 2001**. Effective with the release of July 2001 data, official labor force estimates from the CPS and the LAUS program reflect the expansion of the monthly CPS sample. The overall sample size increased to 72,000 assigned HUs, with about 60,000 eligible households. This expansion of the monthly CPS sample was one part of the Census Bureau's plan to meet the requirements of the State Children's Health Insurance Program (SCHIP, more recently referred to as CHIP) legislation. This legislation requires the Census Bureau to improve state estimates of the number of children who live in low-income families and lack health insurance. These estimates are obtained from the Annual Demographic Supplement to the CPS (now known as the ASEC). In September 2000, the Census Bureau began expanding the monthly CPS sample in 31 states and the District of Columbia. States were identified for sample supplementation based on the standard error of their March estimate of low-income children without health insurance. The regular CPS design was unchanged, and the SCHIP sample was added using its own design criteria. The additional 10,000 households were added to the sample over a 3-month period. BLS chose not to include the additional households in the official labor force estimates, however, until it had sufficient time to evaluate the estimates from the 60,000 household sample.

- **January 2003**. The 2002 Census Bureau occupational and industrial classification systems, which are derived from the 2000 SOC and the 2002 NAICS, are introduced into the CPS. The composition of detailed occupational and industrial classifications in the new systems was substantially changed from the previous systems, as was the structure for aggregating them into broad groups. This created breaks in existing data series at all levels of aggregation.

  Questions on race and ethnicity are modified to comply with new federal standards. Beginning in January 2003, individuals are asked whether they are of Hispanic ethnicity before being asked about their race. Individuals are asked directly if they are Spanish, Hispanic, or Latino. With respect to race, the response category of Asian and Pacific Islander was split into two categories: (1) Asian and (2) Native Hawaiian or Other Pacific Islander. The questions on race were reworded to indicate that individuals could select more than one race and to convey more clearly that individuals should report their own perception of their race. These changes had little or no impact on the overall civilian noninstitutional population and civilian labor force but did reduce the population and labor force levels of Whites, Blacks or African Americans, and Asians beginning in January 2003. There was little or no impact on the unemployment rates of these groups. The changes did not affect the size of the Hispanic or Latino population and had no significant impact on the size of their labor force, but did cause an increase of about 0.5 percentage points in their unemployment rate.

  New population controls reflecting the results of the 2000 Census substantially increase the size of the civilian noninstitutional population and the civilian labor force. As a result, data from January 2000 through December 2002 were revised. In addition, the Census Bureau introduced another large upward adjustment to the population controls as part of its annual update of population estimates for 2003. The entire amount of this adjustment was added to the labor force data in January 2003. The unemployment rate and other ratios were not substantially affected by either of these population control adjustments.

The CPS program begins using the X-12 ARIMA software for seasonal adjustment of time series data with release of the data for January 2003. Because of the other revisions introduced with the January data, the annual revision of 5 years of seasonally adjusted data that typically occurs with the release of data for December was delayed until the release of data for January. As part of the annual revision process, the seasonal adjustment of CPS series was reviewed to determine if additional series could be adjusted and if the series currently adjusted would pass a technical review. As a result of this review, some series that were seasonally adjusted in the past are no longer adjusted. Most of these series were related to I&O.

Improvements are introduced to both the second-stage and composite weighting procedures. These changes adapted the weighting procedures to the new race and ethnicity classification system and enhanced the stability over time of national, state, and substate labor force estimates for demographic groups.

- **January 2004**. Population controls are updated to reflect revised estimates of net international migration for 2000 through 2003. The updated controls resulted in a decrease of 560,000 in the estimated size of the civilian noninstitutional population for December 2003. The civilian labor force and employment levels decreased by 437,000 and 409,000, respectively. The Hispanic or Latino population and labor force estimates declined by 583,000 and 446,000, respectively, and Hispanic or Latino employment was lowered by 421,000. The updated controls had little or no effect on overall and subgroup unemployment rates and other measures of labor market participation.

  Beginning with the publication of December 2003 estimates in January 2004, the practice of concurrent seasonal adjustment is adopted. Under this practice, the current month's seasonally adjusted estimate is computed using all relevant original data up to, and including, those for the current month. Revisions to estimates for previous months, however, are postponed until the end of the year. Previously, seasonal factors for the CPS labor force data were projected twice a year.

With the introduction of concurrent seasonal adjustment, BLS no longer published projected seasonal factors for CPS data.

In addition to introducing population controls that reflected revised estimates of net international migration for 2000 through 2003 in January 2004, the LAUS program introduces a linear wedge adjustment to CPS statewide estimates of the civilian noninstitutional population aged 16 and over, labor force, employment, unemployment, and unemployment rate. This adjustment linked the 1990 decennial census-based CPS estimates, adjusted for the undercount (see January 1994), to the 2000 decennial census-based CPS estimates. This adjustment provided consistent estimates of statewide labor force characteristics from the 1990s to the 2000s. It also provided consistent CPS series for the LAUS program's econometric models used to produce the official labor force estimates for states and selected substate areas. These models use CPS employment and unemployment estimates as dependent variables.

- **April 2004**. For the redesign following the 2000 decennial census, new sample is phased in from April 2004 to July 2005. There were 824 PSUs; the overall sample size decreased slightly, to 71,000 assigned HUs, with about 60,000 households eligible for interview.

- **September 2005**. Hurricane Katrina made landfall on the Gulf Coast on August 29, 2005, after the August 2005 survey reference period. The data produced for the September reference period were the first from the CPS to reflect any impacts of this unusually catastrophic storm. The Census Bureau attempted to contact all sample households in the disaster areas except those areas under mandatory evacuation at the time of the survey. Starting in October, all areas were surveyed. In accordance with standard procedures, uninhabitable households, and those for which the condition was unknown, were taken out of the CPS sample universe. People in households that were successfully interviewed were given a higher weight to account for those missed. Also, starting in October, BLS and the Census Bureau added several questions to identify people who were evacuated from their homes, even temporarily, due to Hurricane Katrina.

Beginning in November 2005, state population controls used for CPS estimation were adjusted to account for interstate moves by evacuees. This had a negligible effect on estimates for the total United States.

- **November 2006**. For the first time, the November survey is conducted 1 week earlier in the month than usual. Interviewing is done during the calendar week that includes the twelfth of the month, and the reference week is the week containing the fifth of the month. (This has often been done for December.) Policy now allows moving November collection earlier in the month to (1) avoid conflicting with the Thanksgiving holiday, and (2) to allow adequate processing time before December data collection begins.

- **January 2007**. The system running the data collection instrument changes from a DOS-based system to BLAISE©, a windows-based system. BLAISE© increases the interviewer's awareness of their position in the survey flow during the interview and enables them to better navigate backward and forward.

- **January 2008**. A new feature is added to the questionnaire to comply with the new Respondent Identification Policy. The policy requires surveys to protect certain sensitive information when using dependent interviewing techniques.

- **June 2008**. Six questions are added to the CPS to identify people with disabilities aged 15 and over. They are typically asked in new and returning households (MIS 1 and 5), in replacement households, and of new household members.

- **January 2009**. CPS switches to the 2007 Census industry classification system (used through 2013). The codes are based on the 2007 NAICS. Changes were relatively minor and historical data were not revised.

- **January 2011**. CPS switches to the 2010 Census occupational classification system. This classification system is based on the 2010 SOC and replaced an earlier version based on the 2000 SOC. The names of broad- and intermediate-level occupational groups remained the same, but some detailed occupations were reclassified between them. This

affected comparability with earlier data, but historical data were not revised.

The questionnaire is modified to allow reported durations of unemployment of up to 5 years. The previous limit was 2 years. The change was phased in two panels (MIS rotation groups) at a time from January 2011 to April 2011. The change increased estimates of mean duration of unemployment, but not the medians.

The Census Bureau incorporates additional safeguards for CPS public-use microdata files to ensure that respondent identifying information is not disclosed; this includes perturbing respondent ages. One result of the measures taken to enhance data confidentiality is that most estimates from public-use microdata files will no longer exactly match the comparable estimates published by BLS. Although certain topside labor force estimates will continue to match published data—such as the overall levels of employed, unemployed, and not in the labor force—estimates below the topside level all have the chance of differing slightly from the published data (but will be well within the sampling variability associated with the CPS).

- **January 2012**. New benchmark population controls reflecting the results of the 2010 Census are used in the weighting process. The civilian noninstitutional population aged 16 and over increased by 1,510,000, but those not in the labor force were disproportionately affected and increased by 1,252,000. There were increases of 258,000 in the civilian labor force, 216,000 in employment, and 42,000 in unemployment. The labor force participation rate and the employment-population ratio were each reduced by 0.3 percentage points. Historical data were not revised.

- **January 2013**. The Census Bureau regional office (RO) structure is revised after remaining substantially unchanged for 50 years. Staff in the 12 ROs began transitioning in phases to a 6-RO structure in January 2012, and the new structure took effect in January 2013. CPS operations began reporting results based on the six ROs immediately.

- **January 2014**. CPS switches to the 2012 Census industry classification system. The codes are based on the 2012 NAICS. The differences between the 2012 and 2007 industry classification systems were minor and did not involve reclassification of industries between the broader industry sectors. Historical data were not revised.

- **April 2014**. For the sample redesign following the 2010 decennial census, new sample is phased in from April 2014 to July 2015. There were 852 PSUs; the overall sample size increased to 74,000 assigned HUs, with about 61,000 households eligible for interview. There was no attempt to maximize PSU overlap with the previous design.

- **January 2015**. BLS begins using X-13ARIMA-SEATS (Signal Extraction in ARIMA Time Series) software to seasonally adjust data. Questions are added on professional certifications and state or industry licenses, and whether they were required for a person's current or most recent job. To limit lengthening the survey and increasing respondent burden, three little-used questions on graduate and professional coursework were removed from the CPS when the three certification and licensing questions were added.

- **May 2015**. Changes to response categories take effect for the relationship-to-reference-person question. The two response categories "spouse (husband or wife)" and "unmarried partner" were replaced with four response categories: "opposite-sex spouse (husband or wife)," "opposite-sex unmarried partner," "same-sex spouse (husband or wife)," and "same-sex unmarried partner."

- **December 2017**: Due to the reduction in contact center workloads and more effective data collection modes the centralized CATI contact center in Hagerstown, Maryland, is closed. The caseload previously handled by the Hagerstown center is reassigned to the remaining two contact centers in Jeffersonville, Indiana, and Tucson, Arizona. (Less than 10 percent of CPS interviews were conducted from the centralized contact centers in 2017.)

## FURTHER READING

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# Unit 2

# Current Population Survey Sample Design and Estimation

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# Chapter 2-1: Sample Frame

## INTRODUCTION

For the 2010-based sample design, the sampling frames and sampling methodology for Current Population Survey (CPS) have undergone important changes. CPS staff now selects the CPS sample from two dynamic sampling frames, one for housing units (HUs) and one for group quarters (GQs). Both frames are based upon the Master Address File (MAF). The MAF is a national inventory of addresses that is continually updated by the U.S. Census Bureau to support its decennial programs and demographic surveys. The MAF, which is maintained by Geography Division (GEO), is described in greater detail in later sections, while the CPS sampling methodology is described in Chapter 2-2, Sample Design.

The MAF replaces a variety of address sources used in the past to construct sampling frames for CPS. For the sample design based upon the 2000 and earlier censuses, CPS sample was selected from a coordinated set of four sampling frames: the unit frame, the area frame, the GQ frame, and the new construction permit frame. The address sources for these frames included the official address list from the most recent census, block listings, and addresses from building permits (Table 2-1.1).

As a comprehensive source for all HU and GQ addresses in the nation, the MAF eliminates the need for costly field visits to conduct area block listings or to collect building permit information for new addresses. Instead, new growth is captured through semiannual updates to the MAF from a variety of address sources, the most important of which is the Delivery Sequence File (DSF). The DSF is the master file of mail delivery points maintained and regularly updated by the U.S. Postal Service (USPS). The DSF and other MAF update sources are discussed in more detail in following sections.

The American Community Survey (ACS), the largest demographic survey conducted by the Census Bureau, has been using the MAF as the sole source for its HU sampling frame since its earliest testing phases in the late 1990s. ACS paired its adoption of a MAF-based sampling frame with an annual sampling methodology that was designed to take full advantage of the dynamic qualities of the MAF. Likewise, during its 2010 Sample Redesign, the Demographic Statistical Methods Division (DSMD) paired its proposal to switch to MAF-based sampling frames with a recommendation to convert to annual sampling for CPS and the other current household surveys. Annual sampling, in which only a year's worth of sample is selected at a time, replaced the previous model in which enough sample to last a decade or more was selected in a one-time operation at the beginning of each sample design. Going forward, annual sampling from a continuously updated MAF-based sampling frame allows CPS the flexibility to adjust sample sizes, reorder the HU universe (including new growth) using updated sort variables, or even change the universe sort variables altogether.

Table 2-1.1.
**Address Sources for the Current Population Survey Sampling Frames for the 2000 and 2010 Sample Designs**

| Sample design | Sampling frame | Address source | Old construction housing units | New growth housing units | Group quarters |
|---|---|---|---|---|---|
| 2000 | Housing units | 2000 Census | √ | | |
| | Area | Block listings | √ | √ | √ |
| | Group quarters | 2000 Census and area block listings | | | √ |
| | Permit | Building permits | | √ | |
| 2010 | Housing units | Master Address File | √ | √ | |
| | Group quarters | Master Address File | | | √ |

## THE MASTER ADDRESS FILE

### A Short History of the MAF

In preparation for the 2000 Census, the Census Bureau created a preliminary version of the MAF that would be used as the comprehensive address source for decennial operations. The core of this early MAF consisted of addresses collected during the 1990 Census operations (the 1990 Address Control File) merged with DSFs provided by the USPS. This proto-MAF was then supplemented and updated by a series of decennial operations. These included the Local Update of Census Addresses (LUCA), a partnership program by which local governments could provide their own address lists, and field listing operations like 2000 Address Canvassing. At the conclusion of the 2000 Census, the MAF was considered a virtually complete inventory of all known HU addresses in the nation.[1]

While previous census address lists were not maintained after the census was complete, the vision for the MAF after 2000 was very different—the MAF would be continually updated with the DSF and other sources so it could serve as the official inventory of HUs and GQs for all future censuses. The MAF would also support the demographic surveys and other statistical programs conducted by the Census Bureau.

Consistent with this vision, the MAF has evolved into a critical corporate resource for the Census Bureau:

- The MAF has been the sole source of addresses for the HU sampling frame for ACS since its implementation as a national survey in 2005.

- The MAF was the major address source for the 2010 Census and will serve the same role for future censuses.

- The MAF is a critical input to the Population Estimates Program.

- The MAF is the sole source of addresses for the HU and GQ sampling frames for CPS and other demographic household surveys, including the American Housing Survey (AHS), the

National Crime Victimization Survey (NCVS), the Consumer Expenditure (CE) Surveys, and the Survey of Income and Program Participation (SIPP).

To further enhance its value, the MAF was integrated in 2007 with the Census Bureau's geospatial database, the Topologically Integrated Geographic Encoding and Referencing (TIGER) System. The TIGER database contains digital representations of all map features and related attributes required by the census. An important function of TIGER is to assign geocodes (i.e., state, county, tract, and block) to the addresses on the MAF. For a short history of TIGER, see Thompson (2014).

The integrated database created by merging the MAF with TIGER is called the MAF/TIGER Database. While the MAF is actually the address portion of the MAF/TIGER Database, it is the better-known acronym and we will use it throughout this chapter to refer to the database maintained by GEO.

### The Content of the MAF

The major purpose of the MAF is to store address and geographic information about the HUs and GQs (as well as some nonresidential addresses) in the United States.[2] Accurate, complete location address information is critical to CPS and the other demographic surveys that conduct personal visit interviews. Most MAF records have complete city-style location addresses, which consist of a house number, street name, and ZIP code; an example of a complete city-style address is "3227 Holt Lane, Anytown, PA, 29999."[3] The importance of a city-style location address is that it is usually sufficient in itself to locate a sample case in the field.

Incomplete location addresses, conversely, are missing house number, street name, or both. For the 2010 Census, the percentage of location addresses that were incomplete dropped to 1.9 percent. For incomplete addresses, the MAF usually has other information, including a location description (for example, "SECOND HOUSE ON

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[1] The MAF did not include GQ addresses at this point in time. GQs were maintained in a separate file called the Special Place/GQ Inventory. GQs would not be merged into the MAF until the 2010 Census.

[2] The MAF includes addresses for Puerto Rico, which are out-of-scope for CPS but in scope for ACS.

[3] The MAF does not contain locality or post office names ("Anytown" in this example) or the two-letter postal abbreviation for the state. The ZIP code must be matched to a separate file to pick up post office name.

LEFT DOWN UNNAMED DIRT ROAD OFF HOLT LANE") or latitude and longitude coordinates that can help a field representative (FR) locate the HU in the field. One of the imperatives of the 2010 Address Canvassing operation was to collect Geographic Positioning System (GPS) coordinates for as many listed HUs as possible. As a result, only 8.2 percent of the incomplete city-style addresses in the 2010 Census were also missing coordinates.

Every MAF record contains a MAFID, which is a unique identifier for that record across the entire MAF. Other fields that are always filled are the HU/GQ indicator, unit status (one purpose of which is to flag known duplicates), and residential status. The MAF also contains action codes ("add," "delete," "verify," etc.) and dates from each source that has provided information for the MAF record.[4]

A MAF record may, but does not always, include entries for these fields: mailing address, location description, latitude and longitude coordinates, census tract, and census block. MAF records may be linked as duplicates through the Surviving MAFID. A record with a nonblank Surviving MAFID is a "retired" record. The Surviving MAFID denotes a different record that replaces or "survives" the original MAFID.

The MAF contains several variables relating to the DSF, including the historical series of DSF flags. Each DSF flag indicates whether the MAFID was on that version of the DSF and whether it was residential or nonresidential. A more detailed discussion of the DSF later in this section provides more information about the DSF content on the MAF.

For GQ records, the MAF contains GQ names, GQ type, location address information, contact information, and information about the size of the GQ.

The geographic information on the MAF is mainly restricted to tract and block codes and latitude and longitude coordinates, but more information can be obtained by matching by block to other geographic files maintained by GEO. This leads

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[4] The action codes and dates for MAF sources are actually provided in a separate product from the MAF extracts. These files, the MAF Operations (MAFOP) data sets, are delivered in conjunction with the MAF extracts, and data from the two files are merged for each county during MAF processing.

to an important concept for MAF-based sampling frames, the ungeocoded HU. MAF records that have been assigned census tract and block codes are said to be geocoded, while records without tract and block codes are ungeocoded.

All MAF HUs that were included on the final census address list for 2010 were geocoded; it was a census requirement that all valid living quarters be assigned block codes for tabulation purposes. Also, MAF HUs that originate from a block listing operation like the Community Address Updating System (CAUS) operation will have geocodes. Ungeocoded HUs result from adding addresses to the MAF from a source that does not provide its own block codes. The primary MAF source without block codes, and therefore for ungeocoded MAF addresses, is the DSF.

Block codes are important to the CPS HU Frame for several reasons:

- Block information can be important in locating an address in the field for personal interview.

- The block code is the "gateway" to other census geography; if you know the block for an address, then you can determine its place, county subdivision, urban or rural status, urban area, principal city status, etc. None of this information is available for ungeocoded HUs (unless imputed).

- Block summary data from the census or ACS is linked to geocoded HUs in the CPS HU Frame for efficient sorting of the universe for sampling.

### Keeping the MAF Up-to-Date

The Census Bureau keeps the MAF as current as possible by continuously updating it using a diverse array of address sources, imagery, and field interview and listing operations. While geographic updates to the TIGER are very important, it is the address updates to the MAF portion that are most critical to the mission of maintaining address-based sampling frames for CPS and other surveys. Demographic surveys depend upon frequent and accurate address updates to the MAF to maintain survey coverage and quality.

The MAF updates take two forms:

- **Augmenting and improving the information for existing MAF addresses**. Examples include (1) adding or correcting location address components like street names, unit designations, and ZIP codes; (2) establishing a link between two MAF records because new information shows they actually represent the same HU; and (3) adding a block code to a previously ungeocoded address.

- **Adding new HU or GQ addresses to the MAF from other address sources or field operations**. Sources of new addresses include the DSF, local partnership files, ACS interviews, field listing operations, and decennial field activities.

## The Delivery Sequence File

The DSF is a national inventory of mail delivery points maintained by the USPS. Since the inception of the MAF, the DSF has been its major source of new growth addresses on the MAF. As discussed previously, the DSF was first used to update the MAF in the late 1990s in preparation for the 2000 Census. Since 2000, the Census Bureau has "refreshed" the MAF with new versions of the DSF twice a year. By 2009, after 9 years of these DSF updates, 15.5 percent of the eligible HUs in the ACS HU frame were DSF addresses added to the MAF since the 2000 Census. This figure far surpassed all other sources of new growth addresses between the 2000 and 2010 censuses.

The semiannual DSF refreshes involve a complex address matching operation. The USPS does not specifically identify the new records on the DSF since the last time the file was delivered, so the Census Bureau determines which records represent new addresses not already on the MAF by matching the entire DSF to the MAF by address.[5] DSF addresses that match existing MAF addresses are used to update those records, while new MAF records are created for DSF addresses not found on the MAF. For further detail on the DSF update process, see U.S. Census Bureau (2017).

An important feature of the DSF refresh is that non-city-style addresses from the DSF are discarded and not used to update the MAF. Examples of non-city-style addresses are "RR 4, Box 16, Anytown, PA 29999" and "P.O. Box 11896, Anytown, PA 29999." These addresses are not used in the DSF match to the MAF because of the low match rates and the impermanent relationship between such addresses and HUs on the ground. To the extent that these non-city-style addresses represent new growth in certain areas, MAF coverage is lost. Another limitation of the DSF is that GQ addresses are not flagged as such, so DSF address updates are classified by default as HUs. The DSF is therefore not a source of new GQs on the MAF, while inadvertently contributing some GQ addresses that are misclassified as HUs and included in the HU Frame.

As discussed above, most ungeocoded HUs on the MAF originate from the DSF. This is because the DSF contains no block codes or GPS coordinates. The primary means by which GEO assigns geocodes to DSF additions, then, is by finding a match to an address segment already in TIGER. Because many new DSF addresses are located on newly built streets or street segments not yet included in TIGER, a large share of the new addresses added to the MAF in each year cannot be assigned a geocode through TIGER. As an example, 56.1 percent of the DSF addresses added to the MAF in 2018 were ungeocoded.[6]

The DSF refresh of the MAF is a complicated process, but there are corresponding challenges for MAF users in determining how to use these DSF updates. To consider just one example among many, the USPS classifies each DSF address as either an Include in Delivery Statistics (IDS) address or an Exclude from Delivery Statistics (EDS) address. The nominal definition of an IDS address is that it represents a current mail delivery point, while an EDS address does not. Research has suggested that some portion of EDS addresses represent planned new construction, so (subject to other criteria) such addresses are included in the CPS HU Frame (Loudermilk, 2010; Ying, 2012). There are many other such choices that must be made in determining which DSF addresses should be included and which should not. This process, referred to as MAF filtering, is a critical component of frame construction for CPS

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[5] Other USPS products, like the Locatable Address Conversion System (LACS) file and the ZIP+4 house number range files, are also used in this process. The LACS file will be discussed in more detail later in this section.

[6] Computed using data from the MAF extracts delivered to DSMD in January 2018 and July 2018.

and all other surveys building a sampling frame from the MAF.

## Local Partnership Files

In 2013, the Census Bureau began receiving address and Geographic Information System (GIS) files through a partnership program involving local governments. This program is modeled upon the decennial partnership program, the LUCA program, and is intended to extend the benefits of such a program to the intercensal period. The files submitted by the local government partners ("local partnership files") can cover places, counties, county subdivisions, American Indian Areas, and even entire states. The files undergo a review for quality and, if acceptable, are used to update existing records and add new addresses to the MAF. The data sources for the partnership files can include building permits, tax assessment data, GIS databases, real estate records, and other types of administrative data. Since many local governments now have very complete and accurate GIS information, the partnership file updates can be an important source of geocodes for previously ungeocoded postcensus additions to the MAF. For more information on the partnership file program, see Trainor (2014). See U.S. Census Bureau (2015) for details on the partnership updates.

### *Field Listing Operations*

Several post-2010 block-listing operations have provided updates to the MAF, including:

- **CAUS and MAF Coverage Study (MAFCS)**. CAUS was implemented in 2003 specifically to address ACS coverage concerns with the MAF. CAUS targeted predominantly rural blocks where DSF coverage of postcensus growth was most problematic due to a combination of suspected high growth and a prevalence of non-city-style addresses. Through block canvassing based on a dependent list from the MAF, CAUS supplemented MAF coverage by adding new addresses and changing or deleting existing MAF addresses in up to 1,500 blocks per year through 2016.

  Starting in 2016, CAUS blocks were combined with sample blocks from the MAF Coverage Study to create a national canvassing workload of 20,000 blocks. MAFCS was designed

to produce yearly MAF coverage estimates for the United States and to provide continuous updates to the MAF for current surveys and the 2020 Census. For 2017, MAFCS selected 20,000 sample blocks; at that point, CAUS was essentially absorbed into MAFCS and no longer existed as a separate program. Though originally planned to continue annually through 2019, the MAFCS program was discontinued in April 2017 (U.S. Census Bureau, 2018).

- **Demographic Area Address Listings (DAAL)**.[7] Block listings for the 2000-based area frame for the current household surveys continued to be conducted until 2014, when the DAAL program was phased out and replaced by the MAF as the sole source of sample for the 2010 sample design. The 2000-based block listings were conducted in blocks that were screened into the area frame for the current surveys; these were in primarily rural areas with high concentrations of non-city-style addresses or in areas with no building permit coverage. The listing results were used to update the MAF.

  Starting in 2012, the Coverage Improvement (CI) Frame began sending blocks out for listing under the DAAL banner. These listings were very limited in scope and were discontinued after 2 years when CPS and AHS, the only participants in the frame, decided to drop out. The results from these listings were used to update the MAF and will do so again in the future should the program be revived. The CI Frame is discussed in more detail later.

- **Census tests and dress rehearsals**. Prior to the 2010 Census, block listings were conducted in a very limited set of counties to support various census tests and dress rehearsals. These listings updated the MAF, as will any future listings conducted in support of 2020 decennial efforts.

ACS provides other MAF updates through its time-of-interview (TOI) updates and the ACS GQ program, which includes both a field listing component and headquarters research. ACS-TOI

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[7] For operational reasons, the term DAAL came over time to refer to both the 2000-based area frame block listings for the current surveys and the CAUS listings. Here, we use DAAL in its original sense to refer to the block listings conducted for the current surveys—the 2000-based area frame listings and their successors, the 2010-based CI Frame listings.

provides only updates to existing MAF records that are in the ACS sample, such as adding block codes or modifying address information. The ACS GQ program is one of the only sources of GQ updates to the MAF in the years between censuses; these updates include both new GQ records and HU-to-GQ conversions. The partnership files provide a very limited number of GQ updates, as did the DAAL program before it was phased out for the current surveys.

Another USPS product, the LACS file, is used in conjunction with the DSF to help mitigate duplication on the MAF. The LACS file is a national dataset of address conversions, often from E-911 readdressing operations in rural areas.[8] If both the "old" and "new" address on a LACS record are found in the MAF, they are linked; the old address is the retired record and the new address is the surviving record. This allows surveys that use the MAF to avoid including both records in their sampling frames, thereby avoiding duplication.

## CREATING AND UPDATING THE CURRENT POPULATION SURVEY SAMPLING FRAMES

While both CPS sampling frames for the 2010 sample design are based upon the MAF, they are created in different ways and on different cycles. The HU Frame was created for the first time in 2013 and is updated every 6 months with the latest MAF data. The GQ Frame, conversely, is created every 3 years. The frame construction and updating processes will be described separately for each frame.

### Current Population Survey Housing Unit Frame

GEO delivers MAF extracts to DSMD twice each year, in January and July.[9] A MAF extract is a "snapshot" of the MAF for a given county that

reflects 6 months of DSF and other updates. The MAF extracts do not contain all information from the MAF. The MAF often contains, for example, multiple location addresses and multiple mailing addresses for a given HU; the MAF extract contains only one instance of each address type (the "preferred address").

The delivery of the MAF extracts from GEO to Demographic Systems Division (DSD) kicks off the semiannual HU Frame update cycles.[10] Details on the production of MAF extracts can be found in U.S. Census Bureau (2016). The MAF extracts are reviewed by DSMD for quality, with a focus on the most recent MAF updates. If errors are discovered, DSMD may request a fix and redelivery of the extracts. Once the MAF extracts have all been delivered by GEO and formally accepted by DSMD, the files are submitted to the MAF processing systems within DSD. These systems perform various quality edits, assign codes, and apply the MAF filtering rules to create a set of Edited MAF Extract files.

The MAF filtering is a critical feature of the frame creation process; its outcomes can have an important effect on frame coverage. The MAF extracts contain all records from the MAF for a given county, including many that should not be eligible for the CPS HU Frame. The filtering rules designate each MAF record as either "valid" (passed the filter and eligible for the HU frame) or "invalid" (failed the filter, ineligible for the frame). While some filtering decisions are easy (for example, any record denoted as "nonresidential" or as a "duplicate" is invalid), others are much less obvious. Should ungeocoded additions from the DSF be valid? How about addresses deleted by the 2010 Census that continue to show up on the DSF?

As a result of research conducted by DSMD as part of the 2010 Sample Redesign, DSMD decided to adopt the ACS filtering rules for CPS and the other current household surveys when they switched to a MAF-based HU frame. DSMD plans to continually assess the filter rules and work with ACS to identify possible enhancements. Most filtering questions revolve around this question,

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[8] E-911 readdressing is the process whereby local or state governments mandate new city-style addresses in areas (typically rural) where non-city-style addresses are common. The purpose of the new addresses, which are usually assigned in a systematic manner (for example, 1550 Fogerty Lane represents the house that is 1550 feet from the start of Fogerty Lane), is to provide better location information to allow faster response by emergency vehicles.

[9] The July MAF delivery also includes two sets of Geographic Reference Files (GRFs), one set with block-level records with corresponding geographic attributes (county subdivision, place, urban or rural, etc.) and the other set with the names for all the geographic entities. The GRFs contain geographic codes that are not included on the MAF extracts, so are needed in MAF processing to attach these geographic codes to the Edited MAF Extract files.

[10] DSD is responsible for the programming systems and production files for all the current surveys, while DSMD is responsible for sample design, survey quality, and operational systems. DSMD and DSD work very closely together on frame construction issues.

"When does a new DSF address represent a new growth HU rather than an existing HU already on the MAF from the census or another source?" Failing to provide the correct answer for any subclass of DSF addresses can create either overcoverage (a new DSF address is included in the frame, but the HU is already on the MAF) or undercoverage (a new DSF address is excluded, but it represents a new growth HU not otherwise represented on the MAF).

The CPS HU Frame actually takes the form of separate HU universes by county, just as the MAF extracts are separate by county. The HU Frame files are called the Unit Frame Universe Files (UFUFs). The original UFUFs for CPS and the other current surveys were created in 2013 and consisted of all the valid and invalid HUs from the MAF at that time. If the invalid HUs are MAF records that we consider ineligible for the HU Frame, though, why are they included on the UFUFs? A decision was made to include all MAFIDs on the UFUFs and make the valid or invalid status the first sort key for sampling. All MAFIDs would thereby be given a chance of selection, but any invalid HUs selected for sample will be suppressed from interview unless the MAFID changes to valid status by the time of the first interview.

Starting with those initial 2013 universe files, the UFUFs are updated every 6 months with MAF data in two ways:

- Each existing UFUF record is updated with the most recent MAF data (addresses, block codes, etc.) and its latest filtering status.

- New growth records are added to the UFUF.

The UFUFs are also updated with sort information from ACS and decennial block-level data as part of the annual sampling process, which takes place once each year as part of the January MAF processing cycle. Each survey participating in annual sampling can sort the frame units in its own way. The CPS sort keys for the UFUFs are discussed in Chapter 2-2, Sample Design.

If the UFUFs that are updated from the January MAF extracts each year are used for annual sampling, what is the purpose of the July updates? In addition to refreshing the MAF data for sample cases that have not yet gone out to interview,

the new growth cases added to the UFUF in the July phase can "activate" CPS sample that was selected in a prior annual sampling phase, thereby increasing the CPS sample size. In fact, every MAF update, whether January or July, has this ability to activate sample cases by adding new growth to the UFUF.[11]

To understand how this new growth works, consider that each UFUF at time of annual sampling consists of two portions: the actual universe, which consists of actual MAFIDs, versus the "skeleton" universe, made up of units not yet linked up with MAFIDs. The skeleton portion of the UFUF is essentially an empty framework that is to be filled in with new growth over time. During annual sampling, CPS selects its sample across both portions of the UFUF. Many lines in the skeleton universe are thereby selected for sample, but will not be activated unless associated with MAFIDs at some later point. This feature of the HU Frame allows for constant augmentation of the CPS sample with new growth up until the final scheduled interview for a given sample designation.

Consider this example:

In the 2013 annual sampling phase, CPS selected sample cases that were all designated A03. Many of these cases were assigned to UFUF units associated with MAFIDs, while others were assigned to empty records in the skeleton portion of the universe. As the skeleton universe was filled in with actual MAF data by subsequent MAF updates (July 2013, January 2014, July 2014, etc.), additional A03 cases were activated and added to the CPS sample. The first interviews for A03 cases began in August 2014, but some A03 cases started interviews as late as March 2016. Therefore, the A03 sample that was originally selected from the HU Frame in 2013 could have been augmented with new cases as late as July 2015.

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[11] Note that while every MAF processing cycle can add new growth to the UFUFs, not all do. An example is the January 2015 cycle, when problems with the MAF delivery could not be fixed in time, so MAF extracts from the previous delivery (July 2014) were substituted. No new growth was added to the UFUFs for that cycle. In July 2015, though, the UFUFs "caught up" when updated with MAF extracts that by then contained an entire year of new growth.

## Group Quarters Frame

The GQ Frame for CPS and the other current surveys is created from MAF extracts only once every 3 years. CPS and the other current surveys participating in the frame each select a 3-year sample of GQs. The first GQ Frame was created from the July 2012 MAF extracts; the second GQ Frame was created from the January 2016 MAF extracts.

The GQs on the frame all come from the MAF, and nearly all GQs on the MAF were collected during the 2010 Census through operations like 2010 Address Canvassing and GQ Validation. Unlike the DSF on the HU side, there is not a dependable source of new GQ addresses for the MAF. ACS GQ operations add some new GQs and HU-to-GQ conversions, the local partnership files can contribute some GQs, and block listing operations like CAUS capture a relatively small number of GQ addresses. For the most part, though, the GQ Frame remains relatively static from one version to the next. There is some possibility that future GQ Frames may include new college housing GQs collected through an independent study by DSMD.

Note that, while the HU Frame contains information down to the HU level, including individual units within apartment complexes, the GQ Frame does not include "unit" information for each GQ. Instead, the MAF provides an expected GQ size; any GQ selected for sample must then be sent to the field for a listing of the "units" (which can be rooms, beds, or people) at the GQ before individual sample units can be identified and interviewed.

The GQ Frame consists only of noninstitutional GQs and excludes institutional GQs. Noninstitutional GQs are facilities for people who are not under formally authorized and supervised care and custody such as college housing, group homes for adults, workers' living quarters, and convents. Institutional GQs include facilities such as prisons, skilled nursing facilities, and residential treatment centers for juveniles.

## Coverage Improvement Frame

In the period immediately following the 2010 Census, the MAF had a very high level of coverage due to 2010 Address Canvassing and other decennial operations that systematically captured address information. That coverage may start to degrade over time in areas where there is no reliable source of new growth (postcensus) addresses. The DSF, as the major source of HU updates to the MAF between censuses, is the primary driver of new growth coverage on the MAF. In most urban and suburban areas, the DSF should be a thorough source of new growth. In more rural areas with more non-city-style addresses or lack of home mail delivery, though, the lack of DSF coverage may lead to MAF undercoverage concerns.[12]

Research conducted as part of the 2010 Sample Redesign (Liu, 2009) suggested a risk of future bias in the CPS state-level, labor force participation estimates due to potential MAF undercoverage. DSMD proposed a coverage improvement operation in the 13 states identified as at-risk in the study: Alabama, Alaska, Arkansas, Kentucky, Maine, Mississippi, Montana, New Hampshire, New Mexico, Oklahoma, Vermont, West Virginia, and Wyoming. Within these 13 states, a universe of blocks with suspect DSF coverage would be identified each year. The blocks would be sampled and the selected blocks would be sent to the field to be canvassed. Because the HU Frame already provides coverage of any HUs in these blocks that were on the MAF, the CI Frame was concerned only with the HUs that were added by the field listers. Any added HUs within the blocks selected by a survey would automatically be in sample for the survey; in effect, these CI Frame additions would supplement and be indistinguishable from the HU Frame sample cases for the survey.

CPS was a participant in the CI Frame from its first sampling and listing phases in 2012, with AHS joining a year later. By late 2014, though, CPS and AHS decided to end their participation in the frame due to cost. Therefore, the CI Frame has been suspended and will not be reinstated unless CPS or other surveys decide that MAF supplementation is needed.

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[12] As stated earlier, non-city-style addresses from the DSF are not used to refresh the MAF, so the MAF may be deficient in coverage in areas with such addresses (even if covered by the DSF).

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# Chapter 2-2: Sample Design

## INTRODUCTION

For more than seven decades, the CPS has been one of the major sources of up-to-date information on the labor force and demographic characteristics of the U.S. population. Because of the CPS's importance and high profile, the reliability of the estimates is evaluated periodically. The design has often been under close scrutiny in response to demand for new data and the need to improve the reliability of the estimates by applying research findings and new types of information (especially decennial census results). All changes are implemented with concern for minimizing cost and maximizing comparability of estimates across time. The methods used to select the sample households for the survey are reevaluated after each decennial census. Based on these reevaluations, the design of the survey is modified and systems are put in place to provide sample for the following decade. The most recent decennial revision incorporated new information from the 2010 Census and was fully implemented as of July 2015.

This chapter describes the CPS sample design as of July 2015. It is directed to a general audience and presents many topics with varying degrees of detail. The following section provides a broad overview of the CPS design.

## SURVEY REQUIREMENTS AND DESIGN

### Survey Requirements

The following bulleted items briefly describe the major characteristics of the CPS sample as of July 2015:

- The CPS sample is a probability sample.

- The sample is designed primarily to produce national and state estimates of labor force characteristics of the civilian noninstitutional population aged 16 and older (CNP16+).

- The CPS sample consists of independent samples from each state and the District of Columbia. Each state sample is specifically tailored to the demographic and labor market conditions that prevail in that particular state. California and New York State are further divided into two substate areas that also have

independent designs: Los Angeles County and the rest of California, New York City and the rest of New York State.[13] Since the CPS design consists of independent samples for the states and substate areas, it is said to be state-based.

- Sample sizes are determined by reliability requirements that are expressed in terms of the coefficient of variation (CV). The CV is a relative measure of the sampling error and is calculated as sampling error divided by the expected value of the given characteristic. The specified CV requirement for the monthly unemployment level for the nation, given a 6.0 percent unemployment rate, is 1.9 percent. The 1.9 percent CV is based on the requirement that a difference of 0.2 percentage points in unemployment rate between 2 consecutive months be statistically significant at the 0.10 level.

- The required CV on the annual average unemployment level for each state, substate area, and the District of Columbia, given a 6.0 percent unemployment rate, is 8.0 percent.

### Overview of Survey Design

The CPS sample is a multistage stratified sample of approximately 72,000 assigned HUs from 852 sample areas. It is designed to measure demographic and labor force characteristics of the civilian noninstitutional population aged 16 and older. Approximately 12,000 of these assigned HUs are sampled under the Children's Health Insurance Program (CHIP) expansion that has been part of the official CPS sample since July 2001. CPS samples HUs from the MAF HU and GQ sections that include all the official 2010 Census addresses and postcensus additions from the USPS, local jurisdictions, and field listings. As of July 2015, sample is drawn annually to allow newly constructed HUs a chance of selection before the transition to a new sample.

The first stage of sampling involves dividing the United States into primary sampling units (PSUs)—most of which comprise a metropolitan area, a

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[13] New York City consists of Bronx, Kings, New York, Queens, and Richmond Counties.

large county, or a group of smaller counties. Every PSU is nested within the boundary of a state. The PSUs are then grouped into strata based on independent information that is obtained from the decennial census or other sources. The strata are constructed so that they are as homogeneous as possible with respect to labor force and other social and economic characteristics that are highly correlated with unemployment. One PSU is sampled in each stratum. The probability of selection for each PSU in the stratum is proportional to its population as of the 2010 Census.

A second stage of sampling is conducted annually; a sample of HUs within the sample PSUs is drawn. Ultimate sampling units (USUs) are small groups of HUs. The bulk of the USUs sampled in the second stage consist of sets of addresses that are systematically drawn from sorted lists of blocks. HUs from blocks with similar demographic composition and geographic proximity are grouped together in the list. In parts of the United States where addresses are not recognizable on the ground, USUs are identified using area sampling techniques.

The CPS sample is usually described as a two-stage sample because PSUs and groups of HUs are each selected. PSUs are selected from strata, and HUs are selected from these PSUs.

Each month, interviewers collect data from the sample HUs. A HU is interviewed for 4 consecutive months, dropped out of the sample for the next 8 months, and interviewed again in the following 4 months. In all, a sample HU is interviewed 8 times; this is known as the 4-8-4 design.

Households are rotated in and out of the sample in a way that improves the accuracy of the month-to-month and year-to-year change estimates. The rotation scheme ensures that in any single month, approximately one-eighth of the HUs are interviewed for the first time, another eighth are interviewed for the second time, and so on. That is, after the first month, six of the eight rotation groups will have been in the survey for the previous month—there will always be a 75 percent month-to-month overlap. Thus, four of the eight rotation groups in any month will have been in the survey for the same month, 1 year ago; there will always be a 50 percent year-to-year overlap. This rotation scheme upholds the scientific tenets of probability sampling, and each month's sample produces an unbiased representation of the target population. The rotation system makes it possible to reduce sampling error by using a composite estimation procedure (Chapter 2-3, Weighting and Estimation) and, at slight additional cost, by increasing the representation in the sample of USUs with unusually large numbers of HUs.

Each state's sample design ensures that most HUs within a state have the same overall probability of selection. Because of the state-based nature of the design, sample HUs in different states have different overall probabilities of selection. The system of state-based designs ensures that both state and national reliability requirements are met.

