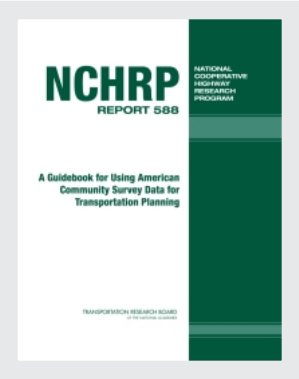

A Guidebook for Using American Community Survey Data for Transportation Planning

DETAILS

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 588

A Guidebook for Using American Community Survey Data for Transportation Planning

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Subject Areas
Planning and Administration • Operations and Safety • Aviation • Public Transit
Rail • Freight Transportation • Marine Transportation

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in cooperation with the Federal Highway Administration

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2007
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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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FOREWORD

By Kimberly M. Fisher
Staff Officer
Transportation Research Board

Census data have long played a central role in transportation planning and analyses. In particular, the planning community has made extensive use of the Census Long Form. Beginning with this decade, the Census Bureau's American Community Survey (ACS) will replace the Census Long Form. This practitioner's guidebook focuses on incorporating ACS data into the transportation planning processes at national, state, metropolitan, and local levels. The guidebook evaluates ACS data and products and demonstrates their uses within a wide range of transportation planning applications. Transportation planners, travel demand forecasters, and others that conduct population and demographic analyses will find this report of significant use. As these transportation professionals struggle to use the limited local data and changing national data as the basis for transportation plans, the report will provide methods and tools to improve the connection between planning and programming.

Transportation planners have relied heavily on the decennial Census "long form" data because these data provided detailed demographic characteristics along with journey-to-work data for small units of geography such as census tracts or traffic analysis zones (TAZs). It is the long form that provided data for the Census Transportation Planning Package (CTPP), the mostly widely used database for transportation planning. The U.S. Census Bureau is replacing the long form with a continuous data collection program called the American Community Survey (ACS). The transportation planning community needs to know how to use this new source of data in applications such as long-range planning and forecasting, environmental and project analysis, and descriptive statistics. The ACS differs from the decennial Census in many ways, especially as it represents a change from data collected at a single point-in-time (April 1, 2000) to data collected continuously throughout the year and summarized annually for large geographic units. Data for TAZs or tracts will be available based on a moving average of data accumulated over a 5-year period.

The ACS provides new opportunities and challenges for assessing transportation trends. Guidance is needed on the application, interpretation, and presentation of these new data for transportation planning practitioners and policymakers. This guidebook identifies the key issues that will face transportation planners as they use ACS data to complete analyses that have historically been performed with the decennial Census Long Form data and outlines potential new transportation planning analyses that transportation planners may conduct with the ACS.

This research effort was conducted by Cambridge Systematics, Inc. along with NuStats, Nancy McGuckin, and Earl Ruiter under NCHRP Project 8-48.

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CHAPTER 1

Introduction

1.1 Overview of the American Community Survey

Census data have long played a central role in transportation planning and analyses. In particular, transportation planners are heavy users of data products concerning population and household characteristics that are derived from the decennial census Long Form, such as the following:

- Summary File data (SF3 and SF4), tables, and profiles;
- Public Use Microdata Sample (PUMS) data (1 percent and 5 percent samples); and
- Census Transportation Planning Package (CTPP) tables (Parts 1, 2, and 3).

Beginning with this decade, the Census Bureau's American Community Survey (ACS) will replace the decennial census Long Form as the preeminent source of U.S. population and household characteristics. In previous decennial censuses, residents of one out of every six addresses were asked to complete the Long Form of the census questionnaire, which gathered demographic, socioeconomic, and housing characteristics data, in addition to the base census questionnaire (or census "Short Form"), which gathered constitutionally mandated population counts, along with age, race, and gender information.

Beginning in 2010, the decennial census will focus solely on collecting the basic census counts by age, race, and gender. The Census Bureau is now collecting additional population and household characteristics data through the rolling sample ACS. Each year, about 3 million of the U.S. addresses, 36,000 Puerto Rico addresses, and residents of 2.5 percent of group quarters facilities will participate in the ACS, providing data that are more up to date, timely, and probably more accurate than the decennial census Long Form data. The primary cost to the data user is a reduction in sample size and the corresponding need to accumulate data over time and/or across geography.

The Census Bureau's stated goals for the ACS are to

- Provide federal, state, and local governments with an information base for the administration and evaluation of government programs;
- Facilitate improvement of the 2010 Census by allowing the decennial census to focus on counting the population; and
- Provide data users with timely demographic, housing, social, and economic statistics updated every year that can be compared across states, communities, and population groups.

The Census Bureau began developing the ACS in the mid 1990s after many years of research indicated the potential value of a "continuous measurement" data collection program. During the initial ACS test period between 1996 and 1998, while the program was still somewhat experimental, preliminary ACS data were collected for a few test sites.

In 1999, the number of test sites was increased to 31 locations, comprising 36 counties and representing a broad range of communities that were selected to provide different combinations

of population sizes, population characteristics, population growth levels, and difficulty of enumeration. The data collection effort for the 31 test sites has been performed annually since 1999. In addition to the test site program, the Census Bureau performed a large-scale (1,203 counties) operational test of ACS methods in the year 2000, entitled the Census 2000 Supplementary Survey (C2SS). In 2002, 2003, and 2004, the data for the 31 test sites were supplemented with data collected for the 1,203 counties in the C2SS.

The Census Bureau began full implementation of ACS for all housing units in 2005. Beginning in 2006, the Census Bureau will start collecting group quarters data, as well as housing unit data. Thus, from 2006 onward, ACS should provide comparable coverage to the decennial census Long Form data collection.

1.2 Some Important Implications of ACS for Data Users

The discontinuation of the decennial census Long Form and the implementation of ACS will significantly affect how transportation planners access, use, and interpret data on population and household characteristics.

Later sections of this guidebook will discuss the details of ACS implementation and how ACS will affect transportation data users' analyses. Some of the more important implications of ACS for transportation data users are summarized here. These, and other ACS issues, are developed further later in the guidebook.

1.2.1 Frequency of Data Releases

The primary benefit of ACS is that the data are being collected and will be disseminated more frequently than the once-in-10-years decennial census Long Form data. Data users will no longer need to rely on aging "snapshot" estimates of population and housing characteristics. Instead, they will be able to use more recently collected data whose accuracy and relevance will not depend on how closely the analysis year conforms to the decennial census year. In addition, the increased frequency of data releases will enable data users to analyze trends over shorter time periods.

1.2.2 Differences between Census 2000 and ACS

Unfortunately, the ACS's differences with the previous census Long Form, in terms of data collection procedures and questions, will make it more difficult for users to compare ACS results with previous census estimates and to understand longer-term trends in demographic, socioeconomic, and economic characteristics. Determining whether differences between ACS estimates and year 2000 Census estimates reflect actual differences in the populations of interest will require analysts to understand the survey differences and to be able to perform significance tests on sample data.

1.2.3 Reduced Sample Size and the Need for Data Accumulation

For the next few years, the ACS sample size will be equivalent to slightly less than 1-in-40 addresses. The decennial census Long Form was sent to about 1-in-6 addresses, with some areas with slightly higher rates and some with slightly lower rates.

Because of the reduced sample size of ACS, it is not possible to replicate the decennial census Long Form data on an annual basis. For most analyses, data users will need to rely on estimates derived from accumulating ACS data across years. ACS annual estimates will be released for areas

with population greater than 65,000, starting with 2005 data that will be released in the fall of 2006. So, for these larger population areas, data users will get new independent ACS estimates for the previous year. Three-year accumulated average estimates will be released for areas with population greater than 20,000 starting in year 2008. In that year, the Census Bureau will release estimates for those areas that are based on averaging the ACS data from 2005, 2006, and 2007. Five-year accumulated averages will be released for all areas starting in year 2010, using accumulated averages for the years 2005, 2006, 2007, 2008, and 2009.

The three- and five-year accumulated averages will be developed every year using the preceding three or five years of ACS data, but analysts will need to be aware that multiyear estimates reported for a specific year are not independent of previous multiyear estimates that have overlapping years. In addition, data users will need to understand the potential impacts of using characteristics data accumulated over time when those characteristics are changing year to year.

1.2.4 Understanding and Reporting Sample Data

Both the decennial census Long Form and ACS are samples of the overall population. Therefore, estimates from both data sources contain uncertainty. Despite the fact that the Census Bureau provides variance estimates for Long Form data, in most cases when using census Long Form data, analysts take the reported estimates as simple points and ignore the level of variance present. However, for the ACS, with its lower sample sizes, the Census Bureau is instructing and enabling users to account for the inherent sampling error in their analyses. The Census Bureau ACS data tables include 90 percent confidence intervals for all estimates so that users can readily see the relative level of uncertainty in the estimates.

Data users will need to determine how the higher uncertainty levels affect their analyses, and they will need to develop effective ways of presenting information with uncertainty.

1.2.5 Data Disclosure Avoidance

Before releasing any ACS data, the Census Bureau first determines whether the information could be used to identify specific households, individuals, or establishments. When the information is deemed to potentially result in wrongful disclosure, Census Bureau staff are required by law to take actions to prevent such identifications. Three types of data disclosure avoidance procedures will be applied to the ACS data: imputation, rounding, and data suppression.

Disclosure avoidance is an important issue for transportation planning uses of Census data, because transportation data users rely on small-area data to a greater extent than almost all other data users. Analyses of journey-to-work flow data will be particularly affected, because home-to-work matrices, even for mid-sized geographic units, will generally consist of small numbers within individual cells, and thus will be subject to data disclosure avoidance.

1.3 Purpose and Organization of this Guidebook

In this guidebook, attempts have been made to identify the key issues that will face transportation planners as they use ACS data to complete analyses that have been heretofore performed with decennial census Long Form data. Potential new transportation planning analyses that ACS may enable also are outlined.

Section 2 describes the implementation of ACS, including the operational steps that the Census Bureau follows to collect and disseminate ACS estimates. This section tries to highlight the

differences between ACS and the traditional census Long Form data collection, as these differences will have direct impacts on data users, such as transportation planners.

Section 3 describes the ACS data products and how users can access these products and other information related to ACS through the Census Bureau's American FactFinder website. This section provides lists of available tables and examples of the different types of ACS tables that are available to users.

Section 4 includes several sections that summarize the special challenges of using ACS data. This section begins by summarizing research on ACS data quality. The first subsection attempts to inform data users about the accuracy and potential biases in the ACS estimates.

Next addressed are two aspects of ACS that may be new to traditional Census data users—the need for the accumulation of data across geographic areas and over time and the need to consider the effects of data disclosure limitations in designing analyses. The ways in which these issues should affect data users' choices about data analysis strategies are demonstrated.

Section 4 then turns to less strategic, and more hands-on, ACS data use issues. Described is the importance of measuring, understanding, and reporting the precision levels in ACS estimates. There is discussion of the comparison of ACS estimates to Census 2000 results, and finally, discussion of effective ways that analysts can take advantage of having more frequent estimates of census variables.

Sections 5 through 9 provide case study examples of potential transportation planning analyses using ACS data. Section 5 discusses the most common uses of census data—descriptive analyses and policy planning analyses. Section 6 describes the application of ACS to trend analyses. With ACS's annual data releases, the opportunities for performing more interesting trend analyses increase.

Section 7 provides case studies on transportation market analyses, including environmental justice analyses. Section 8 discusses the use of ACS in the design and analysis of transportation surveys, particularly household travel surveys. Finally, Section 9 describes how ACS data can be used in place of decennial census data in travel demand modeling analyses.

1.4 Additional Information Sources for an Introduction to ACS

The Census Bureau and others have developed several documents that provide an introduction to ACS.

The Census Bureau American Community Survey website (www.census.gov/acs/www/index.html) includes several introductory documents in Portable Document Format (pdf) in the Survey Basics section, including

- *American Community Survey: A Handbook for State and Local Officials* (issued December 2004);
- *Congressional Toolkit* (issued Spring 2004), which includes several documents that "explain how and why the survey is conducted, its benefits, and how to obtain additional information." The documents, which are provided on CD-ROM to congressional staff, include
  - ACS Tool Kit, an introductory summary of ACS;
  - ACS Housing Fact Sheets, a summary of housing information collected in the ACS and justification for why this information is collected;
  - ACS Population Fact Sheets, a summary of population information collected in the ACS and justification for why this information is collected;

  - ACS Questionnaire, a copy of the mailed questionnaire;
  - ACS Instruction Guide, a copy of the instructions that accompany the questionnaire; and
  - Questions and Answers, an introduction to ACS presented in a question-and-answer format.
- *ACS News Media Toolkit* (updated October 2005), which includes a number of documents that summarize ACS for media data users.

In addition to the Census Bureau overviews, other researchers and data users have assembled many good descriptions of ACS that are suitable for interested new potential users. We recommend the Population Reference Bureau's September 2005 issue of its *Population Bulletin*, which can be found at www.prb.org/pdf05/60.3The_American_Community.pdf.

Transportation users of ACS can find summaries of many relevant ACS issues in FHWA's Census Transportation Planning Package (CTPP) status reports, which can be found at www.fhwa.dot.gov/ctpp/status.htm.

Finally, motivated prospective ACS users could benefit greatly from the on-line course on ACS offered by Statistics.com ($399 as of January 2006) and can be found at www.statistics.com/content/courses/census/index.html.

CHAPTER 2

American Community Survey

The Census Bureau's stated goals for ACS are to

- Provide federal, state, and local governments with an information base for the administration and evaluation of government programs;
- Facilitate improvement of the 2010 Census by allowing the decennial census to focus on counting the population; and
- Provide data users with timely demographic, housing, social, and economic statistics updated every year that can be compared across states, communities, and population groups.

The Census Bureau began developing the ACS in the mid 1990s. In the first few years, while the program was just beginning, preliminary ACS data were collected for a few test sites. In 1999, the number of test sites was increased to 31 locations, comprising 36 counties and representing a broad range of communities that were selected to provide different combinations of population sizes, population characteristics, population growth levels, and difficulty of enumeration. Table 2.1 lists the ACS test sites and the annual sampling rates that were used for each.

The data collection effort for the 31 test sites has been performed annually since 1999, and among the most important outputs of the ACS testing phase has been the compilation of three complete years of data for 1999, 2000, and 2001. In addition to the test site program, the Census Bureau performed a large-scale (1,203 counties) operational test of ACS methods in the year 2000, entitled the Census 2000 Supplementary Survey (C2SS). These data allow for the comparison with Census 2000 decennial data along several dimensions.

The Census Bureau and other researchers have performed a wide range of analyses related to the ACS test data. Many of these efforts are summarized below. In addition, this section describes the key elements of the plan for implementing the full-scale ACS, and how these elements of the ACS program may affect ACS data analyses—particularly those analyses related to transportation planning applications.

2.1 ACS Implementation

The Census Bureau first described their plans for fully implementing ACS in the *American Community Survey Operations Plan* and in associated website documents.[1] These plans have evolved as a result of ACS testing and federal appropriations processes. The schedule for the transition to full implementation has slipped due to limitations and uncertainties in the appropriations process, but the operational components of the program seem to be established and are documented in an ACS

[1] U.S. Census Bureau, *American Community Survey Operations Plan: Release 1* (March 2003). www.census.gov/acs/www/index.html.

Table 2.1. American community survey test sites.

County	1999-2001 Annual Sampling Rate	County	1999-2001 Annual Sampling Rate
Pima County, Arizona	5%	Multnomah County, Oregon	5%
Jefferson County, Arkansas	5%	Fulton County, Pennsylvania	5%
Tulare County, California	5%	Schuylkill County, Pennsylvania	5%
Upson County, Georgia	5%	Sevier County, Tennessee	5%
Miami County, Indiana	5%	Starr County, Texas	5%
Black Hawk County, Iowa	5%	Zapata County, Texas	5%
DeSoto Parish, Louisiana	5%	Petersburg City, Virginia	5%
Calvert County, Maryland	5%	Yakima County, Washington	5%
Hampden County, Massachusetts	5%	Ohio County, West Virginia	5%
Madison County, Mississippi	5%	Oneida County, Wisconsin	5%
Iron County, Missouri	5%	Vilas County, Wisconsin	5%
Reynolds County, Missouri	5%	San Francisco County, California	3%
Washington County, Missouri	5%	Broward County, Florida	3%
Flathead County, Montana	5%	Lake County, Illinois	3%
Lake County, Montana	5%	Bronx Borough, New York	3%
Douglas County, Nebraska	5%	Franklin County, Ohio	3%
Otero County, New Mexico	5%	Fort Bend County, Texas	1%
Rockland County, New York	5%	Harris County, Texas	1%

technical paper on design and methodology.[2] This section describes the ACS operations and implementation schedule based on the descriptions provided by the Census Bureau.

2.1.1 Operational Components of ACS[3]

Once fully implemented, the ACS will sample about 3 million addresses from the Master Address File (MAF) each year and about 2.5 percent of group quarters populations. This annual sample will be systematically divided into 12 monthly samples for interviewing, and the sampled units will then be contacted to provide data. The collected data will then be processed and refined, and made available to data users on an annual basis. Depending on the size of the geographic area under study and the analyses being performed, data users may need to combine multiple years of ACS data to analyze specific geographic areas—the more detailed geography, the greater the number of years that will need to be combined.

To accomplish the ongoing implementation of ACS, the Census Bureau will need to continuously perform the following functions:

- Address list development and updating to provide the sample universe;
- Implementation of sample selection protocols to obtain a sample each month;
- Implementation of the following data collection:
  - Mail out/mail back data collection phase;
  - Computer-assisted telephone interviewing (CATI) data collection phase; and
  - Computer-assisted personal interviewing (CAPI) data collection phase.
- Implementation of data entry and telephone follow-up procedures for mail returns;

[2] U.S. Census Bureau, *Design and Methodology: American Community Survey, Technical Paper 67* (May 2006) U.S. Government Printing Office, Washington, D.C.

[3] This entire section relies heavily upon the ACS *Design and Methodology* and *Operations Plan* documents.

- Data processing as follows:
  - Coding, editing, and imputation procedures; and
  - Weighting, disclosure editing, and tabulation,
- Data product dissemination.

These elements of the ACS process are discussed below.

Address List Development and Update The Census Bureau maintains the MAF, a national address sampling frame for the decennial census and other census data collection activities. Maintaining the quality of this database will be an essential element of successful implementation of the ACS program. Therefore, the Census Bureau is actively engaged in efforts to improve the database and to maintain it into the future.

The MAF was developed for Census 2000 using the previous decennial census list, the U.S. Postal Service's Delivery Sequence File, and address data supplied by local governments. The MAF is linked with the Census's Topologically Integrated Geographic Encoding and Referencing (TIGER) database.

The TIGER system and the MAF currently are being updated by the Census Bureau in preparation for the 2010 decennial census.[4] One update process is called the MAF/TIGER Accuracy Improvement Project, or MTAIP. The project, expected to be complete by 2008, will improve the positional accuracy of street centerlines in the TIGER database.

The update process is using existing data sources whenever possible, including

- State/local/county/tribal GIS files;
- Commercial GIS files; and
- Existing imagery.

If existing data are not available, new sources, such as imagery and field collection, are used.

Although the project will result in spatially more accurate TIGER/Line files, the TIGER/Line identifiers will not change. Attribute data will be conflated to the new geometry. For new segments, if city-style addresses are present in the file, they will be transferred to TIGER.

The MAF/TIGER Accuracy Improvement Project (MTAIP) process is focused on Census 2010 and is expected to be useful to ACS after 2008. A pilot study of acquiring coordinates for residential structures also is being conducted, where attributes, including feature names, address ranges, and address lists as appropriate from state/local/tribal/county GIS files are collected.

The MAF is kept up to date by use of the U.S. Postal Service's Delivery Sequence File for both residential and non-residential addresses. The update takes place twice a year for those blocks that are completely city-style residential addresses. In addition, ACS field representatives note any address corrections found in visiting housing units during the personal visit non-response follow-up data collection phase. The Census Bureau also performs systematic listing and mapping of selected areas to support several of their data collection efforts. Finally, to address quality concerns relating to areas with high concentrations of non-city-style addresses, the Census Bureau has initiated a program called the Community Address Update System (CAUS).

Sample Selection Protocols According to the Design and Methodology document, when ACS is fully implemented, each year the Census Bureau will select a systematic sample of addresses (3 million addresses per year or 250,000 addresses per month) from the most current MAF. Initially, this sampling rate will be equivalent to 2.5 percent of households each year, but this rate will decrease over time as the nation's population increases. In addition, about 2.5 percent of the

[4] Robert Lamacchia, U.S. Census Bureau, "TIGER/MAF Update Process." Presentation to U.S. DOT on July 9, 2004, as part of the ACS FAIP Program.

people in group quarters facilities will be included in the ACS. The sample will be selected from each county in the United States. No address will receive the ACS questionnaire more than once in any five-year period.

To improve the reliability of estimates for small governmental units (such as small counties or American Indian reservations) with less than 1,200 addresses, some areas will be over sampled similar to what was done for the census 2000 Long Form design. For 2005, the actual sampling rates are expected to range from 1.6 percent to about 10 percent each year.

In the future, the Census Bureau also will consider additional over sampling of certain counties to try to improve the reliability of estimates of geographically dispersed small minority population groups (such as Native Hawaiians and other Pacific Islanders, Asians, or American Indians and Alaska Natives) living in urban areas, but these changes would not be made until the current over sampling scheme for mail survey response is fully analyzed.

2.1.2 Questionnaires

The current ACS questionnaire (ACS 2003) is the result of several iterations of questionnaire implementation and revision. After the ACS demonstration period testing (1996-1998) and prior to the comparison period testing (1999-2001), the ACS questionnaire was modified. In addition, the ACS questionnaire was modified after the comparison period, and again for the 2003 ACS. The same questionnaire is being used for the 2003-2007 ACS efforts.

In preparation for the 2008-2012 period, the Census Bureau has been conducting the 2006 ACS Content Test to evaluate potential reworded and reformatted questions and to try new questions related to marital history, health insurance coverage, and veteran's service-related disabilities. Some potential rewording of questions related to work status would have the greatest impact on transportation planners. It is expected that the results of the 2006 test will lead to the 2008 questionnaire, and that this questionnaire will remain the same through 2012.

Appendix A summarizes differences between the current ACS questionnaire and the decennial census Long Form (1990 and 2000) for housing and population questions. The ACS and Census 2000 questionnaires roughly have the same questions (in different question order). The differences in the data collection protocol, however, lead to a few key differences in the population questions, as described below.

Residence Rules The ACS uses different residence rules than have been used in past decennial censuses. Decennial censuses and most surveys use the usual residence concept. The usual residence concept requires that respondents have only one place as their usual residence—most often the place where they spend the most time. The usual residence rule does not count people who are staying somewhere other than their usual residence as occupants of that place. For example, people who spend their winters in Florida and the rest of the year in Vermont, so called "snowbirds," have in the past been enumerated in the census as residents of Vermont, not Florida.

The ACS, in contrast, uses the current residence concept and the Two-Month Rule. Under the Two-Month Rule, anyone who is living for more than two months in a survey unit when the unit is contacted (either by mail, telephone, or personal visit) is considered to be a current resident of that unit.

Persons who are away from a residence for two months or less, regardless of their temporary location or the purpose of their travel, are considered to be "in residence" at the residence. If a residence does not have any occupants for more than two months from when it is sampled for the ACS, it is classified as a vacant housing unit. If a residence is occupied only by individuals that stay there for two months or less, and who have another permanent address, the residence

is classified as a temporarily occupied housing unit. Only limited housing unit data are collected for vacant and temporarily occupied housing units (no household or person data).

The ACS Two-Month Rule has the following exceptions:

- Children (kindergarten through Grade 12) away at boarding schools are considered residents of their parental home. (College students' current residency is based on the Two-Month Rule.)
- Children living in joint custody and who frequently move between separate residences are considered to be residents of the sampled residence if they are present at that residence when contact is initially made.
- Commuter workers who stay in a residence close to where they work and return regularly to their primary residence are considered to be residents of their primary residence, not the work-related one.

The current residence concept suits the ACS, because the ACS continuously collects information from monthly samples throughout the year. The current residence concept recognizes that people can live in more than one place over the course of a year, and that population traits for some areas may be noticeably affected by these shifts. Although ACS will not capture the seasonal changes in the population (because ACS estimates are tied to Census Bureau annual estimates for July 1), ACS can capture the characteristics of the population for the full year.

Reference Date An important difference between ACS data and previous decennial census data that is brought about by the continuous nature of ACS data collection is the reference period of the survey. In the decennial census, the questions are referenced to the beginning of April of the census year, and questions that require retrospective information are tied to the calendar year. For example, in Census 2000 respondents were asked the location of their places of work for the week before the April 1, 2000, census date and their household incomes for the 1999 calendar year. For ACS, the questions are referenced to the time the survey is conducted. Respondents are asked at what location they worked last week. The ACS household income reference period is the 12 months ending in the month prior to the survey.

The ACS's variable reference dates will capture seasonal differences the decennial census could not capture, but it is important that analysts consider the changed reference date definitions before using the ACS data, particularly in comparison with previous census estimates.

Other Questionnaire Differences Although data elements between the ACS and decennial census Long Form are consistent, wording differences (for both the query and the answer categories) do exist. Such wording changes, however, have been common in the evolution of the Long Form because the Census Bureau has a program of continuous improvement for questionnaire items. As in the past, analysts will need to be cautious when trending data elements for which there have been wording changes. Research of survey methods indicates that the wording of questions affects the corresponding answers.

For example, in an instruction for the housing questions, the ACS directs "Please answer the following questions about the house, apartment, or mobile home at the address on the mailing label." The Long Form instructed, "Now, please answer [the housing] questions about your household." While the questions seek essentially the same information, some respondents could have interpreted them differently, thus differences in the population could be identified where none really should exist. There also are small differences in the ways that the ACS and decennial census efforts collect data from respondents in larger households.

2.1.3 Data Collection Procedures

The ACS data collection occurs in continuous, three-month cycles using a combination of mail out/mail back, CATI, and CAPI data collection modes. The data collection protocols were

established based on the Census Bureau's experience with the decennial census and their demographic surveys. Figure 2.1 shows the workflow for the ACS data collection effort.