## FIRST STAGE OF THE SAMPLE DESIGN

The first stage of the CPS sample design is the selection of counties. The purpose of selecting a subset of counties instead of having all counties in the sample is to minimize the cost of the survey. This is done mainly by minimizing the number of FRs needed to conduct the survey and reducing the travel cost incurred in visiting the sample HUs. Two features of first-stage sampling are: (1) to ensure that sample counties represent other counties with similar labor force characteristics that are not selected; and (2) to ensure that each FR is allotted a manageable workload in his or her sample area.

The first-stage sample selection is carried out in three major steps:

- Definition of the PSUs.

- Stratification of the PSUs within each state.

- Selection of the sample PSUs in each state.

These steps are implemented soon after the decennial census.

### Definition of the Primary Sampling Units

PSUs are delineated so that they encompass the entire United States. The land area covered by each PSU is made reasonably compact so an interviewer can traverse it without incurring unreasonable costs. The population is as heterogeneous with regard to labor force characteristics as can be made consistent with the other constraints. Strata are constructed that are homogenous in terms of labor force characteristics to minimize between-PSU variance. Between-PSU variance

is a component of total variance that arises from selecting a sample of PSUs rather than selecting all PSUs. In each stratum, one PSU is selected to represent the other PSUs in the same stratum.

Most PSUs are groups of contiguous counties rather than single counties. A group of counties is more likely than a single county to have diverse labor force characteristics. Limits are placed on the geographic size of a PSU to restrict the distance an FR must travel.

### Rules for Defining Primary Sampling Units

- Each PSU is contained within the boundary of a single state.

- Metropolitan Statistical Areas (MSAs) are defined as separate PSUs using projected 2013 Core-Based Statistical Area (CBSA) definitions. CBSAs are defined as metropolitan or micropolitan areas and include at least one county. Micropolitan areas and areas outside of CBSAs are considered nonmetropolitan areas. If any metropolitan area crosses state boundaries, each state/metropolitan area intersection is a separate PSU.

- For most states, PSUs are either one county or two or more contiguous counties. In some states, county equivalents are used: cities, independent of any county organization, in Maryland, Missouri, Nevada, and Virginia; parishes in Louisiana; and boroughs and census divisions in Alaska.

- The area of the PSU should not exceed 3,000 square miles except in cases where a single county exceeds the maximum area.

- The population of the PSU is at least 7,500 except where this would require exceeding the maximum area specified as 3,000 square miles.

- In addition to meeting the limitation on total area, PSUs are formed to limit extreme length in any direction and to avoid natural barriers within the PSU.

The PSU definitions are revised each time the CPS sample design is revised. Revised PSU definitions reflect changes in metropolitan area definitions and an attempt to have PSUs consistent with other Census Bureau demographic surveys.[14] The following are steps for combining counties, county equivalents, and independent cities into PSUs for the 2010 design:

- The 2010 PSUs are revised by incorporating new or redefined metropolitan areas into the PSU definitions.

- Any single county is classified as a separate PSU if it exceeds the maximum area limitation deemed practical for FR travel (regardless of its 2010 population).

- Other counties within the same state are examined to determine whether they might advantageously be combined with contiguous counties without violating the population and area limitations.

- Contiguous counties with natural geographic barriers between them are placed in separate PSUs to reduce the cost of travel within PSUs.

These steps created 1,987 PSUs in the United States from which to draw the sample for the CPS when it was redesigned after the 2010 decennial census.

### Stratification of Primary Sampling Units

The CPS sample design calls for combining PSUs into strata within each state and selecting one PSU from each stratum. For this type of sample design, sampling theory and cost considerations suggest forming strata with approximately equal population sizes. When the design is self-weighting (i.e., uses the same sampling fraction in all strata) and one FR is assigned to each sample PSU, equal stratum sizes have the advantage of providing equal FR workloads (before population growth and migration significantly affect the PSU population sizes).

Sampling theory and costs dictate that highly populated PSUs should be selected for sample with certainty. The rationale is that some PSUs exceed or come close to the population size needed for equalizing stratum sizes. These PSUs are designated as self-representing (SR). Each

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[14] Final metropolitan area definitions were not available from the Office of Management and Budget when PSUs were defined. Fringe counties having a good chance of being in final CBSA definitions are separate PSUs. Most projected CBSA definitions are the same as final CBSA definitions (Executive Office of the President, 2013).

SR PSU is treated as a separate stratum and is included in the sample.

The following describes the steps for stratifying PSUs for the 2010 redesign:

1.  CPS used several criteria to determine which PSUs would be SR. First, all counties that existed in the 150 most populous CBSAs were set as SR after determining that a natural break in population existed between CBSAs ranked 150 and 151. Then, a formula was used to determine which of the remaining PSUs would become SR. If the calculated field workload (#HU selected) for a PSU is greater than or equal to 55, the PSU is classified as SR.

$$\#HU\ selected \overset{def}{=} \frac{PSU\ MOS}{p(selection) * SI} \geq 55$$

    Where

    $PSU\ MOS =$ total number of HUs in PSU

    $p(selection) =$ probability of selection

    $SI =$ state sampling interval

2.  The remaining PSUs were grouped into non-self-representing (NSR) strata within state boundaries. In each NSR stratum, one PSU was selected to represent all of the PSUs in the stratum. They are formed by adhering to the following criteria:

    a.  Roughly equal-sized NSR strata are formed within a state.

    b.  NSR strata are formed so as to yield reasonable FR workloads of roughly 35 to 55 HUs in an NSR PSU. The number of NSR strata in a state is a function of the 2010 population, civilian labor force, state CV, and between-PSU variance on the unemployment level. (Workloads in NSR PSUs are constrained because one FR must canvass the entire PSU. No such constraints are placed on SR PSUs.) In Alaska, the strata are also a function of expected interview cost.

    c.  NSR strata are formed with PSUs homogeneous with respect to labor force and other social and economic characteristics that are highly correlated with unemployment. This helps to minimize the between-PSU variance.

Key variables used for stratification include:

- Number of males unemployed.
- Number of females unemployed.
- Number of families with female head of household.
- Number of households with three or more people.

In addition to these, a number of other variables were used for stratification in certain states, such as industry and wage variables obtained from Quarterly Census of Employment and Wages program at the BLS. The number of stratification variables in a state ranged from three to six except in Alaska, where the only variable used is the number of males unemployed.

d.  Starting with the 2010 sample redesign, stratifications and PSUs in sample for CPS and CHIP are exactly the same in states that contain CHIP sample.

e.  Table 2-2.1 summarizes the percentage of the targeted population in SR and sampled NSR areas by state. SR percentages for a given state were computed as the ratio of the sum of MOS (measure of size) of all SR PSUs and the total MOS for that state. NSR percentages for a given state were computed as the ratio of the sum of MOS of only the selected NSR PSUs and the total MOS for that state.

The CPS used the PSU Stratification Program (PSP), created by the Demographic Statistical Methods Division of the Census Bureau, to perform the PSU stratification. CPS strata in all states are formed by the PSP. The PSP randomly places NSR PSUs into strata for each state or area by adhering to the NSR stratum size tolerance as the initial stratification. The criterion score is how the stratifications were compared. It is an estimate of variance that would result from the given stratification. The criterion score (using between or total variance) is computed. PSUs are next moved from strata to strata (maintaining sample size criterion) in an attempt to improve (lower) the criterion

Table 2-2.1.

## Civilian Noninstitutional Population 16 Years and Over in Sample Areas for 852-Primary-Sampling-Unit Design by State

| State | Total | | Self-representing | | Non-self-representing | |
|---|---|---|---|---|---|---|
| | Population[1] | Percent | Population[1] | Percent | Population[1] | Percent |
| **Total** . . . . . . . . . . . . . . . | **185,883,503** | **85.8** | **167,296,681** | **77.2** | **18,586,822** | **8.6** |
| Alabama . . . . . . . . . . . . . . . . . | 2,201,623 | 66.7 | 1,559,216 | 48.4 | 602,407 | 18.2 |
| Alaska . . . . . . . . . . . . . . . . . . | 388,785 | 85.2 | 337,864 | 74.1 | 50,921 | 11.2 |
| Arizona . . . . . . . . . . . . . . . . . | 3,905,714 | 90.5 | 3,505,676 | 81.3 | 400,038 | 9.3 |
| Arkansas . . . . . . . . . . . . . . . . | 1,308,227 | 65.8 | 936,784 | 47.1 | 371,443 | 18.7 |
| California . . . . . . . . . . . . . . . . | 25,685,930 | 96.5 | 24,875,235 | 93.5 | 810,695 | 3.0 |
| Los Angeles . . . . . . . . . . . . | 7,286,643 | 100.0 | 7,286,643 | 100.0 | Z | Z |
| Remainder of California. . . | 18,399,287 | 95.2 | 17,588,592 | 91.0 | 810,695 | 4.2 |
| Colorado . . . . . . . . . . . . . . . . | 2,853,127 | 82.4 | 2,613,303 | 75.5 | 239,824 | 6.9 |
| Connecticut . . . . . . . . . . . . . . | 2,568,385 | 100.0 | 2,568,385 | 100.0 | Z | Z |
| Delaware . . . . . . . . . . . . . . . . | 624,999 | 100.0 | 624,999 | 100.0 | Z | Z |
| District of Columbia . . . . . . . . | 472,453 | 100.0 | 472,453 | 100.0 | Z | Z |
| Florida . . . . . . . . . . . . . . . . . . | 12,599,956 | 94.4 | 11,978,102 | 89.7 | 621,854 | 4.7 |
| Georgia . . . . . . . . . . . . . . . . . | 5,177,165 | 78.4 | 4,462,856 | 67.6 | 714,309 | 10.8 |
| Hawaii . . . . . . . . . . . . . . . . . . | 939,702 | 100.0 | 939,702 | 100.0 | Z | Z |
| Idaho . . . . . . . . . . . . . . . . . . . | 810,619 | 78.2 | 624,070 | 60.2 | 186,549 | 18.0 |
| Illinois . . . . . . . . . . . . . . . . . . | 8,145,484 | 89.2 | 7,320,664 | 80.2 | 824,820 | 9.0 |
| Indiana . . . . . . . . . . . . . . . . . . | 3,502,350 | 78.1 | 2,964,356 | 60.1 | 807,994 | 18.0 |
| Iowa . . . . . . . . . . . . . . . . . . . . | 1,265,473 | 59.8 | 736,978 | 34.8 | 528,495 | 25.0 |
| Kansas . . . . . . . . . . . . . . . . . . | 1,380,262 | 71.5 | 1,091,805 | 56.6 | 288,457 | 14.9 |
| Kentucky . . . . . . . . . . . . . . . . | 1,903,506 | 62.9 | 1,360,990 | 44.9 | 542,516 | 17.9 |
| Louisiana . . . . . . . . . . . . . . . . | 2,572,843 | 82.1 | 2,030,269 | 64.8 | 542,574 | 17.3 |
| Maine . . . . . . . . . . . . . . . . . . . | 790,526 | 84.2 | 659,409 | 70.2 | 131,117 | 14.0 |
| Maryland . . . . . . . . . . . . . . . . | 3,864,604 | 95.5 | 3,727,311 | 92.1 | 137,293 | 3.4 |
| Massachusetts . . . . . . . . . . . . | 4,811,359 | 100.0 | 4,811,359 | 100.0 | Z | Z |
| Michigan . . . . . . . . . . . . . . . . | 6,062,207 | 86.6 | 5,177,361 | 73.9 | 884,846 | 12.6 |
| Minnesota . . . . . . . . . . . . . . . | 2,597,419 | 69.7 | 2,274,189 | 61.1 | 323,230 | 8.7 |
| Mississippi . . . . . . . . . . . . . . . | 1,183,622 | 58.3 | 798,265 | 39.3 | 385,357 | 19.0 |
| Missouri . . . . . . . . . . . . . . . . . | 2,839,179 | 68.8 | 2,600,607 | 63.0 | 238,572 | 5.8 |
| Montana . . . . . . . . . . . . . . . . | 523,403 | 77.0 | 433,654 | 63.8 | 89,749 | 13.2 |
| Nebraska . . . . . . . . . . . . . . . . | 875,096 | 70.4 | 696,627 | 56.0 | 178,469 | 14.4 |
| Nevada . . . . . . . . . . . . . . . . . | 1,787,944 | 96.9 | 1,737,016 | 94.1 | 50,928 | 2.8 |
| New Hampshire . . . . . . . . . . . . | 933,310 | 100.0 | 933,310 | 100.0 | Z | Z |
| New Jersey . . . . . . . . . . . . . . . | 6,390,073 | 100.0 | 6,390,073 | 100.0 | Z | Z |
| New Mexico . . . . . . . . . . . . . . | 1,133,369 | 81.3 | 950,061 | 68.1 | 183,308 | 13.1 |
| New York . . . . . . . . . . . . . . . . | 13,219,759 | 92.1 | 12,739,122 | 88.8 | 480,637 | 3.6 |
| New York City . . . . . . . . . . . | 6,316,113 | 100.0 | 6,316,113 | 100.0 | Z | Z |
| Remainder of New York. . . | 6,903,646 | 86.0 | 6,423,009 | 80.0 | 480,637 | 6.0 |
| North Carolina . . . . . . . . . . . . | 5,144,855 | 77.8 | 4,302,744 | 65.1 | 842,111 | 12.7 |
| North Dakota . . . . . . . . . . . . . | 365,709 | 77.5 | 272,519 | 57.8 | 93,190 | 19.7 |
| Ohio . . . . . . . . . . . . . . . . . . . . | 6,601,621 | 82.1 | 6,056,024 | 75.3 | 545,597 | 6.8 |
| Oklahoma . . . . . . . . . . . . . . . . | 1,701,769 | 67.3 | 1,484,962 | 58.8 | 216,807 | 8.6 |
| Oregon . . . . . . . . . . . . . . . . . . | 2,298,939 | 85.5 | 1,798,682 | 66.9 | 500,257 | 18.6 |
| Pennsylvania . . . . . . . . . . . . . | 7,883,979 | 87.1 | 7,167,370 | 79.2 | 716,609 | 7.9 |
| Rhode Island . . . . . . . . . . . . . | 764,720 | 100.0 | 764,720 | 100.0 | Z | Z |
| South Carolina . . . . . . . . . . . . | 2,757,560 | 86.3 | 2,433,050 | 76.2 | 324,510 | 10.2 |
| South Dakota . . . . . . . . . . . . . | 321,254 | 58.6 | 230,650 | 42.1 | 90,604 | 16.5 |
| Tennessee . . . . . . . . . . . . . . . . | 3,488,335 | 78.8 | 2,747,854 | 62.1 | 740,481 | 16.7 |
| Texas . . . . . . . . . . . . . . . . . . . | 15,033,549 | 88.4 | 13,369,052 | 78.7 | 1,664,497 | 9.8 |
| Utah . . . . . . . . . . . . . . . . . . . . | 1,652,069 | 91.5 | 1,533,187 | 84.9 | 118,882 | 6.6 |
| Vermont . . . . . . . . . . . . . . . . . | 455,575 | 100.0 | 455,575 | 100.0 | Z | Z |
| Virginia . . . . . . . . . . . . . . . . . | 4,498,245 | 82.7 | 3,854,979 | 70.8 | 643,266 | 11.8 |
| Washington . . . . . . . . . . . . . . | 3,532,297 | 76.1 | 3,085,917 | 66.5 | 446,380 | 9.6 |
| West Virginia . . . . . . . . . . . . . | 764,529 | 58.2 | 561,890 | 42.8 | 202,639 | 15.4 |
| Wisconsin . . . . . . . . . . . . . . . | 2,785,300 | 69.6 | 2,020,342 | 50.5 | 764,958 | 19.1 |
| Wyoming . . . . . . . . . . . . . . . . | 284,725 | 74.6 | 225,093 | 59.0 | 59,632 | 15.6 |

Z Represents or rounds to zero.
[1] Civilian noninstitutional population from sample areas 16 years of age and over based on the 2010 Census.
Source: U.S. Census Bureau, 2010 Census.

score. All possible swaps of PSUs from one stratum to another are then evaluated. A list of the best stratifications based on criterion score was created and given to the analyst for each state. A national file is then produced containing the chosen stratification for each state.

A consequence of the above stratification criteria is that states that are geographically small, mostly urban, or demographically homogeneous are entirely SR. These states are Connecticut, Delaware, Hawaii, Massachusetts, New Hampshire, New Jersey, Rhode Island, and Vermont. Additionally, the District of Columbia and the New York City and Los Angeles sub-state areas are entirely SR.

## Selection of Primary Sampling Units

Each SR PSU is in the sample by definition. There are currently 506 SR PSUs. In each of the remaining 346 NSR strata, one PSU is selected for the sample following the guidelines described next.

At each sample redesign of the CPS, it is important to minimize the cost of introducing a new set of PSUs. Substantial investment has been made in hiring and training FRs in the existing sample PSUs. For each PSU dropped from the sample and replaced by another in the new sample, the expense of hiring and training a new FR must be accepted. Furthermore, there is a temporary loss in accuracy of the results produced by new and relatively inexperienced FRs. Concern for these factors is reflected in the procedure used for selecting PSUs.

## Objectives of the Non-Self-Representing Selection Procedure

The selection of the NSR PSUs was carried out within the strata using the 2010 Census population. The selection procedure selected one PSU from each stratum with probability proportional to the 2010 population.

## Calculation of Overall State Sampling Interval

After stratifying the PSUs within the states, the overall sampling interval in each state is computed. The overall state sampling interval is the inverse of the probability of selection of each HU in a state for a self-weighting design. By design, the overall state sampling interval is fixed, but the state sample size is not fixed, allowing for growth of the CPS sample because of HUs built after the 2010 Census. (See below for information about how the desired CPS sample size is maintained.)

The state sampling interval is designed to meet the requirements for the variance on an estimate of the unemployment level. This variance can be thought of as a sum of variances from the first stage and the second stage of sample selection.

The first-stage variance is called the between-PSU variance and the second-stage variance is called the within-PSU variance.

The square of the state CV, or the relative variance, is expressed as

$$CV^2 = \frac{\sigma_b^2 + \sigma_w^2}{[E(X)]^2} \qquad (2\text{-}2.1)$$

where

$\sigma_b^2 =$ between-PSU variance contribution to the variance of the state unemployment level estimator

$\sigma_w^2 =$ within-PSU variance contribution to the variance of the state unemployment level estimator

$E(X) = x$, the expected value of unemployment level for the state

The term $\sigma_w^2$ can be written as the variance assuming a binomial distribution from a simple random sample multiplied by a design effect

$$\sigma_w^2 = \frac{N^2 pq(deff)}{n}$$

where
$N =$ the civilian noninstitutional population, 16 years of age and older (CNP16+), for the state

$p =$ proportion of unemployed in the CNP16+ for the state, or $\frac{x}{N}$

$n =$ the state sample size

$q = 1 - p$

$deff =$ the state within-PSU design effect. This is a factor accounting for the difference between the variance calculated from a multistage stratified sample and that from a simple random sample.

Substituting $Np = x$, this formula can be rewritten as

$$\sigma_w{}^2 = SI\,(x)(q)(deff) \qquad (2\text{-}2.2)$$

where $SI =$ the state sampling interval, or $\dfrac{x}{N}$

Substituting Formula 2-2.2 into Formula 2-2.1 and rewriting in terms of the state sampling interval gives

$$SI = \frac{CV^2 x^2 - \sigma_b{}^2}{x\,q\,(deff)},$$

where
$CV^2\,X^2 =$ is the variance. Generally, the overall state sampling interval is used for all strata in a state yielding a self-weighting state design. (In some states, the sampling interval is adjusted in certain strata to equalize FR workloads.) When computing the sampling interval for the current CPS sample, a six percent state unemployment rate is assumed. Table 2-2.1 provides information on the proportion of the population in sample areas for each state.

The CHIP sample is allocated among the states after the CPS sample is allocated. A sampling interval accounting for both the CPS and CHIP samples can be computed as:

$$SI_{COMB} = \left(\frac{1}{SI_{CPS}} + \frac{1}{SI_{CHIP}}\right)^{-1}$$

The between-PSU variance for the combined CPS/CHIP sample can be estimated using:

$$\sigma^2_{B,COMB} = \left(\frac{SI_{COMB}}{SI_{CPS}}\right)\sigma^2_{B,CPS} + \left(1 - \frac{SI_{COMB}}{SI_{CPS}}\right)\sigma^2_{B,CHIP}$$

## SECOND STAGE OF THE SAMPLE DESIGN

The second stage of the CPS sample design is the selection of sample HUs within PSUs. The objectives of within-PSU sampling are to:

- Select a probability sample that is representative of the civilian noninstitutional population.

- Give each HU in the population one chance of selection, with virtually all HUs in a state or substate area having the same overall chance of selection.

- For the sample size used, keep the within-PSU variance of the labor force statistics (in particular, unemployment) at as low a level as possible, subject to respondent burden, cost, and other constraints.

- Select within-PSU sample units annually.

- Put particular emphasis on providing reliable estimates of monthly levels and change over time of labor force items.

USUs are the sample units selected during the second stage of the CPS sample design. Most USUs consist of a geographically compact cluster of approximately four addresses, corresponding to four HUs at the time of the census. Use of HU clusters lowers travel costs for FRs. Clustering slightly increases within-PSU variance of estimates for some labor force characteristics since respondents within a compact cluster tend to have similar labor force characteristics.

## Overview of Sampling Sources

To accomplish the objectives of within-PSU sampling, extensive use is made of data from the 2010 Census. The 2010 Census collected information on all living quarters existing as of April 1, 2010, as well as the demographic composition of people residing in these living quarters. Data on the economic well-being and labor force status of individuals was obtained from the American Community Survey.

These sources provide sampling information for numerous demographic surveys conducted by the Census Bureau.[15] In consideration of respondents, sampling methodologies are coordinated among these surveys to ensure that a sampled HU is selected for one survey only. Consistent definition of sampling frames allows the development of separate, optimal sampling schemes for each survey. The general strategy for each survey is to sort and stratify all the elements in the sampling frame (eligible and not eligible) to satisfy individual survey requirements, select a systematic sample, and remove the selected sample from the frame. Sample is selected for the next survey from what remains. Procedures are developed to determine eligibility of sample cases at the time of

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[15] CPS sample selection is coordinated with the following demographic surveys in the 2010 redesign: the AHS-Metropolitan sample, the AHS-National sample, the CE Survey-Diary sample, the CE Survey-Quarterly sample, the Telephone Point of Purchase Survey, the NCVS, the National Health Interview Survey, the Rent and Property Tax Survey, and the SIPP.

interview for each survey. This coordinated sampling approach is computer intensive and started with the 2000 sample redesign.

## Type of Living Quarters

Two types of living quarters were defined for the census. The first type is a HU. A HU is a group of rooms or a single room occupied as a separate living quarter or intended for occupancy as a separate living quarter.[16] A HU may be occupied by a family, one person, or two or more unrelated people who share the living quarter. About 99 percent of the population counted in the 2010 Census resided in HUs.

The second type of living quarter is a GQ. A GQ is a living quarter where residents share common facilities or receive formally authorized care. Examples include college dormitories, retirement homes, and communes. Some GQs, such as fraternity and sorority houses and certain types of group houses, are distinguished from HUs if they house ten or more unrelated people. The GQ population is classified as institutional or noninstitutional and as military or civilian. CPS targets only the civilian noninstitutional population residing in GQs. As a cost-savings measure, student dormitories are not sampled, since the vast majority of students in dormitories either have a usual residence elsewhere, are not in the labor force, or both. A subset of institutional GQs is included in the GQ frame and given a chance of selection in case of conversion to civilian noninstitutional housing by the time it is scheduled for interview. Less than 1 percent of the population counted in the 2010 Census resided in GQs.

## Development of Sampling Frames

The primary sampling frame used by the CPS in 2010 was the MAF. This file is used by many demographic surveys and comprises 2010 decennial census addresses with updates from the USPS and local governments. Refer back to Chapter 2-1, CPS Frame for more about the MAF. Separate

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[16] Separate living quarters are living quarters in which one or more occupants live separately from any other individual(s) in the building and have direct access to the living quarters without going through another living quarters, such as from outside the building or through a common hall. For vacant units, the criteria of separateness and direct access are applied to the intended occupants (U.S. Census Bureau, Decennial Management Division Glossary [2014]).

HU and GQ frames are created from the MAF. The skeleton frame, described below, is also used as a placeholder for future sample from new construction.

## Housing Units on the MAF

The HU portion of the MAF includes all the official 2010 census addresses and postcensus additions from the USPS, local jurisdictions, and field listings. About 99 percent of CPS sample comes from the HU portion of the MAF. The unit frame consists of HUs in census blocks that contain a very high proportion of complete addresses. The unit frame covers most of the population. A USU in the unit frame consists of a geographically compact cluster of four addresses, which are identified during sample selection. The addresses, in most cases, are those for separate HUs. However, over time some buildings may be demolished or converted to nonresidential use, and others may be split up into several HUs. These addresses remain sample units, resulting in a small variability in cluster size.

## Group Quarters on the MAF

About 1 percent of sample is also selected from the GQs portion of the MAF. The GQs on the MAF consist of noninstitutional facilities such as college dorms, adult group homes, Job Corps centers, and religious GQs.

The GQ frame covers a small proportion of the population. A CPS USU in the GQ frame consists of two HU equivalents. The GQ frame is converted into HU equivalents because the 2010 Census addresses of individual GQs or people within a GQ are not used in the sampling. The number of HU equivalents is computed by dividing the 2010 Census GQs population by the average number of people per household (calculated from the 2010 Census as 2.61).

## Skeleton Frame

The skeleton frame in the 2010 redesign is different from the skeleton frame created for the 2000 redesign. The 2000 skeleton frame, most commonly referred to as the permit frame, was filled in with HUs listed in the permit address listing/new construction operations. The 2010 skeleton frame provides placeholders to be filled

in by new growth identified in the MAF extracts every 6 months. The purpose of the 2000 skeleton frame was to allocate new growth sample in selected areas to a 15-year sampling period. The primary purpose of the skeleton frame for the 2010 redesign is to select sample units from new growth updates as part of annual sampling, and its secondary purpose is to provide representative new growth sample between main sample selection periods.

### Group Quarters Details

An integer number of GQ units is calculated at the census block level. The number of GQ units is referred to as the GQ block MOS and is calculated as follows

$$GQMOS := \frac{NI + CH}{(2\alpha)} + \begin{cases} 1 \ if \ IN \geq 1 \\ 0 \ otherwise \end{cases}$$

where

$NI =$ tabulation block noninstitutional GQ population excluding college housing and military GQs

$CH =$ tabulation block college housing population

$IN =$ number of institutional GQs in the tabulation block

$\alpha =$ estimated average household size in the United States (2.61 for the 2010 redesign)

A quarterly listing of GQs with closeouts occurs every 3 months. Sampling of GQ units is done after units are sampled in the within-PSU sampling stage and after GQ listings have been loaded onto the database. Units are selected monthly by interview date, meaning only the current upcoming sample designation, rotation, and panel are sampled. If more units are selected than the cut-off per segment for the survey, subsampling occurs.

Only the civilian noninstitutional population is interviewed for CPS. An institutional GQ is equivalent to one measure, regardless of the number of people counted there in the 2010 Census.

Unduplication will occur to allow at least 2 years between interviews for a unit within a GQ. For instance, a unit could be selected for CPS in the first sample period with an initial interview date of January 2016. This unit is next eligible to be selected and interviewed with initial interview date after January 2018. This would give that unit at least 9 months off between the two 16-month interview cycles.

## SELECTION OF SAMPLE UNITS

The CPS sample is designed to be self-weighting by state or substate area. A systematic sample is selected from each PSU at a sampling rate of 1 in k, where k is the within-PSU sampling interval. This interval is equal to the product of the PSU probability of selection and the stratum sampling interval. The stratum sampling interval is usually the overall state sampling interval. (See the earlier section in this chapter, "Calculation of overall state sampling interval.")

CPS sample is selected separately for the unit and GQ frames. Since sample is selected at a constant overall rate, the percentage of sample selected from each frame is proportional to population size.

### Within-Primary Sampling Unit Sampling Procedure

Units are arranged within sampling frames based on characteristics of the 2010 Census and geography. The characteristics of the 2010 Census used are percentage of households with female householder, the percentage that are owner occupied, percentage Black, and percentage aged 65 and over. Sorting minimizes within-PSU variance of estimates by grouping together units with similar characteristics. The 2010 Census data and geography are used to sort blocks and units. (Sorting is done within block and state since sampling is performed within block and state.) The MAF HU frame is sorted on block level characteristics, keeping HUs in each block together, and then by a HU identification number to sort the HUs geographically.

CPS selects HUs from the HU frame every year, and selects group quarters from the GQ frame every 3 years. This is different from selecting samples for the entire decade like the past designs.

After frame files are ready, the sampling intervals are computed and adjustments are made, random starts are calculated, and then the sample is selected. A sampling interval is an integral representation of a percentage; i.e., a sampling interval of 20 means 1 out of 20, or 5 percent. A random start is just the initial position in the list where sampling is started.

Example:

Final sampling interval = 5.75
String length = 4
Random start = 3.76
Number of Records = 25

Then the following sequence will be created:

3.76
3.76 + (1 * 5.75) = 3.76 + 5.75 = 9.51
3.76 + (2 * 5.75) = 3.76 + 11.5 = 15.26
3.76 + (3 * 5.75) = 3.76 + 17.25 = 21.01

The rounded up sequence would then be 4, 10, 16, and 22.

The sample cases would be records 4-7, 10-13, 16-19, and 22-25.

## Assignment of Postsampling Codes

Two types of postsampling codes are assigned to the sampled units. First, there are the CPS technical codes used to weight the data, estimate the variance of characteristics, and identify representative subsamples of the CPS sample units. The technical codes include final hit number, rotation group, and random group codes. Second, there are operational codes common to the demographic household surveys used to identify and track the sample units through data collection and processing. The operational codes include field PSU and control number.

**Final hit number**—The final hit number identifies the original within-PSU order of selection. All USUs in a hit string are assigned the same final hit number. For each PSU, this code is assigned sequentially, starting with one. The final hit number is used in the application of the CPS variance estimation method discussed in Chapter 2-4, Variance Estimation.

**Rotation group**—The sample is partitioned into eight representative subsamples, called rotation

groups, used in the CPS rotation scheme. All USUs in a hit string are assigned to the same rotation group. Rotation groups are assigned after sorting hits by state, MSA or non-MSA status (old construction only), SR or NSR status, stratification PSU, and final hit number. Because of this sorting, the eight subsamples are balanced across stratification PSUs, states, and the nation. Rotation group is used in conjunction with sample designation to determine units in sample for particular months during the decade.

**Random group**—The sample is partitioned into ten representative subsamples called random groups. All USUs in the hit string are assigned to the same random group. Since random groups are assigned after sorting hits by state, stratification PSU, rotation group, and final hit number, the ten subsamples are balanced across stratification PSUs, states, and the nation. Random groups can be used to partition the sample into test and control panels for survey research.

**Field PSU**—A field PSU is a single county within a stratification PSU. Field PSU definitions are consistent across all demographic surveys and are more useful than stratification PSUs for coordinating FR assignments among demographic surveys.

## ROTATION OF THE SAMPLE

The CPS sample rotation scheme is a balance between a permanent sample (from which a high response rate would be difficult to maintain) and a completely new sample each month (which results in more variable estimates of change). The CPS sample rotation scheme represents an attempt to strike a balance in the minimization of the following:

- Variance of estimates of month-to-month change: three-fourths of the sample units are the same in consecutive months.

- Variance of estimates of year-to-year change: one-half of the sample units are the same in the same month of consecutive years.

- Variance of other estimates of change: outgoing sample is replaced by sample likely to have similar characteristics.

- Response burden: eight interviews are dispersed across 16 months.

The rotation scheme follows a 4-8-4 pattern. A HU or GQ is interviewed 4 consecutive months, removed from sample for the next 8 months, interviewed the next 4 months, and then retired from sample. The rotation scheme is designed so outgoing HUs are replaced by HUs from the same hit string, which tend to have similar characteristics.

## Rotation Chart

The CPS rotation chart illustrates the rotation pattern of CPS sample over time. Table 2.2-2 presents the rotation chart beginning in January 2018. The following statements provide guidance in interpreting the chart:

- The chart covers the interview period from January 2018 through March 2020 for the CPS and for CHIP. For each month, the chart shows the sample designation and rotation (or rotation group) for the units interviewed. A sample designation is represented by the combination of the letter A or B with a two-digit number. The letter A represents CPS and the letter B represents CHIP, so that the designation A06 is a CPS sample and B06 is a CHIP sample. Each sample designation consists of rotations numbered 1 through 8. Sample designations and rotations appear as column headings and the numbers within the chart refer to the month-in-sample (MIS). For example, the 5 under the column heading A08/B08 (rotation 2) for January 2019 indicates that rotation 2 of sample designation A08 (or B08) is being interviewed for the fifth time (MIS 5).

- The sample units in a particular rotation are interviewed for 4 consecutive months; then,

after a lapse of 8 months, they are interviewed for another 4 months. For example, A08/B08 (rotation 4) is interviewed from March 2018 to June 2018 and again from March 2019 to June 2019. In a given month, two or three sample designations are in operation. For example, in January 2019, units with sample designation A07/B07 (rotations 7 and 8), A08/B08 (rotations 1 and 2), and A09/B09 (rotations 3, 4, 5, and 6) are being interviewed.

- Each month, a new rotation comes into sample for the first time, and another returns to sample after an 8-month rest. The remaining sample designation/rotations were interviewed during the preceding month. For example, in January 2019, A09/B09 (rotation 6) units come into sample for the first time; A08/B08 (rotation 2) units return after an 8-month lapse; A07/B07 (rotations 7 and 8), A08/B08 (rotation 1), and A09/B09 (rotations 3, 4 and 5) sample units are interviewed again after being interviewed in the preceding month, December 2018.

- The chart differentiates the annual samples using light and dark gray shading, with each sample consisting of one-and-a-half sample designations. Each annual sample begins its interviews in April.

- This rotation scheme has been used since 1953. The most recent research into alternate rotation patterns was prior to the 1980 redesign when state-based designs were introduced (Tegels and Cahoon, 1982).

Table 2-2.2.

**Current Population Survey/Children's Health Insurance Program Rotation Chart January 2018–March 2020 Month-in-Sample by Sample Designation and Rotation**

| Sample design | A06/B06 | | | | | | | | A07/B07 | | | | | | | | A08/B08 | | | | | | | | A09/B09 | | | | | | | | A10/B10 | | | | | | | | A11/B11 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rotation: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 |
| 2018 JAN | | 8 | 7 | 6 | 5 | | | | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FEB | | | 8 | 7 | 6 | 5 | | | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MAR | | | | 8 | 7 | 6 | 5 | | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| APR | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| MAY | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| JUN | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| JUL | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | |
| AUG | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | | |
| SEP | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | | |
| OCT | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | | |
| NOV | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | | |
| DEC | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | | |
| 2019 JAN | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | | |
| FEB | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | | |
| MAR | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | | |
| APR | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | | |
| JUN | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | | |
| JUL | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | | |
| AUG | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | | |
| SEP | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | | |
| OCT | | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | | |
| NOV | | | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | | |
| DEC | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | | |
| 2020 JAN | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | | |
| FEB | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | | |
| MAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 7 | 6 | 5 | · | · | · | · | · | · | · | · | 4 | 3 | 2 | 1 | |

Annual sample brackets: 2016 Annual sample (A06/B06); 2017 Annual sample (A07/B07); 2018 Annual sample (A09/B09); 2019 Annual sample (A10/B10).

## Overlap of the Sample

Table 2-2.3 shows the approximate proportion of overlap between any 2 months of sample depending on the time lag between them. The proportion of sample in common has a strong effect on correlation between estimates from different months and, therefore, on variances of estimates of change.

Table 2-2.3.
### Approximate Proportion of Sample in Common for 4-8-4 Rotation System

| Interval (in months) | Percentage of sample in common between 2 months |
|---|---|
| 1. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 75.0 |
| 2, 12 . . . . . . . . . . . . . . . . . . . . . . . . . . | 50.0 |
| 3, 10, 14 . . . . . . . . . . . . . . . . . . . . . . . | 25.0 |
| 4–8, 16 and greater. . . . . . . . . . . . . . | 0.0 |
| 9, 15 . . . . . . . . . . . . . . . . . . . . . . . . . . | 12.5 |
| 11, 13 . . . . . . . . . . . . . . . . . . . . . . . . . | 37.5 |

## Phase-In of a New Design

When a newly redesigned sample is introduced into the ongoing CPS rotation scheme, there are a number of reasons not to discard the old CPS sample 1 month and replace it with a completely redesigned sample the next month. Since redesigned sample contains different sample areas, new FRs must be hired. Modifications in survey procedures are usually made for a redesigned sample. These factors can cause discontinuity in estimates if the transition is made at one time.

Instead, a gradual transition from the old sample design to the new sample design is undertaken. Beginning in April 2014, the 2010 Census-based design was phased in through a series of changes completed in July 2015 (BLS, 2014).

## MAINTAINING THE DESIRED SAMPLE SIZE

The CPS sample is continually updated to include recently built HUs. If the same sampling rates were used throughout the decade, the growth of the U.S. housing inventory would lead to increases in the CPS sample size and, consequently, to increases in cost. To avoid exceeding the budget, the sampling rate is periodically reduced to maintain the desired sample size. Referred to as maintenance reductions, these changes in the sampling rate are implemented in a way that retains the desired set of reliability requirements.

These maintenance reductions are different from changes to the base CPS sample size resulting from modifications to the CPS funding levels. The methodology for designing and implementing this type of sample size change is generally dictated by new requirements specified by BLS. For example, the sample reduction implemented in January 1996 was due to a reduction in CPS funding; new design requirements were specified at that time.

## Developing the Reduction Plan

The CPS sample size for the United States is projected forward for about 1 year using linear regression based on previous CPS monthly sample sizes. The future CPS sample size must be predicted because CPS maintenance reductions are gradually introduced over 16 months and operational lead-time is needed so that dropped cases will not be interviewed.

Housing growth is examined in all states and major substate areas to determine whether it is uniform or not. The states with faster growth are candidates for maintenance reduction. The postreduction sample must be sufficient to maintain the individual state and national reliability requirements. Generally, the sample in a state is reduced by the same proportion in all frames in all PSUs to maintain the self-weighting nature of the state-level design.

## Reduction Groups

The CPS sample size is reduced by deleting one or more subsamples of USUs from each sampling frame.

The original sample of USUs is partitioned into 101 subsamples called reduction groups; each is representative of the overall sample. The decision to use 101 subsamples is somewhat arbitrary. A useful attribute of the number used is that it is prime to the number of rotation groups (eight) so that reductions have a uniform effect across rotations. A number larger than 101 would allow greater flexibility in pinpointing proportions of the sample to reduce. However, a large number of reduction groups can lead to imbalances in the distribution of sample cuts across PSUs, since small PSUs may

not have enough sample to have all reduction groups represented.

All USUs in a hit string have the same reduction group number. For all frames, hit strings are sorted and then sequentially assigned a reduction group code from 1 through 101. The sort sequence is:

1. State or substate.

2. MSA or non-MSA status.

3. SR or NSR status.

4. Stratification PSU.

5. Final hit number, which defines the original order of selection.

The state or national sample can be reduced by deleting USUs from the frame in one or more reduction groups. If there are k reduction groups in the sample, the sample may be reduced by 1/k by deleting one of k reduction groups. For the first reduction applied to redesigned samples, each reduction group represents roughly 1 percent of the sample. Reduction group numbers are chosen for deletion in a specific sequence designed to maintain the nature of the systematic sample to the extent possible.

For example, suppose a state has an overall state sampling interval of 500 at the start of the 2010 design. Suppose the original selection probability of 1 in 500 is modified by deleting 5 of 101 reduction groups. The resulting overall state sampling interval (SI) is

$$SI = 500 \left( \frac{101}{101 - 5} \right) = 526.04$$

This makes the resulting overall selection probability in the state approximately 1 in 526. In the subsequent maintenance reduction, the state has 96 reduction groups remaining. A further reduction of 1 in 96 can be accomplished by deleting 1 of the remaining 96 reduction groups.

The resulting overall state sampling interval is the new basic weight for the remaining uncut sample.

### Introducing the Reduction

A maintenance reduction is implemented only when a new sample designation is introduced, and it is gradually phased in with each incoming rotation group to minimize the effect on survey estimates and reliability and to prevent sudden changes to the interviewer workloads. The basic weight applied to each incoming rotation group reflects the reduction. Once this basic weight is assigned, it does not change until future sample changes are made. In all, it takes 16 months for a maintenance sample reduction and new basic weights to be fully reflected in all eight rotation groups interviewed for a particular month. During the phase-in period, rotation groups have different basic weights; consequently, the average weight over all eight rotation groups changes each month. After the phase-in period, all eight rotation groups have the same basic weight.

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# Chapter 2-3: Weighting and Estimation

## INTRODUCTION

The CPS is a multistage probability sample of HUs in the United States. It produces monthly labor force and related estimates for the total U.S. civilian noninstitutional population (CNP) and provides details by age, sex, race, and Hispanic ethnicity. In addition, the CPS produces estimates for a number of other population subgroups (e.g., families, veterans, and earnings of employed people) on either a monthly, quarterly, or annual basis. Each month a sample of eight panels, or rotation groups, is interviewed, with demographic data collected for all occupants of the sample HUs. Labor force data are collected from people aged 15 and older. Each rotation group is itself a representative sample of the U.S. population. The labor force estimates are derived through a number of weighting steps in the estimation procedure. In addition, the weighting at each step is replicated in order to derive variances for the labor force estimates (see Chapter 2-4, Variance Estimation for details).

The weighting procedures of the CPS supplements are discussed in Chapter 1-3, Supplements. Many of the supplements apply to specific demographic subpopulations and differ in coverage from the basic CPS universe. The supplements tend to have higher nonresponse rates.

To produce national and state estimates from survey data, a statistical weight for each person in the sample is developed through the following steps, each described in this chapter:

1.  Base weighting produces simple, unbiased estimates for the basic CPS universe under ideal survey conditions, such as 100 percent response rate, zero frame error, and zero reporting error. Most sample units within a state have the same probability of selection and therefore have the same base weight.

2.  Nonresponse adjustment reduces bias that would arise from ignoring HUs that do not respond.

3.  First-stage weighting reduces variances due to the sampling of NSR PSUs.

4.  State and national coverage steps and second-stage weighting reduce variances by controlling, or benchmarking, CPS estimates of the population to independent estimates of the current population.

5.  Composite weighting uses estimates from previous months to reduce the variances, particularly for certain estimates of change.

In addition to estimates of basic labor force characteristics, several other types of estimates can be produced on a monthly, quarterly, or annual basis. Each of these involves additional weighting steps to produce the final estimate. These additional estimation procedures provide the estimates for particular subgroups of the CNP. The types of characteristics include:

*   Household-level estimates and estimates of families (such as married-couple families living in the same household) using family weights.

*   Estimates of earnings, union affiliation, and industry and occupation (I&O) of second jobs collected from respondents in the two outgoing rotation groups (about one-fourth of the sample) using outgoing rotation weights.

*   Estimates of labor force status for veterans and nonveterans using veterans' weights.

The independent population controls used in second-stage weighting are produced by the Census Bureau's Population Estimates Program. Monthly population figures are estimated using the 2010 Census as the basis and information from a variety of primarily administrative sources that account for births, deaths, and net migration. Subtracting estimated numbers of resident armed forces personnel and institutionalized people from the resident population gives the CNP. These population controls are updated annually. CPS demographic weighted estimates are benchmarked to the independent monthly controls. The Derivation of Independent Population Controls section later in the chapter provides a reference to the methodology.

Although the processes described in this chapter have remained essentially unchanged since January 1978, and seasonal adjustment has been part of the estimation process since June 1975, modifications have been made in some of

the procedures from time to time. For example, in January 1998, a new compositing procedure was introduced. In January 2003, new race cells were introduced for first-stage weighting and second-stage weighting; also, national and state coverage steps were added. In January 2005, the number of cells used in the national coverage adjustment and in second-stage weighting was expanded to improve the estimates of children.

## BASE WEIGHTING

The CPS selects a sample for every state based on state-specific survey requirements. A sample unit's base weight is equal to the inverse of its probability of selection.

$$w_s = \pi_s^{-1}$$

where

$W_s$ = base weight for a unit in state $s$,

$\pi_s$ = probability of selection for a unit in state $s$.

Almost all sample people within the same state have the same probability of selection. As the first step in estimation, the base weights from eligible individuals in eligible HUs are summed.

### Effect of Annual Sampling

As described in Chapter 2-2, Sample Design, the CPS selects samples annually, which allows for a stabilized sample size at both the state and national levels. CPS annual sampling also includes a selection of samples for newly constructed HUs, and the probabilities of selection for every state are adjusted accordingly to approximately maintain a constant sample size from year to year. Base weights also adjust, as these are inversely related. Construction growth on the sampling frame from year to year is small enough that the adjustments to national base weights are typically only marginal. However, state-specific growth does have the potential to introduce a more noticeable change in a state's base weight.

In addition to the growth associated with the annual sampling, midyear growth also introduces a small amount of additional sample to the CPS. These sample cases are selected with the same probability of selection as other cases in the state and therefore have the same base weight.

## WEIGHTING CONTROL FACTOR

The weighting control factor (WCF) adjusts the base weight to account for any subsampling required in the field or within the Census Bureau's Demographic Statistical Methods Division after a survey selects its sample. As a means to control sample size overrun, field subsampling reduces the number of interviews in a segment to a manageable number when there are more than 15 designated interviews. In the 2010 design, it is no longer necessary to create a separate WCF file. For each month, WCFs are provided in the Universe Control File before FRs go out for interviews.

## NONRESPONSE ADJUSTMENT WEIGHTING

Nonresponse arises when HUs or other units of observation that have been selected for inclusion in a survey fail to provide all or some of the data that were to be collected. This failure to obtain complete results from units selected can arise from several different sources, depending upon the survey situation. There are two major types of nonresponse: item nonresponse and unit nonresponse. Item nonresponse occurs when a cooperating HU fails or refuses to provide some specific items of information. Unit nonresponse refers to the failure to collect any survey data from an occupied sample HU. For example, data may not be obtained from an eligible HU in the survey because of impassable roads, a respondent's absence or refusal to participate in the interview, or unavailability of the respondent for other reasons.

Unit nonresponse in the CPS is also called Type A nonresponse. The nonresponse adjustment is limited to eligible or in-scope HUs. Some HUs are permanently out-of-scope, such as those that are demolished (Type C nonresponse). Some HUs are temporarily out-of-scope, such as those that are vacant or those without any people in the CNP (Type B nonresponse). Eligible HUs that do not respond are Type A nonresponses.

In the CPS estimation process, the weights for all eligible interviewed households are adjusted to account for occupied sample households for which no information was obtained because of unit nonresponse. This nonresponse adjustment is

made separately for similar sample areas that are usually, but not necessarily, contained within the same state. Increasing the weights of responding sample units to account for eligible sample units that have not responded is valid if the responding units are similar to the nonresponding units with regard to their demographic and socioeconomic characteristics. Nonresponse bias is present in CPS estimates when the nonresponding units differ in relevant aspects from those that respond to the survey. For more information, see Chapter 4-1, Nonsampling Error.

## Nonresponse Clusters and Nonresponse Adjustment Cells

Nonresponse adjustment is performed on groups of sample PSUs that have similar metropolitan status and population size in order to reduce bias due to nonresponse. These groups of PSUs are called nonresponse clusters. In general, PSUs with a metropolitan status of similar size in the same state belong to the same nonresponse cluster. PSUs classified as MSAs are assigned to metropolitan clusters of similar size, and nonmetropolitan PSUs are assigned to nonmetropolitan clusters. Within each metropolitan cluster, there is a further breakdown into two nonresponse adjustment cells: "principal city" and "not principal city." The nonmetropolitan clusters are not divided further. In the 2010 redesign, there are 125 clusters (82 metropolitan and 43 nonmetropolitan).

## Computing Nonresponse Adjustment Factors

Weighted counts of responding and nonresponding households are tabulated separately for each nonresponse adjustment cell. The base weight is used as the weight for this purpose. The nonresponse adjustment factor $NRAF_{ij}$ is computed as:

$$NRAF_{ij} = \frac{Z_{ij} + N_{ij}}{Z_{ij}}$$

where

$Z_{ij} =$ weighted count of eligible responding HUs in cell j of cluster $i,$

$N_{ij} =$ weighted count of eligible nonresponding HUs in cell j of cluster $i.$

These factors are applied to data for each responding person except in cells where any of the following situations occur:

- The computed factor is greater than 2.0.

- There are fewer than 50 unweighted responding HUs in the cell.

- The cell contains only nonresponding HUs.

If one of these situations occurs, the weighted counts are combined for the nonresponse adjustment cells within the nonresponse cluster. A common adjustment factor is computed and applied to weights for responding people within the cluster. If, after collapsing, any of the cells still meet any of the situations above, the cell is output to an "extreme cell file" that is created for review each month. This allows the extreme cells to be tracked over time, so adjustments can be made to the cell definitions if needed.

## Nonresponse Adjustment Weights

At the completion of the nonresponse adjustment procedure, the weight for each interviewed person is the product

 (base weight) x (nonresponse adjustment factor)

At this point, records for all individuals in the same household have the same weight, since the adjustments discussed so far depend only on household characteristics.

## BENCHMARKING

Distributions of demographic characteristics derived from the CPS sample in any month will be somewhat different from the true distributions even for such basic characteristics as age, race, sex, and Hispanic ethnicity.[17] These particular population characteristics are closely correlated with labor force status and other characteristics estimated from the sample. Therefore, the variance of sample estimates based on these characteristics can be reduced when, by use of appropriate weighting adjustments, the sample population distribution is brought as closely into agreement as possible with the known distribution of the entire population with respect to these characteristics. This is accomplished by adjusting the weights through a series of benchmarking adjustments.

---

[17] Hispanics may be of any race.

There are five of these primary weighting adjustments in the CPS estimation process:

- First-stage weighting.
- National coverage step.
- State coverage step.
- Second-stage weighting.
- Composite estimation.

In first-stage weighting, weights are adjusted to reduce the variance caused by the PSU sampling using the race distribution. In the national and state coverage steps, weights are adjusted in preparation for second-stage weighting. In second-stage weighting, weights are iteratively adjusted so that aggregated CPS sample estimates match independent estimates of population controls in various age/sex/race and age/sex/ethnicity cells at the national level. Adjustments are also made so that the estimated state populations from CPS match independent state population estimates by age and sex. In first-stage weighting, the population distribution comes from the 2010 Census. For the other steps, the population distribution comes from estimated monthly population controls.

## FIRST-STAGE WEIGHTING

In first-stage weighting, weights are adjusted so that the Black alone/non-Black alone population distribution from the sample NSR PSUs in a state corresponds to the Black alone/non-Black alone population distribution from the 2010 Census for all PSUs in the state.

The purpose is to reduce the contribution to the variance of state estimates arising from the sampling of NSR PSUs. This is called between-PSU variance. For some states, the between-PSU variance makes up a relatively large proportion of the total variance, while the overall contribution of the between-PSU variance at the national level is generally quite small.

There are several factors to be considered in determining what information to use in first-stage weighting. The information must be available for each PSU, correlated with as many of the critical statistics published from the CPS as possible, and reasonably stable over time so that the accuracy gained from the weighting adjustment procedure does not deteriorate. The distribution of the

population by race (Black alone/non-Black alone) crossed with age groups 0 to 15 and 16 and over satisfies all three criteria.

By using the four race/age categories, first-stage weighting compensates for the possibility that the racial composition of the sampled NSR PSUs in a state could differ substantially from the racial composition of all NSR PSUs in the state. The adjustment is not necessary for SR PSUs. The weight adjustment factors are computed once and are unchanged until a new sample of NSR PSUs is selected in a state.

### Computing First-Stage Adjustment Factors

The first-stage adjustment factors are based on the 2010 Census data and are applied only to sample data for the NSR PSUs. Factors are computed in four race/age cells (Black alone/non-Black alone crossed with 0 to 15 and 16 and over age groups) for each state containing NSR PSUs. The following formula is used to compute the first-stage adjustment factors for each state:

$$
FSAF_{sj} = \frac{\sum_{i=1}^{n} C_{sij}}{\sum_{k=1}^{m} \left[\frac{1}{\pi_{sk}}\right] (C_{skj})}
$$

where

$FSAF_{sj}$ = first-stage adjustment factor for state s and age/race cell j (j = 1, 2, 3, or 4),

$C_{sij}$ = 2010 Census civilian noninstitutional population for NSR PSU i (sample or nonsample) in state s, race/age cell j,

$n$ = number of total (sampled and nonsampled) NSR PSUs in state s,

$C_{skj}$ = Census 2010 civilian noninstitutional population for NSR sample PSU k in state s, race/age cell j,

$m$ = number of sampled NSR PSUs,

$\pi_{sk}$ = 2010 probability of selection for sample NSR PSU k in state s.

The estimate in the denominator of each of the factors is obtained by multiplying the 2010 Census CNP in the appropriate race/age cell for each NSR sample PSU by the inverse of the probability of

selection for that PSU and summing over all NSR sample PSUs in the state.

The Black alone and non-Black alone cells are collapsed within a state when a cell meets one of the following criteria:

- The factor ($FS_{s,j}$) is greater than 1.5.
- The factor is less than 0.5.
- There are fewer than four sampled NSR PSUs in the state.
- There are fewer than ten expected interviews in an age/race cell in the state.

### First-Stage Weights

At the completion of first-stage weighting, the weight for each responding person is the product

(base weight) x (nonresponse adjustment factor) x (first-stage adjustment factor)

The weight after the first-stage adjustment is called the first-stage weight. As in nonresponse adjustment weighting, records for all individuals in the same household have the same first-stage weight, since the adjustments discussed so far depend only on household and PSU characteristics, not on any respondent characteristics.

## PAIRING ROTATION GROUPS

Rotation groups, or months-in-sample (MIS), are paired for the national coverage step, state coverage step, and second-stage weighting. Prior to 2003, second-stage benchmarking to population controls was done separately for each of the eight rotation groups in a given month, labeled MIS 1–MIS 8. There were no coverage steps at that time.

Pairing the rotation groups enables the creation of more cell detail in estimation steps. The particular pairing was motivated by the structure of the composite estimation formula, detailed in the Composite Estimation section below, and the observed patterns of MIS bias through 2012 (Erkens, 2012). The pairings are:

- MIS 1 and MIS 5.
- MIS 2 and MIS 6.
- MIS 3 and MIS 7.
- MIS 4 and MIS 8.

## NATIONAL COVERAGE STEP

The national coverage step is an adjustment by race/ethnicity/age/sex groups that ensures weighted CPS estimates match independent national population controls. This coverage step helps correct for interactions between race and Hispanic ethnicity that are not addressed in second-stage weighting. Research has shown that the undercoverage of certain race/ethnicity combinations (e.g., non-Black Hispanic) cannot be corrected with second-stage weighting alone. The national coverage step also helps to speed the convergence of the second-stage benchmarking process (Robison, Duff, Schneider, and Shoemaker, 2002).

### Computing National Coverage Adjustment Factors

In the national coverage step, adjustment factors are calculated that are based on independently derived estimates of the population. People records are grouped into four pairs (MIS 1 and 5, MIS 2 and 6, MIS 3 and 7, and MIS 4 and 8). Each MIS pair is then adjusted to age/sex/race/ethnicity population controls (see Table 2-3.1) using the following formula:

$$NCAF_{jk} = \frac{C_j}{E_{jk}}$$

where

$NCAF_{jk}$ = national coverage adjustment factor for cell $j$ and *MIS* pair $k$,

$C_j$ = national coverage adjustment control for cell $j$,

$E_{jk}$ = weighted tally (using first-stage weights) for cell $j$ and *MIS* pair $k$.

The age ranges in Table 2-3.1 are used to maximize demographic detail while limiting extreme cells with 1) fewer than 20 persons responding each month, and 2) adjustments outside the range 0.6 to 2.0.

Table 2-3.1.
## National Coverage Step Cell Definitions

| White alone, non-Hispanic | | | White alone, Hispanic | | | Black alone, non-Hispanic | | | Asian alone, non-Hispanic | | | Residual race, non-Hispanic | | | Non-White alone, Hispanic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | M | F | Age | M | F | Age | M | F | Age | M | F | Age | M | F | Age | M | F |
| 0 | | | 0 | | | 0-1 | | | 0-4 | | | 0-4 | | | 0-15 | | |
| 1 | | | 1 | | | | | | | | | | | | | | |
| 2 | | | 2 | | | 2-4 | | | | | | | | | | | |
| 3 | | | 3 | | | | | | | | | | | | | | |
| 4 | | | 4 | | | | | | | | | | | | | | |
| 5 | | | 5 | | | 5-7 | | | 5-9 | | | 5-9 | | | | | |
| 6 | | | 6 | | | | | | | | | | | | | | |
| 7 | | | 7 | | | | | | | | | | | | | | |
| 8 | | | 8 | | | 8-9 | | | | | | | | | | | |
| 9 | | | 9 | | | | | | | | | | | | | | |
| 10-11 | | | 10-11 | | | 10-11 | | | 10-15 | | | 10-15 | | | | | |
| 12-13 | | | 12-13 | | | 12-13 | | | | | | | | | | | |
| 14 | | | 14 | | | 14 | | | | | | | | | | | |
| 15 | | | 15 | | | 15 | | | | | | | | | | | |
| 16-19 | | | 16-19 | | | 16-19 | | | 16-24 | | | 16-24 | | | 16 and older | | |
| 20-24 | | | 20-24 | | | 20-24 | | | | | | | | | | | |
| 25-29 | | | 25-29 | | | 25-29 | | | 25-34 | | | 25-34 | | | | | |
| 30-34 | | | 30-34 | | | 30-34 | | | | | | | | | | | |
| 35-39 | | | 35-39 | | | 35-39 | | | 35-44 | | | 35-44 | | | | | |
| 40-44 | | | 40-44 | | | 40-44 | | | | | | | | | | | |
| 45-49 | | | 45-49 | | | 45-49 | | | 45-54 | | | 45-54 | | | | | |
| 50-54 | | | 50-54 | | | 50-54 | | | | | | | | | | | |
| 55-59 | | | 55-64 | | | 55-64 | | | 55-64 | | | 55-64 | | | | | |
| 60-62 | | | | | | | | | | | | | | | | | |
| 63-64 | | | | | | | | | | | | | | | | | |
| 65-69 | | | 65 and older | | | 65 and older | | | 65 and older | | | 65 and older | | | | | |
| 70-74 | | | | | | | | | | | | | | | | | |
| 75 and older | | | | | | | | | | | | | | | | | |

Note: Taken from *Weighting Specifications for the Current Population Survey*, memorandum October 23, 2018.

## National Coverage Weights

After the completion of the national coverage step, the weight for each person is the product

> (base weight) x (nonresponse adjustment factor) x (first-stage adjustment factor) x (national coverage adjustment factor).

This weight will usually vary for people in the same household due to household members having different demographic characteristics.

## STATE COVERAGE STEP

In the state coverage step, weights are adjusted so that CPS estimates by race/sex/age groups match each month's independent state population controls.[18] This coverage steps compensates for some differences in race/sex/age coverage by state.

### Computing State Coverage Adjustment Factors

Table 2-3.2 shows the maximum number of adjustment cells in each state:

- Maximum of six age/sex cells for Black alone, with no pairing of rotation groups.

- Maximum of 24 cells for non-Black alone—the same six age/sex groups further split by MIS pair.

Some collapsing is needed to avoid extreme cells with: (1) fewer than 20 people responding each month, and (2) adjustments outside of the range 0.6 to 2.0.

Table 2-3.2.
### State Coverage Adjustment Cell Definition

| Age | Black alone, all months-in-sample combined (6 cells) | | Non-Black alone, by months-in-sample pair (24 cells) | |
| --- | --- | --- | --- | --- |
| | Male | Female | Male | Female |
| 0–15 . . . . . | | | | |
| 16–44 . . . . | | | | |
| 45 and older . . . | | | | |

---

[18] In the state coverage step, California is split into two parts and each part is treated like a state—Los Angeles County and the rest of California. Similarly, New York is split into two parts with each part being treated as a separate state—New York City (New York, Queens, Bronx, Kings, and Richmond Counties) and the balance of New York. The District of Columbia is generally treated as a state.

In the District of Columbia, all MIS are combined for the non-Black alone group, resulting in six cells. For all other states (including Los Angeles County, balance of California, New York City, and balance of New York State), no further collapsing is done in the non-Black alone cells.

For the Black alone cells, the collapsing varies by state:

- No further collapsing: AL, AR, CA (Los Angeles County and balance of CA), CT, DC, DE, FL, GA, IL, LA, MA, MD, MI, MO, MS, NC, NJ, NY (New York City and balance of NY), OH, PA, SC, TN, TX, VA.

- Collapse to two-sex cells (males of all ages, females of all ages): AK, AZ, CO, IN, KS, KY, MN, NE, NV, OK, RI, WA, WI, WV.

- Collapse to one cell (males and females of all ages): HI, ID, IA, ME, MT, ND, NH, NM, OR, SD, UT, VT, WY.

Each cell is then adjusted to age/sex/race population controls in each state using the following formula:

$$SCAF_{jk} = \frac{C_j}{E_{jk}}$$

where

$SCAF_{jk}$ = state coverage adjustment factor for cell $j$ and MIS pair $k,$

$C_j$ = state coverage adjustment control for cell $j,$

$E_{jk}$ = weighted tally for cell $j$ and MIS pair $k.$

The independent population controls used for the state coverage step are from the same source as those for second-stage weighting.

### State Coverage Weights

After the completion of the state coverage adjustment, the weight for each person is the product

> (base weight) x (nonresponse adjustment factor) x (first-stage adjustment factor) x (national coverage adjustment factor) x (state coverage adjustment factor).

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This weight will vary for people in the same household due to household members having different demographic characteristics.

## SECOND-STAGE WEIGHTING

Second-stage weighting decreases the error in the great majority of sample estimates. Chapter 2-4, Variance Estimation, illustrates the amount of reduction in relative standard errors for key labor force estimates. The benchmark procedure is also a method used to reduce the bias due to coverage errors (see Chapter 4-1, Nonsampling Error). The benchmark procedure adjusts the weights within each MIS pair such that the sample estimates for geographic and demographic subgroups are matched to independent population controls. These independent population controls are updated each month. Three sets of controls are used:

- State/sex/age: the CNP for the states (see footnote 2 for state coverage) by sex and age (0-15, 16-44, 45 and older).

- Ethnicity/sex/age: total national CNP for 36 Hispanic and non-Hispanic age/sex cells (see Table 2-3.3).

- Race/sex/age: total national CNP for 56 White, 36 Black, and 26 "residual race" age/sex cells (see Table 2-3.4).

The specified demographic detail avoids extreme cells with: (1) fewer than 20 people responding monthly and (2) overall adjustments outside the range 0.6 to 2.0.

Table 2-3.3.
### Second-Stage Adjustment Cell by Ethnicity, Age, and Sex

| Age | Hispanic | | Non-Hispanic | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 0–1 . . . . . . . . . . . . . . . . | | | | |
| 2–4 . . . . . . . . . . . . . . . | | | | |
| 5–7 . . . . . . . . . . . . . . . | | | | |
| 8–9 . . . . . . . . . . . . . . . | | | | |
| 10–11 . . . . . . . . . . . . . . | | | | |
| 12–13 . . . . . . . . . . . . . . | | | | |
| 14 . . . . . . . . . . . . . . . . | | | | |
| 15 . . . . . . . . . . . . . . . . | | | | |
| 16–19 . . . . . . . . . . . . . . | | | | |
| 20–24 . . . . . . . . . . . . . . | | | | |
| 25–29 . . . . . . . . . . . . . . | | | | |
| 30–34 . . . . . . . . . . . . . . | | | | |
| 35–39 . . . . . . . . . . . . . . | | | | |
| 40–44 . . . . . . . . . . . . . . | | | | |
| 45–49 . . . . . . . . . . . . . . | | | | |
| 50–54 . . . . . . . . . . . . . . | | | | |
| 55–64 . . . . . . . . . . . . . . | | | | |
| 65 and older . . . . . . . . . | | | | |

Note: Taken from *Weighting Specifications for the Current Population Survey*, memorandum October 23, 2018.

Table 2-3.4.
## Second-Stage Adjustment Cell by Race, Age, and Sex

| White Alone | | | Black Alone | | | Residual Race | | |
|---|---|---|---|---|---|---|---|---|
| Age | Male | Female | Age | Male | Female | Age | Male | Female |
| 0. . . . . . . . . | | | 0–1 . . . . . . . | | | 0–1 . . . . . . . | | |
| 1. . . . . . . . . | | | | | | | | |
| 2. . . . . . . . . | | | 2–4 . . . . . . . | | | 2–4 . . . . . . . | | |
| 3. . . . . . . . . | | | | | | | | |
| 4. . . . . . . . . | | | | | | | | |
| 5. . . . . . . . . | | | 5–7 . . . . . . . | | | 5–7 . . . . . . . | | |
| 6. . . . . . . . . | | | | | | | | |
| 7. . . . . . . . . | | | | | | | | |
| 8. . . . . . . . . | | | 8–9 . . . . . . . | | | 8–9 . . . . . . . | | |
| 9. . . . . . . . . | | | | | | | | |
| 10–11 . . . . . . | | | 10–11 . . . . . . | | | 10–11 . . . . . . | | |
| 12–13 . . . . . . | | | 12–13 . . . . . . | | | 12–13 . . . . . . | | |
| 14. . . . . . . . | | | 14 . . . . . . . . | | | 14–15 . . . . . | | |
| 15. . . . . . . . | | | 15 . . . . . . . . | | | | | |
| 16–19 . . . . . . | | | 16–19 . . . . . . | | | 16–19 . . . . . . | | |
| 20–24 . . . . . . | | | 20–24 . . . . . . | | | 20–24 . . . . . . | | |
| 25–29 . . . . . . | | | 25–29 . . . . . . | | | 25–29 . . . . . . | | |
| 30–34 . . . . . . | | | 30–34 . . . . . . | | | 30–34 . . . . . . | | |
| 35–39 . . . . . . | | | 35–39 . . . . . . | | | 35–39 . . . . . . | | |
| 40–44. . . . . . | | | 40–44. . . . . . | | | 40–44. . . . . . | | |
| 45–49 . . . . . . | | | 45–49 . . . . . . | | | 45–49 . . . . . . | | |
| 50–54 . . . . . . | | | 50–54 . . . . . . | | | 50–54 . . . . . . | | |
| 55–59 . . . . . . | | | 55–64 . . . . . . | | | 55–64. . . . . . | | |
| 60–62. . . . . . | | | | | | | | |
| 63–64 . . . . . | | | | | | | | |
| | | | 65 and older. . . . . . | | | 65 and older. . . . . . | | |
| 65–69 . . . . . . | | | | | | | | |
| 70–74 . . . . . . | | | | | | | | |
| 75 and older. . . . . . | | | | | | | | |

Note: Taken from *Weighting Specifications for the Current Population Survey*, memorandum October 23, 2018

The adjustment is done separately for each MIS pair (MIS 1 and 5, MIS 2 and 6, MIS 3 and 7, and MIS 4 and 8). Adjusting the weights to match one set of controls can cause differences in other controls, so an iterative process is used to simultaneously control all variables. Successive iterations begin with the weights as adjusted by all previous iterations. A total of ten iterations is performed, which results in near consistency between the sample estimates and population controls. The three-dimensional (state/sex/age, ethnicity/sex/age, race/sex/age) weighting adjustment is also known as iterative proportional fitting, raking ratio estimation, or raking.

In addition to reducing the error in many CPS estimates and converging to the population controls within ten iterations for most items, this estimator minimizes the statistic

$$\sum_i W_{2,i} \ln \left( W_{2,i} / W_{1,i} \right)$$

where

$W_{2,i}$ = weight for the $i^{th}$ sample record after the second-stage adjustment,

$W_{1,i}$ = weight for the $i^{th}$ record after the first-stage adjustment.

Thus, the raking adjusts the weights of the records so that the sample estimates converge to the population controls while minimally affecting the weights after the state coverage adjustment. Ireland and Kullback (1968) provide more details on the properties of raking ratio estimation.

### Computing Second-Stage Adjustment Factors

As mentioned before, second-stage weighting involves a three-step weighting adjustment, or rake:

- State step: state/sex/age.
- Ethnicity step: ethnicity/sex/age.
- Race step: race/sex/age.

Second-stage adjustment factors are successively calculated for each raking step, using estimates based on the most recently iterated weights as the basis for each successive adjustment. Since every iterated weighting adjustment is incorporated at every step of the three-step raking procedure, the successive estimates gradually converge to the population controls in all three dimensions.

$$SSAF_{ijk} = \frac{C_j}{m_j E_{i-1,jk}}$$

where

$SSAF_{ijk}$ = second-stage adjustment factor for cell $j$ and MIS pair $k$ after iteration $i$,

$C_j$ = second-stage adjustment control for cell $j$,

$E_{i-1, jk}$ = weighted tally for cell $j$ and MIS pair $k$ at iteration $i-1$ tabulated using the intermediate second-stage weights after iteration $i-1$ (when $i-1$ = 0, this is equal to the estimate tabulated using state-coverage weights),

$m_j$ = number of split MIS pairs in cell $j$ (1 if all MIS combined, 4 if split into pairs).

Each of three raking steps is iterated ten times, enough for most estimates to fully converge.

Note that the matching of estimates to controls for one dimension causes the cells to differ slightly from the controls from the previous dimension. With each successive iteration, these differences decrease. For most cells, after ten iterations, the estimates for each cell have converged to the population controls for each cell. Thus, the weight for each record after second-stage weighting can be thought of as the weight for the record after the state coverage adjustment multiplied by a series of 30 adjustment factors (ten iterations, each with three raking steps).

### Second-Stage Weights

At the completion of second-stage (SS) weighting, the record for each person has a weight reflecting the product of:

(base weight) x (nonresponse adjustment factor) x (first-stage adjustment factor) x (national coverage adjustment factor) x (state coverage adjustment factor) x (second-stage adjustment factor).

The estimates produced after second-stage weighting are referred to as second-stage estimates. Once each record has an second-stage weight, an estimate for any given set of characteristics identifiable in the CPS can be computed by summing the second-stage weights for all respondents that have that set of characteristics. The process for producing this type of estimate is referred to as a Horvitz-Thompson estimator or a simple weighted estimator.

### COMPOSITE ESTIMATION

In general, a composite estimate is a weighted average of several estimates. Most official CPS labor force estimates are derived using a composite estimator. Historically, the CPS composite estimate consisted only of the second-stage estimate, the composite from the preceding month, and an estimate of change from preceding to current month. Over time, the CPS refined the composite, updating the weights used in the weighted average as well as adding a component that captures the net difference between the incoming and continuing parts of the current month's sample. In 1998, the BLS introduced a compositing method that allows more operational simplicity for microdata users as well as determining better compositing coefficients for different labor force categories.

Breaking down the CPS composite estimator into more detail and keeping in mind the underlying 4-8-4 rotation pattern, the estimator and its separate components are understood in terms of the following expression:

$$\hat{Y}_t^{CMP} = (1 - K)\hat{Y}_t^{SS} + K(\hat{Y}_{t-1}^{CMP} + \Delta_t) + A\hat{\beta}_t$$

where

$$\hat{Y}_t^{SS} = \sum_{i=1}^{8} x_{ti}$$

$$\Delta_t = \frac{4}{3}\left[\sum_{i=2}^{4}(x_{ti} - x_{t-1,i-1}) + \sum_{i=6}^{8}(x_{ti} - x_{t-1,i-1})\right]$$

$$\hat{\beta}_t = (x_{t1} + x_{t5}) - \frac{1}{3}\left(\sum_{i=2}^{4} x_{ti} + \sum_{i=6}^{8} x_{ti}\right)$$

$i = $ MIS 1,2,...,8,

$x_{ti} = $ sum of second-stage weights of respondents in month $t$ and MIS $i$ with characteristic of interest,

$K = 0.4$ for unemployed, 0.7 for employed,

$A = 0.3$ for unemployed, 0.4 for employed.

$K$ determines the weight to get the weighted average of two estimators for the current month: (1) the current month's second-stage estimate $\hat{Y}_t^{SS}$ and (2) the sum of the previous month's composite estimator $\hat{Y}_{t-1}^{CMP}$, and an estimator $\Delta_t$ of the change since the previous month. The estimate of change is based on data from sample households in the six rotation groups common to months $t$ and $t$-1 (about 75 percent). Higher correlation in the estimates coming in this part of the sample tends to reduce variance of the estimated month-to-month change. $A$ determines the weight of $\beta_t$, a term adjusting for the difference between the continuing months in sample and the new months in sample. It is intended to reduce both the variance of the composite estimator and the bias associated with time in sample (Breau and Ernst, 1983; and Bailar, 1975). The values given above for the constant coefficients $A$ and $K$ were selected after extensive review of many series for minimum variance for month-to-month change estimates of unemployment and employment.

The composite estimator for the CPS provides, on average, an overall improvement in the variance for estimates of month-to-month change. The composite also provides additional improvements for estimates of change over longer intervals of time, for a given month (Breau and Ernst, 1983).

## Computing Composite Weights

Weights are derived for each record that, when aggregated, produce estimates consistent with those produced by the composite estimator. Composite estimation is performed at the macro level. The composite weights allow one month of microdata to be used to produce estimates consistent with the composite estimators for any given month.

The composite weighting method involves two steps: (1) the computation of composite estimates for the main labor force categories, classified by important demographic characteristics; and (2) the adjustment of the microdata weights, through a series of weighting adjustments, to agree with these composite estimates, thus incorporating the effect of composite estimation into the microdata weights. Under this procedure, the sum of the composite weights of all sample people in a particular labor force category equals the composite estimate of the level for that category. To produce a composite estimate for a particular month, a data user may simply access the microdata file for that month and compute a weighted sum. This composite weighting approach also improves the accuracy of labor force estimates by using different compositing coefficients for different labor force categories. The weighting adjustment method assures additivity while allowing this variation in compositing coefficients.

Composite weights are produced only for sample persons aged 16 or older. The method of computing composite weights for the CPS imitates second-stage weighting. Sample person weights are raked to force their sums to equal control totals. Composite labor force estimates are used as controls in place of independent population controls. The composite raking process is performed separately within each of the three major labor force categories: employed (E), unemployed (UE), and not in the labor force (NILF). These three labor force totals sum to the CNP. Since CNP is a population control, and E and UE are directly estimated, the NILF is indirectly computed as the residual:

$$NILF = CNP - (E + UE)$$

The composite weighting process is similar to the raking process to compute the second-stage weights. Within each labor category, a three-dimensional rake is applied, using the second-stage estimate at the state level as one step and national second-stage estimates for age/sex/race (Table 2-3.5) and age/sex/ethnicity (Table 2-3.6) as the second and third steps.

Table 2-3.5.
## Composite National Race Cell Definition

| White alone | | | Black alone | | | Residual race | | |
|---|---|---|---|---|---|---|---|---|
| Age | Male | Female | Age | Male | Female | Age | Male | Female |
| 16–19 . . . . . . | | | 16–19 . . . . . . | | | 16–19 . . . . . . | | |
| 20–24 . . . . . . | | | 20–24 . . . . . . | | | 20–24 . . . . . . | | |
| 25–29 . . . . . . | | | 25–29 . . . . . . | | | 25–34 . . . . . . | | |
| 30–34 . . . . . . | | | 30–34 . . . . . . | | | | | |
| 35–39 . . . . . | | | 35–39 . . . . . | | | 35–44 . . . . . . | | |
| 40–44 . . . . . . | | | 40–44 . . . . . . | | | | | |
| | | | 45 and older. . . . . . | | | 45 and older. . . . . . | | |
| 45–49 . . . . . . | | | | | | | | |
| 50–54 . . . . . . | | | | | | | | |
| 55–59 . . . . . . | | | | | | | | |
| 60–64 . . . . . . | | | | | | | | |
| 65 and older. . . . . . | | | | | | | | |

Note: Taken from *Weighting Specifications for the Current Population Survey*, memorandum October 23, 2018.

Table 2-3.6.
## Composite National Ethnicity Cell Definition

| Ages | Hispanic | | Non-Hispanic | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 16–19 . . . . . | | | | |
| 20–24 . . . . . | | | | |
| 25–34 . . . . . | | | | |
| 35–44 . . . . . | | | | |
| 45+ . . . . . . . | | | | |

Note: Taken from *Weighting Specifications for the Current Population Survey*, memorandum October 23, 2018.

Data from all eight rotation groups are combined for the purpose of computing composite weights. As with second-stage weighting, each iteration of the composite weight calculation uses the most recently adjusted weights as the basis. The formulas are analogous. Like second-stage weighting, ten iterations are performed in each of the three dimensions for each of the three composited labor force groups (E, UE, and NILF).

While E and UE are estimated directly in composite estimation, NILF is indirectly calculated as the difference between the relevant population control and the sum of E and UE, which is the estimate of the civilian labor force.

The specified demographic detail avoids extreme cells with: (1) fewer than 10 people responding monthly, and (2) overall adjustments outside the range 0.7 to 1.3.

### Final Weights

The composite weights are the final CPS weights and the weights used to compute most BLS published estimates. Within each rotation group or paired MIS, summation of the final weights do not match independent population controls, because data from all eight rotation groups are combined to form the composite weights. However, summation of the final weights for the entire sample will match the independent population controls.

### PRODUCING OTHER LABOR FORCE ESTIMATES

In addition to base weighting to produce estimates for people, several special-purpose weighting procedures are performed each month. These include:

- Weighting to produce estimates for household and families.

- Weighting to produce estimates from data based on only two of eight (outgoing) rotation groups.

- Weighting to produce labor force estimates for veterans and nonveterans (veterans' weighting).

Most special weights are based on second-stage weights. Some also make use of composited

estimates. In addition, consecutive months of data are often used to produce quarterly or annual average estimates. Each of these procedures is described in more detail below.

## Family Weight

Family weights are used to produce estimates related to families and family composition. They also provide the basis for household weights. More than one family may be identified in a HU. For families maintained by women or men with no spouse present, the family weight is equivalent to the second-stage weight of the reference person. For married-couple families, the family weight is equivalent to the wife's second-stage weight (in same-sex marriages, the family weight is the second-stage weight of the reference person).

Weighted tabulations of CPS data by sex and marital status show the same number of married women and married men with their spouses present. The wife's weight is used as the family weight, because CPS coverage ratios for women tend to be higher and subject to less month-to-month variability than those for men.

## Household Weight

The same household weight is assigned to every person in the same HU and is equal to the family weight of the household reference person. The household weight can be used to produce estimates at the household level. This varies from family weight in the situations where more than one family is living in the same household.

## Outgoing Rotation Weights

Some items in the CPS questionnaire are asked only in HUs due to rotate out of the sample temporarily (MIS 4) or permanently (MIS 8) after the current month. These are referred to as the outgoing rotation groups. Items asked in the outgoing rotations include those on earnings (since 1979), union affiliation (since 1983), and I&O of second jobs of multiple jobholders (beginning in 1994). Since the data are collected from only one-fourth of the sample each month, data from 3 or 12 months are used to improve their reliability, and published as quarterly or annual averages.

Since 1979, most CPS files have included separate weights for the outgoing rotations. An individual's

outgoing rotation weight is approximately four times that of his or her final weight. However, these outgoing rotation weights are benchmarked to controls for employment status, which are based on the composited estimates of E, UE, and NILF each month from the full sample. The cells are classified by age, race, sex, and employment status: employed wage and salary workers, other employed, UE, and NILF. The outgoing adjustment factor for each cell is computed by taking the ratio of the total composite weights in the control to the total second-stage weights for the outgoing rotation groups.

The outgoing rotation weights are obtained by multiplying the outgoing adjustment factors by the second-stage weights. For consistency, an outgoing rotation group weight of four times the basic CPS family weight is assigned to all people in the two outgoing rotation groups who were not eligible for this special weighting (mainly military personnel and people aged 15 and younger). Production of monthly, quarterly, and annual estimates using the outgoing rotation weights is completely parallel to production of second-stage estimates from the full sample—the weights are summed and divided by the number of months used.

The composite estimator is not applicable for these estimates because there is no overlap between the quarter samples in consecutive months.

## Family Outgoing Rotation Weight

The family outgoing rotation weight is analogous to the family weight computed for the full sample, except that outgoing rotation weights are used, rather than second-stage weights.

## Veterans' Weights

Since 1986, CPS interviewers have collected data on veteran status from all household members. Veterans' weights are calculated for all CPS household members based on their veteran status. This information is used to produce tabulations of employment status for veterans and nonveterans.

Each individual is classified as a veteran or a nonveteran. Veterans are currently classified into cells based on age, sex, and veteran status (Gulf War, Other War, or Non-War). The composite weights

for CPS veterans are tallied into type-of-veteran/sex/age cells. Separate adjustment factors are computed for each cell, using independently established monthly estimates of veterans provided by the Department of Veterans Affairs. The adjustment factor is the ratio of the independent control total to the sample estimate total for each cell. This adjustment factor is multiplied by the composite weight for each veteran to produce the veterans' weight.

To compute veterans' weights for nonveterans, a table of composited estimates is produced from the CPS data by race (White alone/non-White alone), sex, age, and labor force status (E, UE, and NILF). The veterans' weights produced in the previous step are tallied into the same cells. The estimated number of veterans is then subtracted from the corresponding cell entry for the composited table to produce nonveterans control totals. The composite weights for CPS nonveterans are tallied into the same race/sex/age/labor force status cells. The adjustment factor for each cell is the ratio of the nonveteran control total to the sample estimate total in each cell. The composite weight for each nonveteran is multiplied by the adjustment factor to produce the veterans' weight for nonveterans.

### Estimates of Averages

CPS frequently produces estimates of averages, using multiple months of data. The most commonly computed averages are: (1) quarterly, which provide four estimates per year by grouping the months of the calendar year in nonoverlapping intervals of three, and (2) annual, combining all 12 months of the calendar year. Quarterly and annual averages can be computed by summing the weights for all of the months contributing to each average and dividing by the number of months involved. Averages for calculated cells, such as rates, percentages, means, and medians, are computed from the averages for the component levels, not by averaging the monthly values (for example, a quarterly average unemployment rate is computed by taking the quarterly average unemployment level as a percentage of the quarterly average labor force level, not by averaging the three monthly unemployment rates together).

Although such averaging increases the number of interviews contributing to the resulting estimates by a factor of approximately the number of months involved in the average, the sampling variance for the average estimate is actually reduced by a factor substantially less than that number of months. This is primarily because the CPS rotation pattern and resulting month-to-month overlap in sample units mean that people respond in several months and estimates from the individual months are not independent.

## DERIVATION OF INDEPENDENT POPULATION CONTROLS

The Census Bureau's Population Estimates Program (PEP) produces and publishes estimates of the population for the nation, states, counties, state/county equivalents, cities, towns, and for Puerto Rico and its municipios. The PEP estimates the population for each year following the most recent decennial census using measures of population change. These population estimates are used for federal funding allocations, as controls for major surveys including the CPS and the ACS, for community development, to aid business planning, and as denominators for statistical rates.

The PEP produces estimates of the resident population, which includes all people currently residing in the United States as well as estimates of selected subpopulations. A more complete description of PEP methodology can be found at <www.census.gov/programs-surveys/popest/technical-documentation/methodology.html>.

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# Chapter 2-4: Variance Estimation

## INTRODUCTION

Variance estimation of major CPS statistics serves the following two objectives:

- Estimate the variance of the survey estimates for use in various statistical analyses.

- Evaluate the effect of each of the stages of sampling and estimation on the overall precision of the survey estimates.

CPS variance estimates take into account the magnitude of the sampling error as well as the effects of some nonsampling errors, such as nonresponse and coverage error. Chapter 4.1, Nonsampling Error, provides additional information on these topics. Certain aspects of the CPS sample design, such as the use of one sample PSU per NSR stratum and the use of cluster subsampling within PSUs, make it impossible to obtain a completely unbiased estimate of the total variance. The use of ratio adjustments in the estimation procedure also contributes to this problem. Although imperfect, the current variance estimation procedure is accurate enough for all practical uses of the data, and captures the effects of sample selection and estimation on the total variance. Variance estimates of selected characteristics, and tables that show the effects of estimation steps on variances, are presented at the end of this chapter.

## CURRENT POPULATION SURVEY REPLICATION METHODS

Replication methods are able to provide satisfactory estimates of variance for a wide variety of designs that use probability sampling, even when complex estimation procedures are used (Dippo et al., 1984). This method presumes that the sample selection, the collection of data, and the estimation procedures are independently carried out (replicated) several times. The dispersion of the resulting estimates can be used to measure the variance of the full sample.

It would not be feasible to repeat the entire CPS several times each month simply to obtain variance estimates. A practical alternative is to perturb the weights of the full sample many different times to create new artificial samples, and to apply the regular CPS estimation procedures to these subsamples, or replicates. While CPS uses a fixed number of replicates, the optimal number of replicates can vary by estimate series, meaning that replication variances for any particular estimate may be suboptimal.