The data collection process begins with the mail phase. Sampled addresses are evaluated to determine whether they are accurate and complete. Thus far, over 95 percent of the sample universe have been eligible for the ACS mail out. Those sampled units with non-mailable addresses are assigned to the CAPI follow-up. If a sampled unit has a valid address, the Census Bureau mails a prenotification letter, then the initial mailing package (which includes the ACS questionnaire, an instruction booklet, and related materials), and then a reminder card. If no response is received from an address after three weeks, a replacement mailing package is sent. Currently, only English

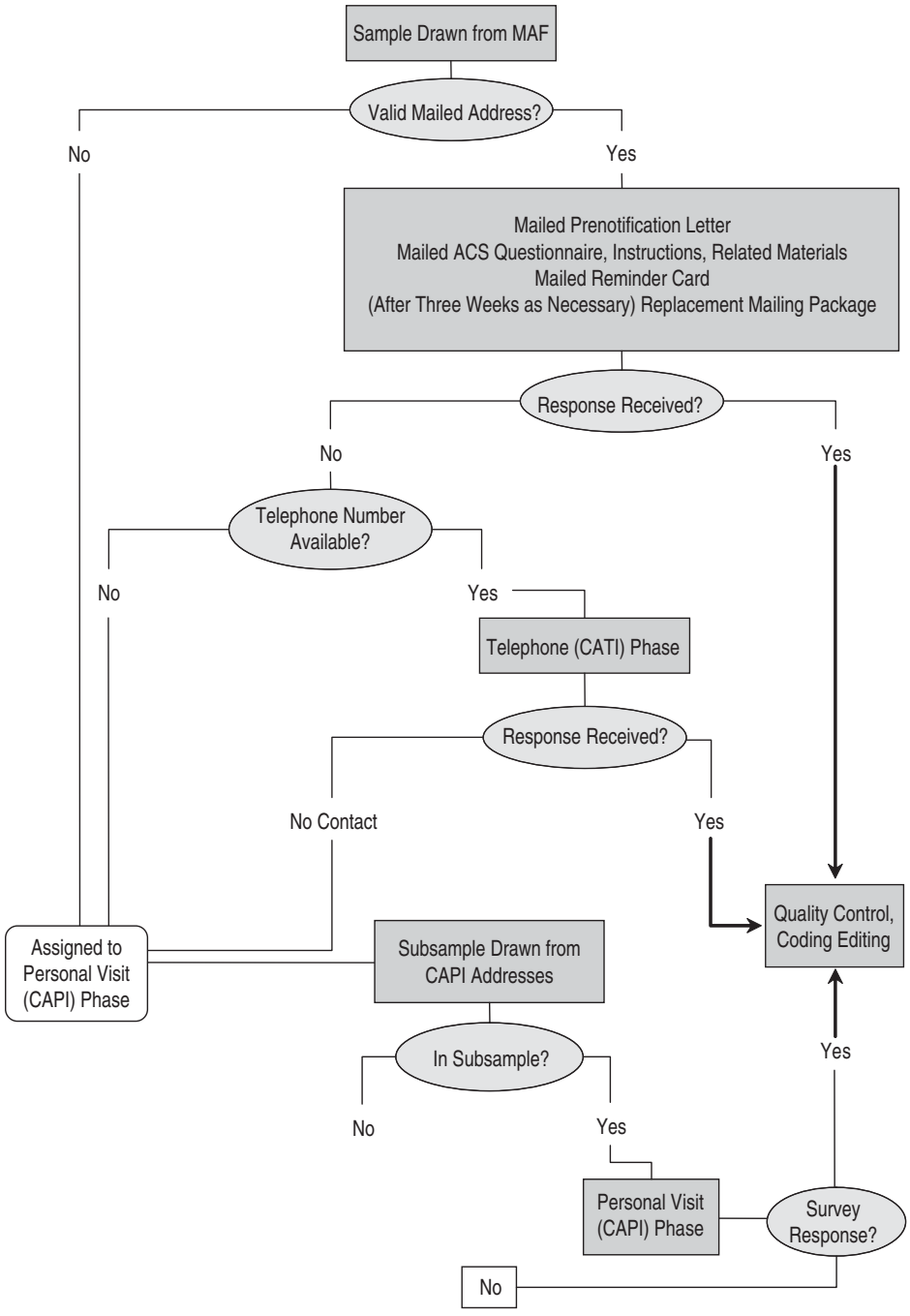


Figure 2.1. Data collection process for ACS monthly sample panels.

language materials are available for U.S. states, but a Spanish language version is used in Puerto Rico, and future plans call for the general availability of a Spanish language package. Alternative language forms will be available upon request.

Mail survey respondents are provided with a toll-free telephone number that respondents may use if they have questions, or if they prefer to provide responses by phone. Assistance is provided in English and Spanish.

About six weeks after the first questionnaire is mailed, the telephone data collection is begun. The Census Bureau contracts with commercial vendors to obtain available telephone numbers for the identified addresses. Households that have not responded but for which telephone numbers have been obtained are contacted by telephone interviewers. Using the Census CATI system, interviewers from three call centers perform the ACS (using the same data collection instrument as for the mail survey) over the phone. The CATI operation makes use of quality assurance and training procedures being used in the best commercial calling facilities. If a respondent refuses to participate in the CATI survey, a refusal conversion specialist calls again and makes a second attempt to complete the interview. The CATI surveys are performed in English and Spanish.

At the conclusion of the CATI operation (which lasts about four weeks for each sample panel), the Census Bureau selects a subsample of remaining uninterviewed addresses for CAPI. The CAPI subsample contains addresses categorized by their geography and whether or not they have mailable addresses. The different address categories are sampled at different rates, as discussed below.

Over a four-week period, Census Bureau field representatives visit CAPI subsample addresses and at each one, verify the existence of the address, determine its occupancy status, and conduct interviews if possible. The field representatives collect the data using laptop computers with English and Spanish translations. The ACS interviewers are more experienced than decennial census interviewers as they are continuously employed by one of the Bureau's 12 regional offices. All interviewers are supervised by senior interviewers with three or more years of experience, and emphasis is given to recruit bilingual staff to improve the data collection from non-English-speaking households. Unlike for the decennial census, proxy interviews from a non-sample housing unit resident are not permitted in the ACS. Proxy interviews within sample housing units are permitted.

The ACS schedule means that each monthly sample panel is collected over a three-month period. As shown in Figure 2.2, the collection of data from the monthly sample panels overlaps

	Calendar Month					
Sample Panel	Feb 2009	Mar 2009	Apr 2009	May 2009	Jun 2009	Jul 2009
Jan 2009	Mail	Phone	Visit			
Feb 2009		Mail	Phone	Visit		
Mar 2009			Mail	Phone	Visit	
Apr 2009				Mail	Phone	Visit
May 2009					Mail	Phone
Jun 2009						Mail

Source: David Hubble, Census Bureau Presentation at [Irvine].

Figure 2.2. Example data collection schedule for ACS monthly sample panels.

Table 2.2. CAPI subsampling rates for the 2005 ACS.

Address and Tract Characteristics	CAPI Subsampling Rate[5]
Unmailable addresses and addresses in remote Alaska	66.7%
Mailable addresses in tracts with predicted levels of completed interviews prior to CAPI subsampling between 0% and 35%	50%
Mailable addresses in tracts with predicted levels of completed interviews prior to CAPI subsampling between 35% and 50%	40%
Mailable addresses in other tracts	33.3%

Source: United States Census Bureau, *Design and Methodology: American Community Survey, Technical Paper 67* (May 2006) U.S. Government Printing Office, Washington, D.C.

Note: Percentage of addresses with uncompleted interviews prior to CAPI phase that are included in CAPI data collection.

so that each step of the survey methodology will proceed in each month. This means that data collection staff can work continuously on their specialty tasks.

Therefore, in February 2009, the Census Bureau's mail phase team will concentrate on the portion of the ACS annual sample that has been assigned to January. Then, in March 2009, they will focus on the sample assigned to February, while the phone (CATI) team works on the January portion of the sample. In April, the mail team will turn their attention to the March sample; the phone team will work with the February sample; and the field representatives will work with a subsample of the January sample. This process continues indefinitely.

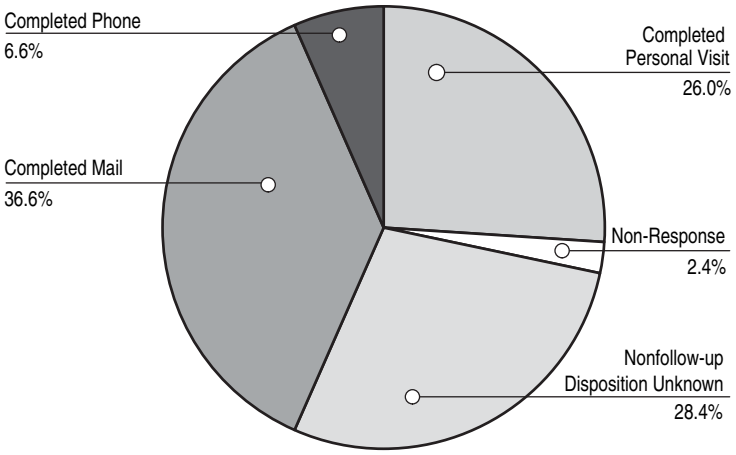
It is important to note that only a portion of the sample households that have not participated in the mail or telephone phases are included in the CAPI subsample. The sampling plan is designed so that desired sample sizes are achieved without having to complete the field interviews with all the households that remain after the mail and phone phases of the effort. The CAPI subsampling rates were initially established to be 1-in-3 of the mailable addresses that have not completed the mail or telephone phases and 2-in-3 of the unmailable addresses. Based on the initial ACS experience, the Census Bureau now applies the subsampling rates shown in Table 2.2.

The actual disposition of households in the 2001 ACS was something like that shown in Figure 2.3. More than a quarter (28.4 percent in the figure) of the households in the original ACS sample did not respond to the mail phase of the data collection or the telephone (CATI) phase of the data collection, but then were never contacted as part of the personal visit phase of the data collection. Since the data collection effort is not completed for this group, the Census Bureau uses a weighted response rate that effectively discounts this group in the response rate calculation.

Figure 2.4 shows the completion results by data collection mode for the 2001 ACS based on the weighted response rate calculation method. By this definition, the weighted response rate for the 2001 ACS was almost 97 percent. The rates for subsequent years have been similarly high. It is important to note that the Census Bureau response rates do not reflect the substantial proportion of households for which the data collection effort is not completed. Thus, the potential for nonresponse bias is higher than one would infer from the reported weighted response rates.

Data Entry and Follow-Up The returned mail surveys are sent to the Census Bureau's processing center, checked in, and reviewed by staff to determine whether they are minimally complete. If so, the returned survey is keyed and automatically reviewed for completeness and internal consistency. If problems are detected, the return is subjected to the Census Bureau's telephone edit follow-up procedures, in which respondents are contacted by phone to clarify

[5] The CAPI Subsampling Rate column represents the percentage of addresses with incomplete interviews prior to CAPI phase that are included in CAPI data collection.



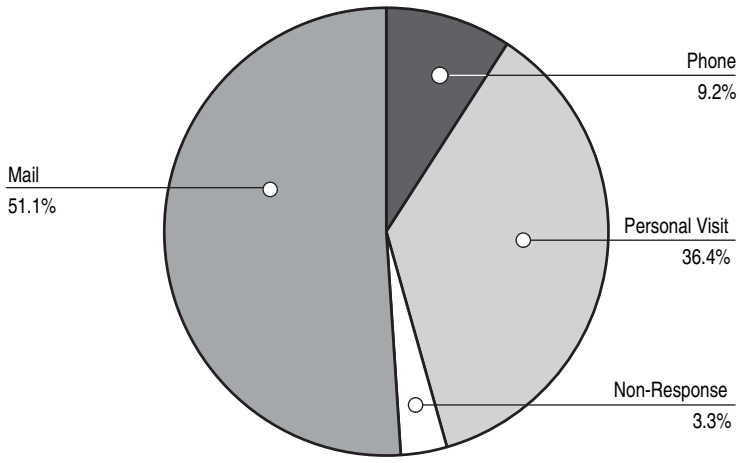
Source: David Hubble, TRB Conference: Census Data for Transportation Planning, May 2005, Irvine, CA.

Figure 2.3. 2001 ACS disposition of sample.

their mailed responses. Because the decennial census process schedule cannot accommodate this data quality review and verification, the final ACS returns are more complete and internally consistent than the census Long Form data.

Coding In the coding phase of the ACS data collection, questionnaire fields with write-in values are coded to a prescribed list of valid values. Manual coding methods are used to assign codes for industry and occupation, and automated coding programs are used to assign codes for the following:

- Place of birth,
- Migration,
- Ancestry,
- Language,
- Race,



Source: David Hubble, TRB Conference: Census Data for Transportation Planning, May 2005, Irvine, CA.

Figure 2.4. 2001 ACS completion results by data collection mode.

- Hispanic origin, and
- Place of work.

The most significant coding effort is the geocoding of reported work locations.

In the processing of Census 2000 data, the work location was geocoded in a two-phase operation using both the workplace address and employer name given by respondents on the Long Form questionnaires.[6] The first phase is an automated or computer-match operation. Records not resolved during this phase moved on to a computer-assisted clerical phase.

In January 2000, the U.S. DOT and Census Bureau cosponsored a program called Work-UP to improve the quality of the employer file used by the Census Bureau in the automated and clerical coding process. In this program, local agencies (MPOs and state DOTs) used customized GIS software to examine and update employer locations. This effort resulted in about 75 percent of the responses being geocoded properly during the first phase.

For records not coded in the first phase, data attributes underwent an allocation process. The allocation procedures used both trip data and job data to assign workplace locations using "standard allocation" and "extended allocation."

Standard allocation used travel time, residence tract, means of transportation, and industry to code work locations to a state, county, and place geocode. In addition, many records were allocated down to the block group and traffic analysis zone (TAZ) level during the standard allocation.

The extended allocation procedure developed for use in CTPP 2000 was targeted at assigning workplace tract and block codes to workers who could not be coded during the standard allocation process. Extended allocation was done in two stages. In the first stage, a set of potential destination areas was identified for each recipient, based on trip characteristics (such as mode and travel time) and residence location. In the second stage, the recipient was matched to a fully geocoded donor who matches the recipient's industry and occupation characteristics and who works in any one of the potential destination areas.

Preliminary negotiations are underway between Census Bureau and U.S. DOT on developing a Work-UP for ACS. The extended allocation system currently is not being used for ACS (because of cost and the insufficient number of donor records). It is expected that when five years of ACS data are collected, the extended allocation process may be implemented. Currently, the rate of origin-destination pairs in ACS is about 75 percent of the successfully geocoded Census 2000. Once the above improvements are made, a better match between ACS and Census 2000 would be expected.

The coded data for each residence are recompiled and a data file is produced for editing and weighting.

Editing and Imputation The Census Bureau's edit and allocation rules are used to account for missing, incomplete, and contradictory responses. As for the Long Form data, the Census Bureau has established specific rules regarding procedures for supplying values for variables that are missing. In the ACS, the values are based on other responses provided by the respondent and on responses for similar households. The editing and imputation procedures allocate the housing and population variables according to a predetermined hierarchy, similar to that used for the census 2000 Long Form.

The ACS editing process begins with the determination of whether collected information constitutes a usable interview. Those responses that are deemed to be non-interviews are included in the later non-response weighting effort. For those responses that are deemed to be interviews, the

[6] Ed Limoges, Sabre Systems Inc., "Allocation of Missing Place of Work Data in Decennial Censuses and CTPP 2000," *CTPP 2000 Status Report*, January 2004.

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Census Bureau staff use automated procedures to identify inconsistent and missing answers that require imputation, or the substitution of reasonable values for missing and incorrect data items.

ACS imputation is accomplished through the use of "assignments," which are rule-based procedures that use established relationships between different data items to fill in or correct the missing or incorrect items, and through the use of "allocations," which are statistical procedures (nearest neighbor methods and hot-deck methods) that use other respondents' data to infer reasonable values for missing or incorrect items.

Table 2.3 shows the item imputation rates of several data items for ACS and for the decennial census Long Form data collection. As the table shows, data item imputation rates are significantly lower for ACS than for the decennial census, and in many cases, appear to be improving over time. These improvements are likely the result of the superior survey design and procedures of the ACS, compared to the decennial census.

It should be noted that although individual transportation-related items show reasonable allocation rates, many of the household items, when combined with person items, show unusual results. This is probably a result of Census Bureau processing the allocations of household items and person items separately without any cross-referencing. Table 2.4 shows that a number of workers from zero-vehicle households were allocated to driving alone for their commute to work. While 16 percent of the weighted respondents from households without vehicles said they "drove alone" to work, almost 60 percent of the workers who reported that they did not have a vehicle and that did not report a mode to work were assigned by Census Bureau procedures to

Table 2.3. Selected ACS imputation rates of interest.

	Imputation Rates[a]				
Description	**2003 ACS**	**2002 ACS**	**2001 ACS**	**2000 (C2SS)**	**Census 2000**
Number of Vehicles Available	1.0	1.1	1.3	1.6	6.2
Place of Birth	6.2	4.4	4.6	634	10.1
Citizenship	0.4	0.4	0.4	0.5	0.8
Previous Residence[b]					
Mobility Status	2.2	2.5	2.6	4.0	6.9
Previous Residence Geography (One or More Parts)	5.9	6.0	7.3	14.9	11.0
Employment Status Recode	3.4	3.5	3.8	6.0	10.9
Place of Work Geography (One or More Parts)	5.2	4.9	5.3	9.9	10.7
Means of Transportation to Work	3.1	3.0	3.1	4.6	7.6
Private Vehicle Occupancy (Carpooling)	4.1	3.9	4.1	5.8	10.0
Time Leaving Home to Go to Work	9.6	9.2	9.9	11.3	15.0
Travel Time to Work (Minutes)	7.0	6.9	7.2	8.7	11.8

Imputation Rates for Items of Branch Interest: 2003, 2002, 2001, and 2000 ACS, and Census 2000 compiled by David Hubble, Census Bureau for the Irvine, CA presentation.

Source: Data are based on 2003, 2002, 2001, and C2SS data from the American Community Survey detailed tabulations and the Summary File 3 from the Census 2000 detailed tabulations.

Note: Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters in the ACS tabulations. However, the Census 2000 data include these persons.

[a] Base to the imputation rate is the population at risk for the characteristic. For example, the imputation rate for "travel time to work" is based on "workers 16 years and over who did not work at home."

[b] Previous residence is for a one-year interval in ACS and for a five-year interval in Census.

Table 2.4. 2002 ACS allocation rates for workers in zero-vehicle households.

		Zero Vehicles in Household	
		Not Allocated	Allocated
Total Workers	Not Allocated	5,065,639	34,425
	Allocated	380,191	108,451
Drove Alone to work	Not Allocated	824,431 (16.3%)	18,624 (54.1%)
	Allocated	226,424 (59.6%)	55,458 (51.1%)

Source: U.S. Census Bureau American Community Survey 2002 PUMS data.

the drove-alone-to-work category. Where both data items were missing, more than half of the respondents that were allocated to households with zero vehicles also were assigned to the drove-alone-to-work category.

Weighting, Disclosure Editing, and Variance Estimation The coded ACS data for a calendar year are weighted so that the combined sample units reflect the actual population as well as possible. Weighting includes the following three adjustments:

1. Initial weights are developed to account for differences in sampling units' probabilities of selection,
2. Initial weights for interviewed households are adjusted to account for non-interviews by month and census tract, and
3. Weights are then adjusted to match independent housing unit and population control totals.

Among its many other activities, the Census Bureau develops annual estimates of population by race/ethnicity, age, and sex. These are based on the previous decennial census counts and a range of administrative records databases. These post-census estimates serve as the weighting targets for ACS and other census surveys. Because of the way they are developed, the post-census estimates will almost certainly be much more accurate immediately following the decennial census. Therefore, by the end of each decade, the ACS estimates are somewhat less likely to reflect the actual population, and it is likely that larger year-to-year differences will be detected in the ACS data as the post-census estimates are updated with new decennial census count data.

ACS users will need to understand that the reported changes in the ACS data for decennial census years and the previous years are likely to be affected by larger than normal changes in the underlying population estimates by race/ethnicity, age, and sex.

The Census Bureau population estimates for previous years are revised when new decennial census count data become available, but the ACS estimates will not be revised. The ACS estimates for each year will be weighted based on the initial Census Bureau population estimates.

Before releasing any ACS data, however, the Census Bureau first edits the database to ensure it is within compliance with disclosure rules. The Census Bureau's Disclosure Review Board (DRB) governs the release of census data as described below:

> Title 13 of the United States Code authorizes the Census Bureau to conduct censuses and surveys. Section 9 of the same Title requires that any information collected from the public under the authority of Title 13 be maintained as confidential. . . . The Census Bureau's internal Disclosure Review Board (DRB) sets the confidentiality rules for all data releases.[7]

[7] See www.census.gov/eos/www/sestats.html.

The effects on the published data of implementing rules to ensure compliance with this law are discussed in Section 4.3 of this guidebook.

2.1.4 Data Product Dissemination

The many ACS data products are made available to users via the Census Bureau's website "American FactFinder" page. American FactFinder provides access to data and products related to the Census Bureau's

- Decennial census,
- ACS,
- Economic census,
- Annual economic surveys, and
- Population estimates program.

The process of locating and obtaining ACS data from American FactFinder is described in the next section of this guidebook.

2.2 Additional Information Sources on ACS Implementation

The key source of ACS operations and implementation information is, of course, the Census Bureau. The website includes the Operations Plan, as well as other documents that summarize different aspects of ACS implementation.

The Census website also includes several archived documents that provide a useful perspective on how ACS was conceived and how it has developed. In addition to providing a historical record, these documents provide insights into how the survey may evolve over time.

For these purposes, we recommend the following documents described in the remainder of this section.

- United States Government Accountability Office, "American Community Survey: Key Unresolved Issues."[8]

The Government Accountability Office report on ACS noted the following as "key unresolved issues":

1. Introduction of a new concept of residence: "Sufficient research has not been conducted to make the final set of rules for the 'current residence' used for ACS."
2. Uncertainty about the new methodology for deriving independent controls for population and housing characteristics: "The Census Bureau has not developed a methodology for using the Intercensal Population Estimates (ICPE) program for the full ACS to derive controls consistent with the ACS residence concept and ACS reference period, or at the same level of geography used for the Census 2000 Long Form."
3. Lack of guidance for users on the characteristics of multiyear averages for small geographic areas: "Because of statistical properties of multiyear averages and users' unfamiliarity with them . . . it is critical for Census Bureau to provide users with guidance on topics such as reliability of multiyear averages for areas with rapidly changing populations, reliability of trends calculated from annual changes in multiyear averages, and the use of multiple estimates from ACS data for geographic areas with populations greater than 20,000."

[8] GAO-05-82, October 2004. See www.gao.gov/new.items/d0582.pdf.

4. Operational procedures, such as questionnaire design, and adjustment to dollar-denominated values, and to the consistency between ACS and Census 2000 data.

Alternatives to improve small geographic area data: An alternative to provide more reliable small area data is to additionally fund a larger sample for 2009-2011, and provide a replacement for the Long Form one year earlier.

- Barry Edmonston and Charles Schultze, editors, "Modernizing the U.S. Census."[9]

This study provides a review of the traditional U.S. census; considers ways to improve coverage, reduce differential undercount, and limit enumeration; examines needs for small area data during intercensal years, and explores the use of sampling methods. It recommends ways to improve initial response rates for both Short and Long Forms, examination and testing of questions on race and ethnicity, use of continuous measurement and other methods to obtain small area data, reduce costs, and suggests a new design for the census questionnaire. Several recommendations are related to the improvement of MAF/Tiger, and development of intercensal estimates for small areas.

Alternatives to the decennial census—such as use of administrative records, a national register, and a rolling census—also are presented.

The panel evaluated the uses of Long Form data to arrive at the conclusion that ". . . in addition to data to satisfy constitutional requirements, there are essential public needs for small area data and data on small population groups of the type and breadth now collected in the decennial census." In the panel's judgment

  - The Long Form is not responsible for the decline in response rates or increase in costs in the previous censuses,
  - Dropping the Long Form would not have a very large effect on response rates, and
  - The inclusion of the Long Form questionnaire for a large sample of households is a cost-effective way of obtaining highly valuable information.

- Daniel L. Cork, Michael L. Cohen, and Benjamin F. King, editors, Panel on Research on Future Census Methods, National Research Council, "Reengineering the 2010 Census: Risks and Challenges."[10]

This study examined the Census Bureau's current plans for a reengineered Census 2010 with MAF/TIGER enhancements, American Community Survey, and Early Integrated Planning as its core concepts. The panel strongly supported the major aims of the Census Bureau's emerging plan for 2010, while noting that considerable challenges must be overcome for the innovations to be successful.

Specifically, the panel noted that the Census Bureau should

  - Develop a sound evidentiary base for its 2010 census plan.
  - Identify, articulate, and quantify risks in the census process (especially the impact of reduced funding on the quality of ACS estimates for small area data). The panel especially noted the need for a clear and early decision on ACS and contingency plans for the traditional Long Form if full ACS funding were not forthcoming. Other ACS issues that concerned the panel included the collection of Group Quarters data, the risk of a

[9] Barry Edmonston and Charles Schultze, eds., "Modernizing the U.S. Census." Washington, D.C., National Academies Press, 1995. See www.nap.edu/openbook/0309051827/html/index.html.

[10] Daniel L. Cork, Michael L. Cohen, and Benjamin F. King, editors, Panel on Research on Future Census Methods, National Research Council, "Reengineering the 2010 Census: Risks and Challenges." Washington, D.C., National Academies Press, 2004. See www.nap.edu/catalog/10959.html.

voluntary versus mandatory response, interaction with intercensal population estimates and the demographic analysis programs, and the use of sequential hot-deck imputation for the treatment of individual non-response.
  - Develop a comprehensive plan for updating and improving the MAF. The panel notes that each of the tasks related to modernization of TIGER carries considerable risk—especially the timeliness of realignment of TIGER geographic features to be consistent with GPS coordinates and the conversion of MAF/TIGER from its current homegrown format to a modern object-oriented computing environment.
  - Work with the postal service in assessing the quality of the Delivery Sequence File.
  - Analyze the Community Address Updating System; and justify plans to implement a complete block canvas.

- Constance F. Citro, Daniel L. Cork, and Janet L. Norwood, editors, Panel to Review the 2000 Census, National Research Council, "The 2000 Census: Counting under Adversity."[11]

The panel's overall conclusion was that "Census 2000 experienced both major successes and significant problems." The successes pointed out in the report are the completeness of demographic coverage and the quality of basic demographic data. Census 2000 saw a halt to the decline in the mail response rates, and operations were conducted in a timely manner. Net undercounts were lower in Census 2000 than in the 1990 Census.

The problems cited included errors in the MAF, a large number of duplicates, problems with some Long Form items such as employment and income, and inaccuracies in the enumeration of Group Quarters population.

The panel found that "census counts at the block level, whether adjusted or unadjusted, are subject to high levels of error, and hence should be used only when aggregated to larger geographies."