### Replication Methods for 1970 and 1980 Designs

Historically, computational burden was balanced with optimality considerations to determine the number of replicates to use. Prior to the 1970 CPS design, variance estimates were computed using 40 replicates. The replicates were subjected to only second-stage weighting for the same age/sex/race categories used for the full sample at the time. Nonresponse and first-stage weighting adjustments were not replicated. (See Chapter 2-3, Weighting and Estimation, for more context on CPS weighting.) Even with these simplifications, limited computer capacity allowed the computation of variances for only 14 characteristics. For the 1970 design, an adaptation of the Keyfitz method of calculating variances was used (Keyfitz, 1957). These variance estimates were derived using the Taylor approximation, dropping terms with derivatives higher than the first. By 1980, improvements in computer memory capacity allowed the calculation of variance estimates for many characteristics, with replication of all stages of the weighting through compositing.

Starting with the 1980 design, variances were computed using a modified balanced half-sample approach. The sample was divided in half 48 times to form replicates that retained all the features of the sample design, such as stratification and within-PSU sample selection. For total variance, a pseudo first-stage design was imposed on the CPS by dividing large SR PSUs into smaller pieces called Standard Error Computation Units (SECUs) and combining small NSR PSUs into paired strata or pseudostrata. One NSR PSU was selected randomly from each pseudostratum for each replicate.

Forming these pseudostrata was necessary since the first stage of the sample design has only one NSR PSU per stratum in the sample. However, pairing the original strata for variance estimation purposes creates an upward bias in the variance

estimator. For SR PSUs, each SECU was divided into two panels, and one panel was selected for each replicate. One column of a 48-by-48 Hadamard orthogonal matrix was assigned to each SECU, or pseudostratum. The unbiased weights were multiplied by replicate factors of 1.5 for the selected panel and 0.5 for the other panel in the SR SECU or NSR pseudostratum (Dippo et al., 1984). Thus, the full sample was included in each replicate, but the matrix determined differing weights for the half samples. These 48 replicates were processed through all stages of the CPS weighting through compositing. The estimated variance for the characteristic of interest was computed by summing a squared difference between each replicate estimate ($\hat{Y}_r$) and the full sample estimate ($\hat{Y}_0$). The complete formula[19] is

$$Var(\hat{Y}_0) = \frac{4}{48} \sum_{r=1}^{k} (\hat{Y}_r - \hat{Y}_0)^2$$

Due to costs and computer limitations, variance estimates were calculated for only 13 months (January 1987 through January 1988) and for only about 600 estimates at the national level. Replication estimates of variances at the subnational level were not reliable because of the small number of SECUs available (Lent, 1991). Generalized sampling errors (explained below) were calculated based on the 13 months of variance estimates. (See Wolter, 1985; Fay, 1984; or Fay, 1989 for more details on half-sample replication for variance estimation.)

## Replication Methods for 1990, 2000, and 2010 Designs

The general goal of the current variance estimation methodology, the method in use since July 1995, is to produce consistent variances and covariances for each month over the entire life of the design. Periodic maintenance reductions in sample size and the continuous addition of new construction to the sample complicated the strategy to achieve this goal. However, research has shown that variance estimates are not adversely affected as long as the cumulative effect of the reductions is less than 20 percent of

the prereduction sample size (Kostanich, 1996). Assigning all future new construction sample to replicates when the variance subsamples are originally defined provides the basis for consistency over time in the variance estimates.

The current approach to estimating the design variances is called successive difference replication. The theoretical basis for the successive difference method was discussed by Wolter (1984) and extended by Fay and Train (1995) to produce the successive difference replication method used for the CPS. The following is a description of the application of this method. Successive USUs are paired in the order of their selection to take advantage of the systematic nature of the CPS within-PSU sampling scheme.[20] Each USU usually occurs in two consecutive pairs: (USU1, USU2), (USU2, USU3), (USU3, USU4), etc. A pair is therefore similar to a SECU in the 1980 design variance methodology. For each USU within a PSU, two pairs (or SECUs) of neighboring USUs are defined based on the order of selection—one with the USU selected before and one with the USU selected after it. This procedure allows USUs adjacent in the sort order to be assigned to the same SECU, thus better reflecting the systematic sampling in the variance estimator. In addition, a large increase in the number of SECUs and in the number of replicates (160 vs. 48) starting with the 1990 design increases the precision of the variance estimator.

The 2010 sample design introduced two major changes in methodology. First, the samples are now selected on an annual rather than decadal basis. Second, a new variance estimator was introduced that includes rotation group among the sort criteria for successive difference replication. This estimator allows estimation of variances and covariances at the rotation group level. See Chapter 2.2, Sample Design, for more information about CPS sampling procedures and 2010 design changes.

## Replicate Factors for Total Variance

Total variance is composed of two types of variance, the variance due to sampling of HUs within PSUs during second-stage sampling (within-PSU variance) and the variance due to the selection of PSUs during first-stage sampling (between-PSU

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[19] The basic formula for balanced half-sample replication uses replicate factors of 2 and 0 with the formula:
$Var(\hat{Y}_0) = \frac{1}{k}\sum_{r=1}^{k}(\hat{Y}_r - \hat{Y}_0)^2$ where k is the number of replicates. The factor of 4 in our variance estimator is the result of using a modified formula with replicate factors of 1.5 and 0.5. See Dippo et al. (1984) for more details.

[20] An ultimate sampling unit is usually a group of four HUs.

variance). Due to the selection of one PSU within NSR stratum in the CPS Design, between-PSU variance cannot be estimated directly using this methodology, but it can be estimated as the difference between the estimates of total variance and within-PSU variance.

To produce estimates of total variance, replicates are formed differently for SR and NSR samples. For NSR PSUs, the original strata within a state are collapsed into pseudostrata of pairs and at most one triplet for states with an odd number of NSR PSUs. After that collapsing, a replication method of the Collapsed Stratum Estimator is used to assign replicate factors to units in these PSUs (Wolter, 1985). In pseudostrata containing a pair of NSR PSUs, replicate factors of 1.5 or 0.5 adjust the weights.[21] These factors are assigned based on a single row from the Hadamard matrix and are further adjusted to account for unequal sizes of the original strata within the pseudostratum (Wolter, 1985). In pseudostrata containing a triplet, for the 1990 design, two rows from the Hadamard matrix were assigned to the pseudostratum, resulting in replicate factors of approximately 0.5, 1.7, and 0.8; or 1.5, 0.3, and 1.2 for the three PSUs assuming equal sizes of the original strata. However, for the 2000 design, these factors were further adjusted to account for unequal sizes of the original strata within the pseudostratum. All USUs in a pseudostratum are assigned the same row number(s).

In SR strata, a single PSU is picked with probability 1; therefore, there is no contribution from between-PSU variance, and the total variance is the within-PSU variance. Successive difference replication is used in these PSUs to create replicate factors. For an SR sample, two rows of the Hadamard matrix are assigned to each pair of USUs creating replicate factors $f_{ir}$ for r = 1, .. , 160:

$$f_{ir} = 1 + (2)^{\frac{-3}{2}} a_{i+1,r} - (2)^{\frac{-3}{2}} a_{i+2,r}$$

where

$a_{i,r}$ = a number in the Hadamard matrix (+1 or −1) for the $i^{th}$ USU in the systematic sample. This formula yields replicate factors of approximately 1.7, 1.0, or 0.3.

As in the 1980 methodology, the unbiased weights (base weight x special weighting factor) are multiplied by the replicate factors to produce unbiased replicate weights. These unbiased replicate weights are further adjusted through the weighting steps applied to the full sample, as described in Chapter 2-3, Weighting and Estimation. A variance estimator for the characteristic of interest is a sum of squared differences between each replicate estimate ($\hat{Y}_r$) and the full sample estimate ($\hat{Y}_0$). The formula is

$$Var(\hat{Y}_0) = \frac{4}{160} \sum_{r=1}^{160} (\hat{Y}_r - \hat{Y}_0)^2$$

The replicate factors 1.7, 1.0, and 0.3 for the SR portion of the sample were specifically constructed to yield a numerator of 4 in the above formula, such that the formula remains consistent between SR and NSR areas (Fay and Train, 1995).

### Replicate Factors for Within-Primary Sampling Unit Variance

All PSUs (NSR or SR) undergo systematic sampling during second-stage sampling; therefore, successive difference replication can be used to estimate within-PSU variance. For SR PSUs, the same replicate factors from total variance estimation are assigned to the within-PSU estimator. This is because the PSUs were picked with probability 1 during first-stage sampling, so only within-PSU variance contributes to the total variance. For sample in an NSR PSU, successive difference replication is also used in order to estimate the contribution to variance from second-stage sampling (within-PSU variance). Alternate row assignments are made for USUs to form pairs of USUs in the same manner that was used for the SR assignments. Thus, for within-PSU variance, all USUs (both SR and NSR) have replicate factors of approximately 1.7, 1.0, or 0.3.

The successive difference replication method is used to calculate total national variances and within-PSU variances for some states and metropolitan areas. For more detailed information regarding the formation of replicates, see Gunlicks (1996).

### Variances for State and Local Areas

For estimates at the national level, total variances are estimated from the sample data by the

successive difference replication method previously described. For local areas that are coextensive with one or more sample PSUs, variance estimators can be derived from the same variance estimation methods used for the SR portion of the national sample. However, variance estimation for states and areas that have substantial contributions from NSR sample areas can be problematic.

Most states contain a small number of NSR sample PSUs, so between-PSU variances at the state level are based on relatively small sample sizes. Pairing these PSUs into pseudostrata further reduces the number of NSR SECUs and increases reliability problems. In addition, the component of variance resulting from sampling PSUs can be more important for state estimates than for national estimates in states where the proportion of the population in NSR strata is larger than the national average. Further, creating pseudostrata for variance estimation purposes introduces a between-stratum variance component that is not in the sample design, causing overestimation of the true variance. The between-PSU variance, which includes the between-stratum component, is relatively small at the national level for most characteristics, but it can be much larger at the state level (Gunlicks, 1993; Corteville, 1996). Thus, this additional component should be accounted for when estimating state variances.

## GENERALIZING VARIANCES

With some exceptions, the standard errors for CPS estimates are based on generalized variance functions (GVFs). The GVF is a simple model that expresses the variance as a function of the expected value of the survey estimate. The parameters of the model are estimated using the direct replicate variances discussed above. These models provide a relatively easy way to obtain approximate standard errors for numerous characteristics.

One could not possibly predict all of the combinations of results that may be of interest to data users. Therefore, a presentation of the individual standard errors based on survey data, while technically possible to compute, would be of limited use. In addition, for estimates of differences and ratios that users may compute, the published standard errors would not account for the correlation between the estimates.

Most importantly, variance estimates are based on sample data and have variances of their own. The variance estimate for a survey estimate for a particular month generally has less precision than the survey estimate itself. The estimates of variance for the same characteristic may vary considerably from month to month or for related characteristics (that might have similar levels of true precision) in a given month. Therefore, some method of stabilizing these estimates of variance, such as by generalization or by averaging over time, is needed to improve both their reliability and usability.

### Generalization Method

The GVF that is used to estimate the variance of an estimated monthly level, x, given a population total N (CNP, 16 years and over) is of the form

$$Var(x; N) = (\alpha + \beta N)\left(x - \frac{x^2}{N}\right) \quad (2\text{-}4.1)$$

where $\alpha$ and $\beta$ are two parameters estimated using least squares regression. The rationale for this form of the GVF model is the assumption that the variance of $x$ can be expressed as the product of the variance from a simple random sample (for a binomial random variable) and a design effect. The design effect ($\delta$) accounts for the effect of a complex sample design relative to a simple random sample. Defining $p = x/N$ as the proportion of the population having some characteristic, where $n$ is the size of the sample, the variance of the estimated monthly level $x$ is

$$Var(x; N) = \frac{N^2 p(1-p)\delta}{n} = \left(\frac{N}{n}\delta\right)\left(x - \frac{x^2}{N}\right) \quad (2\text{-}4.2)$$

Letting $d = \frac{N}{n}\delta$, then

$$Var(x; N) = \frac{N^2 p(1-p)\delta}{n} = d\left(x - \frac{x^2}{N}\right) \quad (2\text{-}4.3)$$

The design effect component $d$ (inclusive of the sampling interval, which fluctuates monthly and tends to increase over time) is estimated by the regression term $(\alpha + \beta N)$, yielding the functional form given in formula 2-4.1. Since $N$ is a known population total, $\alpha$ and $\beta$ are the two modeled GVF parameters for a particular series.

The generalized variance models used from 1947 to 2016 were based on the model form:

$$Var(x) = ax^2 + bx \quad (2\text{-}4.4)$$

The only difference between these model forms is that the historical model (2-4.4) assumed a fixed population level $N$, therefore producing GVF parameters that were useful for time periods in which the true population level was approximately equal to the fixed value. The current model (2-4.2), implemented in 2017, allows $N$ to vary from month to month, resulting in GVF parameters that are useful over the entire reference period of the model (typically 10 or more years). Since $N$ is a population control readily available for every month, the current model was adopted to increase the generalizability of the GVF parameters.

The $\alpha$ and $\beta$ parameters are designed to produce variance estimates for monthly CPS estimates. For estimates of changes or averages over time, adjustment factors are calculated based on historical correlations and an assumption of equal monthly variances, which simplifies the calculation. While monthly variances do change over time, empirical review suggests the equal-variance assumption has negligible impact on the quality of variance estimates for most series.

The $\alpha$ and $\beta$ parameters are updated annually to incorporate recent information into the GVF models. Since the overlap from one model period to the next is very high, the resulting parameters usually do not change much from one year to the next, allowing for smooth comparisons over time. In the event of a major sample reduction, the GVF models would be adjusted to account for the changing sampling intervals and design effects.

## Calculation of Generalized Variance Function Parameters

In 2015, the CPS introduced a new method for computing GVF parameters (McIllece, 2016). The new process models each series individually rather than clustering series with similar design effects. Under the previous method, the model used relative variance as a dependent quantity. Under the new method, the dependent quantity is the design effect times the sampling interval, both of which are stable over time for most series, presuming stability of the CPS sample size. Notably, the fluctuation of the replication process, which is implicitly included in $d$ since direct replicate variances are used (see formulations below), is relatively unstable. By fitting each model on a monthly series history of approximately 10 years

or more, the long-term stability of the sampling interval and the design effect are leveraged, while the relative volatility of the replication procedure is smoothed, resulting in a GVF model fit that accounts for binomial variance and seasonality. Unlike direct replication variances, estimates of variances from this GVF method are not typically volatile, excepting some sparse subgroups.

The GVF model subsequently detailed is only applied to level (i.e., count) and rate series that may be considered binomial, such as number of employed people and the unemployment rate, respectively. Most CPS series fit this criterion. The variances of nonbinomial series, such as means and medians, are not estimated using this specific method.

To estimate the variance of some level estimate $x$, such as total employed or total unemployed, recall the formula 2-4.3:

$$Var(x; N) = d \left( x - \frac{x^2}{N} \right)$$

While this formula represents the theoretical form, binomial variances are not directly computed. Direct CPS variances, as referred to in this chapter, are calculated by the successive difference replication method described in earlier sections. These replicate variances are used in the construction of the GVF model.

Define $V^*(x; N)$ as the replicate estimate of the variance of x, given the population total $N$. Then calculate the design effect component d as

$$d = \frac{V^*(x; N)}{\left( x - \frac{x^2}{N} \right)}$$

By computing $d$ as a ratio based on replicate variance, $d$ implicitly includes the volatility of the replication procedure. Since the quantity is large relative to the size of the estimate $x$, the direct replicate variance estimates are impractical for use. The GVF model, therefore, is constructed to retain the form of binomial variance and any associated seasonal effects, while smoothing through the replication volatility that otherwise destabilizes the variance estimation series.

Let

$\overline{d}$ = the average value of over the model period

$\overline{N}$ = the average value of over the model period

$$d^* = \left(\frac{d - \bar{d}}{\bar{d}}\right)$$

$$N^* = \left(\frac{N - \bar{N}}{\bar{N}}\right)$$

$r_{d^*,N^*}$ = the correlation between $d^*$ and $N^*$ over the model period,

$s_{d^*}$ = the standard deviation of $d^*$ over the model period,

$s_{N^*}$ = the standard deviation of $N^*$ over the model period,

$$\beta_0 = r_{d^*,N^*} \frac{s_{d^*}}{s_{N^*}}$$

The GVF model is constructed as a least squares regression model:

$$\hat{d}^* = \beta_0 N^*$$

Then expanded to estimate by the modeled

$$\hat{d} = (\bar{d} - \bar{d}\beta_0) + \left(\frac{\bar{d}\beta_0}{\bar{N}}\right) N = (\alpha + \beta N)$$

Therefore, the $\alpha$ and $\beta$ GVF parameters from 2-4.1 are calculated as:

$$\alpha = \bar{d} - \bar{d}\beta_0$$

$$\beta = \frac{\bar{d}\beta_0}{\bar{N}}$$

Modeled variances for rate estimates, such as the unemployment rate or the labor force participation rate, are developed analogously to level estimates, but with the base $y$ (the denominator of the rate) replacing $N$. Though $y$ is often an estimate, it is treated as a population value for GVF parameter estimation, as empirical results have indicated that treating the base as a random variable typically has little impact on the variance estimates.

By treating $y$ as a population value, the variance of rate estimates can be approximated by a slight modification to 2-4.1:

$$Var(x; y) = \frac{(\alpha + \beta y)}{y^2}\left(x - \frac{x^2}{y}\right) = \frac{(\alpha + \beta y)}{y}\left(\frac{x}{y} - \frac{x^2}{y^2}\right)$$

$$= \frac{(\alpha + \beta y)}{y} p(1 - p)$$

where $p = \frac{x}{y}$.

The design effect component $d$ for rate series has a slightly different form, which accounts for the

difference in the form of the variance estimators between levels and rates:

$$d = \frac{yV^*(x; y)}{p(1 - p)}$$

Once $d$ is computed over the modeling period, the $\alpha$ and $\beta$ GVF parameters for rate series are developed using the same modeling method that is used for level series (see above), but with the base quantities $y$ and $\bar{y}$ replacing $N$ and $\bar{N}$, respectively, in the least squares regression model.

## Computing Standard Errors

After the parameters $\alpha$ and $\beta$ of formula 2-4.1 are determined, it is a simple matter to construct a table of standard errors of estimates. In practice, such tables show the standard errors that are appropriate for specific estimates, and the user is instructed to interpolate for estimates not explicitly shown in the table. The Bureau of Labor Statistics publishes tables of GVF parameters, which are available in the "Reliability of estimates from the CPS" section of its website https://www.bls.gov/cps/documentation.htm. Table 2-4.1 provides example GVF parameters for the labor force characteristics of several demographic subgroups for the purpose of demonstrating standard error computation. Refer to the source listed previously for current parameters.

Since the standard error of an estimate is the square root of its variance, the approximate standard error, se(x; N), of an estimated monthly total can be obtained with $\alpha$ and $\beta$ from the above table and square root of formula 2-4.1:

$$se(x; N) = \sqrt{(\alpha + \beta N)\left(x - \frac{x^2}{N}\right)} \quad \text{(2-4.5)}$$

In January 2007, there were an estimated 4,406,000 unemployed men from a population $N$ of 230,650,000 people. Obtaining the appropriate $\alpha$ and $\beta$ parameters from Table 2-4.1, an approximate standard error can be calculated for this estimate using equation 2-4.5:

se (4,406,000; 230,650,000)

$$= \sqrt{(1050.17 + 0.00000883 * 230,650,000)\left(4,406,000 - \frac{4,406,000^2}{230,650,000}\right)}$$

$$= \sqrt{3086.8095(4,321,834.2250)} = 115,501.86$$

In January 2017, there were an estimated 4,514,000 unemployed men from a population $N$ of

Table 2-4.1.
## Generalized Variance Function Parameters for Estimates of Monthly Levels

| Characteristic | Parameters | |
| --- | --- | --- |
| | $a$ | $\beta$ |
| **Total:** | | |
| Civilian labor force . . . . . . . . . . . . . . . . . | −4,629.00 | 0.00002821 |
| Employed . . . . . . . . . . . . . . . . . . . . . . . . . | −4,868.95 | 0.00002960 |
| Unemployed. . . . . . . . . . . . . . . . . . . . . . . | 558.44 | 0.00001184 |
| Not in labor force . . . . . . . . . . . . . . . . . . | −4,629.00 | 0.00002821 |
| | | |
| **Men:** | | |
| Civilian labor force . . . . . . . . . . . . . . . . . | −3,045.81 | 0.00001622 |
| Employed . . . . . . . . . . . . . . . . . . . . . . . . . | −2,452.20 | 0.00001450 |
| Unemployed. . . . . . . . . . . . . . . . . . . . . . . | 1,050.17 | 0.00000883 |
| Not in labor force . . . . . . . . . . . . . . . . . . | −2,878.85 | 0.00001860 |
| | | |
| **Women:** | | |
| Civilian labor force . . . . . . . . . . . . . . . . . | −2,678.77 | 0.00001593 |
| Employed . . . . . . . . . . . . . . . . . . . . . . . . . | −2,807.89 | 0.00001687 |
| Unemployed. . . . . . . . . . . . . . . . . . . . . . . | −2,748.05 | 0.00002370 |
| Not in labor force . . . . . . . . . . . . . . . . . . | −1,940.94 | 0.00001401 |
| | | |
| **Both sexes, 16 to 19 years:** | | |
| Civilian labor force . . . . . . . . . . . . . . . . . | −2,804.43 | 0.00001981 |
| Employed . . . . . . . . . . . . . . . . . . . . . . . . . | −3,729.02 | 0.00002414 |
| Unemployed. . . . . . . . . . . . . . . . . . . . . . . | −1,368.68 | 0.00001808 |
| Not in labor force . . . . . . . . . . . . . . . . . . | 1,541.65 | −0.00000164 |

Note: These values are based on standard-error models that were updated with the release of July 2018 data.
Source: Bureau of Labor Statistics, "Reliability of estimates from the CPS" section of <www.bls.gov/cps/documentation.htm>.

254,082,000 persons. Using the same $\alpha$ and $\beta$ parameters from Table 2-4.1, an approximate standard error can be calculated for this estimate using equation 2-4.5:

$se$ (4,514,000; 254,082,000)

$$= \sqrt{(1050.17 + 0.00000883 * 254{,}082{,}000)\left(4{,}514{,}000 - \frac{4{,}514{,}000^2}{254{,}082{,}000}\right)}$$

$$= \sqrt{3293.71(4{,}433{,}804.6457)} = 120{,}845.71$$

In this example, since the values of $x$ are similar, the increase in the standard error estimate of unemployed men is primarily driven by the 23.4 million increase in $N$ population over that decade.

To form 90 percent confidence intervals (rounded to the nearest thousand) around these estimates, 1.645 times the standard error is added and subtracted from the estimate $x$. For the January 2007 estimate of unemployed men, the 90 percent confidence interval is calculated as:

$$4{,}406{,}000 \pm 1.645 * 115{,}501{,}86 \approx (4{,}216{,}000; 4{,}596{,}000)$$

As a practical interpretation, there is about a 90 percent chance that the true number of

unemployed men in January 2007 was between 4.216 million and 4.596 million. Using the same approach, the 90 percent confidence interval for unemployed men in January 2017 was approximately 4.315 million to 4.713 million.

## TOTAL VARIANCE COMPONENTS

The following tables show variance estimates computed using replication methods by type (total and within-PSU) and by stage of estimation. The estimates presented are based on the 2010 sample design and averaged across all twelve months of 2016. This period was used for estimation because the sample design was essentially unchanged throughout the year, and the variances tend to be more stable than in earlier postrecessionary years.

### Within-Primary Sampling Unit Variance Ratios by Weighting Stage

The CPS employs a complex sample design that selects both SR and NSR PSUs within states (see Chapter 2-2, Sample Design). An NSR stratum consists of a group of PSUs, typically including

rural areas, from which only one PSU is selected to be included in the CPS sample. Since this PSU represents the entire stratum, between-PSU variability is introduced, which is a measure of the variability that results from having selected a subset of NSR PSUs throughout the nation. An SR stratum includes only one PSU; therefore, the contribution of between-PSU variance is zero by definition from these sample areas. Both SR and NSR PSUs contribute within-PSU variance, which is the variability introduced by sampling a subset of HUs within each selected PSU.

Total variance is the sum of between-PSU and within-PSU variance. Table 2-4.2 presents ratios of within-PSU to total variance for the primary labor force estimates of selected demographic groups after various stages in weighting. For national estimates, within-PSU variance is the dominant contributor to total variance, which is clearly demonstrated in the table and is consistent across weighting stages. Thus, the effect of selecting NSR PSUs in some strata has a small effect on the total variance of most national estimates.

Different replicate weights are assigned to sample units to reflect either total variance or within-PSU variance. Since the assignment of replicate weights cannot be perfectly optimized for these variance levels—and since the variances calculated using those replicates are only estimates themselves, with their own errors—in some cases,

Table 2-4.2.
**Within-Primary Sampling Unit to Total Variance Ratios: 2016 Annual Averages**
(In percent)

| Characteristic | Nonresponse adjustment | Second stage | Compositing |
|---|---|---|---|
| **Civilian labor force** | **0.99** | **0.98** | **0.96** |
| Men | 0.97 | 0.94 | 0.91 |
| Women | 1.02 | 1.00 | 1.00 |
| White | 0.97 | 0.95 | 0.92 |
| Black | 0.90 | 0.99 | 1.00 |
| Hispanic | 0.95 | 1.00 | 1.01 |
| Asian | 0.97 | 0.98 | 0.99 |
| **Employed** | **0.99** | **0.97** | **0.97** |
| Men | 0.98 | 0.97 | 0.93 |
| Women | 1.01 | 1.01 | 1.02 |
| White | 0.97 | 0.95 | 0.92 |
| Black | 0.91 | 0.97 | 0.99 |
| Hispanic | 0.94 | 0.99 | 1.00 |
| Asian | 0.97 | 0.98 | 0.98 |
| **Unemployed** | **0.99** | **1.00** | **1.01** |
| Men | 0.99 | 1.02 | 1.02 |
| Women | 0.99 | 0.98 | 0.98 |
| White | 0.99 | 0.97 | 0.98 |
| Black | 0.95 | 0.99 | 1.00 |
| Hispanic | 1.03 | 1.01 | 1.03 |
| Asian | 1.00 | 1.01 | 1.02 |
| **Unemployment rate** | **0.99** | **0.99** | **1.01** |
| Men | 1.00 | 1.03 | 1.02 |
| Women | 0.99 | 0.99 | 0.98 |
| White | 0.98 | 0.97 | 0.98 |
| Black | 0.98 | 0.99 | 1.00 |
| Hispanic | 1.01 | 1.01 | 1.02 |
| Asian | 1.00 | 1.01 | 1.01 |
| **Not in labor force** | **0.96** | **0.98** | **0.96** |
| Men | 0.96 | 0.94 | 0.91 |
| Women | 0.95 | 1.00 | 1.00 |
| White | 0.96 | 0.95 | 0.92 |
| Black | 0.87 | 0.99 | 1.00 |
| Hispanic | 0.99 | 1.00 | 1.01 |
| Asian | 0.97 | 0.99 | 0.99 |

Source: U.S. Census Bureau, Tabulation of 2016 Current Population Survey microdata.

the ratio of within-PSU to total variance is slightly greater than one. While this implies a negative between-PSU variance (since it can be derived as total variance minus within-PSU variance), it should not be interpreted that way. By definition, variances cannot be less than zero. Practically speaking, a ratio slightly greater than one can be interpreted to mean that the true between-PSU variance contribution is close to zero, but not actually negative.

## Relative Standard Errors by Weighting Stage

Table 2-4.3 shows how the separate estimation steps affect a survey estimate's relative standard errors (RSEs), calculated as the replicate standard error of an estimate divided by the estimate itself. As stated before, the standard error of an estimate is simply the square root of its variance. It is more instructive to compare RSEs than the standard errors themselves, since the various stages of estimation can affect both the level of a survey estimate and its variance (Hanson, 1978; Train, Cahoon, and Makens, 1978). The nonresponse-adjusted estimate includes base weights, special weighting factors, and nonresponse adjustment. The second-stage estimate includes all weighting steps applied to the full sample except compositing (see Chapter 2-3, Weighting and Estimation).

Table 2-4.3.
### Relative Standard Errors After Selected Weighting Stages: 2016 Annual Averages
(In percent)

| Labor force status | Nonresponse adjustment | Second stage | Compositing |
|---|---|---|---|
| **Civilian labor force** | **0.86** | **0.26** | **0.24** |
| Men | 0.91 | 0.31 | 0.29 |
| Women | 0.95 | 0.40 | 0.36 |
| White | 0.94 | 0.28 | 0.25 |
| Black | 2.31 | 0.81 | 0.74 |
| Hispanic | 2.13 | 0.64 | 0.58 |
| Asian | 3.18 | 1.26 | 1.23 |
| | | | |
| **Employed** | **0.87** | **0.29** | **0.27** |
| Men | 0.92 | 0.35 | 0.32 |
| Women | 0.95 | 0.43 | 0.38 |
| White | 0.94 | 0.31 | 0.28 |
| Black | 2.35 | 0.94 | 0.84 |
| Hispanic | 2.14 | 0.70 | 0.63 |
| Asian | 3.19 | 1.31 | 1.28 |
| | | | |
| **Unemployed** | **2.32** | **2.12** | **2.07** |
| Men | 2.99 | 2.85 | 2.78 |
| Women | 3.25 | 3.05 | 3.02 |
| White | 2.71 | 2.53 | 2.45 |
| Black | 5.24 | 4.82 | 4.76 |
| Hispanic | 5.38 | 4.93 | 4.81 |
| Asian | 10.99 | 10.52 | 10.37 |
| | | | |
| **Unemployment rate** | **2.14** | **2.12** | **2.07** |
| Men | 2.86 | 2.84 | 2.77 |
| Women | 3.05 | 3.03 | 2.99 |
| White | 2.52 | 2.53 | 2.45 |
| Black | 4.70 | 4.78 | 4.67 |
| Hispanic | 4.89 | 4.88 | 4.75 |
| Asian | 10.46 | 10.39 | 10.25 |
| | | | |
| **Not in labor force** | **0.93** | **0.44** | **0.40** |
| Men | 1.16 | 0.70 | 0.64 |
| Women | 1.01 | 0.53 | 0.47 |
| White | 1.04 | 0.48 | 0.42 |
| Black | 2.70 | 1.31 | 1.18 |
| Hispanic | 2.54 | 1.25 | 1.11 |
| Asian | 3.65 | 1.97 | 1.91 |

Source: U.S. Census Bureau, Tabulation of 2016 Current Population Survey microdata.

In Table 2-4.3, the figures across demographic groups for the civilian labor force, employed, and not in labor force show, for example, that the second-stage weighting process substantially reduces RSEs, while compositing further decreases the RSEs but more modestly. The figures for unemployed and unemployment rate demonstrate little difference between RSEs of nonresponse-adjusted and second-stage estimates, but a more consistent, minor decrease in RSEs from second-stage to composite estimates. The RSEs of the unemployment statistics tend to be larger because unemployment is a relatively rare characteristic, typically less than ten percent for most groups in the primary estimation tables, depending on the state of the economy.

## DESIGN EFFECTS

Table 2-4.4 shows the second-stage and composite design effects for the total variances of major labor force characteristics for selected demographic groups. A design effect ($\delta$) is the ratio of the variance from a complex sample design to the variance of a simple random sample (SRS) design. The design effects in this table were computed by solving equation 2-4.3 for $\delta$ for a theoretical response rate of 100 percent and also for realized response rates of approximately 90 percent over the reference period, 2010 to 2017. The design effects for the realized response rates are smaller because the estimated SRS variances increase as the number of respondents decrease.

For the unemployed, assuming about a 90 percent response rate, the design effect for total variance is approximately 1.59 for the second-stage estimate and 1.49 for the composite estimate.

Table 2-4.4.
### Design Effects After Selected Weighting Stages: 2010–2017 Averages
(In percent)

| Labor force status | 100 percent response rates | | 2010–2017 response rates | |
|---|---|---|---|---|
| | Second stage | Compositing | Second stage | Compositing |
| **Civilian labor force. . .** | **1.39** | **1.09** | **1.24** | **0.97** |
| Men. . . . . . . . . . . . . . . | 0.55 | 0.45 | 0.49 | 0.40 |
| Women . . . . . . . . . . . . | 0.77 | 0.59 | 0.69 | 0.52 |
| White . . . . . . . . . . . . . | 0.93 | 0.72 | 0.82 | 0.64 |
| Black . . . . . . . . . . . . . | 0.66 | 0.55 | 0.58 | 0.49 |
| Hispanic. . . . . . . . . . . | 0.54 | 0.44 | 0.48 | 0.39 |
| Asian . . . . . . . . . . . . . | 0.70 | 0.63 | 0.62 | 0.56 |
| | | | | |
| **Employed. . . . . . . . . .** | **1.46** | **1.13** | **1.30** | **1.01** |
| Men. . . . . . . . . . . . . . . | 0.66 | 0.52 | 0.58 | 0.46 |
| Women . . . . . . . . . . . . | 0.84 | 0.64 | 0.75 | 0.57 |
| White . . . . . . . . . . . . . | 1.02 | 0.78 | 0.90 | 0.70 |
| Black . . . . . . . . . . . . . | 0.81 | 0.66 | 0.72 | 0.59 |
| Hispanic. . . . . . . . . . . | 0.66 | 0.52 | 0.58 | 0.46 |
| Asian . . . . . . . . . . . . . | 0.75 | 0.66 | 0.67 | 0.59 |
| | | | | |
| **Unemployed . . . . . . . .** | **1.78** | **1.68** | **1.59** | **1.49** |
| Men. . . . . . . . . . . . . . . | 1.64 | 1.54 | 1.46 | 1.37 |
| Women . . . . . . . . . . . . | 1.56 | 1.48 | 1.39 | 1.31 |
| White . . . . . . . . . . . . . | 1.68 | 1.57 | 1.49 | 1.40 |
| Black . . . . . . . . . . . . . | 1.81 | 1.70 | 1.61 | 1.52 |
| Hispanic. . . . . . . . . . . | 1.83 | 1.74 | 1.63 | 1.55 |
| Asian . . . . . . . . . . . . . | 1.77 | 1.69 | 1.58 | 1.51 |
| | | | | |
| **Not in labor force . . . .** | **1.39** | **1.09** | **1.24** | **0.97** |
| Men. . . . . . . . . . . . . . . | 0.99 | 0.80 | 0.88 | 0.71 |
| Women . . . . . . . . . . . . | 0.94 | 0.71 | 0.84 | 0.63 |
| White . . . . . . . . . . . . . | 1.13 | 0.87 | 1.01 | 0.78 |
| Black . . . . . . . . . . . . . | 1.03 | 0.86 | 0.92 | 0.77 |
| Hispanic. . . . . . . . . . . | 1.02 | 0.82 | 0.91 | 0.73 |
| Asian . . . . . . . . . . . . . | 1.02 | 0.90 | 0.91 | 0.80 |

Source: U.S. Census Bureau, Tabulation of 2010–2017 Current Population Survey microdata.

This means that, for the same number of sample cases, the design of the CPS (including sample selection and weighting) increases total variance by about 60 percent for second-stage estimates and about 50 percent for composite estimates, relative to an SRS design. The design effects for the civilian labor force, employed, and not in labor force for all groups tend to be smaller than those for unemployed. The design effects for composite estimates tend to be smaller than those for SS, which indicates that composite weighting generally increases the precision of estimates.

The design effects in Table 2-4.4 tend to be larger than the analogous design effects reported in past technical papers, such as Table 14-4 of CPS Technical Paper 66, due to a change in the accounting of the sample size. Table 2-4.4 assumes an average of slightly over 1.9 responding adults per eligible sampled household (excluding out-of-scope HUs selected in the sample), which was derived from average respondent data from 2010 to 2017. Past technical papers used different denominators that are not reflective of recent years of data, resulting in smaller design effects than are reported in Table 2-4.4.

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# Chapter 2-5: Seasonal Adjustment

## INTRODUCTION

Short-run movements in labor force time series are strongly influenced by seasonality—periodic fluctuations associated with recurring calendar-related events such as weather, holidays, and the opening and closing of schools. Seasonal adjustment removes the influence of these fluctuations and makes it easier for users to observe fundamental changes in the level of the series, particularly changes associated with general economic expansions and contractions.

While seasonal adjustment is feasible only if the seasonal effects are reasonably stable with respect to timing, direction, and magnitude, these effects are not necessarily fixed and often evolve over time. The evolving patterns are estimated by the X-13ARIMA-SEATS (X-13) program, with procedures based on "filters" that successively average a shifting timespan of data, thereby providing estimates of seasonal factors that change in a smooth fashion from year to year.

For observations in the middle of a series, a set of symmetric moving averages with fixed weights produces final seasonally adjusted estimates. A filter is symmetric if it is centered around the time point being adjusted, with an equal amount of data preceding and following that point. Standard seasonal adjustment options imply a symmetric filter that uses from 6 to 10 years of original data to produce a final seasonally adjusted estimate. Obviously, this final adjustment can be made only where there are enough data beyond the time point in question to adjust with the symmetric filter.

To seasonally adjust recent data, shorter filters with less desirable properties must be used. These filters are referred to as asymmetric because they use fewer observations after the reference point than preceding it. The weights for such filters vary with the number of observations that are available beyond the time point for which estimates are to be adjusted. Seasonally adjusted data for the current year are produced with a technique known as concurrent adjustment. Under this practice, the current month's seasonally adjusted estimate is computed with the use of all relevant original data up to and including data for the current month.

Every time an observation is added, previous estimates will be revised. The number of estimates that are revised depends on the filter. Revisions to a seasonally adjusted estimate for a given time point continue until enough future observations become available to use the symmetric weights. This effectively means waiting up to 5 years for a final adjustment when standard options are used.

At the end of each calendar year, the BLS recalculates the seasonal factors for CPS national series by including another full year of data in the estimation process. On the basis of this annual recalculation, BLS revises the historical seasonally adjusted data for the previous 5 years. As a result, each year's data are generally subject to five revisions before the values are considered final. The fifth and final revisions to data for the earliest of the 5 years are usually quite small, while the first-time revisions to data for the most recent years are generally much larger. For the major aggregate labor force series, however, the first-time revisions rarely alter the essential trends observed in the initial estimates. (For information about seasonal adjustment of the Local Area Unemployment Statistics program's state and local area estimates, see the BLS Handbook of Methods [2018]).

## ADJUSTMENT METHODS AND PROCEDURES

Beginning in 2003, BLS adopted the use of X-12-ARIMA (X-12) as the official seasonal adjustment program for CPS labor force series, replacing the X-11-ARIMA (X-11) program that had been used since 1980. Both X-12-ARIMA and X-11-ARIMA incorporate the widely used X-11 method developed at the Census Bureau in the 1960s. Statistics Canada added to the X-11 method the ability to extend the time series with forward and backward extrapolations from Auto-Regressive Integrated Moving Average (ARIMA) models prior to seasonal adjustment. The X-11 algorithm for seasonal adjustment is then applied to the extended series. When adjusted data are revised after future data become available, the use of forward extensions results in initial seasonal adjustments that are subject to smaller revisions on average.

The enhancements in the X-12 program fall into three basic categories: (1) enhanced ARIMA model selection and estimation, (2) detection and estimation of outlier, trading day, and holiday effects, and (3) new postadjustment diagnostics.

Starting in 2015, BLS moved to the X-13 program, which was developed by the Census Bureau and the Bank of Spain. The X-13 program includes all of the capabilities of the X-12 program, while adding the signal extraction for ARIMA (SEATS) seasonal adjustment methodology. (See the subsequent section titled "X-11 and SEATS decompositions.")

The X-11 and SEATS methods have strong similarities. The ARIMA model of the observed series is the starting point for both. They both also use the same basic estimator, which is a weighted moving average of the series, to produce the seasonally adjusted output. The methods differ in the derivation of moving average weights.

The X-11 method is empirically based. It directly selects the seasonal moving averages from a prespecified set. The weights are not designed for any specific series, but fit a wide variety of series. SEATS is model-based and derives a moving average from the ARIMA model of the series. The moving averages are tailored to the specific modeled properties of the series. The SEATS methodology is flexible in that it can adjust some series that the X-11 method finds too variable. It also facilitates analysis with a variety of error measures produced within the system. See Shiskin et al., (1967), Dagum (1980), Findley et al., (1998), Gomez and Maravall (2001), and Census Bureau (2015) for details on these methods.

For almost all of the national labor force series that are seasonally adjusted by BLS, the main steps of the seasonal adjustment process proceed in the following order:

1.  Time series modeling. A REGARIMA model (a combined regression and ARIMA model) is developed to account for the normal evolutionary behavior of the time series and to control for outliers and other special external effects that may exist in the series.

2.  Prior adjustments. Given an adequate REGARIMA model, the series is modified by prior adjustments for external effects

estimated from the regression part of the model and extrapolated forward 24 months or more by the ARIMA part of the model.

3.  X-11 or SEATS decomposition. The modified and extrapolated series is decomposed into trend-cycle, seasonal, and irregular components by means of a series of moving averages to produce seasonal factors for implementing seasonal adjustment.

4.  Evaluation. A battery of diagnostic tests is produced to evaluate the quality of the final seasonal adjustment.

## Time series modeling

Time series models play an important role in seasonal adjustment. They are used to identify and correct the series for atypical observations and other external effects, as well as to extend the original series with backcasts and forecasts so that fewer asymmetric filters can be used at the beginning and end of the series.

ARIMA models (see Box and Jenkins, 1970 or Kendall and Ord, 1990) are designed to make forecasts of a time series based on only its past values. While these models can represent a wide class of evolving time series patterns, they do not account for the presence of occasional outliers and other special external effects. An outlier represents a sudden break in the normal evolutionary behavior of a time series. Ignoring the existence of outliers may lead to serious distortions in the seasonally adjusted series.

A common form of outlier that presents a special problem for seasonal adjustment is an abrupt shift in the level of the data that may be either transitory or permanent. Three types of outliers are usually distinguished: (1) An additive change that affects only a single observation, (2) a temporary change having an effect that diminishes to zero over several periods, and (3) a level shift or a break in the trend of the data, which represents a permanent increase or decrease in the underlying level of the series. These three main types of outliers, as well as other types of external effects, may be handled by the time series modeling component of the X-13 program. This is done by adding to the ARIMA model appropriately defined regression variables based on intervention analysis originally proposed by Box and Tiao (1975).