The lack of agreement until 1999 on the basic design hampered planning and increased costs for Census 2000. The panel recommended that the Census Bureau, the administration, and Congress should agree on the basic design for Census 2010 and the ACS by 2006.

In its assessment of Census 2000 operations, the panel found "limited pieces of evidence to suggest some problems in the imputation of whole persons." An administrative records experiment conducted in five counties showed that 41 percent of imputed census households were larger in size than linked administrative households, while 27 percent were smaller. "Missing data rates for some Long Form items were high in many cases; in some cases, higher than the comparable rates in 1990. The Census Bureau relied on imputation of these items on procedures that it used for many censuses with little evaluation of their appropriateness or effectiveness." Also determined was that "The Census Bureau should conduct experiments to test the relative costs of more imputation versus more follow-up before deciding whether to continue the 2000 strategy in 2010."

For the household population, missing data item rates were high (10 percent or more) for over one-half of the Long Form items, and very high (20 percent or more) for over one sixth of the Long Form items. Given these high rates of imputation, the panel recommended that the Census Bureau develop procedures to quantify and report variability of 2000 Long Form estimates, further study the effects of imputation, and conduct research on improving imputation methods for ACS (or the 2010 Census if it includes a Long Form).

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[11] Constance F. Citro, Daniel L. Cork, and Janet L. Norwood, Editors, Panel to Review the 2000 Census, National Research Council, "The 2000 Census: Counting under Adversity." Washington, D.C., National Academies Press, 2004. See www.nap.edu/catalog/10907.html.

With respect to the MAF, the panel recommended that the Census Bureau develop procedures to accurately identify housing units within multi-unit structures, redesign the Local Update of Census Addresses (LUCA) program to benefit participating state and local governments, and plan evaluations of MAF well in advance of the 2010 Census.

The panel also recommended the development of an improved Accuracy and Coverage Evaluation (ACE) program for the 2010 Census.

CHAPTER 3

Obtaining ACS Data

ACS products can be accessed easily through the Census Bureau American FactFinder site (http://factfinder.census.gov/home/saff/main.html). From this main page, as shown in Figure 3.1, data users can quickly obtain census facts about specific geographic areas, and can select the Census Bureau data product that they are trying to access.

The "learn more" tab provides users with an overview of ACS and its uses, and includes a link to the Census Bureau's American Community Survey site that includes detailed information about all aspects of ACS. The "get data" tab brings users to the ACS datasets web page, as shown in Figure 3.2, where users can select a strategy for obtaining the data that they need.

Included on the ACS datasets page are links to the Census Bureau's "Draft Quick Guides to the American Community Survey." The 2005 guide is located at www.census.gov/acs/www/Products/users_guide/index.htm. The quick guides provide the most up-to-date specific procedures for obtaining ACS data. When new data become available, new data products are developed, and the American FactFinder website is modified and improved over time, users should obtain the most current quick guide. The Census Bureau also is developing a CD-ROM-based user guide with simple case studies and exercises for data users to become more familiar with ACS data products.

Although the Census Bureau website's specific format and the specific instructions in the Census Bureau quick guides will probably change slightly over time, the process for obtaining data is likely to remain close to what it is now, which is as follows:

1. Select the dataset year.
2. Select the data product.
3. Provide the geography to be analyzed using drop-down lists of available Census geographic areas. (The Census Bureau provides an on-screen mapping option to allow users to ensure that the selected geography is correct.)
4. Provide additional table specifications as required by the particular data product.
5. Obtain results. (The requested data product is provided on screen, and users can download the results in a variety of file formats, including comma delimited, tab delimited, rich text format, or Microsoft Excel.)

3.1 ACS Data Products

The basic ACS data products include

- Base Tables (or Detailed Tables),
- Data Profiles,
- Multiyear Profiles,

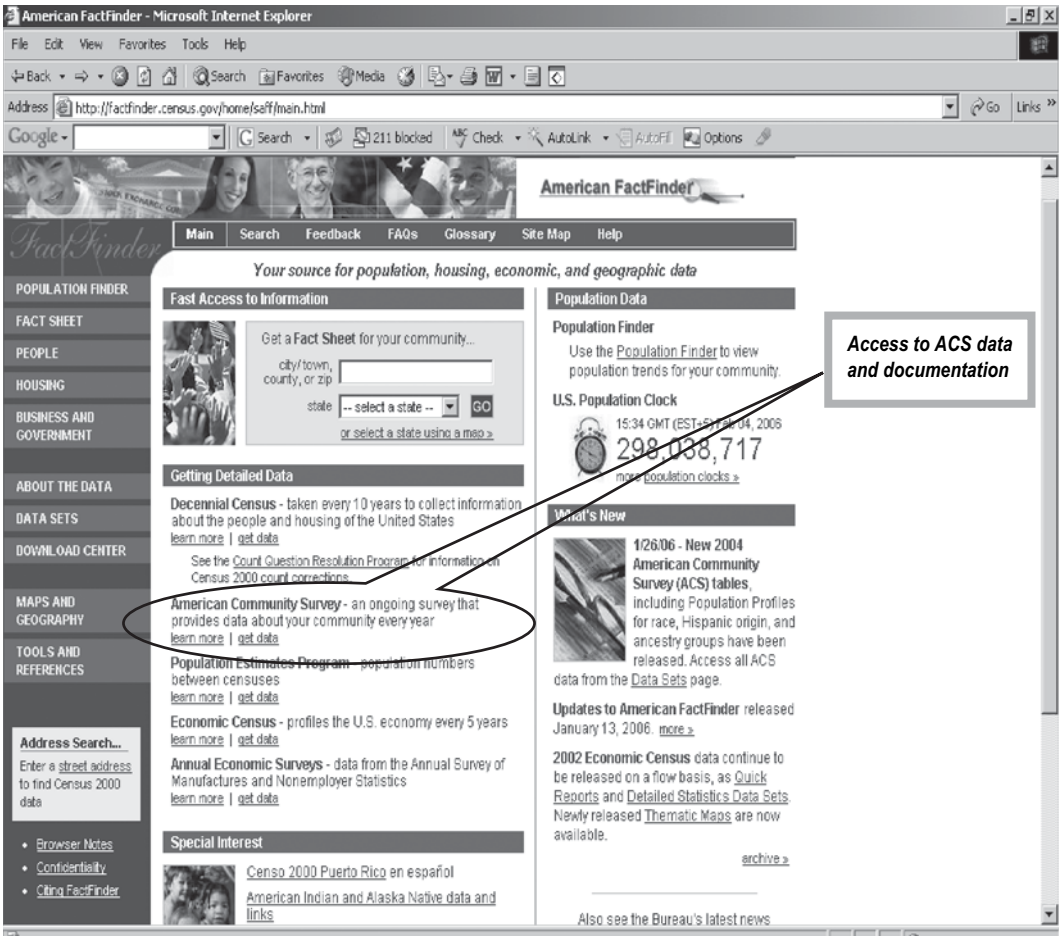

Figure 3.1. American FactFinder website main page.

- Ranking Tables,
- Thematic Maps,
- Subject Tables,
- Selected Population Profiles, and
- Public Use Microdata Sample (PUMS) Database.

These products are summarized in the remainder of this section. With the exception of the PUMS database, examples of these products are included in Appendices B through H at the end of this guidebook. The data products can be found fairly easily on the American FactFinder site but, if necessary, users can refer to the Census Bureau quick guide to determine how to locate these products on the website.

3.1.1 Base Tables

Base Tables, or Detailed Tables, are straightforward descriptive tabulations of basic ACS variables and concepts. These tables are likely to be the most commonly used for focused, custom analyses of ACS data. Base Tables are used when one needs to know a specific piece of information about a geography of interest and, as their name implies, the estimates provided in these tables are the basis of most of the other Census ACS products.

Figure B.1 in Appendix B provides an example of a Base Table (or Detailed Table). Using drop-down lists, the American FactFinder data user can select from the available geographic

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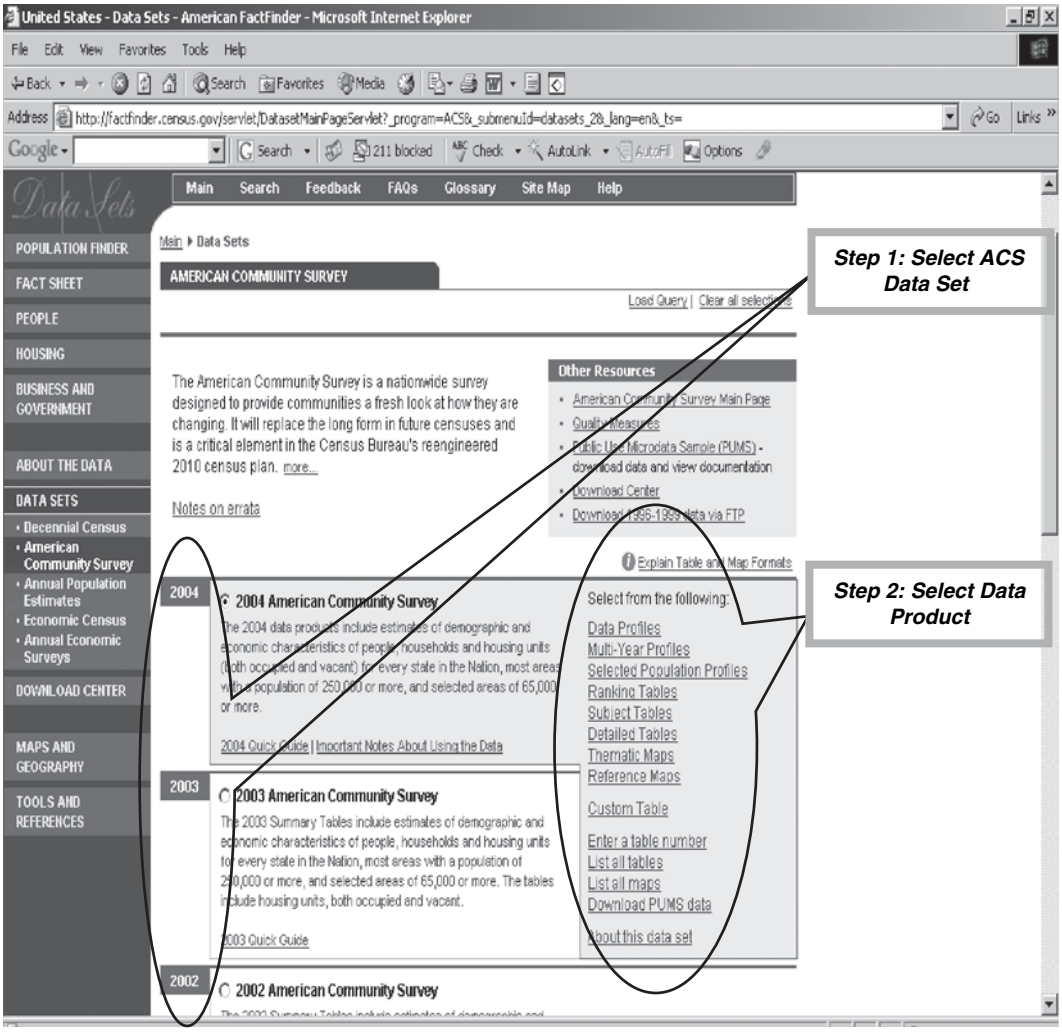

Figure 3.2. American FactFinder ACS datasets page.

areas and detailed tables to have the base table appear on the screen. In addition, these tables may be downloaded in a variety of useful file formats, including

- Rich text format (.rtf),
- Comma delimited (.csv),
- Tab delimited (.lst),
- Microsoft Excel (.xls), and
- Comma delimited database format (.txt).

In addition to obtaining single Base Tables for specific census geographic areas, experienced data users can obtain up to 50 Base Tables at once for census areas for which the data are available at the American FactFinder Download Center (located by following the links to http://factfinder.census.gov/servlet/DownloadDatasetServlet?_lang=en). These downloaded data come in a zipped, comma delimited file format. The Download Center offers similar capabilities for all recent Census Bureau datasets.

Table B.1 in Appendix B lists the many detailed tables that the Census Bureau has made available for the 2004 ACS. Note that several of these tables are commonly used by transportation planners, including especially those tables that are numbered with B08 (followed by three other characters). Some of these Base Tables, such as the workplace-based tables, had

only been available as part of the Census Transportation Planning Package (CTPP) for the decennial census. Their inclusion as ACS Base Tables means that transportation planners will be able to obtain these tables consistently within nine months of the end of the data collection period, rather than having to wait for any special tabulation.

ACS Base Tables will be available at all census geographic levels, from the national level down to the smallest reportable geographic levels (block group level and above). Figure 3.3 summarizes the census geographic levels. A discussion of census geography can be found on the Census Bureau website.

For the 2004 ACS, only state, large county, and large places have single-year detailed tables available, but with full implementation of ACS beginning in 2005 and 2006, over time the tables will be expanded to all census geographic areas. Tables for smaller geographic areas will be

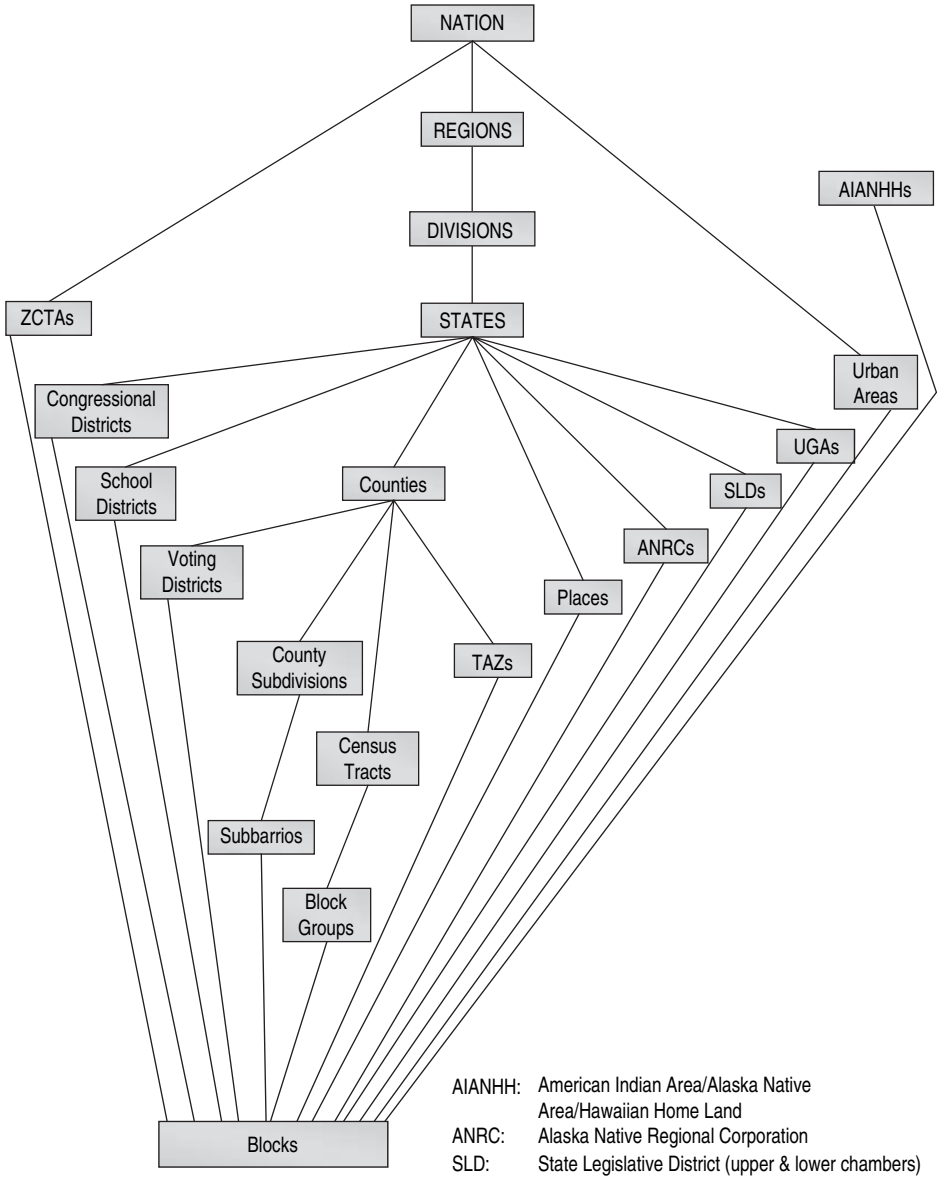

Figure 3.3. Hierarchy of census geographic entities.

produced for multiyear periods. Larger geographic areas will have both single-year tables and multiyear average tables.

Tables B.2 and B.3 in Appendix B provide additional details on transportation-related Base Tables. Table B.2 shows the residence-based tables, and Table B.3 shows the workplace-based tables. These summaries include the population universes used in each of the tables, the number of categories of each variable in the table (shown in parentheses in the table titles), and the total number of table cells. So, for ACS Base Table B08006, the Census Bureau provides estimates for three gender categories (male, female, and total) and 21 categories for means of transportation (19 mode categories, a worked-at-home category, and total), for a total of 63 table cells. The table universe for that table is workers 16 years and over in the specified geographic area.

Even though a particular tabulation variable is the same in two tables, the number of tabulation categories may vary. For instance, in Base Table B08006, Sex of Workers by Means of Transportation, there are 21 categories for means of transportation; in Base Table B08101, Means of Transportation to Work by Age, and in most other tables with this variable, there are seven categories for means of transportation. However, in Base Table B08136, Aggregate Travel Time to Work (in Minutes) of Workers by Means of Transportation, there are 12 categories for means of transportation, and in Base Table B08132, Means of Transportation to Work by Time Leaving Home to Go to Work, there are 6 categories for means of transportation. The tabulation categories were established by the Census Bureau in consultation with transportation data users. Table B.4 lists the variable categories used for ACS Journey to Work transportation-related variables.

3.1.2 Data Profiles

Data Profiles provide users with standardized summaries of the population and housing characteristics for user-selected geographic areas. There are four types of Data Profiles

- General demographic characteristics,
- Selected social characteristics,
- Selected economic characteristics, and
- Selected housing characteristics.

Examples of each of the four available Data Profiles are shown in Appendix C. In addition, the Census Bureau is beginning to offer narrative profiles that will provide narrative descriptions of key data for the population of interest.

Data Profiles will be available at census geographic levels as detailed as the place and county subdivision level once the ACS small area data are reportable. For the convenience of users, and to emphasize the ACS's use of sampling, the profiles include estimates, as well as their upper and lower bounds assuming a 90 percent confidence interval.

3.1.3 Multiyear Profiles

A key advantage of the ACS is its continuous data collection that allows users to track changes, trends, and patterns from year to year. The Multiyear Profiles provide users with tables containing the information from the Data Profiles, but across several years. There are the same four types of Multiyear Profiles as the first four Data Profiles (demographic, social, economic, and housing).

Examples of the Multiyear Profiles are shown in Figures D.1 to D.4 in Appendix D.

The Multiyear Profiles provide users with an indication of whether past year estimates are significantly different from the most current year's estimates from a statistical viewpoint (90 percent confidence level).

3.1.4 Ranking Tables

Ranking Tables allow users to compare geographic areas according to many different characteristics. For the 2004 ACS, there are 81 Ranking Tables. Table E.1 in Appendix E lists these tables. Five of the Ranking Tables are within the Census Bureau's transportation subject area:

- Mean travel time to work;
- Percent of workers who traveled to work by car, truck, or van alone;
- Percent of workers who traveled to work by carpool;
- Percent of workers who traveled to work by public transportation; and
- Percent of workers who worked outside county of residence.

Figure E.1 shows an example of a basic Ranking Table.

Users also may produce ranking tables that identify statistically significant differences between one of the selected geographic areas and the other ranked areas. The tables that highlight statistical differences are interactive (users choose one of the rows to be compared to the others), so unlike the standard ranking tables, these tables cannot be downloaded. Figure E.2 shows a screenshot example of a Ranking Table with statistical significance testing.

In addition to the tables, users also can view the rankings in a chart format, such as that shown in Figure E.3. These charts graphically depict the upper and lower bounds of the estimates (90 percent confidence interval), and therefore show the level of uncertainty in the estimates. These confidence interval charts can only be viewed and printed (but not downloaded).

For 2004, Ranking Tables are available at the state, county, and place level with populations of 65,000 or more. In future releases, Ranking Tables will be available for all states, counties, and places.

3.1.5 Thematic Maps

Thematic Maps show the geographic patterns for several ACS data elements (those available in the Ranking Tables) at the state level. Like the Ranking Table charts, Thematic Maps can be viewed and printed, but these files are not downloadable. Appendix F shows an example of a Thematic Map. It is possible that as more data are available for smaller areas in the future, the Census Bureau will expand the geographic areas available in Thematic Maps.

3.1.6 Subject Tables

The ACS Subject Tables are a group of tables that will allow users to analyze popular topic areas and themes for individual geographic areas. With the Subject Tables, the Census Bureau has sought to combine the information in related Base Tables into single tables. Therefore, Subject Tables are broader than Base Tables, but more focused than Data Profiles. Table G.1 in Appendix G shows the 2004 ACS Subject Tables. It is intended that more Subject Tables will become available over time, based on user demand and Census Bureau determination of the value.

Examples of currently available Subject Tables related to commuting are shown in Figures G.1 and G.2. Figure G.1 shows an example of the Place of Residence Commuting Characteristics by Sex Subject Table. Figure G.2 shows an example of the Means of Transportation to Work by Selected Characteristics Subject Table. Census Bureau Journey-to-Work staff have proposed a third commuting-related Subject Table, a place-of-work-based version of the Commuting Characteristics by Sex Subject Table, but this has not yet been implemented.

Subject Tables will be available for all census geographic levels as the multiyear small area data become available.

3.1.7 Selected Population Profiles

Selected Population Profiles will provide detailed information on selected population groups, such as people in poverty, teenagers, the elderly, workers, children, grandchildren, and immigrants. Selected Population Profiles currently are only available on an example basis for race and ethnicity groups and for ancestry groups, but the Census Bureau has plans for making many more available over time. Appendix H shows an example of a currently available Selected Population Profile. A potential future Selected Population Profile for Workers will include several important transportation-related tabulations.

3.1.8 Public Use Microdata Sample (PUMS) Files

As for the decennial census, the Census Bureau is making a sample of actual responses to the ACS available to users so that users can create their own cross-tabulations. The Census Bureau currently releases ACS PUMS data for the statewide level. In the future, the data will be released at the state and Public Use Microdata Area (PUMA) level.

The ACS PUMS is disaggregate data available at the housing unit and person levels. The Census Bureau selects a sample of housing units that filled out the questionnaires, and publishes the full range of responses from those households while protecting the confidentiality of the data. As a result, the residential geographic detail that is available from the PUMS is limited to the state level (PUMA level in the future). The workplace locations in ACS PUMS data are limited to the county level, because a substantial proportion of work locations would need to be allocated for more detailed geographic specificity.

The data consist of two microdata files that can be linked to each other: one containing housing unit records and the other containing person records. Since weighting factors are provided with the individual records, users can produce any desired cross-classification of variables of interest. In addition, the data can be used to better understanding the relationships among variables (e.g., the characteristics of households with three or more vehicles, vehicle availability discrete choice models, etc.) through regression and modeling applications.

The Census Bureau will provide PUMS data as single-year products. Data users will need to aggregate multiple-year ACS data to create larger samples. Because they are produced annually, ACS PUMS datasets are substantially smaller than the PUMS datasets developed for the decennial census. Table 3.1 compares the number of housing units and persons in the year 2000 decennial census PUMS dataset with the number of housing units and persons in the year 2004 ACS PUMS dataset.

3.1.9 Access to Census Data Records

In addition to these current and planned products, thus far for the test sites, the Census Bureau has provided ACS test site data to allow users to evaluate the data and to make comparisons with Census 2000. However, the evaluation data are for the test sites only and will generally not be available for future years.

Access to actual ACS data is restricted under the Center for Economic Studies (CES) and Regional Data Center (RDC) program to Census Bureau staff and to academic researchers that demonstrate the likelihood that their analyses of these data will benefit the Census Bureau's data collection programs, and that agree to stringent data confidentiality requirements. It is not likely that public agency transportation planners will be able to participate in this program for their applications as they tend not to be purely oriented to research.

Deb Niemeier of the University of California-Davis has documented the protracted process of obtaining the necessary approvals for using RDC Services for her analysis of ACS workplace

Table 3.1. Comparison of data records in 2000 decennial census PUMS and 2004 ACS PUMS.

State Postal Abbreviation	FIPS State Code	Census 2000 PUMS Housing Units	Census 2000 PUMS Population	ACS 2004 PUMS Housing Units	ACS 2004 PUMS Population
U.S.	00	6,098,438	14,081,466	514,830	1,194,354
AL	01	103,912	222,587	7,162	15,657
AK	02	14,013	31,924	3,981	9,235
AZ	04	114,948	259,694	8,468	19,479
AR	05	62,348	133,994	4,100	9,124
CA	06	651,698	1,690,642	45,095	114,921
CO	08	9,559	215,520	7,370	17,100
CT	09	74,709	170,658	5,543	13,346
DE	10	18,386	38,906	4,631	10,170
DC	11	15,526	28,605	3,707	6,814
FL	12	384,600	796,421	28,221	60,907
GA	13	175,784	406,582	12,490	29,002
HI	15	24,806	60,948	4,304	11,155
ID	16	27,968	64,389	4,143	10,061
IL	17	260,396	619,232	19,077	45,612
IN	18	135,532	304,060	10,604	25,046
IA	19	66,846	146,399	8,950	20,036
KS	20	60,663	133,658	7,112	16,144
KY	21	93,295	201,784	10,672	24,122
LA	22	99,162	222,482	8,925	20,619
ME	23	34,342	64,133	4,342	8,585
MD	24	113,969	264,242	9,675	23,067
MA	25	142,183	318,565	10,505	24,593
MI	26	224,214	496,765	17,219	40,159
MN	27	110,095	249,237	8,886	20,998
MS	28	62,868	142,459	8,715	19,861
MO	29	130,222	279,675	9,524	21,820
MT	30	21,871	45,887	4,465	9,545
NE	31	38,679	86,083	5,643	12,890
NV	32	43,056	100,429	4,305	9,770
NH	33	29,132	61,684	4,518	10,237
NJ	34	175,259	420,692	12,824	32,088
NM	35	40,845	91,783	4,153	8,824
NY	36	413,005	953,076	27,766	65,371
NC	37	188,898	399,813	13,231	29,338
ND	38	15,669	32,530	4,489	9,603
OH	39	254,118	569,795	19,775	45,493
OK	40	81,350	173,843	5,531	12,310
OR	41	76,516	171,666	5,939	13,610
PA	42	284,158	618,202	21,389	48,462
RI	44	23,935	52,586	4,571	10,568
SC	45	94,441	199,293	6,714	14,774
SD	46	17,586	38,013	6,251	14,022
TN	47	129,378	282,722	9,685	22,019
TX	48	435,954	1,040,527	27,186	66,385
UT	49	40,457	112,363	4,273	12,194
VT	50	15,761	30,816	4,562	9,527
VA	51	156,800	351,485	11,900	28,024
WA	53	129,378	296,440	10,354	24,146
WV	54	44,393	90,156	7,512	15,147
WI	55	123,858	272,879	10,228	23,159
WY	56	11,897	25,142	4,145	9,215

geocoding.[12] This cautionary tale underscores the poor likelihood that actual ACS data would be made available for transportation planning uses.

3.1.10 Census Transportation Planning Package (CTPP)

For the last several decennial censuses, transportation planners have relied on the CTPP, a series of specialized tabulations produced by the Census Bureau and sponsored by AASHTO, that provided transportation-related estimates, including journey-to-work flow tabulations.

3.2 Additional Information Sources for Obtaining ACS Data

The Census Bureau provides guidance for obtaining ACS data on their ACS website and on the American FactFinder website. The documentation is very accessible. From the ACS main guidance, webpage users can find several useful links and documents, including the following:

- The *ACS in American FactFinder Quick Guide* (discussed previously);
- Other guide documents, including *ACS at a Glance* and *ACS Data Products Overview*;
- New data product announcements;
- Table specifications (shells) for available and proposed new tables; and
- Documentation on the latest year's data release, such as the specific geographic coverage and new tables.

The information on this web page will be continuously updated, so it is likely to be frequently visited by both new and experienced users.

[12] See http://www.fhwa.dot.gov/planning/census/sfacs.pdf (accessed June 2007).

CHAPTER 4

Using ACS Data

Once a data user has obtained the ACS data that are needed for the specific analysis, she or he will need to consider the special issues that affect the ACS data. The issues described in this section will affect how analyses are done and how analysis results are interpreted and reported. As discussed above, the Census Bureau's migration to ACS adds some complexity to common data uses, but also introduces the ability to perform new and better data analyses.

This section begins with a discussion of ACS data quality, focusing on non-sampling errors, bias, and other issues that could affect how well an ACS estimate reflects the actual population. The issues identified in this section can help data users understand their results better, and can help explain why unexpected results may be occurring.

The issues discussed in Section 4.1 are related to the ACS data quality and accuracy. Sections 4.2 and 4.3 describe two Census Bureau data processing issues that affect how users will need to work with and interpret the ACS data. Section 4.2 considers the effects of the Census Bureau's ACS data accumulation over time and geography, and the use of one-, three-, and five-year averages. Section 4.3 discusses potential data use and analysis challenges introduced by data disclosure limitations.

These first three sections outline many of the key issues that data users will need to be aware of to design and implement ACS analyses. The following three sections describe issues related to how analysts actually perform their analyses. Section 4.4 describes the need to consider the effects of sampling error on the ACS estimates. Section 4.5 describes the issues analysts will need to consider in comparing ACS results with Census 2000 results. Finally, Section 4.6 outlines the implications and opportunities of ACS's frequent data releases.

4.1 Accuracy of ACS Data

A key objective for the Census Bureau in migrating from decennial census Long Form data collection to the continuous data collection approach of ACS was to improve the quality of the data collected by improving the ways the data are collected and processed. To evaluate whether this objective is being achieved, the Census Bureau and other researchers have evaluated quality measures for the initial ACS effort and have compared the early ACS results to the decennial census Long Form.

4.1.1 Census Bureau Evaluation of ACS

The Census Bureau has published 11 reports discussing ACS data quality issues based on the test site data and the C2SS experiment. The 11 Census Bureau reports are published under the title, "*Meeting 21st Century Demographic Data Needs—Implementing the American Community*

Survey," and are made available at www.census.gov/acs/www/AdvMeth/Reports.htm. The individual reports are

- Report 1: *Demonstrating Operational Feasibility* (issued July 2001);
- Report 2: *Demonstrating Survey Quality* (issued May 2002);
- Report 3: *Testing the Use of Voluntary Methods* (issued December 2003);
- Report 4: *Comparing General Demographic and Housing Characteristics with Census 2000* (issued May 2004);
- Report 5: *Comparing Economic Characteristics with Census 2000* (issued May 2004);
- Report 6: *The 2001-2002 Operational Feasibility Report of the American Community Survey* (issued May 2004);
- Report 7: *Comparing Quality Measures: The American Community Survey's Three-Year Averages and Census 2000's Long Form Sample Estimates* (issued June 2004);
- Report 8: *Comparison of the American Community Survey Three-Year Averages and the Census Sample for a Sample of Counties and Tracts* (issued June 2004);
- Report 9: *Comparing Social Characteristics with Census 2000* (issued June 2004);
- Report 10: *Comparing Selected Physical and Financial Characteristics of Housing with the Census 2000* (issued July 2004); and
- Report 11: *Testing Voluntary Methods—Additional Results* (issued December 2004)

These reports are summarized throughout the remainder of Section 4.

Data Quality Measures Measuring how accurately a survey like ACS captures the attributes of the survey sample and the population from which it is drawn is very difficult because in order to do so one would need to know the true characteristics of the population (in which case, the survey would not be a very useful effort). Therefore, survey researchers try to detect clues to potential problems in different survey components. In surveys, non-sampling error can result from a variety of problems, including

- Coverage errors,
- Reporting errors,
- Non-response error, and
- Processing and coding errors.

As discussed below, some of these errors lend themselves to quantitative analyses, so that indicators can be used to assess the presence and degree of these non-sampling errors.

Coverage Rates Survey coverage refers to how closely the sampling frame covers the target population. Coverage error occurs

- If housing units that belong to the target population are excluded (called under-coverage),
- If housing units that belong to the target population are counted more than once (over-coverage), or
- If out-of-scope housing units (i.e., those not in the target population) are included in the sampling frame (over-coverage).

The sample completeness rate indicates how well a target population is covered by a survey's sample population. This rate is calculated by dividing the survey's weighted population estimates, without non-response or coverage error adjustments, by the independently derived population estimates or counts.

Unit Response Rates Unit response rates measure the degree of participation of sampled housing units in the survey. Non-response due to inability or unwillingness of housing units to participate can cause bias if the characteristics of non-respondents are different from those of respondents.

Table 4.1. Comparison of C2SS and census 2000 population item imputation rates.

Variable	Percent of Eligible Items	
	Census 2000 Imputation	C2SS Imputation
Relationship	2.2 %	1.5 %
Gender	1.0 %	0.5 %
Age	3.6 %	2.4 %
Hispanic Origin	4.2 %	3.6 %
Race	3.9 %	2.4 %

Source: United States Census Bureau, 2002.

Item Non-Response Item non-response occurs when a given respondent does not provide answers for one or more items on the questionnaire. Robust methods for reducing item non-response were employed through different ACS phases. For mail responses, the automated clerical review and the follow-up operations contribute to reducing item non-response. During the CATI and CAPI procedures, the fact that a response is received to every question by the automated instrument before the next question is asked reduces item non-response significantly even when "don't know" responses are allowed. After all data collection phases, items that were still missing were obtained by borrowing the data from respondents with similar characteristics, a process known as imputation or item allocation.

ACS Data Quality The Census Bureau's first assessment of the potential data quality of ACS was the assessment of the accuracy and timeliness of the C2SS data that is reported in the second report of the Census Bureau evaluation series, available at http://www.census.gov/acs/www/Downloads/Report02.pdf. In this report, Census Bureau experts and managers concluded

> When implemented, the ACS will improve survey quality compared to the decennial census Long Form. That is, some increase in sampling error will occur due to smaller sample sizes in any given year. However, timeliness will greatly improve, and non-sampling error should be reduced by the use of permanent, highly trained field staff.[13]

The report evaluated C2SS on the basis of unit non-response, item non-response, sample completeness, control of processing/measurement errors, and sampling errors.

Unit non-response rates for C2SS were found to be quite low (and lower than other Census Bureau surveys), but statistically significant differences in the response rates were found between census tracts with different dominant racial/ethnic groups. Tracts with 75 percent or more of the population reporting a race or ethnicity of African American/black or American Indian/Alaskan Indian had statistically lower response rates than tracts that were similarly dominated by a population reporting to be white.

In terms of item non-response, the C2SS imputation rates for basic demographic items were significantly lower than for the decennial census. Significant differences in the imputation requirements were found for several key population variables, as shown in Table 4.1.

The C2SS sample completeness was evaluated in relation to Census 2000, and was compared to the sample completeness ratio for the 1990 Census Long Form in relation to 1990 decennial counts (sample completeness measures for the year 2000 Long Form were not yet available at the writing of the report). The percent of the population represented in the C2SS sample was slightly higher than for the 1990 Long Form sample.

[13] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 2: Demonstrating Survey Quality* (May 2002), p. 7.

The researchers believe that through the ongoing monitoring of ACS quality measures, improvements in unit and item response rates can be realized in the future. In addition, improvements in the MAF that are underway and will continue as part of the ACS program will lead to improvements in sample completeness.

It was not possible for the researchers to fully evaluate the potential processing and measurement errors. However, they do note several procedures that help to reduce these errors and have been implemented under the ACS quality assurance program.

Sampling error was the one quality measure that the analysts determined would be adversely affected by ACS. Data users have concluded that the higher sampling error of ACS will have a significant impact on the usefulness of the data. With a sampling rate of 3 million housing units per year, data accumulated over five years will correspond to a sample size of less than three-fourths of the roughly 16.7 percent sampling rate achieved with the Long Form Survey. Considering the effect of sample size alone on the standard error of the estimates and assuming a constant sampling rate of 2.5 percent, the ACS estimates will have a standard error equal to 2.8 times, 1.6 times, and 1.25 times that of the Long Form for annual estimates, three- and five-year moving averages, respectively.[14]

By examining the ACS test site data, the Census Bureau researchers drew the following conclusions:

> While the targeted levels of sampling error for single year estimates were met overall, differentials in levels of mail response for some population groups indicate that sampling error is disproportionately higher, suggesting the need for design changes.[15]

Even with improved survey follow-up procedures to address the problem of differential response to the initial mail surveys, the authors concluded that

> The ACS five-year averages are expected to have somewhat higher [relative standard error levels] than corresponding Census 2000 Long Form estimates... The premise of the ACS design is that this moderate increase in [standard errors] for a five-year average is worthwhile in order to obtain regular updates of the estimates throughout the decade, and to obtain what is expected to be a generally lower level of non-sampling error.[16]

The best assessments of actual ACS (as opposed to C2SS) non-sampling error are the Census Bureau's *Accuracy of the Data* reports, which are updated annually and available at www.census.gov/acs/www/UseData/Accuracy/Accuracy1.htm), and Report 7 of the Census Bureau's ACS evaluation series, which is available at www.census.gov/acs/www/AdvMeth/acs_census/creports/Report07.pdf.

The evaluation report compares Census 2000 data quality measures to the same ACS (1999-2001) data quality measures at the county and census tract level for the ACS test sites.

To analyze the differences at smaller geographic breakdowns, census tracts within the ACS test sites were divided into five groups:

1. County population less than 100,000;
2. County population between 100,000 and 1 million, with tract population less than 4,000;
3. County population between 100,000 and 1 million and tract population greater than 4,000;

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[14] Ronald Eash, Impacts of Sample Sizes in the ACS, presented at TRB Census Data for Transportation Planning: Planning for the Future Conference, May 12, 2005.

[15] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 2: Demonstrating Survey Quality* (May 2002), p. 27.

[16] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 2: Demonstrating Survey Quality* (May 2002), p. 29.

Table 4.2. Comparison of quality measures at the county level.

Characteristic	ACS	Census 2000
Self-Response Rate	55.3%	68.1%
Total Housing Unit Non-Response	4.4%	9.7%
Occupied Housing Unit Non-Response Rate	5.2%	8.7%
Allocation Rates		
Population Item Total Allocation Rates	6.5%	11.2%
Occupied Housing Unit Total Allocation Rates	7.7%	15.8%
Vacant Housing Unit Total Allocation Rates	23.2%	19.8%
Population and Occupied Housing Unit Total Allocation Rates	6.9%	12.8%
Sample Completeness Rates		
Housing Sample Completeness	92.9%	90.3%
Household Population Sample Completeness	90.4%	91.1%

Source: United States Census Bureau, 2004.

4. County population greater than 1 million and tract population less than 4,000; and
5. County population greater than 1 million and tract population greater than 4,000.[17]

Table 4.2 summarizes some of the key quality measures compared in the ACS and Census 2000 at the county level. The figures shown reflect the Census Bureau's weighted definitions of response and completion rates.

Based on their evaluation of all of these items, the authors concluded

> The quality measures suggest that the ACS multiyear averages are at least as good as the estimates from the Long Form. When we also consider the enhanced timeliness of information from the ACS, the superiority of reengineering the 2010 Census over retaining traditional methods is clear.[18]

ACS Unit Response The self-response rate for Census 2000 was 68.1 percent while ACS was lower at 55.3 percent. This means that Census 2000 respondents were more likely to mail back their questionnaires than were ACS respondents. The authors note

> . . . the higher census Long Form self-response rates mean that the success of the census depended less on follow-up operations than did the success of the ACS. This was an expected result—past experience has consistently indicated that the census will produce mail return rates of between 10 to 20 percentage points higher than other similar operations, even decennial tests.[19]

The decennial census benefits from a large advertising and public relations campaign, and, therefore, has much higher visibility. The authors also point out, "Census 2000 used questionnaires in languages other than English, especially in Spanish, which would have increased self-response rates in linguistically isolated areas—the ACS used English questionnaires only."

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[17] Tracts with population less than 500 were discarded for this study; there are about 590 such tracts in the country. The average tract population in the United States (65,000 tracts) is about 4,300.

[18] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 7: Comparing Quality Measures: The American Community Survey's Three-Year Averages and Census 2000's Long Form Sample Estimates* (June 2004), p. vii.

[19] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 7: Comparing Quality Measures: The American Community Survey's Three-Year Averages and Census 2000's Long Form Sample Estimates* (June 2004), p. 15.

Similar statistically different self-response rates were found for each tract group that was analyzed.

Despite the lower initial return rate, the non-response rates for total housing units and occupied housing units were lower in the ACS than in Census 2000. At the tract level, ACS also consistently showed lower rates.

ACS Sample Completeness Rates The sample completeness rate indicates how well a target population is covered by a survey's sample population. Rates greater than 100 would indicate over coverage of the population, and rates less than 100 would indicate under coverage. Both efforts failed to include the whole universe in their samples. The housing unit sample completeness rate for ACS was reported to be 92.9 percent compared to 90.3 percent for Census 2000, while the household population sample completeness rates were 90.4 percent and 91.1 percent respectively.

ACS Item Response Rates and Item Allocation (Imputation) The reported total allocation rates in Table 4.2 are the weighted averages of the item allocation rates for the individual corresponding variables. Both Census 2000 and ACS allocate (impute) responses when items are left blank or responses are out of range. For all population items (54 responses) and occupied housing unit items (29 responses), Census 2000 had higher allocation rates than ACS. Both for population and occupied housing unit responses, the ACS allocation/imputation rate was about five percent lower than the Census 2000 rate, with a similar trend across the five tract groups. The differences in the vacant housing unit items (12 responses) are most likely the result of issues related to the comparability of the two estimates. The lower ACS imputation rates are a strong indication that the quality of ACS data compares favorably with census Long Form data.

The lower (improved) levels of item non-response for ACS can be seen in Table 4.2 in the previous section. While the reduced need for item allocation is very good news for data users, as noted in the previous section, the item allocation procedures used by the Census Bureau are still limited by the individual sequencing of these allocations. Although individual transportation-related items show reasonable allocation rates, many of the household items, when combined with person items, show unusual results. This is likely to result from the Census Bureau's practice of processing the allocations of household items and person items separately without any cross-referencing.

ACS Operational Quality Measures Reports 1 and 6 of the Census Bureau's evaluation series (available at www.census.gov/acs/www/Downloads/Report01.pdf and www.census.gov/acs/www/Downloads/Report06.pdf) reviewed the operational feasibility of ACS. In Report 1, Census Bureau staff reviewed the outcome of the C2SS and the 1999 and 2000 ACS test site deployment to evaluate ACS from an operational standpoint. The key findings of this effort were

1. Implementing the ACS should improve the year 2010 decennial census; and
2. The successful implementation of the C2SS during 2000 demonstrated that full implementation of the ACS is operationally feasible.

According to the report:

> By having only a Short Form in 2010, the Census Bureau can more sharply focus on its constitutional mandates—to fully enumerate the population to apportion the House of Representatives. The ACS development program—supported by a complete and accurate address system—will simplify the decennial design, resulting in improved coverage in 2010.[20]

The researchers also report that C2SS achieved the quality standards, budgets, and schedules that the Census Bureau had established. The C2SS effort came in slightly under budget, and most of the workload issues identified with the effort were attributed to the fact that the C2SS was

[20] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 1: Demonstrating Operational Feasibility* (July 2001), p. 7.

competing with the decennial census for Census Bureau resources. The weighted survey response rates for C2SS and the test counties (1999 and 2000 data) were quite high—above 95 percent.

Report 6 updates Report 1 by examining the ACS operations for 2001 and 2002. The authors state that their analyses, "provide evidence of improved operational quality from the more than adequate levels achieved during the year 2000."[21] During the 2001-2002 period, schedules were maintained and workload levels were close to predicted. The workload issues noted in the first report were resolved because there was no conflict with decennial census activities. Response rates were maintained or improved, and the quality control measures implemented by ACS managers appeared to be effective.

4.2 Data Accumulation over Time and Geography

The Census Bureau aggregates ACS data for small geographic units over multiple years before releasing the data to the public. This is done to improve the reliability of the data reported for small geographic levels, where the smaller annual sample sizes are associated with large standard errors.

4.2.1 Census Bureau Multiple-Year Estimation

Once the ACS program is fully implemented for Census-defined areas with population under 20,000, five-year moving averages will be released. For census areas with population between 20,000 and 65,000, both three- and five-year moving averages will be released. For areas with population greater than 65,000, annual estimates, three-year moving averages, and five-year moving averages will be released.

Table 4.3 shows the percentage of counties and census places in each of the population categories based on Year 2004 Census Bureau population estimates. If five years of fully implemented ACS data were available for 2004 (2000-2004), ACS annual data would be provided for 24 percent

Table 4.3. Percentage of counties and census places in ACS population ranges, 2004.

Measure	United States	Counties	Census Places
Total U.S. Population (2004)	297,550,029		
All Counties/Places			
Number of Areas		3,219	19,465
Population		297,550,029 (100%)	182,048,887 (61%)
More than 65,000 Population			
Number of Areas		780 (24%)	457 (2%)
Population		244,171,662 (82%)	95,491,838 (32%)
20,000 to 65,000 Population			
Number of Areas		1,096 (34%)	1,168 (6%)
Population		40,066,827 (13%)	41,336,894 (14%)
Less than 20,000 Population			
Number of Areas		1,343 (42%)	17,840 (92%)
Population		13,311,770 (4%)	45,220,155 (15%)
Population Outside Areas of this Type		0	115,501,372 (39%)

Source: U.S. Census Bureau Population Estimates Program, 2004.

[21] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs—Implementing the American Community Survey: Report 6: The 2001-2002 Operational Feasibility Report of the American Community Survey* (May 2004), p. iv.

of the counties (with those counties comprising 82 percent of the U.S. population). Three-year average data (2002-2004) would be available for 34 percent of the counties (comprising 13 percent of the U.S. population). The remaining 42 percent of counties (4 percent of the population) would have five-year average data reported.

For the smaller census geographic areas shown in the table—census places—a much larger percentage (92 percent of census places, with 15 percent of the U.S. population) will have only five-year average data available. An additional 39 percent of the U.S. population does not live in a census-defined place.

Figures 4.1 and 4.2 illustrate the availability of single-year ACS estimates for 2004. They show the Minnesota counties and census places for which 2004 ACS data are available. Over time, ACS coverage will improve, but these figures demonstrate that the initial ACS data will have limited scope.

Table 4.4 shows the Census Bureau's current estimates of the number of areas for which single and multiyear ACS data will be available for the Census Bureau's main geographic summary levels. The Census Bureau estimates that they will provide single-year ACS estimates for 761 counties. They will produce three-year estimates for those 761 counties, plus another 1,050 counties with populations between 20,000 and 65,000. The remaining 1,330 counties with populations less than 20,000 will have five-year estimates only.

When the geographic areas of interest are census tracts, census block groups, or census TAZs, all ACS data will be reported as five-year averages.

The combination of data over successive years represents a tradeoff by the Census Bureau, in which the sampling error of the estimates is reduced through the inclusion of greater amounts of data (for multiple years) and data for more current years and with more frequency are made available. This, however, is at the expense of increasing the potential for problems with the inter-

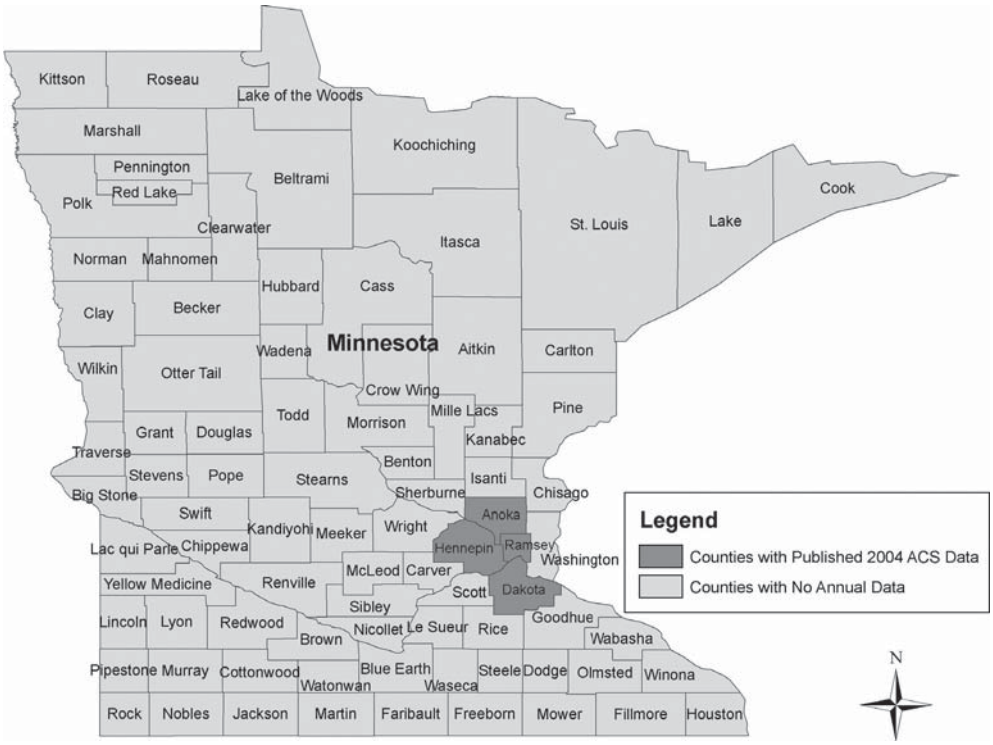

Figure 4.1. Minnesota counties with published 2004 ACS data.

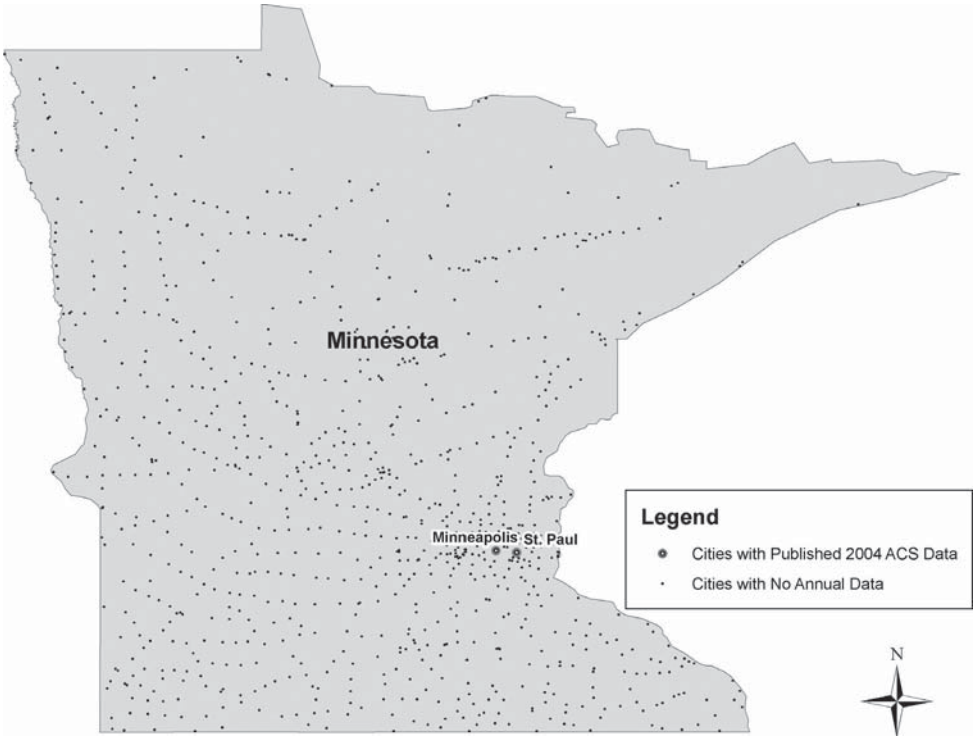

Figure 4.2. Minnesota census places with published 2004 ACS data.

Table 4.4. ACS reporting for census geographic areas, 2005.

	Number of Geographic Areas		
	Single Year Estimates	Three-Year Estimates	Five-Year Estimates
Geography	Population of 65,000 or More	Population of 20,000 or More	
Nation	1	1	1
Census Regions	4	4	4
Census Divisions	9	9	9
States	51	51	51
Counties	761	1,811	3,141
Minor Civil Divisions	97	592	16,536
Places	476	1,983	25,161
American Indian and Alaska Native Areas	15	41	768
Metropolitan, Micropolitan, and Consolidated Statistical Areas	561	905	923
Congressional Districts	436	436	436
School Districts	879	3,290	14,505
Census Tracts	-	-	65,443
Block Groups	-	-	208,790

Source: United States Census Bureau, *Design and Methodology: American Community Survey, Technical Paper 67* (May 2006) U.S. Government Printing Office, Washington, D.C.

pretation of the estimates that span across the years. For stable, slowly changing small geographic areas and variables that do not vary significantly from year to year, combining multiple successive years of data is not likely to be much of a problem for most analyses. However, for variables that do change significantly and for areas that experience large changes over the years, the interpretation of average results will be very difficult.