The combined regression and ARIMA model is referred to as a REGARIMA model and is represented by

$$Y_t = \beta X_t + Z_t \, ,$$

where $Y_t$ is the original series or a logarithmic transformation of it; $X_t$ is a set of fixed regression variables; $\beta$ represents the regression coefficients; and $Z_t$ is a standard seasonal ARIMA model described by the notation (p,d,q)(P,D,Q), where p is the number of regular (nonseasonal) autoregressive parameters, d is the number of regular differences, q is the number of regular moving average parameters, P is the number of seasonal autoregressive parameters, D is the number of seasonal differences, and Q is the number of seasonal moving average parameters.

While the ARIMA model can be very complicated theoretically, in practice it takes a parsimonious form involving only a few estimated parameters. There are well-developed methods for determining the number and types of parameters and the degree of differencing appropriate for a given series.

With respect to specifying the regression component to control for outliers, the X-13 program offers two approaches. First, major external events, such as breaks in trend, are usually associated with known events. In such cases, the user has sufficient prior information to specify special regression variables to estimate and control for these effects.

Second, because it is rare that there is sufficient prior information to locate and identify all of the atypical observations that may exist in a time series, as a second approach to specifying the regression component, REGARIMA offers automatic outlier detection based on work by Chang, Tiao, and Chen (1988). This approach is especially useful when a large number of series must be processed. Of course, both approaches may be combined so that readily available prior information can be used directly, while unknown substantial outliers may still be discovered.

Model adequacy and length of series. The preference is to use relatively long series in fitting time series models, but with some qualifications. Sometimes, the relevance of data in the distant past to seasonal adjustment is questionable, which may lead to using a shorter series.

Even though the filters have limited memory, there are reasons for using longer series. First, for homogenous time series, the more data used to identify and estimate a model, the more likely it is that the model will represent the structure of the data well and the more accurate the parameter estimates will be. The exact amount of data needed for time series modeling depends on the properties of the series involved. Arbitrarily truncating the series, however, may lead to more frequent changes in model identification and to large changes in estimated parameters, which in turn may lead to larger-than-necessary revisions in forecasts.

Second, although level shifts and other types of outliers tend to occur more often in longer series, the X-13 program has the capability of automatically controlling for these effects. Third, some very useful diagnostics available in X-13 typically require a minimum of 11 years of data and, in some cases, as much as 14 years of data. Fourth, attempting to fit longer series often provides useful insights into the properties of the series, including their overall quality and the effects of major changes in survey design.

Extensive use is made of intervention analysis to estimate the magnitude of known breaks in CPS series and of automatic outlier detection to identify and correct for the presence of additional atypical observations. Once a model is estimated, it is evaluated in terms of its adequacy for seasonal adjustment purposes. The criteria essentially require a model to fit the series well (there should be no systematic patterns in the residuals) and to have low average forecasting errors for the last 3 years of observed data. When there is a tradeoff between the length of the series and the adequacy of the model, a shorter series is selected. In this case, the identification of the model is not changed with the addition of new data unless the model fails diagnostic testing.

Acceptable REGARIMA models have been developed for all of the labor force series that are directly adjusted. (For information about directly and indirectly adjusted series, see subsequent section titled "Aggregation procedures.")

## Prior adjustments

Prior adjustments are adjustments made to the original data prior to seasonal adjustment. Their purpose is to correct the original series for atypical observations and other external effects that otherwise would seriously distort the estimates of the seasonal factors. Prior adjustment factors are subtracted from or used as divisors for the original series, depending on whether the seasonal adjustment is additive or multiplicative.

Prior adjustment factors for CPS series may be based on special user-defined adjustments or handled more formally with REGARIMA modeling. Most of the prior adjustment factors for the labor force series are estimated directly from REGARIMA.

Level shifts. The most common type of outlier that occurs in CPS series is the permanent level shift. Most such shifts have been due to noneconomic methodological changes related to revisions in population controls and to major modifications to the CPS design. One notable economic level shift was due to the 2001 terrorist attacks.

Population estimates extrapolated from the latest decennial census are used in the second-stage estimation procedure to control CPS sample estimates to more accurate levels. These intercensal population estimates are regularly revised to reflect the latest information on population change.

During the 1990s, three major breaks occurred in the intercensal population estimates. Population controls based on the 1990 Census, adjusted for the estimated undercount, were introduced into the CPS series in 1994 and, in 1996, were extended back to 1990. In January 1997 and again in January 1999, the population controls were revised to reflect updated information on net international migration.

Population revisions that reflected the results of the 2000 Census were introduced with the release of data for January 2003 and were extended back to data beginning in January 2000. Since 2003, population controls also are updated in January to reflect new estimates of net international migration in the postcensus period, updated vital statistics and other information, and any methodological changes in the population estimation

process. The population revisions introduced in January 2012 incorporated the results of the 2010 Census; those revisions were not extended back to January 2010. Further information on CPS population controls for 1996 to the present is available on the BLS Web site at <www.bls.gov/cps/documentation.htm>.

In 1994, major changes to the CPS were introduced, including a redesigned and automated questionnaire and revisions to some of the labor force concepts and definitions. In January 2003, new I&O classifications also were introduced and were extended back to data beginning in 2000.

To test for the possibility that revisions to the population controls or significant survey changes have important effects on those CPS series with large numerical revisions, each REGARIMA model is modified to include intervention variables for those years. The coefficients for these variables provide estimates of the direction and magnitude of the intervention effects.

Intervention effects for 2000 were necessary for selected employment series related primarily to Hispanic, adult, and agricultural categories. These effects mainly reflect increases in adult and Hispanic employment due to the introduction of the 2000 Census-based population controls and a decline in agricultural employment caused by the change in the industry classification system (see Bowler et al., 2003).

Due to an unusual revision in the population controls in January 2000, the unadjusted employment level of Black or African-American men 20 years or over had a strong upward shift in the first quarter of 2000. This temporary effect is permanently removed from the seasonally adjusted series with the use of the REGARIMA model.

At the end of 2001, unemployed job losers were identified as having had substantial upward level shifts 1 month after the September 11, 2001, terrorist attacks on the World Trade Center in New York City. For more details, see McIntire et al., (2002). Also, four additional series related to workers employed part time for economic reasons were identified as having substantial upward shifts at the time of the terrorist attacks.

*Calendar effects.* Calendar effects are transitory level shifts in a series that result from calendar

events such as moving holidays or the differing composition of weekdays in a month between years. These effects have different influences on the same month across years, thereby distorting the normal seasonal patterns for the given month.

## X-11 and Signal Extraction in ARIMA Time Series Decompositions

The X-11 and SEATS methods of seasonal adjustment contained within the X-13 program assume that the original series is composed of three components: trend-cycle, seasonal, and irregular. Depending on the relationship between the original series and each of the components, the mode of seasonal adjustment may be additive or multiplicative. Formal tests are conducted to determine the appropriate mode of adjustment.

The multiplicative mode assumes that the absolute magnitudes of the components of the series are dependent on each other, which implies that the size of the seasonal component increases and decreases with the level of the series. With this mode, the monthly seasonal factors are ratios with all positive values centered around unity. The seasonally adjusted series values are computed by dividing each month's original value by the corresponding seasonal factor.

In contrast, the additive mode assumes that the absolute magnitudes of the components of the series are independent of each other, which implies that the size of the seasonal component is independent of the level of the series. In this case, the seasonal factors represent positive or negative deviations from the original series and are centered around zero. The seasonally adjusted series values are computed by subtracting the corresponding seasonal factor from each month's original value.

Most seasonally adjusted CPS series are seasonally adjusted using the X-11 component of the X-13 program. Given an appropriate choice for the mode of adjustment, the prior-adjusted, forecasted series is seasonally adjusted by the X-11 component of the X-13 program. The X-11 method applies a sequence of moving average and smoothing calculations to estimate the trend-cycle, seasonal, and irregular components. The method takes either a ratio-to- or difference-from-moving-average approach, depending on whether the multiplicative or additive model is used. For observations in the middle of the series, a set of fixed symmetric moving averages (filters) is used to produce final estimates. The implied length of the final filter under standard options is 72 time points for the 3 by 5 seasonal moving average or 120 time points for the 3 by 9 moving average. That is, to obtain a final seasonally adjusted estimate for a single time point requires up to 5 years of monthly data preceding and following that time point. For recent data, asymmetric filters with less desirable properties than symmetric filters must be used.

Some seasonally adjusted CPS series are adjusted using the SEATS component of the X-13 program rather than the X-11 component. Like the X-11 method, SEATS decomposes the observed series into trend-cycle, seasonal, and irregular components, and the relationship between the components may be additive or multiplicative (via a log transformation). Both the X-11 and SEATS methods use moving averages to decompose the series. The major difference between the two procedures is how the moving averages are constructed. The X-11 method selects from a set of predefined filters, while the SEATS method derives its filters from a decomposition of the ARIMA model fit to the observed series into models for the trend-cycle, seasonal, and irregular components. The SEATS filters therefore are more tailored to the specific properties of the series as reflected in the ARIMA model fit, while X-11 filters are nonparametric in that they can fit a wide variety of series without depending on a specific model.

## Evaluation

A series should be seasonally adjusted if three conditions are satisfied: the series is seasonal, the seasonal effects can be estimated reliably, and no residual seasonality is left in the adjusted series. A variety of diagnostic tools is available for the X-11 method to test for these conditions, including frequency-spectrum estimates, revision-history statistics, and various seasonal tests. The X-13 program provides some of the above diagnostics for SEATS analysis but also provides its own battery of model-based diagnostics. If diagnostic testing shows that any of the three conditions listed fails to hold for a given series, that series is deemed not suitable for seasonal adjustment.

## CONCURRENT SEASONAL ADJUSTMENT

Concurrent seasonal adjustment of national labor force data began for CPS with the release of estimates for December 2003 in January 2004. This practice replaced the projected-factor method, which updated seasonal factors twice a year. Under the latter procedure, projected seasonal factors were used to seasonally adjust the new original data as they were collected. At midyear, the historical series were updated with data for January through June, and the seasonal adjustment program was rerun to produce projected seasonal factors for July through December.

With concurrent seasonal adjustment, the seasonal adjustment program is rerun each month as the latest CPS data become available. The seasonal factors for the most recent month are produced by applying a set of moving averages to the entire data set, extended by extrapolations, including data for the current month. While all previous-month seasonally adjusted estimates are recalculated in this process, BLS policy is not to revise previous months' official seasonally adjusted CPS estimates as new data become available during the year. Instead, revisions are introduced for the most recent 5 years of data at the end of each year.

Numerous studies, including that discussed in Methee and McIntire (1987) on the CPS labor-force series, have indicated that concurrent adjustment generally produces initial seasonally adjusted estimates requiring smaller revisions than do estimates produced with the projected-factor method. Revisions to data for previous months also may produce gains in accuracy, especially when the original data are themselves regularly revised on a monthly basis. Publishing numerous revisions during the year, however, can confuse data users.

The case for revisions to previous-month seasonally adjusted estimates is less compelling for CPS series because the original sample data normally are not revised. Moreover, an empirical investigation indicated that there were no substantial gains in estimating month-to-month changes by introducing revisions to the data for the previous month. For example, it was found that if previous-month revisions were made to the labor force series, the overall unemployment rate would be different in only 2 months between January 2001 and November 2002, in each case by only one-tenth of a percentage point.

## AGGREGATION PROCEDURES

BLS directly seasonally adjusts national series on the basis of age, sex, industry, education, and other characteristics. BLS also provides seasonally adjusted totals, subtotals, and ratios of selected series. It is possible to seasonally adjust an aggregate series either directly or indirectly by seasonally adjusting its components and adding the results, or dividing in the case of ratios. Indirect and direct adjustments usually will not give identical results because, (1) seasonal patterns vary across series, (2) there are inherent nonlinearities in the X-13 program, (3) many series are multiplicatively adjusted, and (4) some series are ratios.

BLS uses indirect seasonal adjustment for most of the major labor force aggregates. Besides retaining, so far as possible, the essential accounting relationships, the indirect approach is needed because many of the aggregates include components having different seasonal and trend characteristics that sometimes require different modes of adjustment.

Examples of indirectly seasonally adjusted series are the levels of total unemployment, employment, and the civilian labor force, as well as the unemployment rate for all civilian workers. These series are produced by the aggregation of some or all of the seasonally adjusted series for the eight major civilian labor force components. The seasonally adjusted level of total unemployment is the sum of the seasonally adjusted levels of unemployment for four age/sex groups: men 16 to 19 years, women 16 to 19 years, men 20 years and over, and women 20 years and over. Likewise, seasonally adjusted civilian employment is the sum of employment in all industries for the same four age/sex groups. The seasonally adjusted civilian labor force is the sum of all eight components. The seasonally adjusted civilian unemployment rate is computed as the ratio of the total seasonally adjusted unemployment level to the total seasonally adjusted civilian labor force (expressed as a percentage).

A problem with producing seasonally adjusted estimates for a series by aggregation is that seasonal adjustment factors cannot be directly

computed for that series. Implicit seasonal adjustment factors, however, can be calculated after the fact by taking the ratio of the unadjusted aggregate to the seasonally adjusted aggregate or, for additive implicit factors, the difference between those two aggregates.

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# Unit 3

# Current Population Survey Operations

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# Chapter 3-1: Instrument Design

## BASIC DESIGN

Chapter 1-2, Questionnaire Concepts and Definitions, describes the current concepts and definitions underpinning the Current Population Survey (CPS) data collection instrument. This chapter offers a general description of how the data collection is designed and how it operates. The current data collection instrument is designed to be administered by live interviewers using a laptop computer or calling from a centralized telephone facility. The CPS is designed to use computer-assisted interviewing (CAI). CAI consists of either a computer-assisted telephone interviewing (CATI) or a computer-assisted personal interviewing (CAPI), which can be conducted in person or by telephone. Interviewers ask the survey questions as they appear on the screen of the laptop (or desktop) computer and then type the responses directly into the computer. A portion of sample households—currently about 10 percent—is interviewed via CATI at contact centers located in Tucson, Arizona, and Jeffersonville, Indiana.

CAI methods allow greater flexibility in questionnaire design than paper-and-pencil data collection methods. Complicated skips, respondent-specific question wording, and carryover of data from one interview to the next are all possible in an automated environment.

CAI allows capabilities such as:

- The use of dependent interviewing, i.e., carrying over information from the previous month for industry, occupation, and duration of unemployment data.

- The use of respondent-specific question wording based on the person's name, age, and sex, answers to prior questions, household characteristics, etc. By automatically bringing up the next question on the interviewer's screen, CAI reduces the probability that an interviewer will ask the wrong set of questions.

- CAI permits the inclusion of several built-in editing features, including automatic checks

for internal consistency and unlikely responses and verification of answers. With these built-in editing features, errors can be caught and corrected during the interview itself.

The CPS instrument is created using Blaise®, a CAI system and survey processing tool for the Windows operating system and the Internet. Developed by Statistics Netherlands and licensed and supported in the United States by Westat, Blaise® includes advanced capabilities that meet the CAI needs of the CPS. The instrument consists of complicated skip patterns and automated question text fills. Other features include help screens and pop-up check boxes to guide and assist accurate data entry. The instrument also collects paradata, which is respondent contact history information recorded by interviewers to help better evaluate the survey experience and willingness to respond.

Typically, households' first and fifth monthly interviews are conducted in person. The remaining monthly interviews are generally done by telephone. The survey instrument questions differ slightly, depending on where households are in their schedule of monthly interviews. The first and fifth interviews collect the vast majority of the demographic information, which is carried forward to subsequent months. The fourth and eighth interviews collect information on earnings and union membership for wage and salary workers. This information is often referred to as outgoing rotation data. Earnings data are collected only in the outgoing rotations in order to reduce the potential for higher nonresponse in other monthly interviews.

At the end of each day's interviewing, the data collected are transmitted to the U.S. Census Bureau's central database. Once files are transmitted, they are deleted from the laptops.

A copy of the questionnaire can be obtained from the Internet at <www.census.gov/programs -surveys/cps/technical-documentation /questionnaires.html>.

## CURRENT POPULATION SURVEY QUESTIONNAIRE

The CPS has been conducted for more than three-quarters of a century and produces some of the most important data used to develop economic and social policy in the United States. Although the U.S. economy and society has experienced major changes since the survey was first conducted in 1940, the concepts used in the measurement of unemployment and the unemployment rate have remained largely unchanged. During the history of the survey, there have been several wholesale reviews of CPS concepts, most notably two presidentially appointed evaluations—the Gordon Committee in the 1960s and the Levitan Commission in the 1970s. While both of these reviews found the main labor force definitions to be sound, they suggested tightening the definition of unemployment at the margins. Many recommendations from the Gordon Committee were implemented into a major redesign of the CPS in 1967. From 1967 to 1993, the survey questionnaire remained virtually unchanged. A major redesign of the survey in 1994 implemented many of the Levitan Commission recommendations. In addition, the CPS questionnaire has expanded to collect more detail about a variety of demographic and labor market characteristics over the years. For more information about the history of the CPS, see Dunn, Haugen, and Kang (2018).

The remainder of this chapter describes the work performed on the data collection instrument and changes implemented in 1994 because of that work. A description of more recent improvements and additions to the survey instrument also appears in this chapter.

## 1994 REDESIGN

A major redesign of the CPS was implemented in January 1994. The 1994 revisions to the survey were designed to take advantage of major advances in survey research methods and data collection technology, as well as to account for recommendations made by the Levitan Commission. This section describes in detail the work performed on the data collection instrument and changes implemented in 1994.

## Objectives of the Redesign

There were five main objectives in redesigning the CPS questionnaire:

- Better operationalize existing definitions and reduce reliance on volunteered responses.

- Reduce the potential for response error in the questionnaire-respondent-interviewer interaction and, hence, improve measurement of CPS concepts.

- Implement minor definitional changes within the labor force classifications.

- Expand the labor force data available and improve longitudinal measures.

- Exploit the capabilities of CAI for improving data quality and reducing respondent burden. See Copeland and Rothgeb (1990) for a fuller discussion.

## Enhanced Accuracy

In redesigning the CPS questionnaire, the Bureau of Labor Statistics (BLS) and the Census Bureau developed questions to lessen the potential for response error. Among the approaches used were:

- Shorter, clearer question wording.

- Splitting complex questions into two or more separate questions.

- Building concept definitions into question wording.

- Reducing reliance on volunteered information.

- Explicit and implicit strategies for the respondent to provide numeric data such as hours and earnings.

- Use of revised, precoded response categories for open-ended questions (Copeland and Rothgeb, 1990).

## Definitional Changes

The labor force definitions used in the CPS have undergone only minor modifications since the survey's inception in 1940 and, with only one exception, the definitional changes and refinements made in 1994 were small. The one major definitional change dealt with the concept of discouraged workers, i.e., people outside the labor

force who are not looking for work because they believe that there are no jobs available for them. As noted in Chapter 1-2, Questionnaire Concepts and Definitions, discouraged workers are similar to the unemployed in that they are not working and want a job. Since they are not conducting an active job search, however, they do not satisfy a key element necessary to be classified as unemployed. The previous measurement of discouraged workers was criticized by the Levitan Commission as being arbitrary and subjective. It was deemed arbitrary because assumptions about a person's availability for work were made from responses to a question on why the respondent was not currently looking for work. It was considered subjective because the measurement was based on a person's stated desire for a job regardless of whether the individual had ever looked for work. A new, more precise measurement of discouraged workers was introduced that specifically asked if a person had searched for a job during the prior 12 months and was available for work. The new questions also enable estimation of the number of people outside the labor force who, although they cannot be precisely defined as discouraged, satisfy many of the same criteria as discouraged workers and, thus, show some marginal attachment to the labor force.

Other minor conceptual and questionnaire changes were made to fine-tune the definitions of unemployment, categories of unemployed people, and people who were employed part-time for economic reasons.

## New Labor Force Information Introduced

With the revised questionnaire, several types of labor force data became available regularly for the first time. For example, information became available each month on the number of employed people who have more than one job and the hours multiple jobholders work on their main job and all of their other jobs combined. By separately collecting information on the number of hours multiple jobholders work on their main job and secondary jobs, it became possible to derive estimates of the number of workers who combined two or more part-time jobs into a full-time work-week and the number of full- and part-time jobs in the economy. The inclusion of the multiple job questions also improves the accuracy of answers

to the questions on hours worked and facilitates comparisons of employment estimates from the CPS with those from the Current Employment Statistics (CES), the survey of nonfarm business establishments. (For a discussion of the CES, see the "BLS Handbook of Methods," referenced at the end of the chapter.) In addition, beginning in 1994, monthly data on the number of hours usually worked per week and data on the number of discouraged workers became available from the entire CPS sample rather than just from those respondents who were in their fourth or eighth monthly interviews.

## Evaluation and Selection of Revised Questions

Planning for the CPS questionnaire revisions implemented in 1994 began 8 years beforehand, when BLS and the Census Bureau convened a task force to identify areas for improvement. Studies employing methods from the cognitive sciences were conducted to test possible solutions to the problems identified. These studies included interviewer focus groups, respondent focus groups, respondent debriefings, a test of interviewers' knowledge of concepts, in-depth cognitive laboratory interviews, response categorization research, and a study of respondents' comprehension of alternative versions of labor force questions (Campanelli, Martin, and Rothgeb, 1991; Edwards, Levine, and Cohany, 1989; Fracasso, 1989; Gaertner, Cantor, and Gay, 1989; Martin, 1987; Palmisano, 1989).

The revised questionnaire developed jointly by Census Bureau and BLS staff used information collected in a large two-phase test of question wording in addition to qualitative research. During Phase I, two alternative questionnaires were tested using the then official questionnaire as the control. During Phase II, one alternative questionnaire was tested with the control. The questionnaires were tested using computer-assisted telephone interviewing and a random-digit dialing sample (CATI/RDD). During these tests, interviews were conducted from the centralized telephone interviewing contact centers of the Census Bureau (Polivka and Rothgeb, 1993).

Both quantitative and qualitative information was used in the two phases to select questions,

identify problems, and suggest solutions. Analyses were based on information from item response distributions, respondent and interviewer debriefing data, and behavior coding of interviewer and respondent interactions. For more on the evaluation methods used for redesigning the questions, see Esposito et al. (1992) and Esposito and Rothgeb (1997).

## Item Response Analysis

The primary use of item response analysis was to determine whether different questionnaires produce different response patterns, which may affect the labor force estimates. Unedited data were used for this analysis. Statistical tests were conducted to ascertain whether differences among the response patterns of different questionnaire versions were statistically significant. The statistical tests were adjusted to take into consideration the use of a nonrandom clustered sample, repeated measures over time, and multiple persons in a household.

Response distributions were analyzed for all items on the questionnaires. The response distribution analysis indicated the degree to which new measurement processes produced different patterns of responses. Data gathered using the other methods outlined above also aided interpretation of the response differences observed. (Response distributions were calculated based on people who responded to the item, excluding those whose response was "don't know" or "refused.")

## Respondent Debriefings

At the end of the test interview, respondent debriefing questions were administered to a sample of respondents to measure respondent comprehension and response formulation. From these data, indicators of how respondents interpret and answer the questions and some measures of response accuracy were obtained.

The debriefing questions were tailored to the respondent and depended on the path the interview had taken. Two forms of respondent debriefing questions were administered—probing questions and vignette classification. Question-specific probes were used to ascertain whether certain words, phrases, or concepts were understood by respondents in the manner intended (Esposito et al., 1992). For example, those who did not

indicate in the main survey that they had done any work were asked the direct probe, "LAST WEEK did you do any work at all, even for as little as 1 hour?" The classification of vignette debriefings was designed to determine if alternative question wording altered respondents' understanding of the question and changed their perception of the concepts underlying them. An example of the vignettes respondents received is, "Last week, Amy spent 20 hours at home doing the accounting for her husband's business. She did not receive a paycheck." Individuals were asked to classify the person in the vignette as working or not working based on the wording of the question they received in the main survey. For example, "Would you report her as working last week, not counting work around the house?" if the respondent received the unrevised questionnaire, or "Would you report her as working for pay or profit last week?" if the respondent received the current, revised questionnaire (Martin and Polivka, 1995).

## Behavior Coding

Behavior coding entails monitoring or audiotaping interviews and recording significant interviewer and respondent behaviors (for example, minor or major changes in question wording, probing behavior, inadequate answers, requests for clarification). During the early stages of testing, behavior coding data were useful in identifying problems with proposed questions. For example, if interviewers frequently reword a question, this may indicate that the question was too difficult to ask as worded; respondents' requests for clarification may indicate that they were experiencing comprehension difficulties; or interruptions by respondents may indicate that a question was too lengthy (Esposito et al., 1992).

During later stages of testing, the objective of behavior coding was to determine whether the revised questionnaire improved the quality of interviewer/respondent interactions as measured by accurate reading of the questions and adequate responses by respondents. Additionally, results from behavior coding helped identify areas of the questionnaire that would benefit from enhancements to interviewer training.

## Interviewer Debriefings

The primary objective of interviewer debriefing was to identify areas of the revised questionnaire

or interviewer procedures that were problematic for interviewers or respondents. The information collected was used to identify questions that needed revision, and to modify interviewer training and the interviewer manual. A secondary objective was to obtain information about the questionnaire, interviewer behavior, or respondent behavior that would help explain differences observed in the labor force estimates from the different measurement processes.

Two different techniques were used to debrief interviewers. The first was the use of focus groups at the centralized telephone interviewing contact centers and in geographically dispersed regional offices (ROs). The focus groups were conducted after interviewers had at least 3 to 4 months experience using the revised CPS instrument. Approximately 8 to 10 interviewers were selected for each focus group. Interviewers were selected to represent different levels of experience and ability. The second technique was the use of a self-administered, standardized interviewer debriefing questionnaire. Once problematic areas of the revised questionnaire were identified through the focus groups, a standardized debriefing questionnaire was developed and administered to all interviewers. See Esposito and Hess (1992) for more information on interviewer debriefing.

## HIGHLIGHTS OF THE 1994 QUESTIONNAIRE REVISION

### General

**Definition of reference week**. In the interviewer debriefings that were conducted in 13 different geographic areas during 1988, interviewers reported that the major activity question, "What were you doing most of LAST WEEK, working or something else?" was unwieldy and sometimes misunderstood by respondents. In addition to not always understanding the intent of the question, respondents were unsure what was meant by the time period "last week" (BLS, 1988). A respondent debriefing conducted in 1988 found that only 17 percent of respondents had definitions of "last week" that matched the CPS definition of Sunday through Saturday of the reference week. The majority (54 percent) of respondents defined "last week" as Monday through Friday (Campanelli et al., 1991).

In the revised questionnaire, an introductory statement was added with the reference period clearly stated. The new introductory statement reads, "I am going to ask a few questions about work-related activities LAST WEEK. By last week I mean the week beginning on Sunday, August 9 and ending Saturday, August 15." This statement makes the reference period more explicit to respondents. Additionally, the major activity question was deleted from the questionnaire. In the past, the question had served as a preamble to the labor force questions, although many people's labor force status was found to be determined by responses to it. In the revised questionnaire, the survey content is defined in the introductory statement, which also defines the reference week.

**Direct question on presence of business**. The definition of employed persons includes those who work without pay for at least 15 hours per week in a family business. In the pre-1994 questionnaire, there was no direct question on the presence of a business in the household. Such a question is included in the revised questionnaire. This question is asked only once for the entire household prior to the labor force questions. The question reads, "Does anyone in this household have a business or a farm?" This question determines whether a business exists and who in the household owns the business. The primary purpose of this question is to screen for households that may have unpaid family workers, not to obtain an estimate of household businesses. For a fuller discussion of the need for a direct question on presence of a business, see Rothgeb et al. (1992), Copeland and Rothgeb (1990), and Martin (1987).

For households that have a family business, direct questions are asked about unpaid work in the family business by all people who were not reported as working last week in an earlier question. BLS produces monthly estimates of unpaid family workers who work 15 or more hours per week.

### Employment-Related Revisions

**Revised "at work" question**. Having a direct question on the presence of a family business not only improved the estimates of unpaid family workers, but also permitted a revision of the "at work" question. In the pre-1994 questionnaire, the "at work" question read, "LAST WEEK, did you do any

work at all, not counting work around the house?" In the revised questionnaire, the wording reads, "LAST WEEK did you do ANY work for (either) pay (or profit)?" (The parentheticals in the question are displayed only when a business or farm is in the household.) The revised wording "work for pay (or profit)" better captures the concept of work that BLS is attempting to measure. See Martin (1987) or Martin and Polivka (1995) for a fuller discussion of problems with the measurement of "work."

**Direct question on multiple jobholding.** In the pre-1994 questionnaire, the actual hours question read: "How many hours did you work last week at all jobs?" During the interviewer debriefings conducted in 1988, it was reported that respondents do not always hear the last phrase "at all jobs." Some respondents who work at two jobs may have only reported hours for one job (BLS, 1988). In the revised questionnaire, a question is included at the beginning of the hours series to determine whether the person holds multiple jobs. A follow-up question also asks for the number of jobs the multiple jobholder has. Multiple jobholders are asked about their hours on their main job and other job(s) separately to avoid the problem of multiple jobholders not hearing the phrase "at all jobs." These new questions also allow monthly estimates of multiple jobholders to be produced.

**Hours series**. The pre-1994 question on "hours worked" read: "How many hours did you work last week at all jobs?" If a person reported 35 to 48 hours worked, additional follow-up probes were asked to determine whether the person worked any extra hours or took any time off. Interviewers were instructed to correct the original report of actual hours, if necessary, based on responses to the probes. The hours data are important because they are used to determine the sizes of the full-time and part-time labor forces. It is unknown whether respondents reported exact actual hours, usual hours, or some approximation of actual hours.

In the revised questionnaire, a revised hours series was adopted. An anchor-recall estimation strategy was used to obtain a better measure of actual hours and to address the issue of work schedules more completely. For multiple jobholders, separate data on hours worked at a main job and other jobs are also collected. The revised questionnaire

first asks about the number of hours a person usually works at the job. Then separate questions are asked to determine whether a person worked extra hours or fewer hours. Finally, a question is asked on the number of actual hours worked last week. The new hours series improves the accuracy of the data and allows monthly estimates of usual hours worked to be produced for all employed people (Polivka and Rothgeb, 1993). In the pre-1994 questionnaire, usual hours were obtained only in the outgoing rotation for employed private wage and salary workers and were available only on a quarterly basis. The revised questionnaire also permits estimates of usual and actual hours on multiple jobholders' main jobs and their other jobs. This information is used to derive estimates of the number of multiple jobholders who work full-time on their main jobs and part-time on their other jobs, those who work full-time on both their main jobs and their other jobs, and those who work part-time on all of their jobs.

**Industry and occupation (Dependent interviewing)**. Prior to the 1994 revision, CPS industry and occupation (I&O) data were not always consistent from month to month for the same person in the same job. These inconsistencies arose, in part, because the household respondent frequently varies from one month to the next. Furthermore, it is sometimes difficult for a respondent to describe an occupation consistently from month to month. Moreover, distinctions at the three-digit occupation and industry level, i.e., at the most detailed classification level, can be very subtle. To obtain more consistent data and make full use of the automated interviewing environment, dependent interviewing for the I&O question, which uses information collected during the previous month's interview in the current month's interview, was implemented in the revised questionnaire for month-in-sample 2–4 (MIS 2–4) households and MIS 6–8 households. Different variations of dependent interviewing were evaluated during testing. See Rothgeb et al. (1992) for more detail.

In the revised CPS, respondents are provided the name of their employer from the previous month and asked if they still work for that employer. If they answer "no," respondents are asked the independent questions on I&O.

If they answer "yes," respondents are asked, "Have the usual activities and duties of your job changed

since last month?" If individuals say "yes," they are then asked the independent questions on occupation, usual activities or duties, and class of worker. If their usual duties have not changed, individuals are asked to verify the previous month's description through the question "Last month, you were reported as (previous month's occupation or kind of work performed) and your usual activities were (previous month's duties). Is this an accurate description of your current job?"

If they answer "yes," the previous month's occupation and class of worker are brought forward and no coding is required. If they answer "no," they are asked the independent questions on occupation, usual activities or duties, and class of worker. This redesign permits a direct inquiry about job change before the previous month's information is provided to the respondent.

**Earnings**. The earnings series in the revised questionnaire is considerably different from that in the pre-1994 questionnaire. In the pre-1994 questionnaire, persons were asked whether they were paid by the hour, and if so, what the hourly wage was. All wage and salary workers were then asked for their usual weekly earnings. In the pre-1994 version, earnings could be reported as weekly figures only, even though that may not have been the easiest way for the respondent to recall and report earnings. Data from early tests indicated that a small proportion (14 percent) of non-hourly-wage workers (n = 853) were paid at a weekly rate, and less than (25 percent) of non-hourly-wage workers (n = 1623) found it easiest to report earnings as a weekly amount (Polivka and Rothgeb, 1993).

In the revised questionnaire, the earnings series is designed to first request the periodicity for which the respondent finds it easiest to report earnings and then request an earnings amount in the specified periodicity as displayed below. The wording of questions requesting an earnings amount is tailored to the periodicity identified earlier by the respondent. (Because data on weekly earnings are published quarterly by BLS, earnings data provided by respondents in periodicities other than weekly are converted to a weekly earnings estimate later during processing operations.)

Revised Earnings Series (Selected items)

1.  For your (MAIN) job, what is the easiest way for you to report your total earnings BEFORE taxes or other deductions: hourly, weekly, annually, or on some other basis?

2.  Do you usually receive overtime pay, tips, or commissions (at your MAIN job)?

3.  (Including overtime pay, tips, and commissions) What are your usual (weekly, monthly, annual, etc.) earnings on this job, before taxes or other deductions?

As can be seen from the revised questions presented above, other revisions to the earnings series include a specific question to determine whether a person usually receives overtime pay, tips, or commissions. If so, a statement precedes the earnings questions that reminds respondents to include overtime pay, tips, and commissions when reporting earnings. If a respondent reports that it is easiest to report earnings on an hourly basis, then a separate question is asked regarding the amount of overtime pay, tips, and commissions usually received, if applicable.

Individuals for whom the easiest way to report is hourly are assumed to be paid hourly. An additional question is asked of people who do not report that it is easiest to report their earnings hourly. The question is displayed below. Studies of the number of minimum-wage workers are based upon those individuals identified as hourly wage workers.

> "Even though you told me it is easier to report your earnings annually, are you PAID AT AN HOURLY RATE on this job?"

## Unemployment-Related Revisions

**People on layoff (direct question)**. Previous research (Rothgeb, 1982; Palmisano, 1989) demonstrated that the pre-1994 question on layoff status—"Did you have a job or business from which you were temporarily absent or on layoff LAST WEEK?"—was long, awkwardly worded, and frequently misunderstood by respondents. Some respondents heard only part of the question, while others thought that they were being asked whether they had a business.

In an effort to reduce response error, the revised questionnaire includes two separate direct questions about layoff and temporary absences. The layoff question is, "LAST WEEK, were you on layoff from a job?" Questions asked later screen

out those who do not meet the criteria for layoff status.

**People on layoff (expectation of recall)**. The official definition of layoff includes the criterion of an expectation of being recalled to the job. In the pre-1994 questionnaire, people reported being on layoff were never directly asked whether they expected to be recalled. In an effort to better capture the existing definition, people reported being on layoff in the revised questionnaire are asked, "Has your employer given you a date to return to work?" People who respond that their employers have not given them a date to return are asked, "Have you been given any indication that you will be recalled to work within the next 6 months?" If the response is positive, their availability is determined by the question, "Could you have returned to work LAST WEEK if you had been recalled?" People who do not meet the criteria for layoff are asked the job search questions so they still have an opportunity to be classified as unemployed.

**Job search methods**. The concept of unemployment requires, among other criteria, an active job search during the previous 4 weeks. In the pre-1994 questionnaire, the following question was asked to determine whether a person conducted an active job search. "What has … been doing in the last 4 weeks to find work?" Responses that could be checked included:

- Public employment agency.
- Private employment agency.
- Employer directly.
- Friends and relatives.
- Placed or answered ads.
- Nothing.
- Other.

Interviewers were instructed to code all passive job search methods, i.e., a job search method that could not directly lead to a job offer, into the "nothing" category. This included such activities as looking at newspaper ads, attending job training courses, and practicing typing. Only active job search methods for which no appropriate response category exists were to be coded as "other."

In the revised questionnaire, several additional response categories were added and the response options were reordered and reformatted to more clearly represent the distinction between active job search methods and passive methods. The revisions to the job search methods question grew out of concern that interviewers were confused by the precoded response categories. This was evident even before the analysis of the CATI/RDD test. Martin (1987) conducted an examination of verbatim entries for the "other" category and found that many of the "other" responses should have been included in the "nothing" category. The analysis also revealed responses coded as "other" that were too vague to determine whether an active job search method had been undertaken. Fracasso (1989) also concluded that the current set of response categories was not adequate for accurate classification of active and passive job search methods.

During development of the revised questionnaire, two additional passive categories were included: (1) "looked at ads" and (2) "attended job training programs/courses." Two additional active categories were included: (1) "contacted school/university employment center" and (2) "checked union/professional registers." Later research also demonstrated that interviewers had difficulty coding relatively common responses such as "sent out resumes" and "went on interviews"; thus, the response categories were further expanded to reflect these common job search methods.

Research conducted in the 2000s indicated a need for instructions on how to code job search methods such as "online advertisements" or "placed resume online." The result of this research was the introduction in 2014 of clearer descriptions on how to code such job search methods into the interviewer instructions and the interviewer manual.

**Duration of job search and layoff**. The duration of unemployment is an important labor market indicator published monthly by BLS. In the pre-1994 questionnaire, this information was collected by the question "How many weeks have you been looking for work?" This wording forced people to report in a periodicity that may not have been meaningful to them, especially for the longer-term unemployed. In addition, asking for the number of weeks (rather than months) may have led respondents to underestimate the duration. In the revised questionnaire, the question reads: "As of the end of LAST WEEK, how long had you been looking for work?" Respondents can select the periodicity

themselves and interviewers are able to record the duration in weeks, months, or years.

To avoid the clustering of answers around whole months, the revised questionnaire also asks those who report duration in whole months (between 1 and 4 months) a follow-up question to obtain an estimated duration in weeks, "We would like to have that in weeks, if possible. Exactly how many weeks had you been looking for work?" The purpose of this is to lead people to report the exact number of weeks instead of multiplying their monthly estimates by four as was done in an earlier test and may have been done in the pre-1994 questionnaire.

As mentioned earlier, the CATI and CAPI technology makes it possible to automatically update duration of job search and layoff for people who are unemployed in consecutive months. For people reported to be looking for work for 2 consecutive months or longer, the previous month's duration is updated without re-asking the duration questions. For those on layoff for at least 2 consecutive months, the duration of layoff is also automatically updated. This revision was made to reduce respondent burden and enhance the longitudinal capability of the CPS. This revision also will produce more consistent month-to-month estimates of duration. Previous research indicates that about 25 percent of those unemployed in consecutive months who received the pre-1994 questionnaire (where duration was collected independently each month) increased their reported durations by 4 weeks plus or minus a week (Polivka and Rothgeb, 1993; Polivka and Miller, 1998). A very small bias is introduced when a person has a brief (less than 3 or 4 weeks) period of employment in between surveys. However, testing revealed that only 3.2 percent of those who had been looking for work in consecutive months said that they had worked in the interlude between the surveys. Furthermore, of those who had worked, none indicated that they had worked for 2 weeks or more.

### Revisions to Not-in-the-Labor-Force Questions

**Response options of retired, disabled, and unable to work**. In the pre-1994 questionnaire, when individuals reported they were retired in response to any of the labor force items, the interviewer was required to continue asking whether they worked last week, were absent from a job, were looking for work, and, in the outgoing rotation, when they last worked and their job histories. Interviewers commented that elderly respondents frequently complained that they had to respond to questions that seemed to have no relevance to their own situation.

In an attempt to reduce respondent burden, a response category of "retired" was added to each of the key labor force status questions in the revised questionnaire. If individuals 50 years of age or older volunteer that they are retired, they are immediately asked a question inquiring whether they want a job. If they indicate that they want to work, they are then asked questions about looking for work and the interview proceeds as usual. If they do not want to work, these individuals are not asked the remainder of the labor force questions and they are classified as not in the labor force—retired. (If they are in the outgoing rotation, an additional question is asked to determine whether they worked within the last 12 months. If so, the I&O questions are asked about the last job held.)

A similar change has been made in the revised questionnaire to reduce the burden for individuals reported to be "unable to work" or "disabled." (Individuals who may be "unable to work" for a temporary period of time may not consider themselves as "disabled" so both response options are provided.) If a person is reported to be "disabled" or "unable to work" at any of the key labor force classification items, a follow-up question is asked to determine whether the person can do any gainful work during the next 6 months. Different versions of the follow-up probe are used depending on whether the person identifies as disabled or as unable to work. Individuals who indicated that their disability prevents them from working in the next 6 months also are skipped around the remaining labor force questions.

**Dependent interviewing for people reported as retired**, disabled, or unable to work. The revised questionnaire also was designed to use dependent interviewing across months for individuals reported to be retired, disabled, or unable to work. An automated questionnaire increases the ease with which information from the previous month's interview can be used during the current month's interview.

Once it is reported that the person did not work during the current month's reference week, the previous month's status of retired (if a person is 50 years of age or older), disabled, or unable to work is verified, and the regular series of labor force questions is not asked. This revision reduces respondent and interviewer burden.

**Discouraged workers**. The implementation of the Levitan Commission's recommendations on discouraged workers resulted in one of the major definitional changes in the 1994 redesign (NCEUS, 1979). The Levitan Commission criticized the pre-1994 definition because it was based on a subjective desire for work and questionable inferences about an individual's availability to take a job. Because of the redesign, two requirements were added: for persons to qualify as discouraged, they must have engaged in some job search within the past year (or since they last worked if they worked within the past year), and they must currently be available to take a job. Formerly, availability was inferred from responses to other questions; now there is a direct question.

Data on a larger group of people outside the labor force (one that includes discouraged workers, as well as those who desire work but give other reasons for not searching such as child care problems, family responsibilities, school, or transportation problems) also have been published monthly since the 1994 redesign. This group is made up of people who want a job, are available for work, and have looked for work within the past year. This group is generally described as having some marginal attachment to the labor force. Also beginning in 1994, questions on this subject are asked of the full CPS sample rather than a quarter of the sample as was done prior to the redesign, permitting estimates of the number of discouraged workers to be published monthly rather than quarterly.

**Findings.** Tests of the revised questionnaire showed that the quality of labor force data improved because of the redesign of the CPS questionnaire, and in general, measurement error diminished. Data from respondent debriefings, interviewer debriefings, and response analysis demonstrated that the revised questions are more clearly understood by respondents and the potential for labor force misclassification is reduced. Results from these tests formed the basis for the design of the final revised version of the questionnaire.