4.2.2 Multiyear Estimation Procedures[22]

When multiyear estimates are developed, the most recent year's geography is used. From time to time, census place and county subdivision definitions change to reflect political boundaries and new development. The multiyear estimates treat all records as though they were in the most recent year's geography, whether or not they actually were in previous years. This means where census geographic changes occur, inconsistencies within ACS estimates from year to year and across adjacent geographic areas will be present.

All ACS dollar value estimates are inflation adjusted to the most recent year of the three- or five-year period (using yearly midpoint CAPI estimates). Similarly, if census variable categories change, the multiyear data will be presented only for the definitions being used in the most current year.

The Census Bureau develops single-year estimates based on the combination of all 12 months of data collected for that year, without regard to the specific month in which the data are collected. Each year's estimates are controlled to that year's county-level annual population estimates (reflecting population as of July 1 of the year). The one-year ACS estimates and percentages are developed by summing the weighted responses and dividing that sum by the weighted sum of the relevant population. For example, a single-year estimate for the percent of workers who carpool to work would be calculated as follows:

$$\text{Percent Who Carpool In Year 1} = p_1 = \frac{\text{Number Who Carpool In Year 1}}{\text{Total Number of Workers In Year 1}} = \frac{N_1}{T_1}$$

Census Bureau estimates of medians for a single year are developed by analyzing the weighted data for the full year and identifying the median point of the estimate.

Initially, the Census Bureau generated multiyear estimates by computing an average based on each year's individual estimates, so a three-year average estimate for the percent of workers who carpool to work would be computed as the sum of the individual yearly estimates divided by the sum of the individual year totals. However, for full implementation of ACS, the annual samples corresponding to the estimation period will be combined together and the estimates will be developed as they are for the single-year estimates with the control totals being equal to the average of the component year controls.

Multiyear median estimates are produced by combining data records from all years, rather than by simply averaging each year's median.

An implication of the multiyear calculations is that three- and five-year estimates may not appear completely consistent at first glance with the single-year estimates for the same geography over those three- or five-year periods. Analysts will need to be careful in comparing estimates for areas of different sizes and should carefully consider their analytical needs when deciding which available estimates to use.

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[22] U.S. Census Bureau, *Design and Methodology: American Community Survey, Technical Paper 67* (May 2006) U.S. Government Printing Office, Washington, D.C.

Suppose, for example, an analyst was interested in understanding and reporting on a particular variable in ACS, such as the percentage of workers reporting that they travel more than one hour to their workplaces for a hypothetical geographic area—a county consisting of a moderate-sized city and two small towns. Collectively, the geography has a population of more than 65,000, so annual ACS estimates, three- and five-year estimates will be available for the full geographic area. For the first year of the analysis, 2010, the city population is about 60,000, so three- and five-year ACS estimates will be available, and the two towns both have populations below 20,000, so only five-year estimates are available.

Table 4.5 shows hypothetical ACS data and reported estimates for the county and its three county subdivision components for several years. The top portion of the table shows the full set of estimates from a hypothetical ACS. However, not all of these results are made available to data users.

The second portion of the table shows the Annual ACS estimates that would be made available for the county. County-level population is available annually for all counties from the Census Bureau Population Estimates Program. In addition, because the county population is more than 65,000, the annual ACS estimates, including those for workers and for workers commuting more than 60 minutes, are reported for the county.

Over time, the population of the city grows to be more than 65,000 as well, so for the last few years shown in the table, annual estimates become available for the city. Unlike the county population, the city population is derived from the ACS data collection—the county population is used as a control total and the ACS data provide an estimate of the county population living in the city. The annual estimates for the city's workers and workers commuting more than 60 minutes are determined in the same way as the county annual estimates.

The third part of the table, shows the hypothetical three-year average data release. Three-year average estimates are available for the county and the city beginning in 2007, and for one of the towns beginning in 2014. The county population estimates are the same as the annual estimates as they are not derived from the ACS and are used as controls, but all the other three-year average estimates are calculated as described above. Because these estimates are three-year averages, the estimates vary both from the published annual estimates and from unpublished actual data.

The final part of the table shows the five-year average estimates. Beginning in 2010, the five-year average estimates would be available for the county, the city, and both towns. Like the three-year averages, these estimates are derived by combining data from the five previous years (three previous years for the three-year averages) and controlling the totals to the average of the county's population estimates for the five years.

In 2010, the analyst has estimates of workers commuting more than 60 minutes of:

- 8,789 for the county, based on the countywide annual estimate for 2009;
- 8,826 for the county, based on the countywide three-year average estimate ending in 2009;
- 8,749 for the county, based on the countywide five-year average estimate ending in 2009;
- 5,677 for the city, based on the city three-year average estimate ending in 2009;
- 5,759 for the city, based on the city five-year average estimate ending in 2009;
- 1,657 for one of the towns, based on the five-year average estimate ending in 2009; and
- 1,333 for the other town, based on the five-year average estimate ending in 2009.

The choice of how to proceed with these various estimates is the analyst's. If the analyst needs to only look at one geography (say, he or she would like to know the number of long-distance commuters at the county level), then using the annual estimate would seem an attractive choice. At the county level, the annual estimate provides the most timely estimate and relies the least on averaging. Similarly, at the city level, the three-year average would likely be more attractive for

Table 4.5. Hypothetical Data Releases for a County and Its City and Towns.

Estimates from ACS Collected Data

	Population				Age 16+ Workers				Percent of Workers Commuting More Than 60 Minutes				Workers Commuting More than 60 Minutes			
Year	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County
2005	54,104	12,717	13,025	79,846	22,183	5,214	5,340	32,737	0.24	0.23	0.22	0.24	5,324	1,199	1,175	7,698
2006	55,186	13,607	13,416	82,209	22,074	5,715	5,366	33,155	0.24	0.24	0.22	0.24	5,298	1,372	1,181	7,851
2007	56,290	14,560	13,818	84,668	23,079	6,261	5,665	35,005	0.24	0.25	0.22	0.24	5,539	1,565	1,246	8,350
2008	57,416	15,579	14,233	87,227	22,966	6,699	5,693	35,358	0.24	0.26	0.23	0.24	5,512	1,742	1,309	8,563
2009	58,564	16,669	14,660	89,893	22,840	7,168	5,717	35,725	0.24	0.27	0.24	0.25	5,482	1,935	1,372	8,789
2010	59,735	17,836	15,100	92,671	23,894	7,848	6,040	37,782	0.24	0.28	0.25	0.25	5,735	2,197	1,510	9,442
2011	62,722	19,085	15,553	97,359	25,089	8,206	6,221	39,516	0.24	0.29	0.26	0.25	6,021	2,380	1,617	10,018
2012	65,858	19,466	16,019	101,344	27,002	8,565	6,568	42,135	0.25	0.30	0.27	0.26	6,751	2,570	1,773	11,094
2013	69,151	19,856	16,500	105,506	27,660	8,538	6,600	42,798	0.26	0.31	0.28	0.27	7,192	2,647	1,848	11,687
2014	72,608	20,253	16,995	109,856	29,769	8,709	6,968	45,446	0.27	0.32	0.29	0.28	8,038	2,787	2,021	12,846

ACS Annual Data Release

	Population				Age 16+ Workers				Percent of Workers Commuting More Than 60 Minutes				Workers Commuting More than 60 Minutes			
Year	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County
2005	n	n	n	79,846	n	n	n	32,737	n	n	n	0.24	n	n	n	7,698
2006	n	n	n	82,209	n	n	n	33,155	n	n	n	0.24	n	n	n	7,851
2007	n	n	n	84,668	n	n	n	35,005	n	n	n	0.24	n	n	n	8,350
2008	n	n	n	87,227	n	n	n	35,358	n	n	n	0.24	n	n	n	8,563
2009	n	n	n	89,893	n	n	n	35,725	n	n	n	0.25	n	n	n	8,789
2010	n	n	n	92,671	n	n	n	37,782	n	n	n	0.25	n	n	n	9,442
2011	n	n	n	97,359	n	n	n	39,516	n	n	n	0.25	n	n	n	10,018
2012	65,858	n	n	101,344	27,002	n	n	42,135	0.25	n	n	0.26	6,751	n	n	11,094
2013	69,151	n	n	105,506	27,660	n	n	42,798	0.26	n	n	0.27	7,192	n	n	11,687
2014	72,608	n	n	109,856	29,769	n	n	45,446	0.27	n	n	0.28	8,038	n	n	12,846

Table 4.5. (Continued).

ACS Three-Year Average Data Release

	Population				Age 16+ Workers				Percent of Workers Commuting More Than 60 Minutes				Workers Commuting More than 60 Minutes			
Year	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County
2005	--	--	--	79,846	- –	- –	- –	- –	--	--	--	--	- –	- –	- –	- –
2006	--	--	--	82,209	- –	- –	- –	- –	--	--	--	--	- –	- –	- –	- –
2007	56,822	n	n	84,668	23,108	n	n	34,625	0.24	n	n	0.24	5,546	n	n	8,201
2008	57,976	n	n	87,227	23,383	n	n	35,535	0.24	n	n	0.24	5,612	n	n	8,501
2009	59,154	n	n	89,893	23,654	n	n	36,429	0.24	n	n	0.24	5,677	n	n	8,826
2010	60,356	n	n	92,671	23,941	n	n	37,394	0.24	n	n	0.25	5,746	n	n	9,203
2011	62,960	n	n	97,359	24,980	n	n	39,310	0.24	n	n	0.25	5,995	n	n	9,825
2012	65,498	n	n	101,344	26,428	n	n	41,540	0.24	n	n	0.26	6,437	n	n	10,627
2013	68,577	n	n	105,506	27,659	n	n	43,162	0.25	n	n	0.26	6,924	n	n	11,376
2014	72,016	20,665	n	109,856	29,286	8,953	n	45,225	0.26	0.31	n	0.27	7,624	2,776	n	12,358

ACS Five-Year Average Data Release

	Population				Age 16+ Workers				Percent of Workers Commuting More Than 60 Minutes				Workers Commuting More than 60 Minutes			
Year	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County	Acity	Bee Town	Cee Ville	Alpha County
2005	--	--	--	79,846	- –	- –	- –	- –	--	--	--	--	- –	- –	- –	- –
2006	--	--	--	82,209	- –	- –	- –	- –	--	--	--	--	- –	- –	- –	- –
2007	--	--	--	84,668	- –	- –	- –	- –	--	--	--	--	- –	- –	- –	- –
2008	--	--	--	87,227	- –	- –	- –	- –	--	--	--	--	- –	- –	- –	- –
2009	59,716	15,511	14,666	89,893	23,996	6,587	5,892	36,475	0.24	0.25	0.23	0.24	5,759	1,657	1,333	8,749
2010	60,948	16,607	15,116	92,671	24,374	7,150	6,044	37,569	0.24	0.26	0.23	0.24	5,850	1,870	1,404	9,125
2011	63,509	18,042	15,808	97,359	25,399	7,797	6,321	39,517	0.24	0.27	0.24	0.25	6,096	2,116	1,520	9,732
2012	65,824	19,173	16,346	101,344	26,345	8,325	6,541	41,212	0.24	0.28	0.25	0.25	6,381	2,341	1,640	10,363
2013	68,498	20,139	16,870	105,506	27,415	8,741	6,751	42,906	0.25	0.29	0.26	0.26	6,758	2,542	1,760	11,061
2014	71,557	20,920	17,379	109,856	28,923	9,076	7,023	45,023	0.25	0.30	0.27	0.27	7,314	2,727	1,901	11,942

many analyses, because the data are more relevant to the current period than the five-year estimate. For the towns, the five-year average estimates are the only available choice.

There may be some instances where analysts would be willing to sacrifice currency of the estimates for the greater precision offered from the multiyear average's larger sample sizes and for the lesser volatility in the average estimates. The three- and five-year estimates tend to dampen the effect of year-to-year changes, so using the averages can help analysts avoid worrying about what may simply amount to random year-to-year noise. Unfortunately, on the other hand, the averaged estimates do not pick up real trends as strongly or as quickly as do single-year estimates. As can be seen by comparing the hypothetical data releases for the commuting issue at the town level to the top part of the table, the multiyear averages lag behind in identifying the increase trend.

Decisions about which estimates to use become more complicated when the analyst needs to examine the variable across different geographic levels. Making comparisons between one-year estimates and multiyear estimates will be problematic if the variable of interest is trending one way or another during the multiyear period or if the variable in the most current year is different than for the previous years.

Suppose the analyst wanted to know the percentage of long-distance commuters in the county that lived in one of the smaller towns. Dividing the five-year average estimates for the towns by the single-year estimate for the county is not really a valid approach, since the two measure the variable over different periods. The more appealing approach would be to use the five-year averages for both the towns and the county for this analysis. This "least common denominator" approach ensures that any regional changes during the averaging period are captured in all of the estimates.

Typically, as a practical point and as in this example, for most variables and geographic areas, the differences between the estimates from the different averages will not be so large that they would materially affect policy decisions, but one could easily think of examples in rapidly changing areas where differences in the single-year, three- and five-year averages, could affect the results of analyses in meaningful ways.

To summarize the elements of choosing the particular ACS estimate to use in analyses, data users should consider the following:

- Is the anticipated analysis related to understanding the most recent conditions and identifying potential recent shifts in the population?
- To what level does the analysis need to be protected from potential random year-to-year noise in the estimates?
- Have there been any significant regional changes in the past few years that might make estimates that include both pre- and post-change ACS data less useful?
- Will the analyses involve multiple geographic levels for which the same types of ACS estimates might not be available?

4.3 Data Disclosure Limitations

As noted in Section 2, before releasing any ACS data, the Census Bureau first edits the database to ensure it is within compliance with disclosure rules. The Census Bureau's DRB governs the release of census data as described below:

> Title 13 of the United States Code authorizes the Census Bureau to conduct censuses and surveys. Section 9 of the same Title requires that any information collected from the public under the authority of Title 13 be maintained as confidential. . . . The Census Bureau's internal Disclosure Review Board (DRB) sets the confidentiality rules for all data releases.[23]

[23] See www.census.gov/eos/www/sestats.html.

4.3.1 Data Disclosure Avoidance

Three types of data disclosure avoidance procedures are expected to be applied to the ACS data with varying effects on data utility: imputation, rounding, and data suppression.

Imputation The confidentiality edit is implemented by selecting a small subset of individual households from the internal sample data files and blanking a subset of the data items on these household records. Responses to those data items are then imputed using the same imputation procedures used for non-response. A larger subset of households is selected for the confidentiality edit for small areas to provide greater protection for these areas. The editing process is implemented in such a way that the quality and usefulness of the data are preserved.[24]

Rounding For the most common decennial census sample data products, a small amount of uncertainty was introduced into the estimates of census characteristics. The sample itself provided adequate protection for most areas for which sample data are published since the resulting data are estimates of the actual counts; however, small areas required more protection.

For CTPP 2000 and other similar projects for which detailed cross-tabulation data for small geographic areas are reported, the Census Bureau enhances confidentiality further by rounding the reported estimates and by establishing minimum response thresholds. The DRB issued a memorandum on December 11, 2001 stating the following rules:

For Part 1 data (place of residence), and Part 2 data (place of work), all published values will be rounded as follows:

- Zero rounds to zero,
- One through seven rounds to four, and
- All other numbers round to the nearest multiple of five. Numbers ending in zero and five are not rounded.

For Part 3 (journey-to-work flows), the DRB allows two tables to be published with no record threshold. These include the following:

- Table 3.1 (Total Workers); and
- Table 3.2 (Vehicles Available by Means of Transportation to Work).

Added to this set were tables of aggregates, means, and medians that were rounded according to specifications used for all sample data products. For all other Part 3 tables (Tables 3.3 through Table 3.7 in CTPP 2000), the DRB set a three-unweighted record threshold.

A key issue to note in the analyzing effects of disclosure rules is the application of independent rounding. Total columns in each table may not match the sum of the categories because totals are rounded independently of the cells, as shown in the rounding example in Table 4.6.

However, because some variables (e.g., travel mode to work) are classified in more than one way depending on which table one uses, the number of possible answers is higher than just two. Up to 15 estimates for the number of transit commuters may be possible[25] when different tables and different geographies are analyzed, as shown in the example in Table 4.7.

While there are very few one-dimensional tables in CTPP 2000, having one-dimensional unrounded tables in ACS would be of great use in establishing control totals as checks for analysts and as inputs to iterative proportional fitting processes.

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[24] See www.census.gov/td/stf3/append_c.html.

[25] Chuck Purvis, Metropolitan Transportation Commission, Oakland, California, e-mail posted to the CTPP news listserve on February 19, 2004.

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Table 4.6. CTPP's independent rounding of table cells and totals.

Sample Table Data	Rounded Value Using Rounding Rules
0 vehicle households = 6	4
1 vehicle households = 14	15
2 vehicle households = 8	10
3 vehicle households = 8	10
4 vehicle households = 3	4
Incorrect Total Rounded Value = 4+15+10+10+4=43, which is rounded to 45.	
Correct Total Rounded Value = 6+14+8+8+3 = 39, which is rounded to 40.	

Source: U.S. Census Bureau CTPP 2000 data.

Table 4.7. CTPP rounding: estimates of transit commuters for different geographic summary levels and CTPP Tables.

Summary Level Category	Number of Levels	Table 2-2 Transit = 5 categories	Table 2-12 Transit = 3 categories	Table 2-27 Transit = 2 categories
TAZ	4,031	319,345	319,553	319,600
Block Group	4,384	319,433	319,521	319,541
Tract	1,403	319,717	319,780	319,836
County	9	320,116	320,129	320,125
MPO	1	320,125	320,120	320,120

Source: U.S. Census Bureau CTPP 2000 data.

A comparison of CTPP 2000 data and Summary File 3 (SF 3)[26] data shows that the CTPP estimates were more likely to be *lower* than the SF 3 values.[27] The effect of rounding a value from one through seven to a value of four generally provided a lower estimate than the actual value.

Rounding as conducted for CTPP 2000 does not affect the statistical significance of the data. However, it does cause a number of distortions while aggregating geography. It is important to minimize the number of geographies that are combined. For example, if the CBD can be defined using tract geography, tracts should be used rather than the more finely defined TAZs.

For both the Census 2000 and ACS datasets supplied by the Census Bureau for the research discussed in Appendix I and Appendix J, the data were subject to further disclosure scrutiny.[28] All estimates were rounded by intervals of 10, rather than intervals of 5. The new rounding rules applied to the ACS research data compound the problems seen for CTPP 2000 and resulted in a significant loss of journey-to-work trip flow data.

Data Suppression In addition, for a CTPP-like product from the ACS, the Census Bureau would establish minimum response thresholds for some of the flow tables. Although rounding is a significant data issue, applying thresholds to journey-to-work flow data will almost certainly eliminate journey-to-work flows for small geography. Table 4.8 shows pairs of geographies

[26] Summary File 3 consists of 813 detailed tables of Census 2000 social, economic, and housing characteristics compiled from a sample of approximately 19 million housing units (about 1 in 6 households) that received the Census 2000 Long Form questionnaire.

[27] Nanda Srinivasan, Cambridge Systematics Inc., "Data Rounding in CTPP 2000" *CTPP Status Report*, April 2004.

[28] Correspondence with Phillip Salopek, U.S. Census Bureau, on July 23, 2004.

Table 4.8. Disclosure effect on Census 2000 versus ACS, Hampden County.

	Part 3: Without Thresholds		Part 3: With Thresholds		Part 1
Data	Total Geographic Pairs with Reported Work Flows	Total Workers with Reported Work Flows	Total Geographic Pairs with Reported Work Flows	Total Workers with Reported Work Flows	Total Workers
Census 2000	8,228	207,120	2,644	147,080	199,220
ACS	6,368	181,563	1,673	118,234	202,024

Source: FHWA CTPP Status Report, April 2004.

tabulated with and without the disclosure rules for Hampden County, Massachusetts, for both the ACS and Census 2000 at the census tract level.

It can be seen that without thresholds, and allowing for a 15 percent sampling rate, the ACS data produces about three-fourths (6,368/8,228) of the number of origin-destination pairs produced by the Long Form. The new rounding rules would affect ACS data more significantly, with only 90 percent (181,563/202,024) of total workers being reported due to rounding.

For tables subject to thresholds, applying the same rules to both the ACS and the Census 2000 data, the number of pairs in ACS is still about 75 to 80 percent (1,673/2,644) of the origin-destination pairs shown in the census Long Form. However, the number of workers in ACS drops further down to about 60 percent (118,234/202,024) of the total workers in Hampden County.

There is a growing concern within the U.S. transportation community that the Census Bureau will continue to use the same rounding and threshold rules for all future origin-destination tables produced from ACS. The effect of these rules would be significant at the census tract level—in the example, producing 1,673 origin-destination pairs when the census Long Form (without disclosure rules) would have produced 8,228 origin-destination pairs, accounting for only 60 percent of workers living in the county. It also is expected that a similar or even more severe loss of flow data will occur at the TAZ level. One implication of this is that transportation analysts might have to resort to aggregating their TAZs into larger geographies for which sufficient flow data are available.

Some researchers have pointed out that if blocks are aggregated so that they are larger than walking distance to a bus stop, for example, then the geography aggregation causes the survey data to become of less value for bus route planning. Similarly, if the aggregate geography is larger than the distance between highway exits, then the survey data cannot be used for highway corridor analysis.

Because the ACS is sampled over time, and at any point in time has less sample size than Census 2000, it may be desirable to have less stringent disclosure rules for ACS. The United Kingdom (UK), for example, has a higher sampling rate and the data are subject to fewer disclosure rules. The census in the UK is conducted solely via the Long Form with about 24 million households surveyed—almost equivalent to the Census 2000 Long Form in the United States. The suite of standard data products from the UK is quite extensive.[29]

Table Variable Collapsing As for the 2000 CTPP, the Census Bureau expects to apply quality control measures on ACS data products for geographic areas for which categorized tables could be misinterpreted.

Any table whose median distribution of covariance for individual cell values is greater than 61 percent will be modified or suppressed for that geography. For example, for a given geography for County X, for a table with 18 means of transportation, individual covariances are calculated for estimates of workers who drove alone, carpooled, etc. If the median of these covariances is

[29] See:www.statistics.gov.uk/census2001/.

greater than 61 percent, then these modes would be collapsed to fewer categories according to predefined collapsed table definitions. If the median of covariances for the collapsed table still exceeds 61 percent, the table will be suppressed for County X.

4.4 Understanding, Working with, and Reporting Sample Data

4.4.1 ACS Sample Size

The ACS questionnaire is sent to 250,000 housing units every month, or equivalently to 3 million housing units annually, drawn from all counties in the U.S. To allow data users to better analyze smaller areas, the Census Bureau applies differential sampling rates based on the area type. The 2005 sampling rates are shown in Table 4.9.

In contrast, the decennial census Long Form was sent to about one of every six addresses. Since both the Long Form and ACS data represent samples of the overall population, they include some imprecision, or margin of error, in their estimates.

4.4.2 Sampling Error

Sampling error is the term given to the error associated with deriving an estimate from a sample rather than an entire population. ACS data are estimates of actual numbers or percentages in the population but because the data are not collected from the whole population, random sampling error will be present. The larger the sample size is, the smaller the sampling error will be but, of course, the specific amount of error in an estimate can only be known if information from the true population were available.

Sampling error is most commonly estimated through the calculation of the standard error associated with the estimate. Standard error is a measure of the deviation of a sample estimate from the average of all possible similar samples. It is an indication of the precision with which a

Table 4.9. ACS Sampling rates, 2005.

Area Type Sampling Rate Category	2005 Final Sampling Rate
Blocks in smallest sampling entities (estimated occupied housing units in block < 200)	10.0%
Blocks in smaller sampling entities (estimated occupied housing units in block ≥ 200 and < 800)	6.9%
Blocks in small sampling entities (estimated occupied housing units in block ≥ 800 and ≤1200)	3.6%
Blocks in large tracts (estimated occupied housing units in block > 1200 and estimated occupied housing units in tract > 2000)	
– Mailable addresses ≥ 75% and predicted levels of completed interviews prior to subsampling > 60%	1.6%
– Mailable addresses < 75% and/or predicted levels of completed interviews prior to subsampling ≤ 60%	1.7%
All other blocks (estimated occupied housing units in block > 1200 and estimated occupied housing units in tract ≤ 2000)	
– Mailable addresses ≥ 75% and predicted levels of completed interviews prior to subsampling > 60%	2.1%
– Mailable addresses < 75% and/or predicted levels of completed interviews prior to subsampling ≤ 60%	2.3%

Source: United States Census Bureau, *Design and Methodology: American Community Survey, Technical Paper 67* (May 2006) U.S. Government Printing Office, Washington, D.C.

sample estimate approximates the population value. Formulas for calculating standard errors associated with sample estimates are straightforward, but since the Census Bureau will calculate and report the standard errors, the reader is referred to any standard statistics textbook for more details on these calculations.

The sampling error of an estimate is usually summarized as a combination of a confidence level and a confidence interval. The confidence level is the percentage of times that drawing a sample of a particular size from a certain population will result in having the actual (but unknown) parameter of interest being within a certain confidence interval.

For instance, a surveyor might report that based on survey results, sample size, and variance levels, the percent of households with zero vehicles for a certain population of households is 10 percent plus or minus 3 percent at the 95 percent confidence level. This means that 95 out of 100 times that we performed a survey with the same sample size, the estimate we determine in the survey—plus or minus 3 percent—will include the true percentage of zero vehicle households. For this example, the confidence level is 95 percent. The confidence interval is 6 percent and the margin of error is ±3 percent.

It is common for analysts to establish a confidence level for reporting and then to calculate the margin of error for the survey-derived estimates associated with that confidence level. The confidence levels selected are generally related to how much uncertainty researchers are able to accept in particular estimates. Medical and scientific researchers sometimes will specify 99 percent confidence levels or higher. Political polls seem to usually report margins of error assuming confidence levels of 95 percent or 90 percent. For a particular sample population and sample size, as confidence levels are increased, the corresponding margins of error around the sample estimates widen.

Suppose a sample parameter is measured from a large sample to have a mean value of *X* and, based on the variation in the sample, the standard error is computed to be *Y*. The confidence intervals for different confidence levels are shown in Table 4.10.