This revised version was tested in a separate year-and-a-half parallel survey prior to implementation as the official survey in January 1994. In addition, the unrevised procedures were used with the parallel survey sample from January 1994 through May 1994. These parallel surveys were conducted to assess the effect of the redesign on national labor force estimates. Estimates derived from the initial year and a half of the parallel survey indicated that the redesign might increase the unemployment rate by 0.5 percentage points. However, subsequent analysis using the entire parallel survey indicates that the redesign did not have a statistically significant effect on the unemployment rate. (Analysis of the effect of the redesign on the unemployment rate and other labor force estimates can be found in Cohany, Polivka, and Rothgeb [1994]). Analysis of the redesign on the unemployment rate along with a wide variety of other labor force estimates using data from the entire parallel survey can be found in Polivka and Miller (1998).

## RECENT IMPROVEMENTS IN THE QUESTIONNAIRE

### Changes to Race and Ethnicity Questions

Starting in 2003, race and ethnicity questions were modified to allow individuals to report being of more than one race. Hispanics were identified through a direct question; previously, individuals' ethnicity was determined through their country of origin or that of their ancestors (Bowler et al., 2003). These changes were made so CPS data would be in accord with Office of Management and Budget (OMB) guidelines on collection of race and ethnicity. The changes were the result of a multiyear research effort that started in 1996 and included two supplements to the CPS that tested alternative question wordings.

### Disability Questions

Development of disability questions for the CPS was a long process that started in the late 1990s. The Presidential Task Force on Employment of Adults with Disabilities formed the Employment Rate Measurement Work Group, which included members from 17 different agencies, to develop a measure of the employment rate of people

with disabilities. Questions proposed for the CPS were tested in the National Comorbidity Survey (NCS) and again in a 2006 supplement to the CPS. However, the disability rate obtained from the CPS was much lower than that from the NCS. The Census Bureau had independently developed and tested six questions on disability for the American Community Survey (ACS). Because the NCS and CPS supplement testing had uncovered problems and because OMB was encouraging federal surveys to use the same questions, the ACS questions were modified slightly so that they could be incorporated into the CPS questionnaire. The six disability questions were added to the monthly CPS in June 2008 (McMenamin and Hipple, 2014).

### Certification and Licensing Questions

The federal Interagency Working Group on Expanded Measures of Enrollment and Attainment (GEMEnA) was formed in 2009 to develop questions to measure the prevalence and key characteristics of nondegree credentials, such as certifications and licenses, for existing federal surveys. The question development process took several years and included cognitive testing, focus groups, consultation with experts, and a number of pilot studies. After additional cognitive testing and stakeholder outreach, BLS made minor changes to three general GEMEnA questions on certifications and licenses so they could be incorporated into the CPS questionnaire. Fielding of the three new questions began in January 2015 (Allard, 2016).

### Introduction of New Relationship Categories to Capture Same-Sex Marriages

In 2010, the Interagency Working Group on Measuring Relationships in Federal Household Surveys was established, convened, and chaired by the Statistical and Science Policy Branch of OMB. At the behest of this group, the Census Bureau conducted focus groups and cognitive testing to develop revised relationship categories. The actual question did not change. Because of these focus group findings, two alternative relationship category groupings were developed. Both groupings underwent further cognitive testing. The version implemented in the CPS contains the response categories that were recommended

for use following this cognitive testing (Kreider, 2017). The Census Bureau began phasing in the new relationship question categories in CPS in May 2015. In addition to the change to response categories for the relationship question, the questions that ask about the presence of parents in the household have also changed. Instead of asking whether the person has a mother present (who is always female) and then whether the person has a father present (who is always male), the questions now ask whether the person has a parent present, and then whether they have another parent present. This allows for the identification of children who live with same-sex parents.

## CONTINUOUS TESTING AND IMPROVEMENTS OF THE CURRENT POPULATION SURVEY AND ITS SUPPLEMENTS

Experience gained during the 1994 redesign of the CPS demonstrates the importance of testing questions and monitoring data quality. The experience, along with contemporaneous advances in research on questionnaire design, informs the development of methods for testing new or improved questions for the basic CPS and its periodic supplements (Martin and Polivka, 1995; Oksenberg et al., 1991; Bischoping et al., 1989; Campanelli et al., 1991; Esposito et al., 1992; Forsyth and Lessler, 1991). Methods to continuously test questions and assess data quality are discussed in Chapter 4-1, Nonsampling Error. Changes to the CPS are made carefully and their effects are consistently monitored. A major strength of the CPS is the ability to compare estimates over time, and even minor changes to the questionnaire can affect data comparability. Proposed revisions to the CPS are evaluated within the context of this comparability. Furthermore, methods to bridge differences caused by changes and techniques to avoid the disruption of historical series are included in the testing of new or revised questions.

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# Chapter 3-2: Conducting the Interviews

## INTRODUCTION

Each month during the interview week for CPS, field representatives (FRs) and computer-assisted telephone interviewers attempt to contact and interview a knowledgeable adult household member living in each sample household to complete an interview. Generally, the week containing the twelfth is the reference week (i.e., the week about which the labor force questions are asked). Interviewing typically begins the week containing the nineteenth of the month. As outlined in Chapter 2-2, Sample Design, a sample household is in sample for 8 months total. It is in sample for 4 consecutive months, not in the sample for the next 8 consecutive months, and in the sample again for the next 4 consecutive months. Each month, one-eighth of the households are in sample for the first time (referred to as MIS 1), one-eighth for the second time (MIS 2), and so on, through the eighth time (MIS 8). Because of this schedule, each interviewer conducts different types of interviews within their weekly assignment (due to differing MIS cases).

An introductory letter is sent to each sample household prior to its first- and fifth-month interviews. The letter describes the CPS, announces the forthcoming visit, provides potential respondents with information regarding their rights under the Privacy Act, the voluntary nature of the survey, and the guarantees of confidentiality for the information they provide.

Figure 3-2.1 shows the front side of the introductory letter sent to sample units in the area administered by the Atlanta Regional Office. Ideally, a personal visit interview is required for all MIS 1 households because the CPS sample is strictly a sample of addresses. The Census Bureau has no way of knowing who the occupants of the sample household are or whether the household is occupied or eligible for interview. A personal visit is attempted for its MIS 5 interview. For some MIS 1 and MIS 5 households, telephone interviews are conducted if, for example, the respondent requests a telephone interview during the initial personal visit.

## NONINTERVIEWS AND HOUSEHOLD ELIGIBILITY

The FR's first task is to establish the eligibility of the sample address for the CPS. There are many reasons an address may not be eligible for interview. For example, the address may have been condemned, demolished, or converted to a permanent business. Regardless of the reason, such sample addresses are classified as Type C noninterviews. Type C units have no chance of becoming eligible for the CPS interview in future months because the condition is considered permanent. These addresses are stricken from the lists of sample addresses and are not visited again in subsequent months. All households classified as Type C undergo a supervisory review of the circumstances surrounding the case before the determination becomes final.

Type B ineligibility includes units that are intended for occupancy but are not occupied by any eligible individuals. Reasons for such ineligibility include a vacant housing unit (either for sale or rent) or a unit occupied entirely by individuals who are not eligible for a CPS labor force interview, such as individuals with a usual residence elsewhere (URE), or who were in the armed forces. These Type B noninterview units have a chance of becoming eligible for interview in future months because the condition is considered temporary (e.g., a vacant unit could become occupied). Therefore, Type B units are reassigned to FRs in subsequent months. These sample addresses remain in sample for the entire 8 months that households are eligible for interview. An FR visits the unit each succeeding month to determine whether it has changed status and either continues the Type B classification, revises the noninterview classification, or conducts an interview as applicable. All Type B cases are subject to supervisory review. Some of these Type B households are eligible for the Housing Vacancy Survey, which is described in Chapter 1-3, Supplements.

Figure 3-2.1.
## Sample Introductory Letter

CPS-263(MIS-1)(L) ATLANTA  (3-2018)

**UNITED STATES DEPARTMENT OF COMMERCE**
**Economics and Statistics Administration**
**U.S. Census Bureau**
Washington, DC 20233-0001 OFFICE OF THE DIRECTOR

A Message from the Director of the U.S. Census Bureau:

Dear Resident,

Your address has been selected to participate in the **Current Population Survey**.  This monthly survey is the source of the Nation's unemployment rate that you may hear about in the news. The U.S. Census Bureau conducts this survey in partnership with the U.S. Bureau of Labor Statistics.

The Current Population Survey collects information on employment and earnings of people living in the United States. The results help determine federal funding for veteran's programs, youth activities, food assistance and more. The survey results are also used by the Federal Reserve to set interest rates.

**The success of this survey depends on your participation**.  We cannot substitute another address for yours. Your address is part of a scientifically selected sample of addresses chosen throughout the country. Your answers represent hundreds of other U.S. households.

Answers to frequently asked questions are on the back of this letter. If you have other questions, please visit census.gov/cps, or call your Census Bureau Regional Office at 1-800-424-6974, #53939.

You do not need to take any action at this time. A Census Bureau representative will contact you soon to ask your household to complete the survey.

Thank you in advance for participating in this important survey.

United States™
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One final set of households not interviewed for CPS are Type A households. These are households that the FR determined were eligible for a CPS interview, but for which no useable data were collected. To be eligible, the unit has to be occupied by at least one person eligible for an interview (i.e., an individual who is a civilian, at least 15 years of age, and does not have a URE). Even though these households were eligible, they were not interviewed because the household members refused, were absent during the interviewing period, or were unavailable for other reasons. All Type A cases are subject to supervisory review before the determination is made final. Every effort is made to keep such noninterviews to a minimum. All Type A cases remain in the sample and are assigned for interview in all succeeding months. Even in cases of confirmed refusals (cases that still refuse to be interviewed despite supervisory attempts to convert the case), the FR must verify that the same household still resides at that address before submitting a Type A noninterview.

Table 3-2.1 shows how the three types of noninterviews are classified and various reasons that define each category. Table 3-2.2 lists the main household information collected for each noninterview category and briefly summarizes each item.

## INITIAL INTERVIEW

If the unit is not classified as a noninterview, then the FR initiates the CPS interview. The FR attempts to interview a knowledgeable adult household member (known as the household respondent). The FRs are trained to ask the questions worded exactly as they appear on the computer screen. The interview begins with the verification of the unit's address and confirmation of its eligibility for a CPS interview. Part 1 of Table 3-2.3 shows some of the household items asked at the beginning of the interview. Once eligibility is established, the interview moves into the demographic portion of the instrument. The primary purpose of this portion is to establish the household's roster, which is the listing of all household residents at the time of the interview. The main concern here is to establish an individual's usual place of residence. (These rules are summarized in Table 3-2.4.)

Table 3-2.1.
### Noninterviews: Types A, B, and C

**Type A**
| | |
|---|---|
| 1 | No one home |
| 2 | Temporarily absent |
| 3 | Refusal |
| 4 | Language barrier |
| 5 | Unable to locate |
| 6 | Other occupied |

**Type B**
| | |
|---|---|
| 1 | Entire household in the armed forces |
| 2 | Entire household under 15 years |
| 3 | Vacant regular |
| 4 | Temporarily occupied by persons with usual residence elsewhere |
| 5 | Vacant—storage of household furniture |
| 6 | Unfit or to be demolished |
| 7 | Under construction, not ready |
| 8 | Converted to temporary business or storage |
| 9 | Unoccupied tent site or trailer site |
| 10 | Permit granted, construction not started |
| 11 | Other Type B—Specify |

**Type C**
| | |
|---|---|
| 1 | Demolished |
| 2 | House or trailer moved |
| 3 | Outside segment |
| 4 | Converted to permanent business or storage |
| 5 | Merged |
| 6 | Condemned |
| 7 | Unused line of listing sheet |
| 8 | Unlocatable sample address |
| 9 | Unit does not exist or unit is out-of-scope |
| 10 | Other Type C—Specify |

For all individuals residing in the household who do not have a URE, a number of personal and family demographic characteristics are collected. Part 1 of Table 3-2.5 shows the demographic information collected from MIS 1 households. These characteristics are the relationship to the reference person (the person who owns or rents the home), parent or spouse or cohabitation partner pointers (if applicable), age, sex, marital status, educational attainment, veteran status, current armed forces status, race, and Hispanic ethnicity. As shown in Table 3-2.6, these characteristics are collected in an interactive format that includes a number of consistency edits embedded in the interview itself. The goal is to collect as consistent

Table 3-2.2.

## Noninterviews: Main Household Items Asked for Types A, B, and C

*Note: This list is not complete and covers only the main data items. It does not include related items used to identify the final response such as probes and verification screens. See the Current Population Survey Interviewing Manual for illustrations of the actual instrument screens for all Current Population Survey items.*

| TYPE A CASES | | |
|---|---|---|
| | **Item name** | **Item generally asks** |
| 1 | TYPA | Which specific kind of Type A is the case? |
| 2 | ABMAIL | What is the property's mailing address? |
| 3 | ACCESS | Is access to the household direct or through another unit? This item is answered by the interviewer based on observation. |
| 4 | LIVQRT | What is the type of housing unit (house/apartment, mobile home/trailer, etc.)? This item is answered by the interviewer based on observation. |
| 5 | INOTES-1 | The interviewer may want to make notes about the case that might help with the next interview. |

| TYPE B CASES | | |
|---|---|---|
| | **Item name** | **Item generally asks** |
| 1 | TYPB | Which specific kind of Type B is the case? |
| 2 | ABMAIL | What is the property's mailing address? |
| 3 | ACCESS | Is access to the household direct or through another unit? This item is answered by the interviewer based on observation. |
| 4 | LIVQRT | What is the type of housing unit (house/apartment, mobile home/trailer, etc.)? This item is answered by the interviewer based on observation. |
| 5 | SEASON | Is the unit intended for occupancy year-round, by migrant workers, or seasonally? |
| 6 | BCINFO | What is the name, title, and phone number of the contact who provided the Type B information or was the information obtained by interviewer observation? |
| 7 | INOTES-1 | The interviewer may want to make notes about the case that might help with the next interview. |

| TYPE C CASES | | |
|---|---|---|
| | **Item name** | **Item generally asks** |
| 1 | TYPC | Which specific kind of Type C is the case? |
| 2 | ACCESS | Is access to the household direct or through another unit? This item is answered by the interviewer based on observation. |
| 3 | LIVQRT | What is the type of housing unit (house/apartment, mobile home/trailer, etc.)? This item is answered by the interviewer based on observation. |
| 4 | BCINFO | What is the name, title, and phone number of the contact who provided the Type C information or was the information obtained by interviewer observation? |
| 5 | INOTES-1 | The interviewer may want to make notes about the case that might help with the next interview. |

a set of demographic characteristics as possible. The final steps in this portion of the interview are to verify the accuracy of the roster. To this end, a series of questions is asked to ensure that all household members have been accounted for.

The FR then collects labor force data about all civilian adult individuals (at least 15 years of age) who do not have a URE. In the interest of timeliness and efficiency, a household respondent (preferably, the most knowledgeable household member, though any household member aged 15 or over can be a household respondent) generally provides the data for each eligible individual.

Since household respondents provide data about themselves, just over one-half of the CPS labor force data is collected by self-response. The remainder is collected by proxy from the household respondent. In certain limited situations, collection of the data from a nonhousehold member is allowed; all such cases receive supervisory review before the data are accepted into the CPS processing system.

In a household's initial interview, information about a few additional characteristics are collected after completion of the labor force portion of the interview. This information includes

Table 3-2.3.

## Interviews: Main Household Items Asked in Month-In-Sample 1 and Replacement Households

*Note: This list is not complete and covers only the main data items. It does not include related items used to identify the final response such as probes and verification screens. See the Current Population Survey Interviewing Manual for illustrations of the actual instrument screens for all Current Population Survey items.*

| PART 1. Items Asked at the Beginning of the Interview | | |
|---|---|---|
| | **Item name** | **Item generally asks** |
| 1 | INTROb | Does the interviewer want to classify the case as a noninterview? |
| 2 | NONTYP | What type of noninterview is the case (A, B, or C)? It is asked or not depending on the answer to INTROb. |
| 3 | VERADD | What is the street address (as verification)? |
| 4 | MAILAD | What is the mailing address (as verification)? |
| 5 | TENUR | Is the unit owned, rented, or occupied without paid rent? |
| 6 | ACCESS | Is access to the household direct or through another unit? This item is answered by the interviewer (not read to the respondent). |
| 7 | LIVQRT | What is the type of housing unit (house/apartment, mobile home/trailer, etc.)? This item is answered by the interviewer (not read to the respondent). |

| PART 2. Items Asked at the End of the Interview | | |
|---|---|---|
| | **Item name** | **Item generally asks** |
| 1 | TELHH | Is there a telephone in the unit? |
| 2 | TELAV | Is there a telephone elsewhere on which people in this household can be contacted? This is asked or not depending on the answer to TELHH. |
| 3 | TELWHR | If there is a telephone elsewhere, where is the phone located? This is asked or not depending on the answer to TELAV. |
| 4 | TELIN | Is a telephone interview acceptable? |
| 5 | TELPHN | What is the phone number and is it a home or office phone? |
| 6 | BSTTM | When is the best time to contact the respondent? |
| 7 | NOSUN | Is a Sunday interview acceptable? |
| 8 | THANKYOU | Is there any reason why the interviewer will not be able to interview the household next month? |
| 9 | INOTES-1 | The interviewer may want to make any notes about the case that might help with the next interview. The interviewer is also asked to list the names/ages of ALL additional persons if there are more than 16 household members. |

Table 3-2.4.

## Summary Table for Determining Who Is to Be Included as a Member of the Household

| | Include as a member of the household |
|---|---|

**A. PERSONS STAYING IN SAMPLE UNIT AT TIME OF INTERVIEW**

Person is member of family, lodger, servant, visitor, etc.

| | Include as a member of the household | |
|---|---|---|
| 1. Ordinarily stays here all the time (sleeps here) | Yes | |
| 2. Here temporarily—no living quarters held for person elsewhere | Yes | |
| 3. Here temporarily—living quarters held for person elsewhere | | No |

**Person is in armed forces**

| | | |
|---|---|---|
| 1. Stationed in this locality, usually sleeps here | Yes | |
| 2. Temporarily here on leave—stationed elsewhere | | No |

**Person is a student**—here temporarily attending school—living quarters held for person elsewhere

| | | |
|---|---|---|
| 1. Not married or not living with immediate family | | No |
| 2. Married and living with immediate family | Yes | |
| 3. Student nurse living at school | Yes | |

**B. ABSENT PERSON WHO USUALLY LIVES HERE IN SAMPLE UNIT**

| | | |
|---|---|---|
| **Person is inmate of institutional special place**—absent because inmate in a specified institution regardless of whether or not living quarters held for person here | | No |
| **Person is temporarily absent on vacation, in general hospital, etc.** (including veterans' facilities that are general hospitals)—living quarters held here for person | Yes | |

**Person is absent in connection with job**

| | | |
|---|---|---|
| 1. Living quarters held here for person—temporarily absent while ''on the road'' in connection with job (e.g., traveling salesperson, railroad conductor, bus driver) | Yes | |
| 2. Living quarters held here and elsewhere for person but comes here infrequently (e.g., construction engineer) | | No |
| 3. Living quarters held here at home for unmarried college student working away from home during summer school vacation | Yes | |
| **Person is in armed forces**—was member of this household at time of induction but currently stationed | | No |

**Person is a student in school**—away temporarily attending school—living quarters held for person here

| | | |
|---|---|---|
| 1. Not married or not living with immediate family | Yes | |
| 2. Married and living with immediate family | | No |
| 3. Attending school overseas | | No |

**C. EXCEPTIONS AND DOUBTFUL CASES**

**Person with two concurrent residences**—determine length of time person has maintained two concurrent residences

| | | |
|---|---|---|
| 1. Has slept greater part of that time in another locality | | No |
| 2. Has slept greater part of that time in sample unit | Yes | |

**Citizen of foreign country temporarily in the United States**

| | | |
|---|---|---|
| 1. Living on premises of an Embassy, Ministry, Legation, Chancellery, Consulate | | No |
| 2. Not living on premises of an Embassy, Ministry, etc. | | |
| a. Living here and no usual place of residence elsewhere in the United States | Yes | |
| b. Visiting or traveling in the United States | | No |

Table 3-2.5.
## Interviews: Main Demographic Item Asked[1]

*Note: This list is not complete and covers only the main data items. It does not include related items used to identify the final response such as probes and verification screens. See the Current Population Survey Interviewing Manual for illustrations of the actual instrument screens for all Current Population Survey items.*

| PART 1. Items Asked at the Beginning of the Interview | | |
|---|---|---|
| | **Item name** | **Item generally asks** |
| 1 | HHRESP | What is the line number of the household respondent? |
| 2 | REFPER | What is the name of the reference person (i.e., person who owns/rents home, whose name should appear on line number 1 of the household roster)? |
| 3 | NEXTNM | What is the name of the next person in the household (lines number 2 through a maximum of 16)? |
| 4 | URE | Is the sample unit the person's usual place of residence? |
| 5 | HHMEM | Does the person have his/her usual place of residence elsewhere? (This is asked only when the sample unit is not the person's usual place of residence.) |
| 6 | SEX | What is the person's gender? This item is answered by the interviewer (not read to the respondent). |
| 7 | MCHILD | Is the household roster (displayed on the screen) missing any babies or small children? |
| 8 | MLODGE | Is the household roster (displayed on the screen) missing any lodgers, boarders, or live-in employees? |
| 9 | MELSE | Is the household roster (displayed on the screen) missing anyone else staying there? |
| 10 | RRP | How is the person related to the reference person? The interviewer shows a flashcard from which the respondent chooses the appropriate relationship category. |
| 11 | SUBFAM | Is the person related to anyone else in the household? This is asked only when the person is not related to the reference person. |
| 12 | SBFAM_WHO | Who on the household roster (displayed on the screen) is the person related to? This is asked/not asked depending on answer to VR-NONREL. |
| 13 | PAR1/PAR2 | What is the parent's line number? |
| 14 | BIRTHM | What is the month of birth? |
| 15 | BIRTHD | What is the day of birth? |
| 16 | BIRTHY | What is the year of birth? |
| 17 | AGE | How many years of age is the person (as verification)? |
| 18 | MARITL | What is the person's marital status? This is asked only of people 15+ years of age. |
| 19 | SPOUSE | What is the spouse's line number? This is asked only of people 15+ years of age. |
| 20 | COHAB | Does the person have a boyfriend, girlfriend, or partner in the household? |
| 21 | AFEVER | Has the person ever served on active duty in the U.S. armed forces? This is asked only of people 17+ years of age. |
| 22 | AFWHEN | When did the person serve? This is asked only of people 17+ years of age who have served in the U.S. armed forces. |
| 23 | AFNOW | Is the person in the U.S. armed forces now? This is asked only of people 17+ years of age who have served in the U.S. armed forces. Interviewers will continue to ask this item each month as long as the answer is ''yes.'' |
| 24 | EDUCA | What is the highest level of school completed or highest degree received? This is asked only of people 15+ years of age. It is asked for the first time in Months-in-Sample 1, and then verified in Months-in-Sample 5 and in specific months (i.e., February, July, and October). |
| 25 | CERT1 | Does the person have a currently active professional certification or a state or industry license? Do not include business licenses such as liquor or vending. |
| 26 | CERT2 | Were any of the certifications/licenses issued by the federal, state, or local government? |

See note at end of table.

Table 3-2.5.
**Interviews: Main Demographic Item Asked[1]**—Con.

| | Item name | Item generally asks |
|---|---|---|
| **PART 2. Items Asked at the End of the Labor Force Interview** | | |
| 27 | DS1 | Does anyone in this household have serious difficulty hearing? If the response is yes, then the instrument asks "Who is that?" and "Anyone else?" |
| 28 | DS2 | Does anyone in this household have serious difficulty seeing, even when wearing glasses? If the response is yes, then the instrument asks "Who is that?" and "Anyone else?" |
| 29 | DS3 | Because of a physical, mental, or emotional condition, does anyone in this household have serious difficulty concentrating, remembering, or making decisions? If the response is yes, then the instrument asks "Who is that?" and "Anyone else?" |
| 30 | DS4 | Does anyone in this household have serious difficulty walking or climbing stairs? If the response is yes, then the instrument asks "Who is that?" and "Anyone else?" |
| 31 | DS5 | Does anyone in this household have serious difficulty dressing or bathing? If the response is yes, then the instrument asks "Who is that?" and "Anyone else?" |
| 32 | DS6 | Because of a physical, mental, or emotional condition, does anyone in this household have difficulty doing errands alone such as visiting a doctor's office or shopping? If the response is yes, then the instrument asks "Who is that?" and "Anyone else?" |
| 33 | NTVT | What is the person's country of birth? |
| 34 | MNTVT | What is his/her mother's country of birth? |
| 35 | FNTVT | What is his/her father's country of birth? |
| 36 | CITIZN | Is the person is a U.S. citizen? This is asked only when neither the person nor both of his/her parents were born in the United States or U.S. territory. |
| 37 | CITYPA | Was the person born a U.S. citizen? This is asked when the answer to CITZN-scrn is yes. |
| 38 | CITYPB | Did the person become a U.S. citizen through naturalization? This is asked when the answer to CITYA-scrn is no. |
| 39 | INUSYR | When did the person come to live in the United States? This is asked of U.S. citizens born outside of the 50 states (e.g., Puerto Ricans, U.S. Virgin Islanders, etc.) and of non-U.S. citizens. |
| 40 | FAMINC | What is the household's total combined income during the past 12 months? The interviewer shows the respondent a flashcard from which he/she chooses the appropriate income category. |

[1] There are two occasions when demographic items are asked: (1) all month-in-sample 1 households and (2) any month-in-sample 2 through 8 household where additional members are added.

Table 3-2.6.
## Demographic Edits in the Current Population Survey Instrument

*Note: The following list of edits is not complete; only the major edits are described. The demographic edits in the Current Population Survey instrument take place while the interviewer is creating or updating the roster. After the roster is in place, the interviewer may still make changes to the roster such as adding or deleting persons or changing variables.*

| | EDUCATION EDITS |
|---|---|
| 1 | The instrument will force interviewers to probe if the education level is inconsistent with the person's age; interviewers will probe for the correct response if the education entry fails any of the following range checks:<br><br>▪ If 19 years of age, then the person should have an education level below that of a master's degree (EDUCA-scrn < 44).<br><br>▪ If 16–18 years of age, then the person should have an education level below that of a bachelor's degree (EDUCA-scrn < 43).<br><br>▪ If 15 years or younger , the person should have an education level below college (EDUCA-scrn < 40). |
| 2 | The instrument will force the interviewer to probe before it allows lowering an education level reported in a previous month-in-sample. |

| | VETERANS EDITS |
|---|---|
| | The instrument will display only the answer categories that apply (i.e., periods of service in the armed forces), based on the person's age. For example, the instrument will not display certain answer categories for a 40-year-old veteran (e.g., World War I, World War II, Korean War), but it will display them for a 99-year-old veteran. |

| | NATIVITY EDITS |
|---|---|
| | The instrument will force the interviewer to probe if the person's year of entry into the United States is earlier than his/her year of birth. |

| | SPOUSE LINE NUMBER EDITS |
|---|---|
| 1 | If the household roster does not include a spouse for the reference person, their SPOUSE line number will be set to zero. It will also omit the first answer category (i.e., married spouse present) when it asks for the spouse; likewise for the reference person. |
| 2 | The instrument will not ask the SPOUSE line number for both spouses in a married couple. Once it obtains the first SPOUSE line number on the roster, it will set the second spouse's marital status equal to that of his/her spouse. |
| 3 | For each household member with a spouse, the instrument will ensure that his/her SPOUSE line number is not equal to his/her own line number, nor to his/her own PARENT line number (if any). In both cases, the instrument will not allow the wrong entry and will display a message telling the interviewer to "TRY AGAIN." |

| | PARENT LINE NUMBER EDITS |
|---|---|
| 1 | The instrument will never ask for the reference person's PARENT line number. It will set the reference person's PARENT line number equal to the line number of whomever was reported on the roster as the reference person's parent or equal to zero if no one on the roster fits that criteria. |
| 2 | Likewise, for each individual reported as the reference person's child (S_RRP=22), the instrument will set his/her PARENT line number equal to the reference person's line number, without asking for each individual's PARENT line number. |
| 3 | The instrument will not allow more than two parents for the reference person. |
| 4 | If an individual is reported to be a brother or sister of the reference person, and the reference person's PARENT is recorded, the instrument will: (a) first verify that the parent to which both siblings are pointing to is indeed the line number belonging to the reference person's PARENT; and if so, (b) set the PARENT line number equal to the reference person's PARENT line number. |
| 5 | For each household member, the instrument will ensure that the PARENT line number is not equal to his/her own line number. In such a case, the instrument will not allow the interviewer to make the wrong entry and will display a message telling the interviewer to "TRY AGAIN." |

questions on family income, disabilities, country of birth of each household member, country of birth of each member's father and mother, and for the foreign-born, year of entry into the United States and citizenship status. See Part 2 of Table 3-2.5 for a list of these items.

## SUBSEQUENT MONTHS' INTERVIEWS

For households in sample for the second, third, and fourth months, the FR has the option to conduct the interview over the telephone. The respondent must approve the use of this interviewing mode. Such approval is obtained at the end of the first month's interview upon completion of the labor force and any supplemental questions. Telephone interviewing is the preferred method for collecting the data; it is much more time and cost efficient. Approximately 85 percent of interviews in these three MIS are obtained by telephone. See Part 2 of Table 3-2.3 for the questions asked to obtain consent for the telephone interview. FRs must attempt to conduct a personal visit interview for the fifth-month interview. After one attempt, a telephone interview may be conducted provided the original household still occupies the sample unit. This fifth-month interview follows a sample unit's 8-month dormant period and is used to reestablish rapport with the household. Fifth-month households are more likely than any other MIS households to be a replacement household—i.e., a household in which all the previous month's residents have moved out and been replaced by an entirely different group of residents. This can and does occur in any MIS except for MIS 1. Households in MIS 6, 7, and 8 are also eligible for telephone interviewing. Once again, approximately 85 percent of the interviews of these cases are obtained by telephone.

The first thing the FR does in subsequent interviews is update the roster. The instrument presents a screen (or a series of screens for MIS 5 interviews) that prompts the FR to verify the accuracy of the roster. Since households in MIS 5 are returning to sample after an 8-month hiatus, additional probing questions are asked to establish the household's current roster and to update some characteristics. See Table 3-2.7 for a list of the major items asked in MIS 5 interviews. If there are any changes, the interviewer goes through the necessary steps to add or delete individuals and update relationship items (e.g., relationship to reference person, marital status, and parent, spouse, or unmarried partner pointers) that may be subject to change. After making the appropriate corrections, the instrument takes the interviewer to any items, such as educational attainment, that require periodic updating.

The labor force interview in MIS 2, 3, 5, 6, and 7 collects the same information as the MIS 1 interview. MIS 4 and 8 interviews are different in several respects. These interviews include additional questions for employed wage and salary workers about their usual weekly earnings at their sole or main job, as well as union membership for that job. In addition, for all individuals who are multiple jobholders, information is collected on the I&O of their second job. For individuals who are not in the labor force, additional information on their previous labor force attachment is obtained.

After an initial interview, dependent interviewing is used in the collection of several items. Information collected in the previous month's interview is carried forward into the current interview to ease response burden and improve the quality of the labor force data. This is most noticeable in the collection of I&O of the main job; job description data from the previous month are imported into the current month's interview, and interviewers verifying whether an individual still has the same job. Other information collected using dependent interviewing includes items on duration of unemployment and data on the not in labor force subgroups of the retired and people who are not working due to a disability. Dependent interviewing is not used in the MIS 5 interviews or for any of the data collected solely in MIS 4 and 8 interviews.

The CPS uses centralized contact centers in Jeffersonville, Indiana, and Tucson, Arizona, for CATI. These have been used since 1983. The first

Table 3-2.7.
## Interviews: Main Household and Demographic Items Asked in Month-in-Sample 5

*Note: This list is not complete and covers only the main data items. It does not include related items used to identify the final response such as probes and verification screens. See the Current Population Survey Interviewing Manual for illustrations of the actual instrument screens for all Current Population Survey items.*

| | Item name | Item generally asks |
|---|---|---|
| **HOUSEHOLD ITEMS** | | |
| 1 | HHNUM | Is the household a replacement household? |
| 2 | VERADD | What is the street address (as verification)? |
| 3 | CHNGPH | Does the current phone number need updating? |
| 4 | MAILAD | What is the mailing address (as verification)? |
| 5 | TENUR | Is the unit owned, rented, or occupied without paid rent? |
| 6 | TELHH | Is there a telephone in the unit? |
| 7 | TELIN | Is a telephone interview acceptable? |
| 8 | TELPHN | What is the phone number and is it a home or office phone? |
| 9 | BESTTI | When is the best time to contact the respondent? |
| 10 | NOSUN | Is a Sunday interview acceptable? |
| 11 | THANKYOU | Is there any reason why the interviewer will not be able to interview the household next month? |
| 12 | INOTES-1 | The interviewer may want to make any notes about the case that might help with the next interview. The interviewer is also asked to list the names/ages of ALL additional persons if there are more than 16 household members. |

| | Item name | Item generally asks |
|---|---|---|
| **DEMOGRAPHIC ITEMS** | | |
| 13 | RESP1 | Is the respondent different from the previous interview? |
| 14 | STLLIV | Are all persons listed still living in the unit? |
| 15 | NEWLIV | Is anyone else staying in the unit now? |
| 16 | MCHILD | Is the roster (displayed on the screen) missing any babies or small children? |
| 17 | MAWAY | Is the roster (displayed on the screen) missing usual residents temporarily away from the unit (e.g., traveling, at school, in the hospital)? |
| 18 | MLODGE | Is the roster (displayed on the screen) missing any lodgers, boarders, or live-in employees? |
| 19 | MELSE | Is the roster (displayed on the screen) missing anyone else staying in the unit? |
| 20 | EDUCA | What is the highest level of school completed or highest degree received? This is asked for the first time in Month-in-Sample 1, and then verified in Month-in-Sample 5 and in specific months (i.e., February, July, and October). |
| 21 | CHANGE | Since last month, has there been any change in the roster (displayed with full demographics), particularly in the marital status? |

Table 3-2.8.
## Interviewing Results for October 2017

| Description | October 2017 |
|---|---|
| **TOTAL HOUSEHOLDS** | **72,151** |
| Eligible households. | 61,040 |
| Interviewed households | 52,638 |
| Response rate (unweighted) | 86.24 |
| Response rate (weighted). | 86.41 |
| Noninterviews | 19,513 |
| Rate | 27.04 |
| Type A | 8,402 |
| Rate (unweighted) | 13.76 |
| Rate (weighted). | 13.59 |
| No one home | 1,095 |
| Temporarily absent | 196 |
| Refused | 6,547 |
| Language barrier. | 36 |
| Unable to locate. | 25 |
| Other—specify | 503 |
| Callback needed—no progress. | 0 |
| Type B | 10,634 |
| Rate (unweighted) | 14.84 |
| Rate (weighted). | 13.88 |
| Entire household armed forces | 158 |
| Entire household under the age of 15. | 4 |
| Temporarily occupied with people with URE. | 974 |
| Vacant regular | 7,892 |
| Vacant household furniture storage. | 346 |
| Unfit, to be demolished | 425 |
| Under construction, not ready. | 336 |
| Converted to temporary business or storage | 100 |
| Unoccupied tent or trailer site | 234 |
| Permit granted, construction not started | 73 |
| Other Type B. | 92 |
| Type C | 477 |
| Rate (unweighted) | 0.66 |
| Rate (weighted). | 0.91 |
| Demolished. | 93 |
| House or trailer moved. | 52 |
| Outside segment | 0 |
| Converted to permanent business or storage | 48 |
| Merged. | 11 |
| Condemned | 10 |
| Unused serial number/listing sheet line. | 2 |
| Unlocatable sample address | 0 |
| Unit does not exist or unit is out-of-scope | 227 |
| Other Type C | 34 |

Source: Derived from the Current Population Survey Summary Report, October 2017.

Table 3-2.9.
## Telephone and Personal Field Interviewing for October 2017

| Months-in-sample (MIS) | Total | | Field telephone | | Field personal visit | | CATI center | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| MIS 1 . . . . . . . . . . . . . . . . . | 6,346 | | 1,210 | 4.7 | 5,136 | 22.8 | Z | Z |
| MIS 2 . . . . . . . . . . . . . . . . . | 6,469 | | 3,425 | 13.2 | 2,353 | 10.4 | 691 | 14.8 |
| MIS 3 . . . . . . . . . . . . . . . . . | 6,563 | | 3,624 | 14.0 | 2,243 | 9.9 | 696 | 14.9 |
| MIS 4 . . . . . . . . . . . . . . . . . | 6,413 | | 3,421 | 13.2 | 2,150 | 9.5 | 842 | 18.1 |
| MIS 5 . . . . . . . . . . . . . . . . . | 6,558 | | 2,431 | 9.4 | 4,127 | 18.3 | Z | Z |
| MIS 6 . . . . . . . . . . . . . . . . . | 6,624 | | 3,805 | 14.7 | 2,201 | 9.8 | 618 | 13.3 |
| MIS 7 . . . . . . . . . . . . . . . . . | 6,740 | | 3,776 | 14.6 | 2,148 | 9.5 | 816 | 17.5 |
| MIS 8 . . . . . . . . . . . . . . . . . | 6,925 | | 3,743 | 14.4 | 2,188 | 9.7 | 994 | 21.3 |
| **Total (MIS 1–8)** . . . . . . . . | **52,638** | | **25,435** | **100.0** | **22,546** | **100.0** | **4,657** | **100.0** |
| MIS 1 and MIS 5 . . . . . . . . . | 12,904 | 24.5 | 3,641 | 28.2 | 9,263 | 71.8 | Z | Z |
| MIS 2–4 and MIS 6–8. . . . . | 39,734 | 75.5 | 21,794 | 54.9 | 13,285 | 33.4 | 4,657 | 11.7 |

Z Represents or rounds to zero.
Note: This table for October 2017 is consistent with usual monthly results.
Source: Derived from the Current Population Survey Summary Report, October 2017.

use of CATI in production was the Tri-Cities Test, which began in April 1987. Each month about 10,000 cases are sent to these telephone centers, but no MIS 1 or MIS 5 cases are sent. Most of the cases sent to CATI are in metropolitan areas, which eases recruiting and hiring efforts in those areas. Selection is made by RO supervisors based on the FR's analysis of a household's probable acceptance of a telephone center interview and the need to balance workloads and meet specific goals on the number of cases sent to the centers. About 65 percent are interviewed and the remainder is recycled to FRs. The net result is that about 8 percent of all CPS interviews are completed at a CATI center. The centers generally cease labor force collection on the Wednesday of interview week (which is generally the week containing the nineteenth of the month), allowing field staff 3 or 4 days for follow-up activities. Generally, about 80 percent of the recycled cases are interviewed.

Tables 3-2.8 and 3-2.9 show the results of a typical month's CPS interviewing, October 2017. Table 3-2.8 lists the outcomes of all the households in the CPS sample. For monthly interviewing, Type A rates average around 15 percent with an overall noninterview rate in the range of 28 to 30 percent. In October 2017, the Type A rate was 13.76 percent. The overall noninterview rate for October 2017 was 27.04 percent.

## REFERENCES

U.S. Census Bureau, Current Population Survey Interviewing Manual, 2015, retrieved from <www.census.gov/programs-surveys/cps /technical-documentation/complete.html>.

# Chapter 3-3: Transmitting the Interview Results

## INTRODUCTION

FRs send completed CPS work through electronic data transmissions. Secure lines are used for all data transmissions between the Census Bureau headquarters, the Jeffersonville, Indiana, National Processing Center (NPC), two CATI contact centers, ROs, field supervisors, and FRs. This chapter provides a summary of these procedures and how the data are prepared for production processing.

## THE SYSTEM

The system for the transmission of data is centralized at the Census Bureau headquarters. All data transfers must pass through headquarters even if headquarters is not the final destination of the information. The system was designed this way for ease of management and to ensure uniformity of procedures within a given survey as well as between different surveys. The transmission system was designed to satisfy the following requirements:

- Provide minimal user intervention.
- Upload or download in one transmission.
- Transmit interview responses in one transmission.
- Transmit software upgrades with data.
- Maintain integrity of the software and the assignment.
- Prevent unauthorized access.

The central database system at headquarters cannot initiate transmissions. Either the FRs or the ROs must initiate any transmissions. Devices in the field are not continuously connected to the headquarters' computers; rather, the field devices contact the headquarters' computers to exchange data using a secure Census Virtual Private Network (VPN). The central database system servers store messages and case information required by the FRs or the ROs. When an FR connects, the transfer of data from the FR's device to headquarters' database is completed first and then any outgoing data are transferred to the FR's device.

A major concern is the need for security. Both the Census Bureau and the BLS are required to honor the pledge of confidentiality given to CPS respondents. The system is designed to safeguard this pledge. All transmissions between the headquarters' central database and the FRs' devices are encrypted and occur over the secure Census VPN. All transmissions between headquarters, the NPC, the CATI centers, and the ROs are over secure telecommunications lines that are leased by the Census Bureau and are accessible only by Census Bureau employees.

## TRANSMISSION OF INTERVIEW DATA

Each FR is expected to make a telecommunications transmission at the end of every workday during the interview period. Additional transmissions may be made at any time as needed. Each transmission is a batch process in which all relevant files are automatically transmitted and received. The device connects to the headquarters' central database and transmits the completed cases. At the same time, the central database returns any other data to complete the FR's assignment and any software or security updates. The RO or field supervisory staff performs a data transmission when releasing or reassigning work and after completing check-in and supervisory review activities.

### CATI Contact Center Transmissions

All cases are initially sent to the ROs and assigned to FRs. A subset of the cases are selected for CATI. These cases are then sent back to the Master Control System (MCS) and subsequently to a WebCATI System. The WebCATI system has a central database where cases are shared between the two CATI contact centers. Data are moved between MCS and WebCATI using secure database links. Data are moved between WebCATI and the two CATI contact centers using encryption and secure transmission lines.

All cases sent to CATI are ultimately sent back to the MCS. Both response data and operational data are provided.

- Cases with an interview disposition of complete, sufficient partial, out-of-scope, or "Congressional refusal" are sent to the MCS and headquarters.
- All other cases are recycled to the field. These include noncontacts, refusals, and unavailable.

Each recycled case is transmitted directly to the assigned FR. Case notes that include the reason for the recycle are also transmitted to the FR to assist in follow-up. These transmissions are similar to the transmission of the initial assignment except for the timing (i.e., they occur after the start of data collection). The ROs monitor the progress of the CATI recycled cases.