Both the decennial census Long Form and ACS are sample datasets, so sampling error will be present in estimates from either source. Despite this fact, one almost never sees precision levels reported for census Long Form estimates. Analysts generally report census Long Form estimates as single numbers. The Census Bureau does make the precision levels available to users, but most data users choose not to work with them. Not incorporating the uncertainty levels into analyses simplifies analyses, some of which are already fairly complicated. However, in practical application, this also has the effect that many users of the analyses do not understand the nature of these data. A common misconception of many consumers and users of these data is that they are census data and therefore are actually based on a 100 percent sample of the population (like the decennial census Short Form data).

Because the ACS sample sizes are smaller than those of the Long Form, the sampling errors will be more significant for ACS, and the misconception that the estimates are completely precise is

Table 4.10. Confidence intervals for a large sample parameter with a mean value *X* and a standard error *Y*.

	Confidence Interval	
Confidence Level	**Low**	**High**
80 percent	X – 1.28 * Y	X + 1.28 * Y
90 percent	X – 1.65 * Y	X + 1.65 * Y
95 percent	X – 1.96 * Y	X + 1.96 * Y
99 percent	X – 2.58 * Y	X + 2.58 * Y

more likely to lead to erroneous conclusions. For this reason, the Census Bureau is making a concerted effort to stress that ACS estimates are just that, statistical estimates, and not counts.

The Census Bureau calculates the standard errors for all estimates reported in ACS data products using procedures that account for the sample design and estimation methods. These procedures are described in the Census Bureau's *Accuracy of the Data* reports, which are updated annually (available at www.census.gov/acs/www/UseData/Accuracy/Accuracy1.htm).

All ACS estimates are reported with margins of error or confidence intervals corresponding to the 90 percent confidence level. Using the reported estimates and upper and lower bounds, data users are able to incorporate ACS's sampling error into their analyses and data presentations.

Example Calculations for Incorporating Sampling Error into ACS Analyses To help analysts use and interpret the margin of error provided with the ACS estimates, the Census Bureau provides formulas and some example calculations to guide data users in the *Accuracy of the Data* reports. There are four example calculations from this source presented and annotated below.

1. Calculation of the standard error of an ACS estimate,
2. Calculation of the standard error of the sum (or difference) of ACS estimates,
3. Calculation of the standard error of the ratio of two ACS estimates, and
4. Calculation of the standard error of the proportion of an ACS total estimate in an ACS subtotal estimate.

Although these examples are for a generic analysis for a wider audience, the same procedures will be used by transportation planners in their most common analyses, as is demonstrated by the case study sections that follow in this guidebook.

Example Calculation 1 Determine the standard error of a reported ACS estimate.

Problem The ACS estimates the number of males in the United States that have never married to be 33,290,195. The reported lower bound of the estimate is 33,166,192, and the reported upper bound is 33,414,198. What is the standard error of the estimate of the number of males who have never married?

Relevant Equations.

Standard error = 90 percent confidence margin of error/1.65

Margin of error = max(upper bound – estimate, estimate – lower bound)

Note: Many, but not all, ACS intervals are symmetrical around the reported estimate, so choosing the maximum interval is the conservative approach to establishing the margin of error.

Calculations

Margin of error = max(33,414,198 – 33,290,195), (33,290,195 – 33,166,192))= 124,003

Standard error = 124,003/1.65 = 75,153

Discussion The standard error calculation, in and of itself, may not be particularly edifying, but it is a first step that allows users to perform other calculations, like those shown below. Also, by knowing the standard error, analysts can establish upper and lower bound estimates for other confidence levels. For instance, the 95 percent margin of error is 1.96 * 75,153 = 147,300.

Example Calculation 2 Determine the Standard Error of a Sum of Reported ACS Estimates.

Problem As noted in the previous example calculation, the number of males that have never been married is estimated to be 33,290,195, with upper and lower bounds of 33,414,198 and 33,166,192. The estimate of the number of females that have never married is 29,204,857 with a

reported lower bound of 29,090,048, and a reported upper bound of 29,319,666. What is the estimated number of all people who have never married?

Relevant Equations.

Standard error (SE) of a sum

$$SE(\hat{X}+\hat{Y}) = \sqrt{[SE(\hat{X})]^2 + [SE(\hat{Y})]^2}$$

Notes: The Census Bureau states that this method will underestimate the standard error if the items in a sum are highly positively correlated, and will overestimate the standard error if the items in the sum are highly negatively correlated. This equation also is valid for the standard error of the difference of ACS reported estimates: $SE(\hat{X} - \hat{Y}) = SE(\hat{X} + \hat{Y})$.

Calculations The point estimate of the number of people who have never married is

33,290,195 + 29,204,857 = 62,495,052.

From the previous example, the standard error of the estimates for males is 75,153. Application of the same equation for females yields a standard error of 69,581. Therefore, the standard error of the sum is

$$SE(62,495,052) = \sqrt{(75,153)^2 + (69,581)^2} = 102,418$$

Once the standard error of the sum has been calculated, analysts can calculate and report associated confidence intervals. The 90 percent confidence interval for the total number of people who have never married (based on equation in the first example) is

(62,495,052-1.65(102,418)) to (62,495,052+1.65(102,418)), or
62,326,062 to 62,664,042 people.

Discussion The summation of estimates propagates the sampling error inherent in the individual addend estimates, so the importance of evaluating and reporting the uncertainty in estimates derived in this manner is increased.

Many census data users, including transportation planners, will frequently need to combine individual census estimates in this way to address their specific analysis needs. The detailed delineations in several of the transportation-related ACS tabulations will frequently require analysts to sum individual estimates. For instance, ACS tabulations of commuting time of day break the day into very detailed day parts. To analyze longer periods, such as peak periods as opposed to peak hours, analysts will need to sum the time period components.

Example Calculation 3 Determine the standard error of a ratio of reported ACS estimates.

Problem Suppose the statistic of interest is the ratio of the number of women who have never married to the number of men who have never married. What is the ratio and the standard error of the ratio of females who have never married to males who have never married?

Relevant Equations.

Standard error of a ratio

$$SE\left(\frac{\hat{X}}{\hat{Y}}\right) = \frac{1}{\hat{Y}}\sqrt{[SE(\hat{X})]^2 + \frac{\hat{X}^2}{\hat{Y}^2}[SE(\hat{Y})]^2}$$

Note: This approximation is valid for ratios of two estimates where the numerator is not a subset of the denominator.

Calculations The equation inputs are calculated as shown above.

$$SE\left(\frac{29,204,857}{33,290,195}\right)=\frac{1}{33,290,195}\sqrt{(69,581)^2+\frac{(29,204,857)^2}{(33,290,195)^2}(75,513)^2}=0.29 \text{ percent.}$$

The ratio of the two estimates is (29,204,857/33,290,195) = 87.73 percent, and the upper and lower bounds for the 90 percent confidence level are

87.73% ± 1.65*0.29% = 87.25% − 88.21%

Discussion This example demonstrates a technique for evaluating how the sampling errors affect the calculation of ratios between two parallel estimates. A transportation-based example of this type of comparison would be if an analyst wanted to make a statement such as, "there are *X* times more two-vehicle households than zero-vehicle households in geographic area *Y*."

These comparisons are not usually that useful for single-variable tables, but are very common and useful when analyzing cross-tabulations, where an analyst might want to say something like, "workers in zero-vehicle households are X times more likely to commute by transit than workers in two-vehicle households."

The more common comparison between a subtotal estimate and its corresponding total estimate (e.g., "X percent of the households have zero vehicles") is covered in the next example calculation.

Example Calculation 4 Determine the standard error of a percentage.

Problem: Now, suppose the statistic of interest is the percentage of females who have never married in relation to the total number of people who have never been married. What is the percentage of people who have never married that are women, and what is the standard error of the percentage?

Relevant Equations.

Standard error of a proportion:

$$SE(\hat{p})=\frac{1}{\hat{Y}}\sqrt{(SE(\hat{X}))^2-\frac{\hat{X}^2}{\hat{Y}^2}(SE(\hat{Y}))^2}$$

Note: This approximation is valid for proportions of two estimates where the numerator (X) is a subset of the denominator (Y).

Calculations The point estimate for the proportion of the total that are female is (29,204,857/62,495,052)∗100% = 46.73%.

From the previous calculations, we know the standard error of the number of females who have never married is 69,581. The standard error for all people who have never married is 102,418.

The standard error of the proportion is

$$SE\left(\frac{29,204,857}{62,495,052}\right)=\frac{1}{62,495,052}\sqrt{(69,581)^2-\frac{(29,204,857)^2}{(62,495,052)^2}(102,418)^2}=0.08 \text{ percent.}$$

The proportion is 46.73 percent, and the upper and lower bounds for the 90 percent confidence level are as follows:

46.73% ± 1.65 * 0.08% = 46.60% − 46.86%

Discussion Determining the percentage that an ACS estimate makes up of an ACS estimated total will be a very common procedure for transportation planners and other census data users. For example, to calculate mode shares for different commuting modes, analysts will apply this procedure.

4.4.3 Confidence Intervals

As discussed earlier, the effect of the smaller ACS sample size, compared to the Long Form sample size, is to increase the sampling error and consequently to increase the standard errors of the estimates. The fact that the ACS estimates are less reliable than the corresponding Long Form estimates is well recognized by the Census Bureau, and has led to the release of 90 percent confidence intervals along with the ACS estimates. Previously, confidence intervals were not released with Long Form estimates. Instead, the dataset documentation included a description of the methodology and tables of parameters that users could employ in calculating these intervals.

Data users should learn how to use and interpret these confidence intervals. The various case studies presented in this guidebook illustrate how the confidence intervals affect the conclusions drawn from the analysis. For example, by examining the standard errors (computed from the estimate and the confidence interval) of estimates for two time periods or two populations, one can determine whether there is any real (or statistically significant) change in the value of the corresponding characteristic or whether the change is attributed to random error.

4.5 Comparison of ACS Estimates to Census

It is likely that many, or most, new ACS data users will begin their analyses of ACS by comparing ACS estimates to Census 2000 Long Form estimates. There are many methodological differences between the census Long Form and ACS, including differences in

- Sample sizes,
- Data collection procedures,
- Field staff training and capabilities,
- Wording of some questions,
- Reference periods,
- Editing procedures,
- Weighting, and
- Rounding.

Therefore, it would not be that surprising to see differences in the estimates that are not actual differences that can be supported by conventional wisdom or other data sources. Certainly, some of these differences are due to actual improvements in methods, as discussed in Section 4.1. In addition, over time, differences between ACS estimates and Census 2000 estimates will become historical footnotes, as only ACS will be carried into the future.

Nevertheless, these facts may not help an analyst very much as she or he tries to understand how important population variables are actually changing within a region. When unexpected differences between ACS and previous Census 2000 estimates are found, analysts may benefit by going through the following checklist:

- Examine the ACS margins of error and standard errors, as discussed in the previous section. An ACS point estimate may look odd compared to the Census 2000 estimate, but the differences may be statistically indistinguishable due to the limited sample sizes and the variability in the data.
- Remember the Census 2000 Long Form data represent sample data as well. The Census 2000 documentation provides the ability to estimate standard errors for those estimates.
- Investigate ACS and Census 2000 data quality measures, such as item imputation rates, related to the specific questionable conflicting results. Imputation rate tables are available with the other base tables on the American FactFinder website.
- Compare the Census 2000 and ACS questionnaires for the item(s) in question, and judge whether differences in the surveys would naturally lead to differences in the estimates. The ACS residency definition and reference period definition are likely to be the cause of many measured differences between the datasets.

- Determine whether the curious finding is consistent with what other comparisons between the datasets have noted. Many comparison studies are discussed below.
- Decide whether applying benchmarking analysis could address the identified issues. A technique for performing this analysis is summarized below.
- To the extent possible, identify and utilize validation datasets and administrative records to determine whether the new ACS estimates are reasonable.
- Develop caveat language for reports and presentations to explain the dataset differences and the effects of these differences on your analyses.

The following subsections provide guidance on implementing these strategies. We begin by exploring the research that has been conducted on differences between Census 2000 and ACS to help analysts better understand where structural differences between the datasets can be expected.

4.5.1 Census Bureau Comparison Reports

Four of the reports in the Census Bureau ACS evaluation series compare the results of the C2SS and the decennial census for

- General demographic and housing characteristics (Report 4);
- Economic characteristics (Report 5);
- Social characteristics (Report 9); and
- Physical and financial housing characteristics (Report 10).[30]

Each of the reports concludes that at the national level, the C2SS estimates were similar to those produced from the Census 2000 sample. In addition, the researchers compared county-level estimates for counties corresponding to 18 of the ACS test sites. Few county-level estimate differences were found to be substantive. Even when differences were deemed to be statistically significant (which was common due to the large sample sizes), the report authors note, "data users would in general come to similar conclusions, implement similar programs, and allocate funds in a similar way regardless of which dataset they used."

Where differences were found, the researchers considered potential methodological reasons, and recommended actions for the ACS design. Among the reasons identified for differences were the following:

- Sample coverage differences between the C2SS and decennial census Long Form;
- Differences in the reference periods (Census 2000 focused on a single point of time in April 2000; C2SS referred to "last week" and covered all of year 2000);
- Questionnaire presentation differences, including question wording and response categories;
- Different proxy rules and survey follow-up mechanisms;
- Different weighting and estimation procedures;
- Better internal checks and verification procedures in C2SS than in Census 2000; and
- Interviewers who were more experienced and better trained for C2SS than the enumerators for Census 2000.

A fifth report in the Census series, *Report 8: Comparison of the American Community Survey Three-Year Averages and the Census Sample for a Sample of Counties and Tracts* compares estimates from the census 2000 Long Form to the same ACS estimates(1999-2001) at the county and census tract level for the 36 ACS test sites.[31]

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[30] See www.census.gov/acs/www/AdvMeth/Reports.htm.

[31] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs – Implementing the American Community Survey: Report 8: Comparison of the American Community Survey Three-Year Averages and the Census Sample for a Sample of Counties and Tracts* (June 2004).

For this analysis, the Census Bureau selected a manageable number of variables for analysis. Four types of estimates were evaluated.

- **Demographic estimates** included
  - Age,
  - Race,
  - Gender,
  - Hispanic origin,
  - Relationship,
  - Tenure, and
  - Housing occupancy.
- **Social estimates** included
  - School enrollment,
  - Educational attainment,
  - Marital status,
  - Disability status,
  - Grandparents as caregivers,
  - Veteran status,
  - Nativity and place of birth,
  - Region of birth of foreign born,
  - Language spoken at home, and
  - Ancestry.
- **Economic estimates** included
  - Employment status,
  - Commuting to work,
  - Occupation,
  - Industry,
  - Class of worker,
  - Income, and
  - Poverty status.
- **Housing estimates** included
  - Units in structure,
  - Year structure built,
  - Rooms,
  - Year householder moved into unit,
  - Vehicles available,
  - House heating fuel,
  - Occupants per room,
  - Value,
  - Mortgage status and selected monthly owner costs,
  - Selected monthly owner costs as a percentage of household income,
  - Gross rent, and
  - Gross rent as a percentage of household income.

For the county-level comparison, the majority of ACS estimates were in agreement with the Census 2000 estimates. Some of the statistically significant county-level differences were found to be small enough that they would not impact the use of the data. In addition, many of the differences could be attributed to differences in the questionnaires, procedures or both.

Unfortunately, because of the small sample size in the ACS, meaningful comparisons at the census tract level were difficult to perform. Although the general patterns for the tract data tended to mirror the county patterns, the high levels of variance for the tracts tended to reduce the number of detectable differences.

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The report uses the Z-score to determine whether differences are due to the sampling variability or are probably due to issues other than sampling variability.

The report finds that most of the variables show small differences between the ACS and Census 2000. At the county level, a large number of counties showed statistically significant differences in disability status, Hispanic origin, and employment status. Some other authors[32-33] (Stern, 2003, Salvo et al., 2004) have noted that the Census 2000 disability rates may have been inflated, partly because of misinterpretation of the Census 2000 survey question.

Stern notes that "differences in disability are traced to computer interviewing in the ACS (a clear improvement over the Census 2000 and ACS mail questionnaire). Differences in race responses are partly traced to the use of permanent field staff where the response "some other race" is not a response category in most other surveys and a much smaller number of these responses are observed in ACS than in Census 2000."[34]

Differences also were seen in labor force participation, mean travel time (Census 2000 estimates are consistently higher), vehicles available in households (Census 2000 estimates were significantly higher in six counties for households with no vehicles, and ACS estimates were significantly higher in five counties for households with three or more vehicles), and means of transportation to work. The carpool to work category (in mode to work) recorded the highest difference with ACS numbers consistently lower in 9 of 36 counties.

Tables 4.11 through 4.14 summarize the county-level differences reported for the sample census variables. Note, of the 36 counties analyzed, small is defined as fewer than 4 counties with significant differences; moderate is defined as between 4 and 8 counties; large is defined as 9 or more counties.

Table 4.11. Number of counties with statistically significant differences between ACS and Census 2000 demographic estimates.

Estimate Category	ACS – Census 2000 Difference[35]
Sex	Small
Age	Moderate
Race	Large
Hispanic Origin	Large
Relationship	Large
Tenure	Moderate
Household by Type	Large
Housing Occupancy	Large

Source: United States Census Bureau, 2004.

[32] S.M. Stern, (2003). Counting People with Disabilities: How Survey Methodology Influences Estimates in Census 2000 and the Census 2000 Supplementary Survey. Report submitted to the U.S. Census Bureau. Washington, D.C.
[33] Joseph Salvo, Peter Lobo, and Timothy Calabrese. *Small Area Data Quality: A Comparison of Estimates 2000 Census and the 1999-2001 ACS, Bronx, New York Test Site*, 2004.
[34] U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs—Implementing the American Community Survey: Report 8: Comparison of the American Community Survey Three-Year Averages and the Census Sample for a Sample of Counties and Tracts* (June 2004), p. xvii.
[35] Of the 36 counties analyzed, small is defined as fewer than four counties with significant differences; moderate is defined as between four and eight counties; large is defined as nine or more counties.

Table 4.12. Number of counties with statistically significant differences between ACS and Census 2000 social estimates.

Estimate Category	ACS – Census 2000 Difference
School Enrollment	Moderate
Educational Attainment	Moderate
Marital Status	Moderate
Grandparents as Caregivers and Veteran Status	Small
Disability	Large
Nativity and Place of Birth	Moderate
Region of Birth of Foreign Born	Small
Language Spoken at Home	Large
Ancestry	Large

Source: United States Census Bureau, 2004.

Table 4.13. Number of counties with statistically significant differences between ACS and Census 2000 economic estimates.

Estimate Category	ACS – Census 2000 Difference
Employment Status	Large
Commuting to Work	Moderate
Occupation	Small
Industry	Small
Class of Worker	Moderate
Household Income	Moderate
Income by Type	Large
Family Income	Small
Poverty Status	Small

Source: United States Census Bureau, 2004.

Table 4.14 Number of counties with statistically significant differences between ACS and Census 2000 housing estimates.

Estimate Category	ACS – Census 2000 Difference
Units in Structure	Large
Year Structure Built	Large
Number of Rooms	Large
Year Householder Moved into Unit	Small
Number of Vehicles	Moderate
House Heating fuel	Moderate
Selected Housing Characteristics	Large
Occupants per Room	Large
Housing Value	Moderate
Mortgage Status and Selected Owner Costs	Small
Selected Monthly Costs as a Percentage of Household Income	Moderate
Gross Rent	Moderate
Gross Rent as a Percentage of Household Income	Large

Source: United States Census Bureau, 2004.

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4.5.2 Local Area Experts Comparison Reports

In addition to the reports prepared by staff, the Census Bureau contracted with four local experts to provide site-specific analysis of these data. With their local knowledge of the counties, they provided a comprehensive interpretation of the data from a user perspective.

Bronx County, New York Bronx County data were assessed in the report summarized at www.census.gov/acs/www/AdvMeth/acs_census/lreports/SalvoLoboCalabrese.pdf and written by Joseph Salvo, Peter Lobo, and Timothy Calabrese in March 2004.

Because the three-year aggregate ACS sample size for the Bronx (10.2 percent of total housing units) was very small at the census tract level, this report examined data at a neighborhood level.[36] The 355 tracts in the Bronx were aggregated to 88 neighborhoods. The report finds that the mail return rates between the census and ACS are only modestly correlated (0.42). The average Census 2000 return rate was 53 percent. During the period 1999-2001, the ACS had an average return rate of 36 percent, decreasing from 38 percent in 1999 to 34 percent in 2001. The ACS also has a response rate that varies by geographic area. However, the allocation levels were lower in the ACS than in Census 2000, both for housing and population items.

The ACS produced higher percentages for people in the labor force than Census 2000. Carpool rates in ACS were about 2 percent smaller than Census 2000. Table 4.15 shows some of the variables for which statistically significant and meaningful[37] differences were found between the ACS and Census 2000.

The authors expressed concern regarding the adequacy of five-year accumulated data at the census tract level, as follows:

> Another concern, again related to the heavy dependence in the ACS on non-response follow-up, is that five years of data may not be enough to generate reliable estimates at the census tract level if mail return rates do not improve. This study provides a good illustration of what limits a 9 versus 15 percent sample placed on our ability to derive reliable estimates, namely the use of 88 neighborhood tract aggregates in lieu of estimates for the actual 355 census tracts.

Table 4.15. Variables with statistically significant differences in Bronx County: ACS versus Census 2000.

Variable	ACS	Census 2000
Population Aged 21-64 with Disability	19.0%	31.8%
Commute Via Carpool	7.0%	9.3%
Commute via Public Transportation	57.0%	53.9%
Mean Travel Time to Work	40.4 minutes	43.1 minutes
Civilian Employment	50.3%	45.7%
Median Household Income	$26,185	$27,611
Mean Earnings	$41,552	$44,116
Poverty Status of Individuals	56.8%	58.8%
Vehicles Available in Household = 1	30.1%	28.8%

Source: Salvo, Lobo, and Calabrese, 2004.

[36] ACS sample rates were 15 percent for Puma, Hampden, Douglas, and Multnomah Counties. For Broward, Bronx, San Francisco, Lake, and Franklin Counties, the ACS three-year aggregate sampling rate was closer to 10 percent.

[37] "Meaningful" differences are defined by the authors as statistically significant differences of 2 percent or more between ACS results and Census 2000 results.

Multnomah County, Oregon Multnomah County ACS test site data were assessed in the report found at www.census.gov/acs/www/AdvMeth/acs_census/lreports/hough_swanson.pdf and written by George Hough and David Swanson in March 2004.

Examining the self-response rates for Multnomah County, the authors state that if the only data for the survey were to come from self-response, ACS would have significant problems in areas where there is a concentration of minority populations. The most important issue underlying all of their concerns is funding the ACS effort continuously. "Sufficient funding for implementing the 2010 ACS plan must be ensured for a longer time horizon than the annual federal budget process now allocates."

However, the ACS allocation rates were lower than those of Census 2000 for population and housing items. ACS provided better data than Census 2000 for sample unit non-response rates, occupied sample unit non-response rates, and housing unit sample completeness ratios, with no significant difference observed for the household population sample completeness ratios.

Census 2000 results were better than ACS when examining vacant housing unit non-response rates. The Census 2000 sample uses population, housing unit, and household controls, while the ACS weights housing units and population solely. Using the specific housing unit and population weights to estimate households results in a difference between the number of householders and corresponding households of about 5,000.

Another contribution of this report is an alternate analysis of differences by using a method called "Loss Function." The Loss Function summarizes the information in the absolute numeric and absolute percent differences by combining them in a weighted fashion. Using the Loss Function, the authors identified some concerns with the measurement of race variables in ACS. The authors suggest that the Census Bureau release estimates for aggregated racial groupings as opposed to the detailed race groups that currently are provided. Significant differences also were observed for Hispanic population.

San Francisco and Tulare Counties, California Data from San Francisco and Tulare Counties were assessed in the report provided at www.census.gov/acs/www/AdvMeth/acs_census/lreports/gage.pdf and written by Linda Gage.

This report compared ACS and Census 2000 data for San Francisco and Tulare Counties. The report notes striking differences in data collection on race, disability status, vacancy status, number of rooms in structure, and grandparents as caregivers. However, 80 percent of the total variables were comparable. There were significant differences in the percentage of foreign-born, educational attainment, and language spoken at home—the author states that the rates of allocation in Census 2000 are the reason for the differences. Response rates were significantly improved under the ACS for most difficult items such as income. The report's findings on non-response are consistent with the Census Bureau's quality measures report. Census 2000 data shows higher percentages of workers commuting by carpool, longer commute times, and higher percent of households without vehicles than ACS. ACS shows higher percent of households with one vehicle.

The author provides strategies for analyzing and using census data. ACS prospects and predicaments also are delineated in the report as follows:

- The amount of data available to make your own assessment of the comparability, quality, usefulness, and potential benefits of ACS is initially overwhelming. The data, quality measures, and geography make analysis a challenge. Statistical measures like the differences, standard errors, Z-scores and P-values can help quickly identify significant differences but some statistically significant differences may not be meaningful differences in the world of the data user. In general, the ACS appears to be measuring the same things in much the same ways as the census and getting similar results. There is still much to learn about data comparability, reasons for differences and whether "different" is better, worse or just different. There are dif-

ferences between the census and ACS, some statistically significant differences. These may ultimately be welcome differences if ACS data are consistent, more current, and of higher quality than data from the Census 2000 Long Form sample. A few suggestions as you proceed to use the ACS data:
  - Do not try to analyze all the data all at once even if you use all the items or must supply them to others.
  - Concentrate on the data items that you already use in your work frequently. Compare those items with the census data.
  - Do not assume the census picture is more accurate. Check the quality measures.
  - Compare ACS and census data to administrative records that you may have available.
  - Consider whether the data make sense.
  - Learn to use and provide standard errors supplied with ACS data.
  - Communicate your findings with the Census Bureau and others evaluating the ACS data. This will improve the survey as it matures.
- ACS has been designed to collect and provide more complete and current demographic, social, economic, and housing information between censuses and to replace the Census 2010 Long Form. The success of this endeavor depends upon continuous and adequate funding, sufficient sample sizes, and a current and accurate MAF. Shortfalls in any of these areas could reduce data quality. The decennial census is subject to the same perils.
- As the ACS continues to evolve and improve, a few of the identified challenges include:
  - Resident populations in facilities such as prisons and dormitories (group quarters),
  - Improving the Census Bureau's population estimates used as the population controls for the ACS, and
  - Assisting data users to use a series of averaged data and data for small jurisdictions and seasonal areas.

Vilas and Oneida Counties, Wisconsin and Flathead and Lake Counties, Montana Data from these sample Wisconsin and Montana counties were assessed in the report provided at www.census.gov/acs/www/AdvMeth/acs_census/lreports/vossetal.pdf and written by Paul Van Auken, Roger Hammer, Paul Voss, and Daniel Veroff in March 2004.