## Transmission of Interviewed Data From the Centralized Database

Each day during the production cycle, field staff send files to headquarters with the results of the previous day's interviewing. (See Figure 3-3.1 for an overview of the daily processing cycle.) The headquarters' production processing system usually receives three files per day: one combined file from the CATI contact centers and two files from the field. At this time, cases requiring I&O coding are identified and a file of these cases is created. This file is then used by NPC coders to assign the appropriate I&O codes. The I&O data are not transmitted to NPC; rather, the NPC coding staff remotely accesses the data on headquarters' servers. Chapter 3-4, Data Preparation, provides an overview of the I&O coding and processing system.

The CATI contact centers finish sending files to headquarters by the middle of the week including the nineteenth of the month (the week that interviewing generally begins). All data are received by headquarters usually on Tuesday or Wednesday of the week after interviewing begins.

Figure 3-3.1.

## Overview of Current Population Survey Monthly Operations for a Typical Month

| | Week 1 (week containing the 5th) | | | Week 2 (week containing the 12th) | | | | | | | Week 3 (week containing the ) | | | | | | | | | | Week 4 (week containing the 26th) | | | | Week 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thu | Fri | Sat | Sun | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Mon | Tue | Wed | Thu | Fri | Sat | Sat thru Thu | Fri |

Field representatives (FRs) pick up computerized questionnaire via transmission. *(Week 1)*

FRs and computer-assisted telephone interviewing (CATI) interviewers complete practice interviews and home studies. *(Week 2)*

FRs pick up assignments via transmission. *(Week 2)*

CATI Interviewing:
- CATI contact centers transmit completed work to headquarters nightly.
- CATI supervisors monitor interviewing progress.

Computer-assisted-personal interviewing:
- FRs transmit completed work to headquarters nightly.
- Regional offices (ROs) monitor interviewing assignments and progress.

All assignments completed except for telephone holds.

All interviews completed.

ROs complete final field closeout.

Processing begins:
- Files received overnight are checked in by ROs and headquarters daily.
- Headquarters performs initial processing and sends eligible cases to the National Processing Center (NPC) for Industry and Occupancy (I&O) coding.

NPC sends back completed I&O cases.

Headquarters performs final computer processing edits, recodes, weighting. Census Bureau delivers data to Bureau of Labor Statistics (BLS). *(Week 4)*

BLS analyzes data. *(Week 5)*

Results released to public at 8:30 a.m. by BLS. *(Week 5, Fri)*

# Chapter 3-4: Data Preparation

## INTRODUCTION

For the CPS, postdata collection activities transform raw data into a microdata file that can be used to produce estimates. Several processes are needed for this transformation. The raw data files must be read and processed. Textual I&O responses must be coded. Even though some editing takes place in the instrument at the time of the interview (see Chapter 3-2, Conducting the Interviews), further editing is required once all data are received. Editing and imputations, explained below, are performed to improve the consistency and completeness of the microdata. New data items are created based upon responses to multiple questions. These activities prepare the data for weighting and estimation procedures, described in Chapter 2-3, Weighting and Estimation.

## DAILY PROCESSING

For a typical month, CATI starts on Sunday of the week containing the nineteenth of the month and continues through Wednesday of the same week. The answer files from these interviews are sent to headquarters on a daily basis from Monday through Thursday of this interview week. CAPI also begins on the same Sunday and continues through Tuesday of the following week. The CAPI answer files are again sent to headquarters daily until all the interviewers and ROs have transmitted the workload for the month. This phase is generally completed by Wednesday of the week containing the 26th of the month.

Various computer checks are performed to ensure the data can be accepted into the CPS processing system. These checks include, but are not limited to, ensuring the successful transmission and receipt of the files, confirming the item range checks, and rejecting invalid cases. Files containing records needing four-digit I&O codes are electronically sent to the NPC for assignment of these codes. Once the NPC staff has completed the I&O coding, the files are electronically transferred back to headquarters where the codes are placed on the CPS production file. When all of the expected data for the month are accounted for and all of NPC's I&O coding files have been returned and

placed on the appropriate records on the data file, editing and imputation are performed.

## INDUSTRY AND OCCUPATION CODING

The I&O code assignment operation requires 10 coders to assign approximately 30,000 codes for 1 week. The volume of codes has decreased significantly with the introduction of dependent interviewing for I&O codes (see Chapter 3-1, Instrument Design). Both new monthly CPS cases and people whose I&O have changed since the previous interview are sent to NPC for coding. For those whose I&O information has not changed, the four-digit codes are brought forward from the previous month of interviewing and require no further coding.

A computer-assisted I&O coding system is used by the NPC I&O coders. Files of all eligible I&O cases are sent to this system each day. Each coder works at a computer where the screen displays the I&O descriptions that were captured by the FRs at the time of the interview. The coder then enters a four-digit numeric code for industry based on the Census Industry Classification. The coder also assigns a four-digit numeric code for occupation based on the Census Occupational Classification.

A substantial effort is directed at supervision and control of the quality of this operation. The supervisor is able to turn the dependent verification setting "on" or "off" at any time during the coding operation. The "on" mode means that a particular coder's work is verified by a second coder. In addition, a 10 percent sample of each month's cases is selected to go through a quality assurance system to evaluate the work of each coder. The selected cases are verified by another coder after the current monthly processing has been completed.

After this operation, the batch of records is electronically returned to headquarters for the next stage of monthly production processing.

## EDITS AND IMPUTATIONS

The CPS is subject to two sources of nonresponse. The most frequent source is nonresponding households (unit nonresponse). To compensate

for unit nonresponse, the weights of nonresponse households are distributed among interviewed households as explained in Chapter 2-3, Weighting and Estimation. The second source of data loss is from item nonresponse, which occurs when a respondent either does not know the answer to a question or refuses to provide the answer. Item nonresponse in the CPS is modest (see Chapter 4-1, Nonsampling Error, Table 4-1.1).

Before the edits are applied, the daily data files are merged and the combined file is sorted by state and primary sampling unit (PSU). This is important because many labor force and I&O characteristics are geographically clustered.

The edits effectively blank all entries in inappropriate questions (e.g., followed incorrect path of questions) and ensure that all appropriate questions have valid entries. For the most part, illogical entries or out-of-range entries have been eliminated with the use of electronic instruments; however, the edits still address these possibilities that may arise from data transmission problems and occasional instrument malfunctions. The main purpose of the edits, however, is to assign values to questions where the response was "Don't know" or "Refused." This is accomplished by using one of the three imputation techniques described below.

The edits are run in a deliberate and logical sequence. Household and demographic variables are edited first because several of those variables are used to allocate missing values in later edits. The labor force variables are edited next since labor force status and related items are used to impute missing values for I&O codes and so forth.

The three imputation methods used by the CPS edits are described below:

1.  **Relational imputation** infers the missing value from other characteristics on the person's record or within the household. For instance, if race is missing, it is assigned based on the race of another household member, or failing that, taken from the previous record on the file. Similarly, if relationship data are missing, it is assigned by looking at the age and sex of the person in conjunction with the known relationships of other household members. Missing occupation codes are sometimes assigned by analyzing the industry codes

and vice versa. This technique is used as appropriate across all edits. If missing values cannot be assigned using this technique, they are assigned using one of the two following methods.

2.  **Longitudinal edits** are used in most of the labor force edits as appropriate. If a question is blank and the individual is in the second or later month's interview, the edit procedure looks at last month's data to determine whether there was an entry for that item. If so, last month's entry is assigned. The exception to filling missing values from the previous month longitudinally is when handling blank labor force items for MIS 5 interviews. In this specific instance, the longitudinal link is broken for MIS 5 interviews. If the item cannot be assigned using this technique, the item is assigned a value using the appropriate hot deck as described next.

3.  **The "hot deck" imputation** method assigns a missing value from a record with similar characteristics. Hot decks are defined by variables such as age, race, and sex. Other characteristics used in hot decks vary depending on the nature of the unanswered question. For instance, most labor force questions use age, race, sex, and occasionally another correlated labor force item such as full- or part-time status. This means the number of cells in labor force hot decks are relatively small, perhaps fewer than 100. On the other hand, the weekly earnings hot deck is defined by age, race, sex, usual hours, occupation, and educational attainment. This hot deck has several thousand cells.

All CPS items that require imputation for missing values have an associated hot deck. The initial values for the hot decks are the ending values from the preceding month. As a record passes through the editing procedures, it will either donate a value to each hot deck in its path or receive a value from the hot deck. For instance, in a hypothetical case the hot deck for question X is defined by the characteristics Black, non-Black, male, female, and age 16–25/25 and older. Further assume a record has the value of White, male, and age 64. When this record reaches question X, the edits determine whether it has a valid entry. If so,

that record's value for question X replaces the value in the hot deck reserved for non-Black, male, and age 25 and older. Comparably, if the record was missing a value for question X, it would be assigned the value in the hot deck designated for non-Black, male, and age 25 and older.

As stated above, the various edits are logically sequenced, in accordance with the needs of subsequent edits. The edits and recodes, in order of sequence, are:

1. **Household edits and recodes**. This processing step performs edits and creates recodes for items pertaining to the household. It classifies households as interviews or nonresponse and edits items appropriately. Hot deck imputations defined by geography and other related variables are used in this edit.

2. **Demographic edits and recodes**. This processing step ensures consistency among all demographic variables for all individuals within a household. It ensures all interviewed households have one and only one reference person and that entries stating marital status, spouse, and parents are all consistent. It also creates families based upon these characteristics. It uses relational imputation, longitudinal editing, and hot deck imputation defined by related demographic characteristics. Demographic-related recodes are created for both individual and family characteristics.

3. **Labor force edits and recodes**. This processing step first establishes an edited Major Labor Force Recode (MLR), which classifies adults as employed, unemployed, or not in the labor force. Based upon MLR, the labor force items related to each series of classification are edited. This edit uses longitudinal editing and hot deck imputation matrices. The hot decks are defined by age, race, and/or sex and, possibly, by a related labor force characteristic.

4. **I&O edits and recodes**. This processing step assigns four-digit I&O codes to those I&O

eligible individuals for whom the I&O coders were unable to assign a code. It also ensures consistency, wherever feasible, between industry, occupation, and class of worker. I&O related recode guidelines are also created. This edit uses longitudinal editing, relational, and hot deck imputation. The hot decks are defined by such variables as age, sex, race, and educational attainment.

5. **Earnings edits and recodes**. This processing step edits the earnings series of items for earnings-eligible individuals. A usual weekly earnings recode is created to allow earnings amounts to be in a comparable form for all eligible individuals. There is no longitudinal editing because this series of questions is asked only of MIS 4 and 8 households. Hot deck imputation is used here. The hot deck for weekly earnings is defined by age, race, sex, major occupation recode, educational attainment, and usual hours worked. Additional earnings recodes are created.

6. **School enrollment edits and recodes**. School enrollment items are edited for individuals 16 to 54 years old. Longitudinal edits or hot deck imputation based on age and other related variables are used as necessary.

7. **Disability edits and codes**. The disability items are asked of all interviewed adult records in MIS 1 and 5. Valid responses from MIS 1 and 5 are longitudinally filled into MIS 2–4 and 6–8 as appropriate. Any missing data, regardless of MIS, are filled using longitudinal or hot deck imputation.

8. **Certification edits and recodes**. The certification items are edited in their own separate edit after completion of the I&O edit since the occupation and labor force data are used in the imputation process for these items. Any missing data are filled using longitudinal or hot deck imputation.

# Chapter 3-5: Organization and Training of the Data Collection Staff

## INTRODUCTION

The data collection staff for all Census Bureau programs is directed through six ROs and two contact centers. The ROs collect data using two modes: CAPI and CATI. The six ROs report to the Chief of the Field Division, whose headquarters is located in Washington, DC. The two CATI facility managers report to the Chief of the NPC located in Jeffersonville, Indiana.

## ORGANIZATION OF REGIONAL OFFICES/CATI FACILITIES

The staffs of the ROs and CATI contact centers carry out the Census Bureau's field data collection programs for both sample surveys and censuses. Currently, the ROs supervise over 7,000 part-time and intermittent FRs who work on continuing current programs and one-time surveys. Approximately 2,700 of these FRs work on the CPS. When a census is being taken, the field staff increases dramatically.

The location of the ROs and the boundaries of their responsibilities are displayed in Figure 3-5.1. RO areas were originally defined to evenly distribute the office workloads for all programs. Table 3-5.1 shows the average number of CPS units assigned for interview per month in each RO.

Each RO is headed by a Regional Director (RD) and has two Assistant Regional Directors (ARDs). The CPS is the responsibility of the program and management analysis coordinator who reports to the RD through the ARD. The program coordinator has two or three CPS Regional Survey Managers-Expert (RSM-E) on staff. The RSM-Es work with Regional Survey Managers-Geography (RSM-G) in the RO. Each RO has eight RSM-Gs. The typical RO employs about 360 to 580 FRs who are assigned to the CPS. Most FRs also work on other surveys. ROs have a total of 408 full-time Field Supervisors (FSs) who supervise teams of FRs. Each FS is assigned around 17 FRs. The primary function of the FS is to assist the RSM-Es and RSM-Gs with training and supervising the field interviewing staff. In addition, the FSs conduct nonresponse reinterview follow-up with eligible households. Like FRs, the FSs work out of their home. However, the FRs are part-time or intermittent employees.

Despite the geographic dispersion of the sample areas, there is a considerable amount of personal contact between the supervisory staff and the FRs accomplished mainly through the training programs and various aspects of the quality control program. For some of the outlying PSUs, it is necessary to use the telephone and written communication to keep in continual touch with all FRs. The ROs, RSMs, and FSs also communicate with the FRs using e-mail. FRs mostly communicate with their FS and sometimes their RSM-G. The RSM-Gs and FSs communicate with the RSM-Es. In addition to communications relating to the work content, there is a regular system for reporting progress and costs.

The CATI contact centers are staffed with one facility manager per each site who directs the work of two to four Supervisory Operations Specialists or Ops Specialists. Each Ops Specialist is in charge of about five to ten supervisors or Supervisory Statistical Assistants (Sups). Sups are in charge of about 10 to 20 interviewers. In addition to conducting data collection for CPS, the CATI contact centers also conduct quality control reinterview follow-up with eligible households.

A substantial portion of the budget for field activities is allocated to monitoring and improving the quality of the FRs' work. This includes FRs' group training, monthly home studies, personal observation, and reinterview. Approximately 25 percent of the CPS budget (including travel for training) is allocated to quality enhancement. The remaining 75 percent of the budget went to FR and FS salaries, all other travel, clerical work in the ROs, recruitment, and the supervision of these activities.

## TRAINING FIELD REPRESENTATIVES

Approximately 20 to 25 percent of the CPS FRs leave the staff each year. As a result, the recruitment and training of new FRs is a continuing task in each RO. To be selected as a CPS FR, a candidate must pass the Basic Skills Test on reading,

arithmetic, and map reading. Applicants who pass the Basic Skills Test must then pass the scored Mock and Structured Job Interviews. Additionally, the FR is required to live in or near the PSU in which the work is to be performed and have a residence telephone and, in most situations, an automobile. As a part-time or intermittent employee, the FR works 40 or fewer hours per week or month. In most cases, new FRs are paid at the GS–3 level and are eligible for payment at the GS–4 level after 1 year of fully successful or better work. FRs are paid mileage for the use of their own cars while interviewing and for commuting to classroom training sites. They also receive pay for completing their home-study training packages.

## FIELD REPRESENTATIVE TRAINING PROCEDURES

### Initial training for new Field Representatives

When appointed, each FR undergoes an initial training program prior to starting his/her assignment. The initial training program consists of up to 20 hours of preclassroom home study, 3.5 to 4.5 days of classroom training (dependent upon the trainee's interviewing experience) conducted by an RSM or coordinator. The first day of training (not required for experienced staff) is dedicated to Generic Path to Success training, where FRs learn generic soft interviewing skills and administrative tasks. An on-the-job field observation by the FS during the FR's first 2 days of interviewing is also required. The classroom training includes comprehensive instruction on the completion of the survey using the laptop computer. In classroom training, special emphasis is placed on the labor force concepts to ensure that the new FRs fully grasp these concepts before conducting interviews. In addition, a large part of the classroom training is devoted to practice interviews that reinforce the correct interpretation and classification of the respondents' answers. A 12-hour post-classroom training consists of home-study exercise and test.

Trainees receive extensive training on interviewing skills, such as how to handle noninterview situations, how to probe for information, ask questions as worded, and implement face-to-face and telephone techniques. Before beginning the first month observation and assignment, each FR also completes a practice phone interview with an experienced FS. Each FR completes a home-study exercise before the second month's assignment and, during the second month's interview assignment, is observed for at least 1 full day by the FS who gives supplementary training if needed. The FR also completes a home-study exercise and a final review test prior to the third month's assignment.

### Training for All Field Representatives

As part of each monthly assignment, FRs are required to complete a home-study exercise, which usually consists of questions concerning labor force concepts and survey coverage procedures. Once a year, the FRs are gathered in groups of about 12 to 15 for 1 or 2 days of refresher training. These sessions are usually conducted by RSM or FSs. These group sessions cover regular CPS and supplemental survey procedures.

### Training for Interviewers at the CATI Centers

Candidates selected to be CATI interviewers receive classroom training. The classroom training consists of 3 days (15 hours) of new hire orientation training and 2 days (10 hours) of computer training in the CATI case management system, WebCATI. Additionally, CATI interviewers selected for CPS complete a 5-hour CPS subject matter self-study and receive a 3-day classroom training (15 hours) specifically about the CPS. New CPS interviewers are then closely monitored by having coaches observe recorded interviews. Prior to data collection each month, all CATI interviewers are required to come into the contact center to complete a self-study that provides a review and clarification of specific CPS concepts.

## FIELD REPRESENTATIVES PERFORMANCE GUIDELINES

Performance guidelines have been developed for CPS CAPI FRs for response, nonresponse, and production. Response and nonresponse rate guidelines have been developed to ensure the quality of the data collected. Production guidelines have been developed to assist in holding costs within budget and to maintain an acceptable level of efficiency in the program. Both sets of guidelines are intended to help supervisors analyze activities of individual FRs and to assist supervisors in identifying FRs who need to improve their performance.

Each FS is responsible for developing each employee to his or her fullest potential. Employee development requires meaningful feedback on a continuous basis. By acknowledging strong points and highlighting areas for improvement, the FS can monitor an employee's progress and take appropriate steps to improve weak areas.

FR performance is measured by a combination of the following: response rates, production rates, supplement response, reinterview results, observation results, accurate payrolls submitted on time, deadlines met, reports to FS, training sessions, and administrative responsibilities.

The most useful tool to help supervisors evaluate the FRs performance is the CPS 11–39 form. This report is generated monthly and is produced using data from the Regional Office Survey Control System (ROSCO) and Cost and Response Management Network, known as CARMN systems. This report provides the supervisor information on:

- Workload and number of interviews.
- Response rate and numerical rating.
- Noninterview results (counts).
- Production rate, numerical rating, and mileage.
- Meeting transmission goals.

## EVALUATING FIELD REPRESENTATIVE PERFORMANCE

Census Bureau headquarters, located in Suitland, Maryland, provides guidelines to the ROs for developing performance standards for FRs' response and production rates. The ROs have the option of using the production guidelines, modifying them, or establishing a completely different set of standards for their FRs. ROs must notify the FRs of the standards.

### Response Rate Guidelines

Maintaining high response rates is of primary importance to the Census Bureau. The response rate is defined as the proportion of all sample households eligible for interview that is actually interviewed. It is calculated by dividing the total number of interviewed households by the sum of the number of interviewed households, the number of refusals, noncontacts, and eligible households that were not interviewed for other reasons,

including temporary refusals. (All of these noninterviews are referred to as Type A noninterviews.) Type A cases do not include vacant units, those that are used for nonresidential purposes, or other addresses that are not eligible for interview.

### Production Guidelines

The production guidelines used in the CPS CAPI program are designed to measure the efficiency of individual FRs and the RO field functions. Efficiency is measured by total minutes per case. The measure is calculated by dividing total time reported on payroll documents, which includes interview time and travel time, by total workload. When looking at an FR's production, FSs must consider extenuating circumstances, such as:

- Unusual weather conditions such as floods, hurricanes, or blizzards.
- Extreme distances between sample units or assignments that cover multiple PSUs.
- Large number of inherited or confirmed refusals.
- Working part of another FR's assignment.
- Inordinate number of temporarily absent cases.
- High percentage of Type B/C noninterviews that decrease the base for the nonresponse rate.
- Other substantial changes in normal assignment conditions.
- Personal visits/phones.

The supplement response rate is another measure that FSs must use in measuring the performance of their FR staff.

### Transmittal Rates

The ROSCO system allows the supervisor to monitor transmittal rates of each CPS FR. A daily receipts report is printed each day showing the progress of each case on CPS.

### Observation of Fieldwork

Field observation is one of the methods used by the supervisor to check and improve performance of the FR staff. It provides a uniform method for assessing the FR's attitude toward the job, use of the computer, and the extent to which FRs apply CPS concepts and procedures during actual work situations. There are three types of observations:

- Initial observations (N1, N2, N3).
- General performance review.
- Special needs (SN).

Initial observations are an extension of the initial classroom training for new hires and provide on-the-job training for FRs new to the survey. They also allow the survey supervisor to assess the extent to which a new CPS CAPI FR grasps the concepts covered in initial training and are an integral part of the initial training given to all FRs. A 2-day initial observation (N1) is scheduled during the FR's first CPS CAPI assignment. A second 1-day initial observation (N2) is scheduled during the FR's second CPS CAPI assignment. A third 1-day initial observation (N3) is scheduled during the FR's fourth through sixth CPS CAPI assignment.

General performance review observations are conducted at least annually and allow the supervisor to provide continuing developmental feedback to all FRs. Each FR is regularly observed at least once a year.

SN observations are made when an FR has problems or poor performance. The need for a SN observation is usually detected by other checks on the FR's work. For example, SN observations are conducted if an FR has a high Type A noninterview rate, a high minutes-per-case rate, a failure on reinterview, an unsatisfactory evaluation on a previous observation, made a request for help, or for other reasons related to the FR's performance.

An observer accompanies the FR for a minimum of 6 hours during an actual work assignment. The observer notes the FR's performance including how the interview is conducted and how the computer is used. The observer stresses the requirement to ask questions as worded and in the order presented on the CAPI screen. The observer also covers adhering to instructions on the instrument and in the manuals, knowing how to probe, recording answers correctly and in adequate detail, developing and maintaining good rapport with the respondent conducive to an exchange of information, avoiding questions or probes that suggest a desired answer to the respondent, and determining the most appropriate time and place for the interview. The observer also stresses vehicular and personal safety practices.

The observer reviews the FR's performance and discusses the FR's strong and weak points with an emphasis on correcting habits that interfere with the collection of reliable statistics. In addition, the FR is encouraged to ask the observer to clarify survey procedures not fully understood and to seek the observer's advice on solving other problems encountered.

## Unsatisfactory Performance

When the performance of an FR is at the unsatisfactory level over any period (usually 90 days), he or she may be placed in a trial period for 90 days. Depending on the circumstances, and with guidance from the Human Resources Division, the FR will be issued a letter stating that he or she is being placed in a Performance Improvement Plan (PIP). These administrative actions warn the FR that his or her work is substandard, provide specific suggestions on ways to improve performance, alert the FR to actions that will be taken by the survey supervisor to assist the FR in improving his or her performance, and notify the FR that he or she is subject to separation if the work does not show improvement in the allotted time. Once placed on a PIP, the RO provides performance feedback during a specified time period (usually 30 days, 60 days, and 90 days).
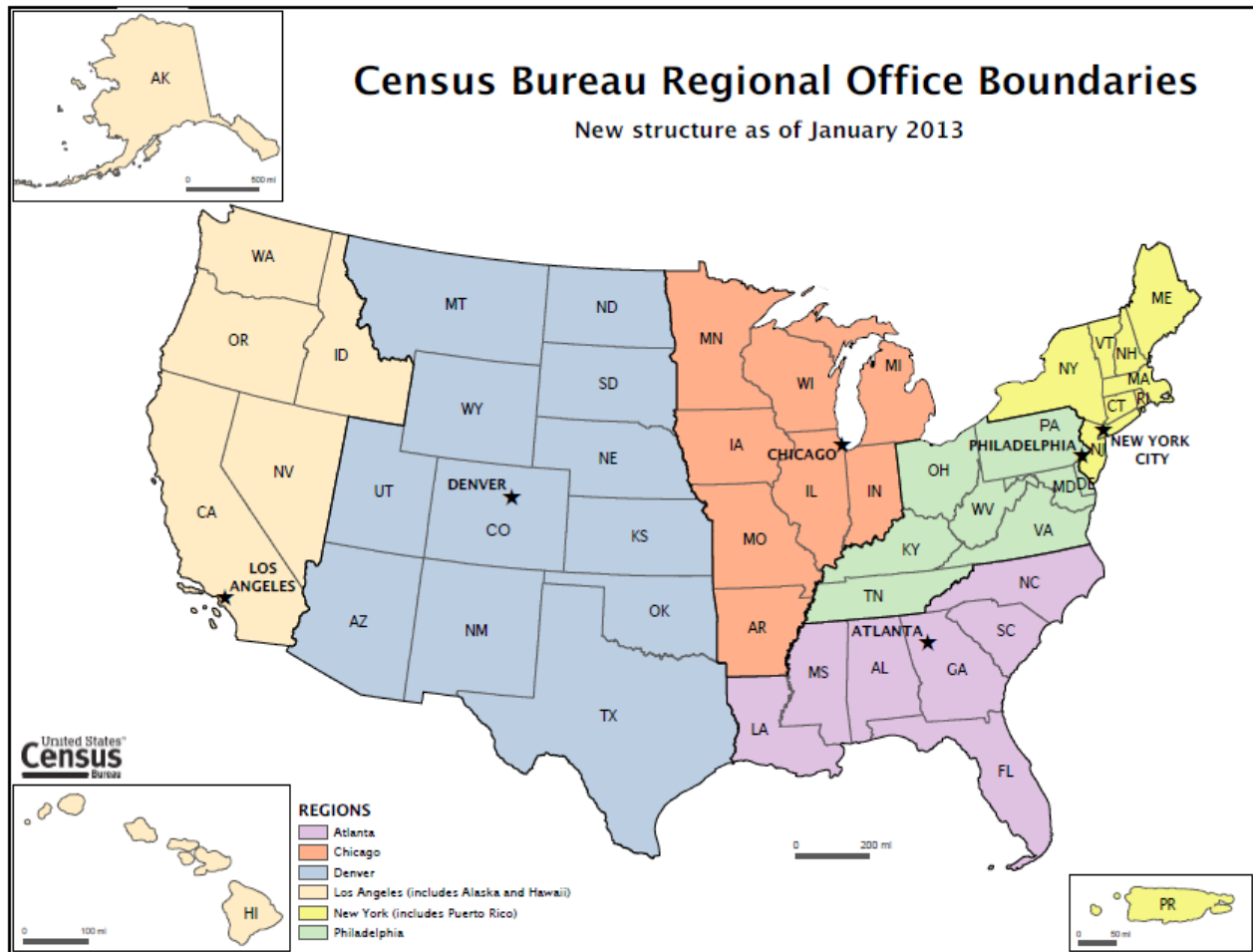
## EVALUATING INTERVIEWER PERFORMANCE AND QUALITY GUIDELINES AT THE CATI CONTACT CENTERS

Each CPS supervisor is responsible for ensuring their assigned interviewers perform at satisfactory levels. Interviewer performance is measured at both an overall level and a survey-specific level. Interviewers' performance evaluations take into account their attendance and administrative responsibilities such as completing their payrolls correctly, completing required self-studies, and completing required training classes. Additionally, interviewer performance is measured for each survey they are assigned to, and performance is measured qualitatively and quantitatively.

Each CATI interviewer's work on CPS is measured qualitatively through the review of recorded interviewing sessions. Calls are digitally recorded and reviewed using the NICE Interaction Management (NIM) software. The recordings capture the

Figure 3-5.1.
**U.S. Census Bureau Regional Office Boundaries**

## Census Bureau Regional Office Boundaries
### New structure as of January 2013

REGIONS
- Atlanta
- Chicago
- Denver
- Los Angeles (includes Alaska and Hawaii)
- New York (includes Puerto Rico)
- Philadelphia

content of each call, and the content is stored in NIM. Informed consent is received from respondents in order for the calls to be recorded, and all calls that receive consent are recorded. The NIM software randomly assigns recent recordings to coaches or monitors at the contact centers. Coaches are then required to review and evaluate these sessions in a timely manner as the coach/monitor assignments expire in the NIM software after 5 days. Coaches evaluate these sessions using an evaluation scorecard that has numerous categories relating to survey specific guidelines and procedures. Each category has a set point value and a "yes/no" option. Coaches are also required to note a specific timeframe on the recording when an issue occurred and describe the reason an element was marked down. The overall score can range from zero to 100. Scores below 81 are considered unsatisfactory.

Interviewers are given feedback on all of their monitoring sessions below the score of 100; however, only those sessions below 81 are given immediate feedback. Feedback can be conducted by either a coach or a supervisor, and the interviewer has the opportunity to observe their own recording. This gives an interviewer an opportunity to see any errors made and ensure the evaluation is reflective of their performance. If the interviewer is in agreement with the evaluation, they digitally sign the evaluation; however, if they are in disagreement, they have the option to dispute the evaluation and have it reviewed by a supervisor.

Interviewers who receive three consecutive unsatisfactory evaluations or demonstrate severe misconduct on CPS are placed on an Individual Coaching Assistance plan. Under this plan, a minimum of three to five inbound and three to five outbound calls are randomly assigned to coaches

to evaluate each month. Interviewers remain in the Individual Coaching Assistance plan until they receive three consecutive satisfactory evaluations. Once this occurs, the interviewer is placed onto a Systematic plan where one inbound and one outbound call is assigned to coaches to evaluate each week. Interviewers who are newly trained on CPS are placed on an Initial plan. This plan follows the same guidelines as the Individual Coaching Assistance plan; however, it is considered a continuation of training and poor scores under this program do not affect an employee's performance evaluation.

Interviewers' work on CPS is measured quantitatively using WebCATI statistics. Supervisors meet with interviewers on an individual basis each month to review their statistics on each survey. Supervisors are able to use statistics from WebCATI to track interviewer completes, efficiency (measured by completes per hour), call attempts per hour, refusal conversion rates, and numerous other categories. Supervisors can then compare these statistics to prior months' performance levels and the contact center averages.

Table 3-5.1.
**Average Monthly Workload by Regional Office: 2017**

| Regional office | Total | Percent | Base workload | CATI workload |
|---|---|---|---|---|
| **Total . . . . . . . .** | **73,382** | **100.00** | **66,528** | **6,854** |
| New York. . . . . . . . . . . | 10,696 | 14.58 | 9,681 | 1,015 |
| Philadelphia . . . . . . . . . | 12,982 | 17.69 | 11,779 | 1,203 |
| Chicago. . . . . . . . . . . . | 9,799 | 13.35 | 8,916 | 883 |
| Atlanta. . . . . . . . . . . . . | 12,594 | 17.16 | 11,396 | 1198 |
| Denver. . . . . . . . . . . . . | 16,075 | 21.91 | 14,581 | 1,494 |
| Los Angeles . . . . . . . . . | 11,236 | 15.31 | 10,175 | 1,061 |

Note: Derived from Current Population Survey Monthly Summary Report, January 2017–December 2017.

# Unit 4

# Current Population Survey Data Quality

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# Chapter 4-1: Nonsampling Error

## INTRODUCTION

This chapter discusses sources of nonsampling error that can affect the Current Population Survey (CPS) estimates. The effect of nonsampling error is difficult to measure, and the full impact on estimates is generally unknown. The CPS strategy is to examine potential sources of nonsampling error and to take steps to minimize their impact. Some sources of nonsampling error are external; CPS measures cannot control those (e.g., Master Address File [MAF] errors or errors in benchmark population controls).

Total survey error comprises sampling error and nonsampling error. The sampling error of an estimate is commonly measured by its standard error (square root of the variance). Nonsampling errors can arise at any stage of a survey, and they can affect both bias and variance, but the principal concern is usually with introducing bias into a survey.

Nonsampling error can be attributed to many sources and many types could affect the results of a census as well as a survey. The following categories of nonsampling errors are discussed in this chapter:
- Processing error.
- Coverage error.
- Nonresponse error.
- Measurement error.
- Other sources of nonsampling error.

The sources, controls, and quality indicators of nonsampling errors presented in this chapter do not necessarily constitute a complete list.

## PROCESSING ERROR

### Computer Processing Error

All survey operations, from sampling to field processing to tabulation, involve computer processing. At any stage of survey operations, it is conceptually possible for computer processing errors to be introduced. Best practices in development and testing prevent major computer processing problems. Quality assurance procedures also track data processing and detect errors.

Computer systems at the U.S. Census Bureau and the Bureau of Labor Statistics (BLS) are compliant with federal requirements. This applies to hardware, platforms, operating systems, software, backups, and security procedures that control access to computers. There is tight security on data files and the production systems for CPS processing. There are contingency plans for continuing operations under weather-related and other emergencies. Both agencies have offsite backups that allow processing to continue should primary systems fail.

Production system development is rigorous. Programs have written specifications and data files have detailed documentation. Production programs are written with standard programming languages that have commercial support. Testing procedures ensure files can be read and that programs conform to specifications. Changes to the production system are tested using prior data, simulating associated changes in data files as needed.

Quality assurance procedures during monthly processing include the following:

- Embedded checks in programs identify faulty data.

- Record counts and file sizes are tracked at various stages of production.

- Person weights are summed to make sure they add to the benchmark population controls.

- The Census Bureau and the BLS independently produce a set of tables and compare them cell by cell.

- Data are compared to the previous month and to the same month of the previous year by geographic, demographic, and labor force characteristics.

### Sample Processing Error

The CPS sample is coordinated with the samples of several other demographic surveys conducted by the Census Bureau. The sample selection process accounts for needed sample sizes, determines necessary sampling intervals, and has a protocol to ensure that a housing unit (HU) is

selected for at most one survey in a 5-year period. Sampling verification has a testing phase and a production phase. Verification in both phases is done independently by an information technology specialist and a subject-matter expert.

The testing phase includes systems testing and unit testing. In systems testing, programs are tested individually and collectively per specifications. In unit testing, trial data sets are run through the programs. In particular, simulated data sets with unusual observations are used to test the performance of the system in extreme situations.

The goal of the production phase is to verify that samples were selected as specified and that selected HUs have appropriate information, such as correct sampling probabilities. The number of HUs selected is compared to a computed target for each state. Outputs at several stages of sampling are compared to results from the previous annual sample to monitor consistency. The sample files are checked for incomplete or inconsistent HU information.

### Field Processing Error

Many field processing errors are prevented by computer systems. Particular attention is given to the transmission of sample assignments and data.

Monthly sample processing operations send out assignments through the regional offices (ROs) to field representatives (FRs) and to telephone interviewers in the contact centers. That information is shared with supervisory and RO staff. ROs verify that each interviewer obtained their entire assignment. The system ensures each sampled HU that is to be interviewed is assigned once and only once. During data collection, daily summary information about each interviewer is available. The ROs can make modifications to interviewer assignments, if necessary.

Quality assurance procedures are implemented on data transmissions from FRs and the contact centers. During data collection, daily summary information on transmissions is tracked. ROs verify that all FR assignments are returned and resolve any discrepancies before certifying completion. System checks verify total counts and ensure that one final report—either a response or a reason for

nonresponse—is obtained for every HU and only one response is retained per HU.

New interviewers are thoroughly trained on retrieving assignments and transmitting data. They are periodically assigned refresher training. See Chapter 3-5, Organization and Training of Staff, for more information.

## COVERAGE ERROR

Coverage error exists when a survey does not completely represent the population of interest. The population of interest in the CPS is the civilian noninstitutional population aged 16 and over (CNP16+). Ideally, every person in this population would have a known, nonzero probability of being sampled or "covered" by the CPS.

### Sampling Frame Omission

The CPS reaches persons in the CNP16+ through a sample of HUs selected from the MAF, which serves as its sampling frame. The MAF is used by several demographic surveys conducted by the Census Bureau. For more information about the MAF, see Chapter 2-1, CPS Frame.

The MAF is a list of living quarters nationwide, updated semiannually, which may be incomplete or contain units that cannot be located. Delays in identifying new construction and adding those HUs to the MAF is the primary cause of frame omission. Other examples of omission include units in multiunit structures missed during canvassing, mobile homes that move into an area after canvassing, and new group quarters that have not been identified.

### Housing Unit Misclassification

CPS operations classify some sampled HUs, including some group quarters (Chapter 2-1, CPS Frame), as temporarily (Type B) or permanently (Type C) out-of-scope. The remaining HUs are treated as in-scope, although some do not respond (Type A). Misclassification can result by identifying too few (overcoverage) or too many (undercoverage) HUs as out-of-scope. Misclassification reduces the efficiency of weighting adjustments made to compensate for HU nonresponse.

Type B HUs remain in interviewer assignments and are rechecked in later months. There are many reasons for a Type B classification. There may be no in-scope persons living in the HU. For example, the unit may be vacant, the adults may all be in the armed forces, the unit may only be inhabited by persons under the age of 16, or all persons in the unit may have a usual residence elsewhere. Examples of other Type B HUs include those under construction but not ready for habitation, conversions to temporary business or storage, and to-be-demolished structures. Type C HUs do not remain in interviewer assignments. Type C examples include demolished structures, mobile residences that have moved, and structures converted to permanent business or storage.

Misclassification errors are minimized with uniform procedures and guidelines for identification of Type B and Type C HUs. However, some structures may not be easily classified by the interviewer. Type B HUs may be especially difficult to identify in some situations as there is a wide range of reasons for that classification. Errors made in classifying out-of-scope HUs affect CPS coverage.

### Housing Unit Roster Error

Creating the HU roster is a step in determining CPS coverage. During the first interview of a HU, the HU roster is established. It can be changed during subsequent interviews.

The automated questionnaire guides the rostering process, minimizing potential errors, and interviewers are trained to handle difficult situations. Some errors may still arise, affecting CPS coverage. Examples include omission of residents, erroneous inclusion of persons, misclassification of persons as armed forces or usual residence elsewhere, and misclassification of demographic information of residents. Demographic information, such as age, sex, race, and ethnicity, is used to benchmark CPS data to corresponding population controls. Misclassification of respondents affects the efficiency of CPS weighting.

Another potential source of coverage error is changing HU composition. A HU is included in the CPS sample for 8 months. It is interviewed for 4 consecutive months, excluded from interview the next 8 months, and interviewed again for the next 4 months. The characteristics of the HU roster are subject to change over this 16-month period (Grieves and Robison, 2013).

### Coverage Ratios

Coverage ratios are measures of CPS coverage monitored at various stages of the weighting process, calculated by dividing weighted respondent totals by corresponding population controls. The weighting and benchmarking steps reduce CPS coverage error by calibrating respondent weights to the population controls for certain demographic subgroups. However, since both the weighting process and the population controls themselves are imperfect, some coverage error remains after the weighting process is complete. For example, the iterative second-stage weighting procedure does not eliminate all nonsampling errors associated with undercoverage or overcoverage. Instead, it eliminates the relative undercoverage or overcoverage compared to benchmark CNP16+ controls for particular subgroups. See Chapter 2-3, Weighting and Estimation, for details about the weighting process and population controls, including specific weighting terminology that is utilized in the tables of this section.

A coverage ratio less than 1.00 represents undercoverage, while a coverage ratio greater than 1.00 represents overcoverage. As displayed in Figure 4-1.1, using first-stage weights, the national coverage ratio for total CNP16+ ranged from 0.872 to 0.900 between December 2014 and December 2017. Coverage ratios remained generally the same over this 3-year time period. Coverage for Whites (0.896 to 0.927) is higher than for total CNP16+, while coverage is poorer for Blacks (0.771 to 0.820), Hispanics (0.787 to 0.842), and other race and ethnicity groups (0.765 to 0.835).

### NONRESPONSE ERROR

After identifying out-of-scope (Type B and Type C) HUs, the remaining sampled HUs are identified as eligible to be interviewed. In any given month of inclusion in the CPS sample, the HU's residents may not provide usable or complete data. This section discusses nonresponse errors in the CPS

Figure 4-1.1.

**Current Population Survey Total Coverage Ratios: December 2014–December 2017, National Estimates**



Source: U.S. Census Bureau, Current Population Survey Monthly Summary Report, December 2014–December 2017.
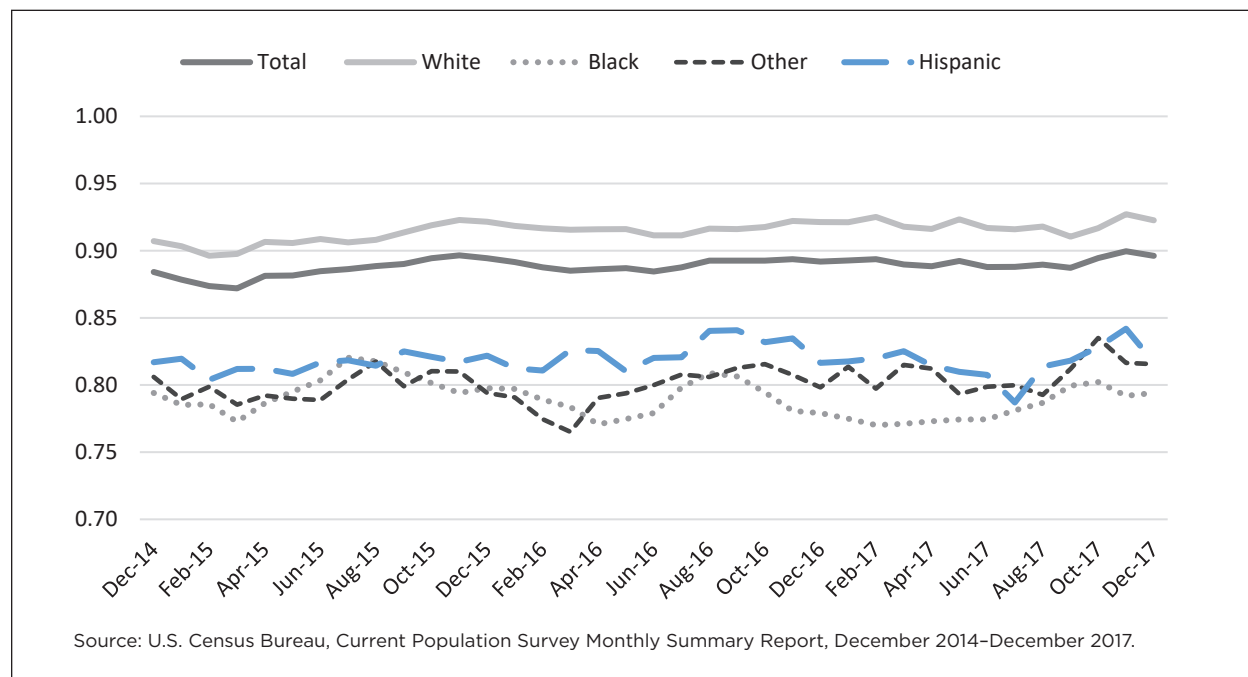
and the methods used to minimize their impact on the quality of CPS estimates.

The CPS is affected primarily by unit nonresponse and item nonresponse. Unit nonresponse occurs when the residents of eligible HUs are not interviewed. Item nonresponse occurs when the residents of HUs eligible for interviewing provide incomplete responses, answering some but not all questions in the interview. Both of these types of nonresponse are discussed in more detail in the following sections.

Person nonresponse occurs when some individuals within an eligible HU are not interviewed. Person nonresponse has not been much of a problem in the CPS because any responsible person aged 15 or over in the HU is able to respond for others in the HU as a proxy.

### Unit (Type A) Nonresponse

In CPS, unit nonresponses—eligible HUs that do not yield any interviews—are called Type A nonresponses. There are many reasons why a Type A nonresponse may occur. A majority of Type A nonresponses are due to refusals, which can result from privacy concerns, attitudes toward

the government, or other reasons. Other potential reasons, such as language barriers or inability to locate HUs, cause few Type A nonresponses, since alternative language speaking interviewers (from the contact centers) and Global Positioning Systems are utilized to avoid these problems.

The Type A nonresponse rate is calculated by dividing total Type A nonresponses by total eligible HUs. This can be computed using raw counts or by weighting each HU by its base weight. National unweighted Type A nonresponse and refusal rates from December 2014 to December 2017 are shown in Figure 4-1.2. The overall Type A rate ranged from 11.7 percent to 15.1 percent during this 37-month timespan, mostly resulting from refusals, which varied between 8.0 percent and 11.9 percent. About two-thirds of Type A nonresponses were due to refusals.

As discussed in Chapter 2-3, Weighting and Estimation, the weights of responding HUs are increased to account for nonresponding units. These nonresponding HUs may systematically differ from responding HUs, introducing bias into the weighting and estimation process. This bias is a source of nonsampling error. Weighting-cell nonresponse adjustment compensates for

Figure 4-1.2.
## Current Population Survey Nonresponse Rates: December 2014–December 2017, National Estimates
(Percent)



Source: U.S. Census Bureau, Current Population Survey Monthly Summary Report, December 2014–December 2017.
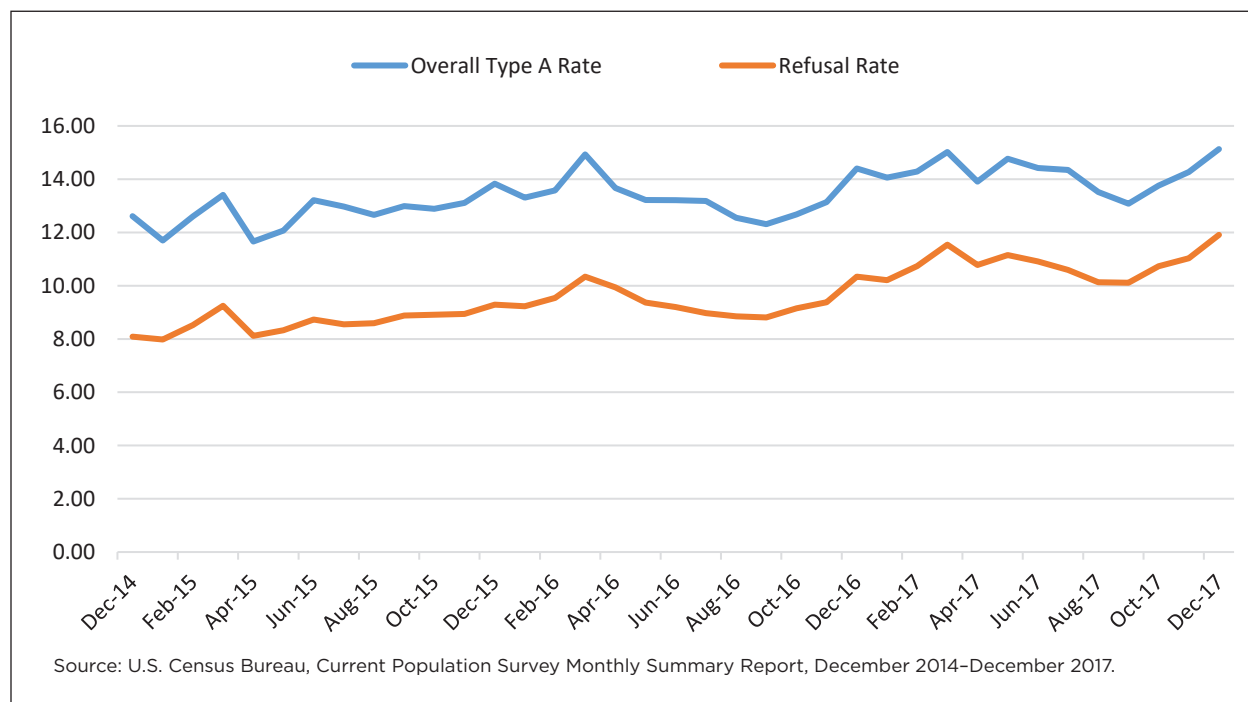
nonresponse rates that differ by geographic area and metropolitan status, which reduces bias due to HU nonresponse but does not eliminate it. How closely responding HUs resemble nonresponding HUs varies by weighting cell.

Dissimilarities between respondents and nonrespondents can arise for many reasons. Mode of interview can affect responses. Households in the CPS sample in the first or fifth month tend to have different response propensities than in other months. Respondents refusing to answer items related to income data are more likely to refuse to participate in subsequent months and are less likely to be unemployed (Dixon, 2012). Demographic information may be related to response propensity in some areas, but it is not explicitly included in weighting cell construction.

The best way to limit nonresponse error is to have uniform procedures in place to limit nonresponse and increase response rates. For example:

- An interviewer must report a possible refusal to the RO as soon as possible so conversion attempts can be made.

- Monthly feedback is provided to the interviewers for converting reluctant respondents.

- All ROs send tailored letters to not-interviewed HUs that remain in the survey for additional months.

Unit nonresponse is also subject to misclassification error. Some Type A nonresponses may be misclassified as Type B (temporarily out-of-scope) or Type C (permanently out-of-scope) HUs. For example, a difficult-to-reach HU may be misclassified as "vacant" when it should be classified as a Type A nonresponse.

By its very nature, unit nonresponse error can be difficult to quantify or assess since it occurs when sample units do not respond to the survey. Research findings by Tucker and Harris-Kojetin (1997) and Dixon (2004, 2012), show little bias arising from unit nonresponse, particularly for major CPS estimates like the unemployment rate.

### Item Nonresponse

Item nonresponse occurs when answers are not provided for all questions (or items) of the CPS

interview. Item nonresponse rates, which include invalid data as well as missing values, vary by question, as shown in Table 4-1.1. Item nonresponse is quite small for demographic and labor force questions, but is larger for industry, occupation, and earnings data.

To minimize item nonresponse, navigation is built into the automated CPS questionnaire so that questions are not inadvertently skipped, and only appropriate responses for a person's path through the questionnaire can be recorded. However, the automated questionnaire does not include extensive editing, and some items can be left blank. For example, a proxy respondent may be unsure of another HU member's hours of work, or a person may refuse to answer a sensitive question.

Ignoring item nonresponse runs the risk of incurring bias. Item nonresponses generally are not randomly distributed. For example, it is common for item nonresponse rates to differ by geography and demographics. The CPS uses item imputation to fill in item nonresponses. Three imputation methods, detailed in Chapter 3-4, Data Preparation, are used:

- **Relational**. Likely values are logically inferred by analyzing monthly answers for other data items provided by the respondent.

- **Longitudinal**. A previous month's value provided by the respondent may be used.

- **Hot deck**. A value is assigned from a similar HU or person.

The CPS imputation procedures are imperfect and can introduce bias. A nonsampling error occurs when an imputed value is incorrect. However, there is no definitive way of knowing which imputed values are incorrect. What is important is the net effect of all imputed values. Imputations are consistent with what is known about the distributions of responses. Biased estimates result when the characteristics of nonrespondents differ from the characteristics of respondents.

The magnitude of nonsampling error arising from item nonresponse is difficult to quantify, but its impact is likely very small for demographic and labor force questions since their item nonresponse rates are very low. Depending on the net effect of imputed values, bias may be (but is not necessarily) larger for industry, occupation, and earnings data since their item nonresponse rates are higher.

## MEASUREMENT ERROR

Survey measurement may be incorrect for a variety of reasons. Vague concepts, imperfectly designed questions, interviewer errors, and respondent errors all can contribute to measurement error. The mode of interview, personal visit or telephone, is known to affect measurement. Errors may arise when a respondent provides answers for another member of the household. A respondent may not know the true answer to a question or may provide an estimate such as for earnings or the dates of a job search. Despite extensive training for interviewers and coders, industry and occupation (I&O) data based on open-ended descriptions given by respondents may be coded incorrectly.

### Automated Questionnaire

CPS concepts are well defined; particularly those for labor force classification (see Chapter 1-2, Questionnaire Concepts and Definitions). When the first automated questionnaire was designed, it was thoroughly tested for agreement with the concepts.

The Census Bureau and the BLS are cautious about adding or changing questions. New questions are reviewed to make sure they will not interfere with the collection of basic labor force information. The testing protocol avoids unintended disruptions to historical series and detects problems with question wording. Refer to Chapter 1-2, Questionnaire Concepts and Definitions, for more information on the CPS questionnaire and the protocol for testing questions.

Table 4-1.1.
### National Current Population Survey Item Types, Monthly Average Percentage of Invalid or Missing Values: July 2017–December 2017

| Household | Demographic | Labor force | Industry and occupation | Earnings[1] |
|---|---|---|---|---|
| 5.5 | 2.9 | 3.2 | 15.0 | 24.4 |

[1] Certain items of the earnings series of questions had invalid/missing rates around 40 percent.
Source: U.S. Census Bureau, Current Population Survey Summary Report, July 2017 through December 2017.

The automated questionnaire contains several features that help control measurement error as listed below.

- Names, pronouns, and reference dates are inserted into questions.

- Question wording is standard and uses plain language.

- Complex questions are split into several shorter questions.

- Navigation of complicated skip patterns is built into the questionnaire, so that a respondent is not asked questions that can be skipped based on answers to earlier questions.

- Human error is reduced by keying responses into predefined categories, so that only valid responses may be accepted for a question.

- On-screen help is available to assist matching open-ended responses to predefined response categories.

- Basic real-time edits check responses for internal consistency, allowing many potential errors to be corrected prior to transmission.

Another helpful feature in controlling measurement error is that HU and person data are carried forward to the next interview. Prior months' responses can be accepted as still current under the proper circumstances such as a person's occupation when there is no change of job. In addition to reducing respondent and interviewer burden, the automated questionnaire avoids erratic variation in I&O codes for people who have not changed jobs but describe their I&O differently in successive months. The automated questionnaire provides the interviewer opportunities to review and correct information before continuing to the next series of questions.

## Mode of Interview

A panel of HUs is included in the CPS sample for 8 months. Ideally, interviews are conducted in person by a FR during a HU's first and fifth months-in-sample (MIS 1 and 5). Interviews during the other months (MIS 2–4 and MIS 6–8) are usually conducted over telephone by a FR or an interviewer from the contact centers. In some cases, a combination of in-person and telephone may be needed to complete an interview.

The mode of interview can systematically affect responses. Mode effects cannot be easily estimated using current CPS sample since there are confounding influences—e.g., HUs are not randomly assigned to interview mode.

A parallel survey was conducted in 1992 to 1993 before the implementation of the automated questionnaire. A study found only modest mode-of-interview effects (Thompson, 1994). It is unknown if similar effects would be realized in the full CPS survey conducted by staff fully acclimated to the automated questionnaire.

## Proxy Reporting

The CPS seeks information about all eligible people in a sample HU, whether or not they are available for an interview. Since CPS data collection occurs in a brief time schedule, interviewers can accept reports from any knowledgeable person in the household aged 15 or older to provide information about all household members.

Respondents who provide answers about other household members are called proxy reporters. Measurement error occurs when proxy reporters are unable to provide accurate information about the demographic and labor force characteristics of other household members. Self-reporting is typically more accurate for CPS data (Kojetin and Mullin, 1995; Tanur, 1994). The CPS instrument is designed to reduce measurement error if a proxy respondent cannot provide labor force or earnings information for someone. The instrument allows the interviewer to skip over the questions for that person and go to the next eligible person. At the end of the interview, the interviewer can ask if anyone else can provide the needed information for the person, and if not, set up a callback for a later time.

Table 4-1.2.
### Percentage of Current Population Survey Labor Force Reports by Type of Respondents: 2015–2017

| Type | Percent |
|------|---------|
| Self reports. . . . . . . . . . . . . . | 50.6 |
| Proxy reports. . . . . . . . . . . . | 49.2 |
| Both self and proxy . . . . . . . | 0.1 |

Source: U.S. Census Bureau, Tabulation of 2015–2017 Current Population Survey Microdata.

Table 4-1.2 shows overall proxy reporting levels for 2015 through 2017. The level of proxy reporting in the CPS has historically been around 50 percent.

Proxy reporters are more likely to be found at home when the interviewer calls or visits. For this reason, the incidence of proxy reporting tends to be systematically related to important labor force characteristics and demographics. If proxy answers contain systematic reporting errors, then bias is introduced into related estimates. As it is difficult to measure how much response error occurs due to proxy reporting, it is difficult to assess the resulting bias in CPS estimates.

## OTHER SOURCES OF NONSAMPLING ERROR

### Industry and Occupation Coding Verification

Files containing records needing I&O codes are transmitted electronically to the National Processing Center (NPC). For each record on the file, the NPC coder enters four-digit numeric I&O codes that best represent the job description recorded during the CPS interview. Nonsampling error can arise during the coding process due to unclear descriptions or incorrect coding assignment.

A substantial effort is directed at the supervision and quality control of the I&O coding operation. If the initial coder cannot determine the proper code, the case is assigned a referral code and will later be coded by a referral coder. During coding, a supervisor may turn on dependent verification in which the work is verified by a second coder. Additionally, a sample of each month's cases is selected to go through a quality assurance system to evaluate each coder's work. See Chapter 3-4, Data Preparation, for more information on I&O coding.

### Current Population Survey Population Controls

Benchmark controls for the monthly CNP16+ are used for the weighting steps that produce second-stage weights and composite weights. National and state CPS population controls are developed by the Census Bureau. Starting with data from the most recent decennial census, the population controls are estimates that are annually updated using administrative records and

projection techniques. This is done independently from the collection and processing of CPS data. See Chapter 2-3, Weighting and Estimation, for more detail on weighting and population controls.

As a means of controlling nonsampling error throughout the process of creating population controls, numerous internal consistency checks in the programming are performed. For example, input files containing age and sex details are compared to external counts and internal redundancy is intentionally built into the system. The BLS reviews a time series of CNP16+ population controls for unexpected changes. An important means of assuring that quality data are used as input into the CPS population controls is continuous research into improvements in methods of making population estimates and projections.

The population controls have no sampling error, but nonsampling error is present, specifically arising from statistical modeling. The modeled changes over time tend to be smooth, and although some subnational CNP16+ populations may fluctuate seasonally, there is no seasonal component in the models. There is also nonsampling error in the input data for the models. The inputs are examined and frequently updated in order to limit nonsampling error. CPS implements changes in the CNP16+ controls each January, resulting in level shifts for some series that affect CPS weighting and estimation.

While the CNP16+ controls contain nonsampling error, there are many benefits to using them in CPS weighting. The decennial censuses exercise extreme care in ensuring good population coverage. Changes over time are relatively smooth, whereas CPS estimates of the CNP16+ would appear erratic, primarily due to sampling error, if not benchmarked to these controls. The models used to update the population controls have performed well historically.

### Month-in-Sample Bias

The CPS is a panel survey with a 4-8-4 rotation scheme (Chapter 2-2, Sample Design). Each panel, or rotation group, is included in the survey 4 consecutive months-in-sample (MIS 1–MIS 4), is rotated out for 8 months, and is rotated back in for another 4 consecutive months (MIS 5–MIS 8). Collected data systematically differs across the 8

months in sample, and this is referred to as MIS bias. Several possible sources contribute to MIS bias. Each MIS has a different mix of data collection modes, persons listed on housing rosters (Grieves and Robison, 2013), and different housing-unit nonresponse rates. Although MIS bias has changed over the decades (Erkens, 2012), one continuing characteristic is that the estimated unemployment rate is usually highest in MIS 1.

The usual MIS bias measure used by the CPS is a simple ratio index. This index is the ratio of the estimate based on a particular MIS group to the average estimate from all eight MIS groups combined, multiplied by 100. This calculation treats the average of all eight MIS groups as an unbiased estimate. Table 4-1.3 shows 2014 to 2015 2-year average MIS bias indexes for total employed and total unemployed.

While the MIS bias indexes are close to one for all months for total employed, for total unemployment they are much more variable. Relatively, the estimate of unemployed persons is higher in MIS 1 than in other months, and there is a decreasing trend across the MIS, such that MIS 7 and MIS 8 tend to have the lowest estimates of unemployed persons.

## Composite Estimation

Composite estimates, described in Chapter 2-3, Weighting and Estimation, systematically differ from second-stage estimates. Presuming that second-stage estimates are closer to unbiased than composite estimates, the composite estimation process introduces a bias into estimates that is more noticeable for estimates of levels than rates. This bias is a form of nonsampling error.

In 2014 and 2015, average monthly composite estimates of total employment fell below second-stage estimates by more than 400,000.

Analogously for unemployment, composite estimates fell below second-stage estimates by more than 100,000. Over that same time frame, average monthly composite estimates of the labor force participation rate and employment-population ratio were about 0.2 percent lower, while the composited unemployment rate fell below second-stage estimates by an average of 0.05 percent.

## Seasonal Adjustment

Seasonal adjustment models, described in Chapter 2-5, Seasonal Adjustment, are applied to CPS composite estimates. Seasonal adjustment models are generated using X-13ARIMA-SEATS software. Relating to nonsampling errors, two perspectives may be considered:

- In the strict sense of classical finite sampling theory, seasonal adjustment is a linear or near-linear transformation of the survey data, which does not introduce any new nonsampling errors into the estimation process. Any nonsampling error present in the seasonal adjustment process already existed in the survey.

- Viewed in a broader context, seasonal adjustment may introduce some model specification error and error arising from estimating the unobserved seasonal component, but because it performs smoothing of the estimates it likely reduces total error (inclusive of sampling error). To minimize the potential impact of specification error, seasonally adjusted series are thoroughly reviewed to confirm that the ARIMA models fit sufficiently well.

In either perspective, seasonal adjustment is not considered to be a major source of nonsampling error in the CPS, and sampling error tends to be reduced as a result of the seasonal adjustment

Table 4-1.3.
### Month-in-Sample Bias Indexes for Total Employed and Total Unemployed Average: January 2014–December 2015

| Employment | Month-in-sample | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Employed . . . . . . . . . . | 1.02 | 1.02 | 1.01 | 1.01 | 0.99 | 0.98 | 0.98 | 0.99 |
| Unemployed. . . . . . . . | 1.14 | 1.06 | 1.04 | 0.98 | 0.97 | 0.95 | 0.92 | 0.93 |

Source: U.S. Census Bureau, Tabulation of 2014–2015 Current Population Survey microdata.

process at the state or local level (Tiller, 1992) and the national level (Evans et al., 2015).

## METHODS TO REDUCE NONSAMPLING ERROR

### Interviewer Training and Performance Monitoring

Comprehensive interviewer training can reduce nonsampling error. Training to convert reluctant respondents can improve CPS response rates, and higher response rates are associated with lower nonresponse error. In addition, interviewer training lessens response error by improving the accuracy of survey data.

Interviewers are trained on concepts, on what answers are acceptable, on how to interpret verbal responses, on how to choose the correct responses from menus, and on how to probe to obtain sufficient information from a respondent. Detailed manuals are provided to interviewers.

Monitoring and observing interviewers can also reduce nonsampling error. Interviews are observed immediately after interviewers complete initial training. Additionally, observations are made as part of general performance review and for interviewers who are identified as needing additional help. Interviews in the contact centers are regularly monitored by supervisors with feedback provided to the interviewer. The emphasis is on reinforcing good habits and correcting habits that interfere with the collection of reliable statistics. Refer to Chapter 3-5, Organization and Training of the Data Collection Staff, for more information.

Behavior that is examined during observation or monitoring includes whether interviewers:

- Ask questions as worded and in the order presented on the questionnaire.

- Adhere to instructions on the instrument and in the manuals.

- Probe for answers that are consistent with CPS concepts.

- Avoid follow-up questions or probes that suggest a particular answer to the respondent.

- Record answers in the correct manner and in adequate detail.

- Develop and maintain good rapport with the respondent conducive to obtaining accurate information.

- Determine the most appropriate time and place for the interview.

- Are competent in using the laptop or computer.

In addition, continuing efforts are made to improve interviewer performance. Periodic refresher training and training on special topics is given to all interviewers. Quality assurance procedures (such as the reinterview program described in Chapter 4-2, Reinterview Design and Methodology), administrative procedures, and the collection of performance measures all contribute to evaluating the performance of interviewers. When needed, tailored training is assigned to an interviewer.

Performance measures are gathered on each interviewer's monthly assignment, including Type A nonresponse rate, item nonresponse rates, reasons for nonresponse, number of HUs classified as Type B and Type C, and length of time taken per interviewed HU. Many of these measures are gathered and examined by automated methods.

Acceptable ranges are set for some performance measures. An interviewer may have poor response rates, too many noninterviews, an unusually high rate of blank items, or an unusually high or low minutes-per-interview measure. If so, the interviewer is considered to be in need of additional training or other remedial action.

FR performance measures are summarized for the nation and each RO. Each RO can make a determination about any general remediation that is needed to improve interviewer performance. National "don't know" and refusal rates are monitored for individual questions; a high item nonresponse rate may be attributable to the question itself and not to poor interviewer performance. Changes to historical response patterns can be detected.

Finally, additional monitoring and evaluation is done by experts in questionnaire design and interviewing (behavioral scientists). Observation by behavioral scientists provides a platform for assessing interviewers' attitudes toward the job and is an attempt to evaluate individual interviewers. In conjunction with other techniques, such as interviewer debriefing, the aim is to improve overall data collection. Behavioral scientists' studies can recommend changes to training, instructions, the automated questionnaire, or survey procedures.

### Edit Modules

After transmission to Census Bureau headquarters, there are eight edit modules applied to the data (Chapter 3-4, Data Preparation):

- Household.
- Demographic.
- Labor force.
- I&O.
- Earnings.
- School enrollment.
- Disability.
- Certification.

Each module establishes consistency between logically related monthly items. Longitudinal checks are made for consistency with prior responses. Inappropriate entries are deleted and become item nonresponses. If the labor force edit finds that insufficient data has been collected to determine a person's labor force status, then data for that person is dropped.

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# Chapter 4-2: Reinterview Design and Methodology

## INTRODUCTION

The CPS Reinterview Program, which has been in place since 1954, conducts a second interview on about 3 percent of sample households each month. This quality control (QC) reinterview program provides a measure of control or feedback about the quality of data received from the respondent and the original interviewer. The QC reinterview is used to deter data falsification and to monitor the FRs adherence to established procedures.

## REINTERVIEW DATA SELECTION AND COLLECTION

The sample for the QC reinterview is a subsample of the CPS. For this subsample, HUs are selected by a specific method and specific field procedures are followed. To minimize respondent burden, a subsampled household is reinterviewed only once. Sample selection for reinterview is performed immediately after the monthly interview assignments to FRs. This sample does not include the contact center's Computer-Assisted Telephone Interviewing (CATI) interviewers because the contact centers have their own QC program in place. With the CATI monitoring program, interviews are recorded (with the permission of the respondent) and reviewed by coaches and monitoring staff. These staff members review and evaluate the interviewers' performance and provide feedback to the interviewers.

The QC reinterview is used to measure some nonsampling errors (as discussed in Chapter 4-1, Nonsampling Error) attributable to FRs. The QC reinterview is used to make decisions as to whether the FRs adhered to procedures and to check for any possible falsification. QC reinterview checks if the FR:

- Falsified responses.
- Did not ask questions as worded.
- Did not ask all questions.
- Provided auxiliary information that could influence or lead a respondent to answer differently.
- Did not use the proper equipment to capture data.

- Did not maintain the standards established by the Census Bureau and BLS.

### Sampling Methodology

Previous research has indicated that inexperienced FRs (less than 5 years of work with the Census Bureau) are more likely to have significant procedural errors than experienced FRs, so more of them are selected for QC reinterview each month (U.S. Census Bureau, 1993 and 1997). Research has also indicated that inexperienced FRs falsify a greater percentage of households than experienced FRs, so fewer of their cases (households) are needed to detect falsification. The QC reinterview sampling selection system is set up so that a selected FR is in reinterview at least once but no more than four times within a 15-month cycle.

The QC reinterview sample is selected in two stages:

First Stage (assignment of FRs for QC reinterview)

- The QC reinterview uses a 15-month cycle. FRs are randomly assigned to one of the 15 different groups. Throughout the cycle, new FRs are assigned to the groups.

- The system is set up so that an FR is in reinterview at least once but no more than four times within the 15-month cycle.

Second Stage (subsample of households for QC reinterview)

- Each month, one of the 15 groups of interviewers is included for QC reinterview.

- A subsample of households is selected from each FR's interview assignment.

- The number of households subsampled per FR assignment is based on the length of tenure of the FR (fewer for inexperienced FRs since fewer cases are needed to detect falsification).

- Typically, 3 percent of CPS households are assigned for QC reinterview each month.

In addition to the two-stage QC reinterview sample, any FR with an original interview assignment can be put into supplemental reinterview. These are cases available to the ROs to add to reinterview at their discretion. The FR can be flagged for supplemental reinterview for the next assignment

period or the FR's inactive cases can be activated during the current assignment period. Inactive cases are those cases that were not selected for the prior two-stage or the supplemental reinterview. FRs flagged for review based on various data quality indicators may be put into supplemental reinterview.

All households are eligible for QC reinterview, except noninterviews for occupied households. Eligible households include completed and partial interviews as well as noninterviews due to the HU being unoccupied such as vacant units. In addition, FRs are evaluated on their rate of noninterviews for occupied households with penalties for a high noninterview rate. Therefore, FRs have no incentive to misclassify a case as a noninterview for an occupied household. See Figure 4-2.1 for an overview of determining QC reinterview household eligibility and data collection methods.

### Data Collection Methods

Contact centers attempt all QC reinterviews with a valid telephone number, and if not completed, the cases are then transferred to the ROs for assignment to FRs. Cases without a valid telephone number are sent directly to the ROs for assignment to FRs. These FRs must not fall under

the same supervisory chain as the original FR who conducted the interview. This minimizes bias when reviewing the work of the FR. Most reinterviews are conducted by telephone, but in some cases by personal visit. They are conducted on a flow basis extending through the week following the interview week.

For QC reinterview, the reinterviewers are instructed to try to reach the original household respondent, but are allowed to conduct the reinterview with a proxy, another eligible household respondent.

The QC reinterview asks questions to determine if the FR conducted the original interview and followed interviewing procedures. The labor force questions are not asked. The QC reinterview instrument allows reinterviewers to indicate whether any noninterview misclassifications occurred or any falsification is suspected.

### Quality Control Reinterview Evaluation

Cases are assigned outcome codes and disposition codes. These codes are based upon the judgment of the reinterviewer and the response of the reinterview respondent. The outcome codes are used as an indicator of the reinterview result (e.g., confirming correct or incorrect information, the

Figure 4-2.1.
### Quality Control Reinterview Sampling Diagram
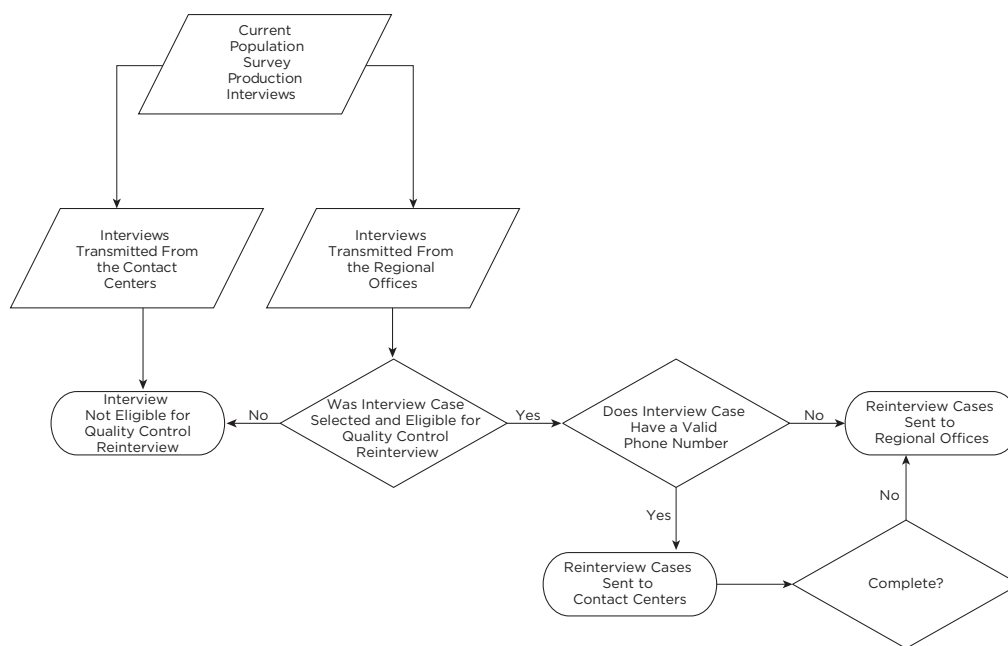
type of noninterview, or any discrepancies found). The reinterview outcome codes are similar to the ones used for the original interviews (see Table 3-2.1 of Chapter 3-2, Conducting the Interviews).

Disposition codes are used as an indicator for cases suspected of falsification, which triggers a falsification investigation. The most common cause for a disposition of suspected falsification is a finding that FR training procedures were not followed. A data falsification investigation is triggered by the case being flagged as having at least one of three discrepancy types: household was not contacted; the interviewer classified the unit as a Type B or C noninterview when it should have been an interview or Type A; or the respondent said the interviewer did not use a laptop during a personal visit interview. Any of these discrepancies would be considered a major departure from FR training procedures.

Reinterview outcome and disposition codes are summarized in a manner similar to those for the original interview (refer to Table 3-2.8 of Chapter 3-2, Conducting the Interviews). Examples of reinterview results are shown in Table 4-2.1 and Table 4-2.2.

## Adherence to Training Procedures

Reinterview is a quality check for FRs, to check their adherence to training procedures. Most of the suspected cases stem from a deviation from training procedures. Findings such as those below typically result from these deviations:

- According to the respondent, the FR did not contact the household.
- The FR was not polite.
- The FR did not use a laptop during an in-person interview.
- According to the respondent, there were errors made on the household roster.

## Falsification

Reinterview can help provide measures of "curbstoning" or survey data falsification (Kennickell, 2015) and serves as a deterrent.

Falsification can be defined as a manipulation of the data collected. It can be intentional or unintentional. Examples of unintentional falsification can range from a simple typo to a household member omission or deviations from procedure. Examples of intentional falsification can range from making up one or more responses to having fictional interviews. FRs suspected of falsification may undergo an investigation; results of these investigations can vary from an oral or written warning, recommendations for additional training, or termination.

Periodic reports on the QC reinterview program are issued. These reports identify: (1) a preliminary count of cases and FRs suspected of falsification, (2) the results of the investigation with the confirmed falsification counts for cases and FRs, and (3) unweighted (see formula below) and weighted falsification rates. (See Appendix A, Weighting Scheme for Quality Control Reinterview Estimates).

### Unweighted Falsification Rate

$$= \left( \frac{\text{\# of interviewers suspected of falsification}}{\text{\# of interviewers in reinterview}} \right)$$

Since FRs are made aware of the QC reinterview program and are informed of the results following reinterview, falsification has not been a major problem in the CPS. Only about 0.5 percent of CPS FRs are found to have falsified data. FRs found to have falsified data typically resign or have their employment terminated.

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U.S. Census Bureau, "Falsification Study Results for 1990–1997," memorandum from Preston Jay Waite to Richard L. Bitzer, May 8, 1997.

Table 4-2.1.
**Reinterview Results for November 2016—Counts**

| Description | November 2016 |
|---|---|
| **ORIGINAL INTERVIEW CASES SELECTED FOR RANDOM REINTERVIEW** . . . . . . . . . . . . . . . | **1,897** |
| | |
| **ORIGINAL INTERVIEW CASES ELIGIBLE FOR RANDOM REINTERVIEW** . . . . . . . . . . . . . . . . | **1,629** |
| Complete or sufficient partial reinterviews . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1,217 |
| Reinterview noninterviews . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 412 |
| Noninterviews . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 367 |
| Headquarters discretion . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 45 |
| Regional office discretion . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| | |
| **NONINTERVIEWS EXCLUDING HEADQUARTERS AND REGIONAL OFFICE DISCRETION CASES** | |
| **Type A.** . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | **361** |
| Language problem . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 |
| Unable to locate . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 6 |
| Unable to complete, bad telephone number . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 73 |
| Insufficient partial . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 |
| No one home . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 101 |
| Temporarily absent . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 4 |
| Respondent can't remember or refused . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 55 |
| Other Type A . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 120 |
| | |
| **Type B.** . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | **2** |
| Entire household under or over age limit . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Temporarily occupied by persons with URE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 |
| Vacant, regular . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 |
| Vacant, storage of household furniture . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Converted to temporary business or storage . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Unoccupied mobile home, trailer, or tent site . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Household institutionalized or temporarily ineligible . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Unfit, to be demolished . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Other Type B . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| | |
| **Type C.** . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | **2** |
| Demolished . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| House or trailer moved . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Converted to permanent business or storage . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Condemned . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Moved out of country . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0 |
| Deceased . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 |
| Other Type C . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 |
| | |
| **Type D.** . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | **2** |
| Household replaced by new household . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 2 |

Source: U.S. Census Bureau, Demographic Statistical Methods Division, November 2016 Current Population Survey Reinterview.

Table 4-2.2.
**Reinterview Results for November 2016—Statistics**

| Description | November 2016 |
|---|---|
| **Number of interviewers in reinterview**.................... | **482** |
| **Number of reinterview cases conducted**.................. | **1,629** |
| **Reinterview completion rate**............................ | **74.7% (1,217/1,629)** |
| Telephone reinterview rate................................ | 91.3% (525/575) |
| Proxy reinterview rate..................................... | 4.6% (75/1,629) |
| Household accuracy rate ................................... | 97.3% (934/960) |
| Households with missing members (adds).................. | 15 |
| Households with additional members (drops)............... | 9 |
| Households with both adds and drops ..................... | 2 |
| Original noninterview misclassification rate.................. | 5.5% (19/347) |
| **Total discrepancies**..................................... | **225** |
| Household not contacted.................................. | 26 |
| Status incorrect........................................... | 50 |
| Roster incorrect .......................................... | 26 |
| Not all questions asked.................................... | 41 |
| **Laptop usage rate** ...................................... | **98.0% (436/445)** |
| **No laptop used**......................................... | **9** |
| Bad phone number collected .............................. | 73 |
| **Suspected falsification rate by reinterview cases conducted**.......................................... | **4.9% (80/1,629)** |
| **Suspected falsification rate by interviewer**................ | **13.9% (67/482)** |
| Number of interviewers with falsification confirmed.......... | 1 |

Source: U.S. Census Bureau, Demographic Statistical Methods Division, November 2016 Current Population Survey Reinterview.

# Appendix: Weighting Scheme for Quality Control Reinterview Estimates

To produce reinterview weights, data are stratified by the reinterview period and the experience level of the FRs. For the CPS, FRs are considered experienced after 5 years of work at the Census Bureau. Each month of the year is an interview period for the CPS. The data related to the quality of the production survey (falsification, household coverage/roster accuracy, politeness, noninterview misclassification, discrepancies) are weighted for the QC reinterview reports, provided there are sufficient experience-level data available for the CPS FRs. The data related to the quality of the reinterview survey (reinterview completion rate, lag time average, reinterview telephone rate) are not weighted.

At the beginning of each 15-month CPS cycle, CPS FRs are randomly assigned to one of 15 groups. New CPS FRs throughout the cycle are added to the groups. Generally, FRs are not regrouped throughout the cycle. A sample for random reinterview is selected each month. The sample size will depend on the experience level of the FR originally assigned to the case. Each case preselected for reinterview remains in the reinterview sample even if the case is reassigned to another FR in the same RO.

The reinterview weight is the reciprocal of the probability of selection into the reinterview sample. The probability of selection in an interview period is dependent upon:

- The numbers of experienced and inexperienced FRs selected for random reinterview for the interview period.

- The total numbers of experienced and inexperienced FRs for the interview period.

- The number of cases preselected for random reinterview in the interview period for each originally assigned FR.

- The originally assigned FR's assignment size in the interview period.

To determine the reinterview weight for cases originally assigned to a specific FR during an interview period:

1. Assess the FR's experience level, j, for that interview period (month).

2. Compute $P_{1j}$ as follows:
$$P_{1j} = \frac{\text{\# of cases preselected for random reinterview for that FR for interview period}}{\text{\# of production cases originally assigned to that FR for interview period}}$$

3. Compute $P_{2j}$ as follows:
$$P_{2j} = \frac{\text{\# of FRs of experience level j preselected for reinterview for interview period}}{\text{\# of FRs of experience level j in interview period}}$$

4. The probability of selection of production cases originally assigned to that FR into reinterview for that interview period is pj = $P_{1j} * P_{2j}$ .

5. The reinterview weight for all random reinterview cases originally assigned to that CPS FR for that interview period is wj = $1/P_j$ .

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# Acronyms

| | |
|---|---|
| ACS | American Community Survey |
| ADS | Annual Demographic Supplement |
| AHS | American Housing Survey |
| ARD | Assistant Regional Director |
| ARIMA | Auto-Regressive Integrated Moving Average |
| ASEC | Annual Social and Economic Supplement |
| ATUS | American Time Use Survey |
| BLS | Bureau of Labor Statistics |
| CAI | Computer-Assisted Interviewing |
| CAPI | Computer-Assisted Personal Interviewing |
| CARMN | Cost and Response Management Network |
| CATI | Computer-Assisted Telephone Interviewing |
| CAUS | Community Address Updating System |
| CBSA | Core-Based Statistical Area |
| CCM | Civilian U.S. Citizen's Migration |
| CCO | CATI and CAPI overlap |
| CE | Consumer Expenditure |
| CES | Current Employment Statistics |
| CHIP | Children's Health Insurance Program |
| CI | Coverage Improvement |
| CNP | Civilian Noninstitutional Population |
| CNP16+ | Civilian Noninstitutional Population age 16 and over |
| CNCS | Corporation of National and Community Service |
| CPS | Current Population Survey |
| CV | Coefficient of Variation |
| DAAL | Demographic Area Address Listings |
| DSD | Demographic Systems Division |
| DSF | Delivery Sequence File |
| DSMD | Demographic Statistical Methods Division |
| EDS | Exclude from Delivery Statistics |
| EDMAFX | Edited MAF Extract |
| FNS | Food and Nutrition Service |
| FR | Field Representative |
| FS | Field Supervisor |
| GEMEnA | Group on Expanded Measures of Enrollment and Attainment |
| GEO | Geography Division |
| GEOP | Geographic Programs Operation |
| GDP | Geographic Data Processing |
| GIS | Geographic Information System |
| GPS | Global Positioning System |

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| | |
|---|---|
| GQ | Group Quarters |
| GRF | Geographic Reference File |
| GVF | Generalized Variance Function |
| HU | Housing Unit |
| HVS | Housing Vacancy Survey |
| I&O | Industry and Occupation |
| IDS | Include in Delivery Statistics |
| LACS | Locatable Address Conversion System |
| LAUS | Local Area Unemployment Statistics |
| LUCA | Local Update of Census Addresses |
| MAF | Master Address File |
| MAFCS | MAF Coverage Study |
| MAFID | MAF Identifier |
| MAFOP | MAF Operations |
| MCS | Master Control System |
| MIS | Month-In-Sample |
| MIS1 | Month-In-Sample 1 |
| MLR | Major Labor Force Recode |
| MOS | Measure of Size |
| MSA | Metropolitan Statistical Area |
| N1, N2, N3 | Initial Observations 1, 2, and 3 |
| NAICS | North American Industry Classification System |
| NCEUS | National Commission on Employment and Unemployment Statistics |
| NCS | National Comorbidity Survey |
| NCVS | National Crime Victimization Survey |
| NICL | noninterview clusters |
| NILF | Not in Labor Force |
| NIM | NICE Interaction Management |
| NPC | National Processing Center |
| NRAF | Net Recruits to the Armed Forces |
| NSR | Non-Self-Representing |
| OMB | Office of Management and Budget |
| PIP | Performance Improvement Plan |
| PSU | Primary Sampling Unit |
| PWBA | Pension and Welfare Benefits Administration |
| QC | Quality Control |
| RD | Regional Director |
| RDD | Random-Digit Dialing |
| REGARIMA | Combined regression and ARIMA time series model |
| RO | Regional Office |
| ROSCO | Regional Office Survey Control System |
| RSE | Relative Standard Error |

| RSM-E | Regional Survey Managers - Expert |
|---|---|
| RSM-G | Regional Survey Managers - Geography |
| SCHIP | State Children's Health Insurance Program |
| SEATS | Signal Extraction in ARIMA Time Series |
| SECU | Standard Error Computation Unit |
| SIPP | Survey of Income and Program Participation |
| SN | Special Needs |
| SOC | Standard Occupational Classification |
| SR | Self-Representing |
| SRS | Simple Random Sample |
| SS | Second-Stage |
| Sups | Supervisory Statistical Assistants |
| TIGER | Topologically Integrated Geographic Encoding and Referencing System |
| TOI | Time of Interview |
| UE | Unemployed |
| UFUF | Unit Frame Universe File |
| URE | Usual Residence Elsewhere |
| USPS | United States Postal Service |
| USU | Ultimate Sampling Unit |
| VPN | Virtual Private Network |
| WPA | Work Projects Administration |

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