This report assesses ACS attributes and quality measures at county and tract levels for counties with seasonal population. Based on seasonality in these counties, the authors anticipate ACS values to be higher for older population, median age, occupied housing units, median income, and housing values, and lower for unemployment and average household size.

Because rural census tracts are so large in geographic extent and encompass governmental units, the authors would like to have data at the minor civil division level, in addition to census tracts.

Because the Census Bureau expects ACS to achieve a (five-year) sample that is 75 percent of the census Long Form, and because the housing unit response is roughly around 75 percent of those originally in the sample, the ACS "interviewed" sample size would be 56 percent ($0.75 \times 0.75 = .56$) of the "100 percent response" census Long Form. The authors expect this to be exacerbated in rural areas. All four counties studied exhibited a sizeable difference in economic and housing attributes for over 20 percent of items. ACS was successful in capturing some of the seasonal variations.

Plotting the annual estimates of ACS at the county level, the authors found that ACS would be unable to provide reliable annual estimates for smaller areas like Vilas and Oneida Counties, particularly if they are not over sampled.

The authors also plotted the ratio of ACS and Census 2000 standard errors at the geography of census tract to find substantial cases where the ratio is more than 1.3, the level predicted by the Census Bureau.

The authors did not make any conclusions on the comparison of the ACS and Census 2000 data, citing the following four reasons:

1. Lack of data at the minor civil division level for comparison: The authors believe that data at the minor civil division level is critical to providing meaningful data for governmental units in rural areas.
2. Access to uncontrolled estimates from ACS: The authors want to review the ACS numbers, properly weighted, but without the final control to the population and housing estimates to examine what the ACS implies in terms of numbers of people/housing units in addition to their characteristics.
3. Because of a sampling error, ACS samples for some of the counties are substantially smaller than Census 2000 samples, thus yielding estimates with higher standard errors and more uncertainty.
4. One of the goals of the ACS is for standard errors in ACS not to exceed Census 2000 standard errors by more than 33 percent at all levels of census geography. At the tract level, attribute standard errors for the ACS appear to exceed those obtained in the Long Form by more than 33 percent.

4.5.3 ACS Transportation-Related Research

One objective was to compare the ACS data to the decennial census data so as to be able, to the extent possible, to make conclusions about the differences between the data sources, the relative accuracy of the data sources, and the adequacy of the ACS data. The differences between the ACS and CTPP estimates can be attributed to several factors, including differences in sampling rates, survey methodology, wording of the questions, timeframe of data collection, control totals, and rounding. It is important to understand both the magnitude and the significance of these differences, and how they would impact transportation planning applications.

We evaluated the general quality and validity of three-year accumulations (1999-2001) of ACS transportation-related data based on residence, workplace, and flow for nine test counties by comparing them to Census 2000 data that corresponds to CTPP Part 1, Part 2, and Part 3 data. The ACS and census data tables were provided to the project team by FHWA, which had received them for evaluation from the Census Bureau. Appendix I summarizes the analyses that were conducted. Some conclusions of these analyses were as follows:

- In general, the CTPP and ACS datasets appear to show the same patterns for the transportation-related tables. Only a small number of tracts and TAZs in the test counties for which data were available had significant variances between the two datasets.
- When we correlated the differences that were found with other tract and TAZ variables, we detected some systematic biases in the residence-based estimates, most notably for the following variables:
  - Disability status;
  - Disability status by mode to work;
  - Tenure (specifically, the owned-with-mortgage category);
  - Number of workers in the household by vehicles available by household income;
  - Poverty status (specifically the category for incomes between 100 percent and less than 150 percent of poverty); and
  - Telephone availability.
- Although the analyses of workplace-based estimates were more limited by the available comparison data, we did not identify any systematic biases.
- Effective comparisons of worker flow data were not possible.

4.5.4 Questionnaire Considerations

There are many questionnaire and data collection differences between ACS and the census Long Form data that affect the comparability of individual estimates (see Section 2 and Appendix A), but two differences are likely to affect many of the estimates, including transportation-related characteristics. The ACS residency definition and reference period definition will have an important effect on many comparisons of ACS and Census 2000.

Residency Definition The ACS uses different residence rules than have been employed in past decennial censuses. Although the decennial census uses the usual residence concept, the ACS uses the current residence concept along with the Two-Month Rule.

The current residence concept suits the ACS, because the ACS continuously collects information from monthly samples throughout the year. The current residence concept recognizes that people can live more than one place over the course of a year, and that population estimates for some areas may be noticeably affected by these people. Seasonal areas can experience important increases in their population over the year, increases that are not measured when only usual residents are recognized.

While the use of the current residence concept gives a more accurate picture of an area's population, it does present some challenges (for example, in integrating ACS data with intercensal population estimates, which employ the decennial census usual residence definition).[38]

Reference Period Since ACS data are collected continuously, the annual ACS estimates represent cumulative data over the 12-month interview cycle, and thus average annual conditions. In contrast, decennial census data represent point-in-time conditions.

The implications of the different reference dates are that ACS data will more accurately capture average conditions in seasonal areas. Decennial census data will only reveal characteristics of those areas on a single day, which might be quite different from conditions at other times of the year.

Using average annual data in models or analyses that are developed based on point-in-time data might be inconsistent, and this presents challenges to the analyst. For example, using average annual data or multiyear moving average data to calibrate/validate a travel demand model (e.g., trip distribution models, mode choice models) that predicts at a single point in time is theoretically inconsistent. However, this might not be a major issue if changes in household characteristics or mode choices are not significant over the period when the data are collected.

It is important to note that even though the rolling reference period procedures are used in ACS, the ultimate population control for any given year is the July 1 estimate. The implications of this control for seasonal analysis are discussed in Section 4.6.

4.5.5 Bridging between Year 2000 Census Data and ACS

Much of the discussion in previous sections has focused on identifying why seemingly surprising differences might occur between Census 2000 Long Form estimates and ACS estimates from roughly the same time. This section describes how the analyst might apply corrective factors to allow for better comparisons.

Suppose the following data shown in Table 4.16 on the mean travel time in a given area are available. The analyst wants to determine the change in the mean travel time from 2000 to 2005. Decennial census data are available in year 2000 but not in any of the following years; ACS data are not available for this area in year 2000 but are available afterwards.

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[38] Amy Symens Smith, "The American Community Survey and Intercensal Population Estimates: Where Are the Crossroads?" 1998. See www.census.gov/population/www/documentation/twps0031/twps0031.html.

Table 4.16. Example of ACS and census data comparison.

Year	ACS Mean Travel Time	Census Mean Travel Time
2000	NA	30
2001	28.8	NA
2002	29.0	NA
2003	29.2	NA
2004	29.4	NA
2005	29.6	NA

The 2001 to 2005 ACS travel time series shows an increasing trend in travel time over the years. However, the Census 2000 mean travel time estimate is larger than the ACS estimates in each of the years from 2001 to 2005. If analysts compare the raw Census 2000 estimate to the 2005 ACS estimate, they might erroneously conclude that congestion has decreased, and lowered journey-to-work travel times by 0.4 minutes.

However, this conclusion is probably inaccurate because the two estimates are drawn from two different surveys. When one accounts for the inherent differences between the surveys corrected through an analytical comparison of Census 2000 and C2SS data, a more reasonable conclusion can be drawn. As discussed below, the Census 2000 estimate can be converted to a 2000 ACS-like estimate by multiplying it by a factor of 0.9552, resulting in a 2000 estimate of 28.7 minutes. Given this estimate, one could conclude that the travel time increased between years 2000 and 2005 by 0.9 minutes.

The process of reconciling the estimates from one survey to the estimates from another survey is called benchmarking. It is typically done when two surveys with different precision levels and collection frequencies are available for providing estimates of a given population's characteristics. The survey that is normally used as the benchmark is the one whose estimates are more reliable. Different methods exist for benchmarking such as constrained estimation,[39] prediction models,[40] and imputation of adjusted responses.[41]

Since future data releases will only be from the ACS, Census 2000 data can be reconciled to produce year 2000 ACS-like data that could then be more consistently compared to future releases of ACS data. One method that has been used to bridge this gap is regression analysis. Year 2000 ACS data are available from C2SS for 216 counties with population above 250,000. The C2SS data for these counties can be used together with decennial census data for the same counties to analyze the differences between the two data sources.

For this guidebook, the following variables were analyzed:

- Mode to work,
- Travel time to work,

[39] This method can consist, for example, of adjusting the weights used to obtain the ACS estimates so that the ACS weighted annual average for selected characteristics would be equal to that of the census.

[40] In this method, a model (e.g., a regression) is developed using census estimates as the dependent variables and ACS estimates as predictors (or independent variables). The fitted equation can then be used to calibrate the ACS estimates to the census estimates by doing empirical Bayes' smoothing. This only applies, however, to the ACS variables included in the model.

[41] This method consists of estimating "what proportion of ACS respondents must have given the wrong answers to produce the observed differences, and then imputing the necessary proportion of different answers to bring agreement [with the census]". It requires the estimation of a measurement error model based on the differences between ACS and the census.

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- Vehicle availability, and
- Income.

For each variable of interest, we regressed the 2000 ACS estimate as the dependent variable against the 2000 decennial census estimate as the independent variable. The slope of this regression (with no intercept) provides a factor that can be interpreted as a factor that could be multiplied by the census estimate to obtain an ACS-like estimate. We did this analysis using all 216 county observations, as well as separately by metropolitan statistical area/consolidated metropolitan statistical area (MSA/CMSA) size to account for any biases that might be a function of area size.

Table 4.17 shows the factors obtained for means of transportation to work. The following categories are used: percent that drove alone, percent that carpooled, percent that used public transportation, and percent that walked.

Therefore, based on this regression analysis, we could conclude that the Census 2000 drove-alone mode share would be more consistent with ACS estimates if the census estimate were multiplied by 1.0099. Note that some of the factors for the walk and transit modes are fairly large, indicating that there were significant differences between the raw Census 2000 and ACS-like C2SS estimates.

Table 4.18 shows the factors obtained for vehicle availability, and used the categories of percent of zero-vehicle households and average auto ownership (average vehicles per household).

Tables 4.19 and 4.20 show the factors obtained for travel time to work. Categories used are mean travel time (minutes), percent with short commutes (less than 20 minutes), and percent with long commutes (greater than 20 minutes).

Table 4.21 shows the factors obtained for median household income.

Of course, these benchmarking factors are crude measures of the differences between Census 2000 and ACS, but analyses like these could help analysts understand and report trend data that rely on the different datasets.

Table 4.17 Means of transportation to work.

Mode	Pooled Sample	MSA/CMSA < 1 Million	MSA/CMSA: 1-5 Million	MSA/CMSA > 5 Million
Drove-Alone	1.0099			
Carpool	0.9249			
Public Transportation		0.9701	1.0043	1.0861
Walked		0.7579	0.8496	0.9265

Table 4.18 Vehicle availability.

Vehicles Available	Pooled Sample	MSA/CMSA < 1 Million	MSA/CMSA: 1-5 Million	MSA/CMSA > 5 Million
Zero		0.9164	0.8887	0.9617
Average Number	1.0182			

Table 4.19 Mean travel time to work.

Travel Time	Pooled Sample
Mean travel time	0.9552

Table 4.20 Travel time to work.

Travel Time	Pooled Sample
Percent of commuters with short commutes (< 20 minutes)	1.0207
Percent of commuters with long commutes (> 20 minutes)	0.986

Table 4.21. Median income.

Median Income	MSA/CMSA < 1 Million	MSA/CMSA:1-5 Million	MSA/CMSA > 5 Million
Decennial 2000	0.9396	0.955	0.9648
Decennial 1999	0.971	0.9869	0.997

4.6 Implications of ACS Data Release Frequency

4.6.1 Frequency of Data Releases

Annual estimates will be released for areas with population greater than 65,000, starting in year 2006. Three-year moving average estimates will be released for areas with population greater than 20,000 starting in year 2008. Five-year moving averages will be released for all areas starting in year 2010. Table 4.22 illustrates the data release schedule.

The main advantage of ACS in this respect is the timeliness of the data. This is especially important in mid-decade or during the years prior to the decennial census, where the census data from the previous decennial census would have become relatively outdated. Moreover, the availability of the ACS data on an annual basis, especially for large areas where the estimates are more reliable, enhances the ability to do trend analysis and use other time series analysis methods.

The availability of continuously updated data, however, might create burdens for analysts and data keepers. Transportation analysts should determine the frequency of updating their travel surveys (development and expansion), market analyses (e.g., environmental justice analysis), and travel demand models. This will depend on the particular analysis performed, area size, cost of the update, and utility obtained from updating the analysis. For example, travel demand models might not need to be updated annually; a five-year modeling cycle might be sufficient.

Moreover, users should determine which type of ACS estimate to use when there is more than one type available for a given area. For example, for areas with population greater than 65,000, annual estimates, three- and five-year moving averages are released. For areas with population between 20,000 and 65,000, three- and five-year moving averages are released. The type of estimate to use will depend on the purpose of the analysis, as follows:

- Consistency—If the characteristics of two populations in areas of similar geographic scales (e.g., populations of two counties or two states) are compared, it is important to use the same

Table 4.22. ACS Data release schedule.

		Data for the Previous Year Released In…						
Type of Data	Population/Size of Area	2006	2007	2008	2009	2010	2011	2012
1.Annual Estimates	65,000+	→	→	→	→	→	→	→
2.Three-Year Averages	20,000+			→	→	→	→	→
3.Five-Year Averages	Tract/Block Group					→	→	→

type of estimate to ensure consistency. For example, if County A has a 65,000+ population and County B has a population less than 65,000, then it is recommended that the multiyear or cumulative average estimate from County A (rather than the single-year estimate, which is available) be used to compare it to the moving average estimate from County B (where annual estimates are unavailable).
- Reduction in Lag Time—If the timeliness of the data is important for the analysis, and if the single-year estimates are deemed reliable (e.g., with reasonable standard errors and without too many fluctuations), the analyst could use the single-year estimates rather than the moving average estimates to reduce the lag time between the analysis year and data collection year.
- Greater Reliability—If the analysis focuses on a certain subpopulation for which three- and five-year moving averages are available, and if greater reliability is desired, the five-year moving averages would be more stable to use.
- Reducing Correlations—Moving averages that include overlapping years are correlated (see the discussion below). Therefore, when testing for the significance of an annual rate of change, it is recommended that annual estimates be used rather than moving average estimates that include overlapping years.

4.6.2 Measuring ACS Changes Across Years

The improved frequency of data allows users to better analyze changes within prescribed geographic areas. A new data product, the multiyear profile, provided by the Census Bureau summarizes the year-to-year changes in ACS estimates and identifies statistically significant differences.

The computational techniques used by the Census Bureau, as well as those that can be used by ACS analysts, for comparing estimates across years are summarized in a Census Bureau data accuracy memorandum entitled *2002 and beyond Change Profile Accuracy*.[42]

This document provides two useful example calculations that are summarized below. These examples show how to

- Determine the statistical significance of differences in percent distributions; and
- Determine the statistical significance of other differences.

Example Calculation 1 Determine if a year-to-year difference in an ACS percentage is statistically significant.

Problem The 2001 ACS for Bronx County, New York, estimates the number of women, aged 15 and over, to be 533,280, with lower and upper bounds of 533,062 and 533,498, respectively. The estimated number of these women who have never married is 213,545, with a lower bound of 208,349 and an upper bound of 218,741.

In 2002, ACS estimated the number of women age 15 and over to be 538,338, with lower and upper bounds of 537,558 and 539,118, and the number of these women who have never married to be 220,675, with lower and upper bounds of 214,146 and 227,204.

Did the percentage of women who have never been married increase significantly between the years?

Relevant Equations

Standard error = 90 percent confidence margin of error/1.65

Margin of error = max(upper bound – estimate, estimate – lower bound)

[42] See www.census.gov/acs/www/Downloads/ACS/accuracy2002change.pdf.

Note: many, but not all, ACS intervals are symmetrical around the reported estimate, so choosing the maximum interval is the conservative approach to establishing the margin of error.

Standard error of a proportion:

$$SE(\hat{p}) = \frac{1}{\hat{Y}}\sqrt{(SE(\hat{X}))^2 - \frac{\hat{X}^2}{\hat{Y}^2}(SE(\hat{Y}))^2}$$

Note: this approximation is valid for proportions of two estimates where the numerator (X) is a subset of the denominator (Y).

Difference

$$DIFF = 100 \times \left(\hat{P}_{Final} - \hat{P}_{Initial}\right)$$

Standard error of the difference:

$$SE(DIFF) = \sqrt{[SE(\hat{P}_{Final})]^2 + [SE(\hat{P}_{Initial})]^2}$$

Margin of error of the difference:

$ME(DIFF)$ = 1.65 x $SE(DIFF)$

Calculations

Year 2001

$SE(\hat{X}) = SE(213{,}545) = (218{,}741 - 213{,}545)/1.65 = 3{,}149$

$SE(\hat{Y}) = SE(533{,}280) = (533{,}498 - 533{,}280)/1.65 = 132$

$$SE(\hat{p}) = SE(0.400) = \frac{1}{533{,}280}\sqrt{(3{,}149)^2 - \frac{213{,}545^2}{533{,}280^2}(132)^2} = 0.006$$

Year 2002

$SE(\hat{X}) = SE(220{,}675) = (227{,}204 - 220{,}675)/1.65 = 3{,}957$

$SE(\hat{Y}) = SE(538{,}338) = (539{,}118 - 538{,}338)/1.65 = 473$

$$SE(\hat{p}) = SE(0.410) = \frac{1}{538{,}338}\sqrt{(3{,}957)^2 - \frac{220{,}675^2}{538{,}338^2}(473)^2} = 0.007$$

Comparison

$DIFF = 100 \times (0.410 - 0.400) = 1.0$ *percent*

$SE(DIFF) = \sqrt{[0.006]^2 + [0.007]^2} = 0.9$ *percent*

$ME(DIFF) = 1.65 \times 0.9 = 1.5$ *percent*

Lower bound = 1.0 percent – 1.5 percent = –0.5 percent

Upper bound = 1.0 percent + 1.5 percent = 2.5 percent

Discussion Since the lower bound and upper bound have different signs, the year-to-year difference is not significant at the 90 percent confidence level.

Example Calculation 2 Compare differences for other estimates.

Problem The mean travel time to work for Bronx County in 2001 was 41.0 minutes, with an upper bound of 41.7 minutes. In 2002, the ACS mean travel time to work was 41.8 minutes with an upper bound of 42.8 minutes. Did the mean travel time to work change significantly between the years?

Relevant Equations Means and other non-percentage ACS estimates are as follows:

Difference:

$$DIFF = \left(\hat{X}_{Final} - \hat{X}_{Initial}\right)$$

Standard error of the difference:

$$SE(DIFF) = \sqrt{[SE(\hat{X}_{Final})]^2 + [SE(\hat{X}_{Initial})]^2}$$

Margin of error of the difference:

$$ME(DIFF) = 1.65 \times SE(DIFF)$$

Calculations

Year 2001

$$SE(\hat{X}) = SE(41.0) = (41.7 - 41.0)/1.65 = 0.4$$

Year 2002

$$SE(\hat{X}) = SE(41.8) = (42.8 - 41.8)/1.65 = 0.6$$

Comparison

$$DIFF = (41.8 - 41.0) = 0.8 \text{ minutes}$$

$$SE(DIFF) = \sqrt{[0.4]^2 + [0.6]^2} = 0.7 \text{ minutes}$$

$$ME(DIFF) = 1.65 \times 0.7 = 1.2 \text{ minutes}$$

Lower bound = 0.8 minutes – 1.2 minutes = –0.4 minutes

Upper bound = 0.8 minutes + 1.2 minutes = 2.0 minutes

Discussion Since the lower bound and upper bound have different signs, the year-to-year difference is not significant at the 90 percent confidence level. With the standard errors of 0.4 minutes for 2001 and 0.6 minutes for 2002, the difference in the mean travel time would have to had been more than 1.2 minutes for the difference to be statistically significant.

Alternatively, if the 2002 standard error were 0.27 minutes, the difference of 0.8 minutes would have been statistically significant at the 90 percent confidence level:

$$DIFF = (41.8 - 41.0) = 0.8 \text{ minutes}$$

$$SE(DIFF) = \sqrt{[0.4]^2 + [0.27]^2} = 0.48 \text{ min}$$

$$ME(DIFF) = 1.65 \times 0.48 = 0.79 \text{ min}$$

Lower bound = 0.8 minutes – 0.79 minutes = 0.01 minutes

Upper bound = 0.8 minutes + 0.79 minutes = 1.59 minutes.

An analyst is not restricted to using the 90 percent confidence level even though the Census Bureau reports the data at this level. If one wanted to compare the mean travel times for the different years using a confidence level of 80 percent, the calculations could be accomplished as shown below:

Year 2001

$SE(\hat{X}) = SE(41.0) = (41.7 - 41.0)/1.65 = 0.4$

Year 2002

$SE(\hat{X}) = SE(41.8) = (42.8 - 41.8)/1.65 = 0.6$

The calculation Census Bureau upper and lower bounds for values use a 90 percent confidence level. Thus, 1.65 is used as the denominator.

$DIFF = (41.8 - 41.0) = 0.8$ minutes

$SE(DIFF) = \sqrt{[0.4]^2 + [0.6]^2} = 0.7$ minutes

$ME(DIFF) = 1.28 \times 0.7 = 0.9$ minutes

For the comparison, the critical value associated with the 80 percent confidence level, 1.28, is used to calculate the margin of error of the difference. Table 4.10 showed factors associated with different confidence levels, and a statistics textbook would include others.

Lower bound = 0.8 minutes – 0.9 minutes = –0.1 minutes

Upper bound = 0.8 minutes + 0.9 minutes = 1.7 minutes.

Therefore, even at the 80 percent confidence level, the lower and upper bounds of the difference are opposite signs indicating that the difference is not statistically significant.

In practice, it is not likely that an analyst would be interested in making comparisons with confidence levels that are lower than the Census Bureau's 90 percent. It is more likely that if one were using a different confidence level, it would be the 95 percent confidence level (for which one would use a critical value factor of 1.96).

4.6.3 Multiyear Averaging/Analysis of Overlapping Averages

The main advantage of moving averages, as compared to annual estimates, is that moving averages smooth the data and are thus more reliable (lower standard errors, less year-to-year variation). Since moving averages smooth out the random fluctuations in the data, they can provide a clearer visual picture of the overall trend in a certain variable of interest. The main disadvantage of moving averages is the lag time associated with them. If conditions are relatively stable across the years over which data are averaged, multiyear average estimates will be close to the annual estimates. However, if conditions change dramatically in a given year, the annual estimate reflects the change in a more timely manner than does the multiyear average.

There are two issues to consider with regard to the use of ACS multiyear averages. The first issue is related to the comparison of two moving averages that include overlapping years. It is important to note that statistically valid annual estimates of change cannot be computed from the difference of two moving averages if the two moving averages are based on data from overlapping years, such as from a moving average of years 1996-1998 and a moving average of years 1997-1999. This is because when standard statistical procedures are used to test for significant differences between estimates over time, it is assumed that the two estimates are drawn from independent samples. This assumption is violated in the case of the overlapping moving averages.

One tempting way to look at the comparison of two consecutive overlapping moving averages, say 2003-2005 and 2004-2006, is that it is in essence a comparison of the difference between 2006

(which is only in the second multiyear period) and 2003 (which is only in the first multiyear period). Unfortunately, the fact that the Census Bureau has released these data as multiyear averages is a recognition that a direct comparison between 2003 by itself and 2006 by itself for this geography is not valid because the individual year sample sizes will not support the comparison. When an analyst uses the multiyear overlapping estimates to make conclusions about single years, he or she is, in effect, cheating by using an artificially high number of data records that include the overlapping years (2004 and 2005, in this case). The analyst is claiming the reduced sampling error that comes with more data records, but in reality, only a portion (a third, in this case) of each sample's records actually contribute to the comparison the analyst is making.

This is not to say that one should not get a qualitative idea of the pattern of change from examining these overlapping moving averages, especially as they accumulate over time. Such time series will be very informative to data users as they try to capture what is happening in a region over time. However, there is a need to be cautious about making definitive conclusions about the differences of the overlapping estimates.

As the combination of multi- and single-year averages accumulate for geographic areas of different sizes, it is likely that it will be common for transportation planners and other ACS data users to develop factoring methods and iterative proportional fitting methods that combine multiyear average estimates for smaller geographic areas and single-year estimates for corresponding larger geographic areas to synthesize single-year estimates for geographic areas that do not support this level of ACS reporting. For more homogenous areas and ACS characteristics, these methods will provide reasonable small area estimates. However, analysts will need to remember that the ACS sample sizes do not really support such analyses, and therefore any conclusions drawn from these synthesized data are speculative.

The second issue related to multiyear estimates is that moving averages also present problems when used as dependent variables in several statistical models (such as time series models) and regression models, since the statistical properties of the data (such as autocorrelations) would be affected by the moving averages. Users should understand the implicit statistical assumptions in their analyses and be sure that the ACS data comply with these assumptions. For instance, if an analyst wanted to test the effect of gasoline prices on commuting modes for a small area (requiring multiyear averaging), he or she will not be able to use monthly, or even annual, gas price data effectively. The analyst will need to develop estimates of the independent variable in the same timeframe during which the ACS data are available.

4.6.4 Seasonality Analysis Using ACS

ACS data are collected throughout the year, as opposed to at a single point in time like the census Long Form data, so it will be important for data users to remember that analyses of other data in conjunction with ACS data will need to reflect the full year.

Because seasonality is very interesting from a transportation planning perspective, as travel patterns can vary significantly throughout the year, U.S. DOT has sponsored an analysis of seasonality using Hampden County, Massachusetts, data. For this guidebook, seasonality in two other ACS test counties, Broward County, Florida, and Pima County, Arizona, were analyzed using the evaluation datasets provided by FHWA and the Census Bureau. These datasets also were used for the comparisons described in Appendix I. The seasonality analyses that were performed with these data relied on information about the quarter of the year in which the data were collected. Since quarter data generally will not be available to ACS users, the results of these analyses are included in Appendix J. The key lesson from the analysis is that for some locations, seasonality will have an important effect on ACS results but, unfortunately, without information

on the time of year that the responses were obtained, we will not have much opportunity to address the issue.

4.6.5 ACS Continuity

An important concern about replacing the census Long Form with the continuous ACS is that by separating the sample data collection from the constitutionally mandated census count, ACS is more likely than the Long Form to be cut back or eliminated during the government's budgeting process.

Effect of Missing Data. Given the large standard errors of the ACS estimates, any further reduction in sample size will adversely impact the quality of its estimates, which will be reflected in larger standard errors. The relationship between the sampling rate and the resulting standard error of the estimates is shown by the following equation:

$$SE\left(\hat{Y}\right) = \sqrt{S\hat{Y}\left(1 - \frac{\hat{Y}}{N}\right)}$$

where

S is the inverse of the sampling rate minus 1,
$\hat{Y}$ is the estimate,
N is the total count of people or housing units, and
$SE(\hat{Y})$ is the standard error of $\hat{Y}$.

For example, if the sampling rate is cut by half, the resulting standard error is equal to $\sqrt{\frac{S_2}{S_1}} \approx \sqrt{2} = 1.41$ times the original standard error.

Sample size reduction due to potential budget cuts could have an effect on different phases of the ACS data collection program. The effect of eliminating the data collection, even for a single year, will be severe, and because of the multiyear averaging, will be long lasting.

Effect of Making ACS Voluntary The Census Bureau evaluated the effects of making participation in ACS voluntary, rather than mandatory. In two data quality reports that analyzed this issue, the Census Bureau responded to questionnaire content and increasing public privacy concerns by evaluating the potential effects of having ACS implemented as a voluntary survey. These reports are

- *Report 3: Testing the Use of Voluntary Methods* and
- *Report 11: Testing Voluntary Methods—Additional Results.*

To analyze the potential effects of this change, the Census Bureau performed a test using the March and April 2003 ACS sample. Four experimental mail treatments were used as follows:

- A mandatory treatment identical to the mandatory treatment that had been used previously,
- An alternative mandatory treatment that attempted to improve the user-friendliness of the mail survey,
- A standard voluntary approach similar to that used for other voluntary Census Bureau surveys, and
- A voluntary treatment that explicitly told respondents that the survey was voluntary.

Voluntary methods also were applied to the telephone and in-person surveys. The responses to the different treatments were then compared with each other and with the year 2002 mandatory treatment.

Based on their analyses of the data, the analysts drew the following conclusions:

- A dramatic decrease (more than 20 percentage points) occurred in mail response when the standard survey was voluntary.
- The reliability of estimates was adversely impacted by the reduction in the total number of completed interviews—producing reliable results with voluntary methods would require an increased initial sample size.
- The decrease in cooperation across all three modes of data collection resulted in a noteworthy, but not critical, drop in the weighted survey response rate.
- The estimated annual cost of implementing the ACS would increase by at least $59.2 million if the survey was voluntary and reliability was maintained.
- Levels of item non-response for the data collected under voluntary and mandatory methods were very similar. Although the differences in item non-response at the topic level were statistically significant, the item non-response rates were very similar.
- The use of voluntary methods had a negative impact on traditionally low-response areas that will compromise our ability to produce reliable data for these areas and for small population groups such as blacks, Hispanics, Asians, American Indians, and Alaska Natives.
- The change to voluntary methods had the greatest impact on areas that have traditionally high levels of cooperation and on white and non-Hispanic households.
- Compared to a standard voluntary survey, the use of a more direct presentation of the voluntary message 1) resulted in an additional decrease of four percentage points in mail response and 2) had only a minor additional impact on data quality, with an additional 1.6 percent decrease in the interview rate and an additional 0.4 percent decrease in the survey response rate.
- Compared to the current mandatory treatment, the revised mandatory treatment, which was intended to be more user-friendly, resulted in only a slight increase in mail cooperation (increase of 1.9 percentage points).
- Although the mail check-in rates were much higher for the mandatory treatments than for the voluntary treatments, the overall patterns of mail responses over time were remarkably similar across all four treatments.

CHAPTER 5

Policy Planning and Other Descriptive Analyses Using ACS Data

Perhaps the most common and straightforward uses of census Long Form data by transportation planners and other data users are descriptive analyses where the census data are summarized in useful ways to illuminate various characteristics of different populations of interest.

This section describes how basic transportation planning descriptive analyses and data summaries will be affected by the migration to ACS from the decennial Long Form. Section 5.1 broadly defines the different types of descriptive analyses and how these summaries are used. This section also provides some examples of uses of census data for developing descriptive analyses. A more detailed list of specific examples of uses of census data for this purpose is provided at the end of the section. Section 5.2 describes the benefits and limitations of shifting from the Long Form to ACS data related to the development of descriptive analyses. Finally, Section 5.3 provides case study examples showing how one could develop different types of descriptive analyses using ACS data.

5.1 Descriptive Analyses

Descriptive analyses are reports, summarys, charts, and/or maps that summarize the characteristics of a given population in a given year or the change in those characteristics over time. When planners are asked to provide estimates regarding the characteristics of their regional population, or of specific subpopulations, some common data sources are the Decennial Census Summary File 3, the CTPP, and PUMS files which are all derived from the census Long Form data.

Agencies and city planners use descriptive analyses for different purposes such as:

- Understanding the demographic, social, economic, and housing characteristics of people in their region;
- Evaluating the change in certain indicators of interest over time; and
- Guiding policy planning analyses (such as vehicle occupancy studies, employment concentration studies, corridor studies, etc.), environmental justice analyses, and other miscellaneous applications.

5.1.1 Examples of Descriptive Analyses

As discussed above, the Census Bureau provides data users with several packaged products for performing descriptive analyses in addition to the actual datasets from which users can perform their own descriptive analyses.

The Census Bureau's American FactFinder website provides quick and easy on-line access to data tables and thematic maps. On their website, the Census Bureau provides ready-made demographic profile tables at the state, county, and place level of geography (places with more

than 25,000 population), comparison and ranking tables, Census briefs, and Census special reports.

These descriptive analysis products provide most data users, particularly infrequent users, with the summaries that they require. In addition, the decennial census datasets are made available to users who frequently need to perform more detailed, ad hoc descriptive analyses.

For the last several decennial censuses, transportation planners have relied on the CTPP, a series of specialized tabulations produced by the Census Bureau and sponsored by AASHTO. The special tabulation and mapping software that is available with the CTPP data allow users to perform descriptive analyses on issues of particular interest to the transportation community.

Figures 5.1, 5.2, and 5.3 show examples of how some researchers have presented descriptive analyses of Census Bureau data.[43] Figure 5.1 provides a thematic map showing mean travel time ranges by county. Figure 5.2 provides a bar chart showing mean travel time by county. Figure 5.3 provides a pie chart showing the distribution of workers by mode of transportation to work. A list of some more specific examples of using Census data to do descriptive analyses also is provided at the end of this section.

5.1.2 ACS for Descriptive Analyses

As for the products based on the census 2000 Long Form, the ACS data releases described in Section 3 of this guidebook provide most data users with very efficient means of obtaining the

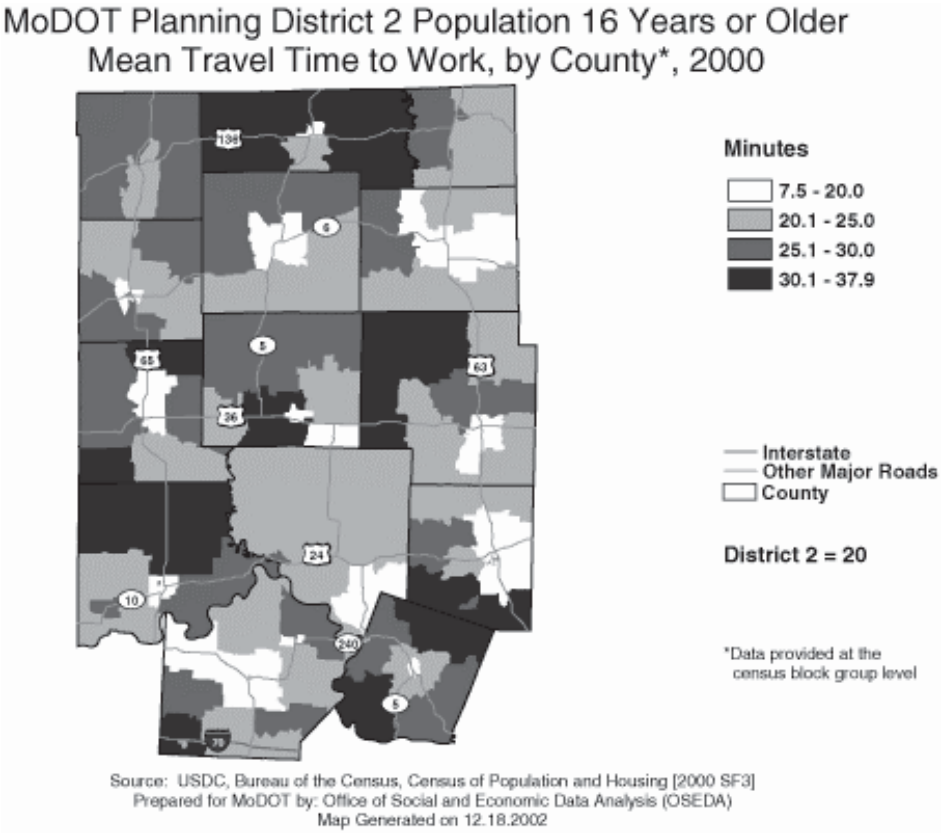
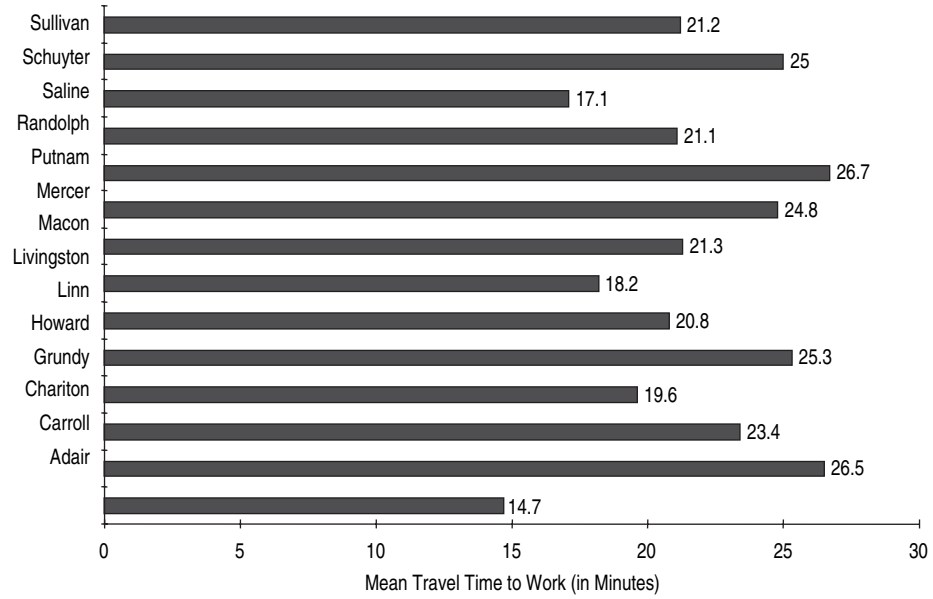


Figure 5.1. Mean travel time to work distribution by county.

[43] These figures are obtained from the Missouri Department of Transportation Socio-Economic Indicator Resource web page at http://oseda.missouri.edu/modot/planning/northcentral_transportation.shtml.



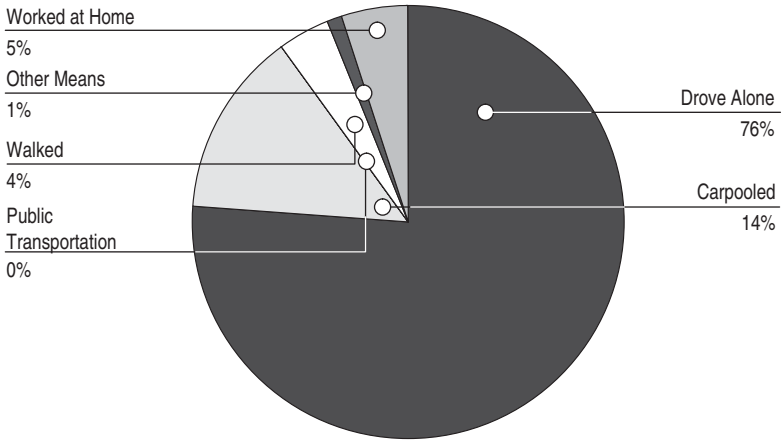
Source: USDC, Bureau of Census, Census of Housing and Population, Summary File 3 (2000)
Produced by: The Office of Social and Economic Data Analysis, UOE (TDranginis, August 2002)

Figure 5.2. Mean travel time to work by county, 2000.

descriptive data that they need. Users also will have access to the available ACS data and PUMS files on a frequent and regular basis.

Although special transportation-related tables based on ACS, similar to CTPP, have not been defined as of yet, the Census Bureau has included some of the most commonly used transportation data items in the base data release, and the Census Bureau appears to still be interested in providing special tabulations to its many various user groups. As part of the research effort that included this guidebook, recommendations for a future CTPP product also were developed.

Therefore, the general ability of users to perform descriptive analyses of the types most commonly performed will remain as the Census Bureau completes the migration to ACS.



Source: USDC, Bureau of Census, Census of Housing and Population, Summary File 3 (2000)
Produced by: The Office of Social and Economic Data Analysis, UOE (TDranginis, August 2002)

Figure 5.3. Distribution of workers by mode of transportation to work.

The opportunity to improve upon current descriptive analyses by taking advantage of more timely data and important caveats to using ACS data for descriptive analyses in terms of data availability are discussed in the next section.

5.2 Benefits and Limitations of ACS for Descriptive Analyses

In discussions with transportation planners, the main perceived benefit of ACS identified was the timeliness of the data. For descriptive analyses of larger geographies, ACS will provide analysts with more current data and pre-made Census Bureau descriptive analysis products at a quicker rate than the decennial Long Form data collection approach.

With a Long Form data collection approach, an analyst interested in finding the percentage of households with no vehicles in their state could obtain a year 2000 estimate beginning in August or September of 2002. If a traditional decennial census Long Form data collection effort were to be performed, there would be no new estimate for the state available until the summer of 2012, when new year 2010 data became available to users. With the ACS, the analyst can obtain this estimate for the previous year as early as late summer of the next year. These data will be available for 2005 and beyond. If the analyst needed the data in the summer of 2011, with the ACS they will be able to get a 2010 estimate (as well as similar estimates for 2005 through 2009, depending on the geographic size of the area under study). By comparison, with the Long Form data collection approach they would still only have the year 2000 estimate in the summer of 2011.

The migration to ACS, however, does raise a few challenges for data users performing descriptive analyses. First, the ACS sample sizes are significantly smaller than those of the census Long Form. While it is very common for analysts to present Long Form estimates as point estimates, without regard to sampling error, users probably will want to show or report the larger standard errors in the ACS estimates.

In addition, with smaller geographic areas, analysts will need to rely on data accumulated from multiple years. For areas with populations of more than 65,000, annual ACS estimates will be available. For areas with populations of between 20,000 and 65,000, analysts will need to rely on three-year averages. For areas with populations of less than 20,000, including tracts and block groups, analysts will need to rely on five-year averages.

For many descriptive analyses, the averaging across years of the estimates will not have too much of an effect. However, for some analyses of population and household characteristics that can vary over relatively small periods of time, it will be much more difficult for analysts to understand the characteristics of interest.

The analysis of smaller geographic areas also will be complicated by the Census Bureau's disclosure avoidance procedures. The ACS's smaller sample sizes and the Census Bureau's stricter rules on avoiding publication of estimates where there is a possibility that an individual can be identified, will make descriptive analyses of many small areas more difficult.

5.3 Descriptive Analysis Case Studies

The following case studies illustrate how a data user might compile descriptive analyses using ACS data, and provide a step-by-step description of how to obtain the data, do the computations, and present the results.

For this purpose, assume that you are a transportation analyst working in a Metropolitan Planning Organization (MPO). Your manager has asked you to compile descriptive statistics on commuting-to-work characteristics for a county in the area served by the MPO. In the first analysis, you will develop a change estimates profile. In the second analysis, you will compile a ranking profile. In the third analysis, you will develop descriptive statistics for a "state of the system" report.[44] Section 3 of this guidebook provides detailed instructions on downloading ACS data, and Section 4 describes the basic procedures that are applied in the case studies.

5.3.1 Analysis 1: Change Estimates Profile

You have been asked to produce a profile of Lake County showing selected commuting-to-work characteristics and how they have changed from 2002 to 2003. For presenting the results of the change profile analysis to your MPO director, it is important to show the year-to-year differences and an assessment as to whether the change is statistically significant. It is not necessary to include the technical details of the standard error and confidence interval computations.

You could produce some charts and graphs to help visualize the change in commuting characteristics between 2002 and 2003. Figures 5.4 and 5.5 are bar charts showing the distribution of workers by means of transportation to work and by departure time to work in 2002 and 2003, respectively. If additional detail is needed, you can also show the actual numbers in tabular format, such as the estimates in each of the years, the percentages, the difference in percentages, and whether the difference is statistically significant (see Table 5.4).

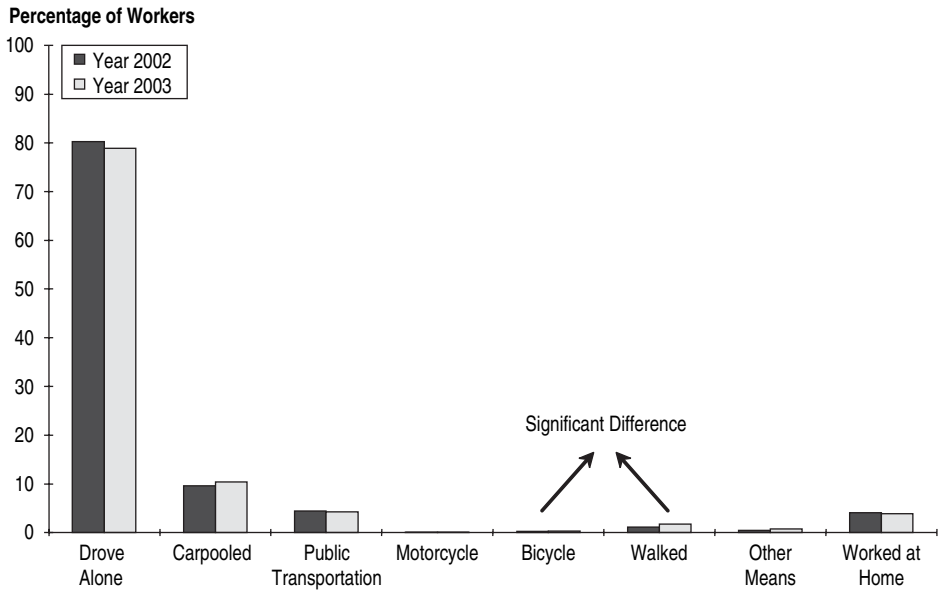


Figure 5.4. Distribution of workers by means of transportation to work in Lake County, 2002 and 2003.

[44] The data used for the first two example case studies are from ACS estimates for Lake County, Illinois, for 2002 and 2003, and on fictitious hypothetical estimates for the same county. The data used for the third case study are from ACS estimates for the San Francisco Bay Area, California, for 2000 through 2003. The Bay Area case study is based on a poster presentation at the TRB Census Data for Transportation Planning Conference in Irvine, California, in May 2005 developed and presented by Shimon Israel of MTC.

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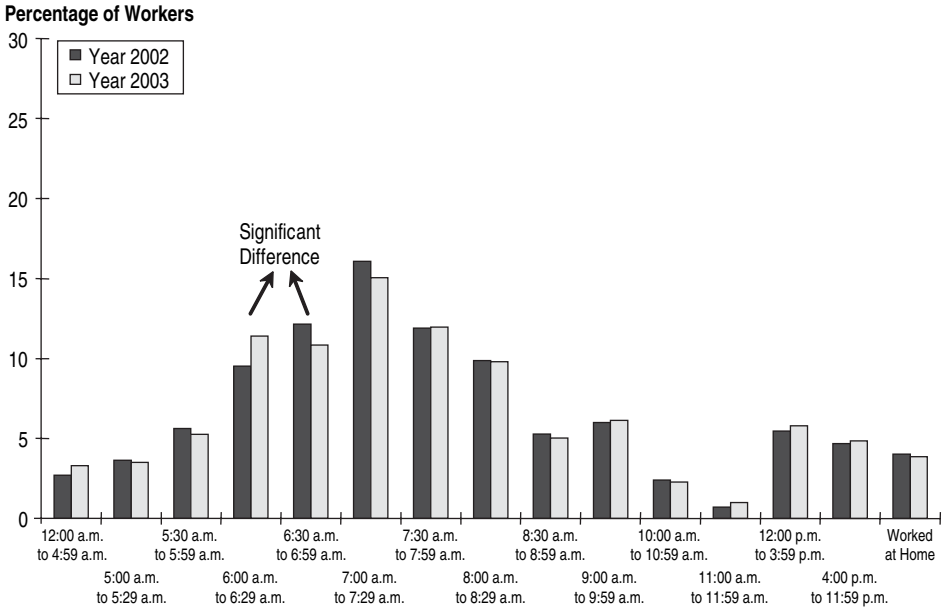

Figure 5.5. Distribution of workers by departure time to work in Lake County, 2002 and 2003.

The following conclusions could accompany the graphs:

- For mode to work, except for "walk" and "other means," there were no significant changes between 2002 and 2003 in the percentage of workers using any given transportation mode for commuting to work. For workers who walked to work, the difference in percentages is 0.63 percent (increase), and it is a statistically significant increase not caused by sampling error. For workers who used "other means" to work, the difference in percentages is 0.27 percent (increase), and it also is a statistically significant increase.
- For departure time to work, except for the time period from 6:00 A.M. to 6:59 A.M., there were no significant changes between 2002 and 2003 in the percentage of workers departing from home to work in any given time period. The increase in the percentage of workers departing during the time period from 6:00 A.M. to 6:29 A.M. was 1.87 percent in 2003 relative to 2002, and this increase is statistically significant. The decrease in the percentage of workers departing from 6:30 A.M. to 6:59 A.M. was 1.31 percent in 2003 relative to 2002, and this decrease is statistically significant.

Available Data Since Lake County has a population greater than 65,000 (according to Census 2000, the total population of Lake County is 644,356), ACS data for Lake County will be released annually. Since Lake County was one of the test sites during the demonstration phase of the ACS, both the 2002 data and 2003 detailed data tables are available on the American FactFinder website. Beginning with the full implementation of ACS, these data will be available via the website for any county of this size. Table 5.1 shows selected commuting-to-work characteristics for Lake County for years 2002 and 2003. The data files and estimates included in the Census Bureau detailed tabulations are released with a lower bound and an upper bound corresponding to the 90 percent confidence interval. The 90 percent confidence interval means that 90 times out of 100 the true value of the parameter for that area falls between the lower and upper bounds of an estimate derived from a sample like the one taken.

Analysis Steps The first part of this discussion summarizes the steps you would need to follow for analyzing the change in the percentage of workers who used public transportation to work between 2002 and 2003. The second part provides a means to determine if this change is statistically significant.

Table 5.1. Selected commuting-to-work characteristics for lake county, 2002 and 2003 ACS data.

	2002 Data			2003 Data		
	Estimate	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
Total Population	654,067	*****	*****	663,721	*****	*****
Total Households	222,841	221,092	224,590	226,074	224,274	227,874
Mode to Work:						
Total Workers 16+	314,647	309,478	319,816	316,525	312,408	320,642
Car, Truck, or Van:	282,426	276,882	287,970	282,407	277,642	287,172
Drove Alone	252,516	247,114	257,918	249,687	244,713	254,661
Carpooled	29,910	27,176	32,644	32,720	29,361	36,079
All Public Transportation:	13,829	12,087	15,571	13,299	11,567	15,031
Bus or Trolley Bus	1,860	1,114	2,606	2,527	1,686	3,368
Streetcar or Trolley Car	117	0	307	138	6	270
Subway or Elevated	541	241	841	776	401	1,151
Railroad	11,110	9,508	12,712	9,557	8,121	10,993
Ferryboat	39	0	103	43	0	115
Taxicab	162	0	330	258	48	468
Motorcycle	249	72	426	72	0	155
Bicycle	728	314	1,142	916	360	1,472
Walked	3,459	2,390	4,528	5,459	4,167	6,751
Other Means	1,315	804	1,827	2,176	1,567	2,785
Worked at Home	12,641	10,994	14,288	12,196	10,652	13,740
Departure Time to Work						
Total Workers 16+	314,647	309,478	319,816	316,525	312,408	320,642
Did Not Work at Home:	302,006	296,960	307,052	304,329	300,014	308,644
12:00 a.m. to 4:59 a.m.	8,499	6,950	10,048	10,439	9,008	11,870
5:00 a.m. to 5:29 a.m.	11,426	9,827	13,025	11,089	9,688	12,490
5:30 a.m. to 5:59 a.m.	17,732	15,472	19,993	16,619	14,774	18,464
6:00 a.m. to 6:29 a.m.	29,941	27,374	32,508	36,024	33,579	38,469
6:30 a.m. to 6:59 a.m.	38,229	35,096	41,362	34,311	32,047	36,575
7:00 a.m. to 7:29 a.m.	50,545	47,247	53,843	47,632	44,422	50,842
7:30 a.m. to 7:59 a.m.	37,398	34,357	40,439	37,845	35,023	40,667
8:00 a.m. to 8:29 a.m.	31,061	28,089	34,033	30,954	28,449	33,459
8:30 a.m. to 8:59 a.m.	16,582	14,818	18,346	15,951	14,473	17,429
9:00 a.m. to 9:59 a.m.	18,903	16,639	21,167	19,434	17,463	21,405
10:00 a.m. to 10:59 a.m.	7,585	6,315	8,856	7,202	5,982	8,422
11:00 a.m. to 11:59 a.m.	2,227	1,595	2,859	3,112	2,390	3,834
12:00 p.m. to 3:59 p.m.	17,191	15,223	19,159	18,379	16,159	20,599
4:00 p.m. to 11:59 p.m.	14,687	12,893	16,481	15,338	13,531	17,145
Worked at Home	12,641	10,994	14,288	12,196	10,652	13,740

Source: American FactFinder web site.

Note: An '*****' entry in the lower and upper bound columns indicates that the estimate is controlled. A statistical test is not appropriate.

In any given year i, the estimate of the proportion of workers $\hat{P}_i$ who used a particular mode to work is equal to the estimate of the number of workers $\hat{X}_i$ who used that mode divided by the estimate of the total number of workers $\hat{Y}_i$, as given by the following equation:

$$\hat{P}_i = \frac{\hat{X}_i}{\hat{Y}_i} \tag{5.1}$$

The difference in the percentages of workers who used a particular mode to work between two years is given by

$$DIFF = 100\% \times \left(\hat{P}_{final\ year} - \hat{P}_{initial\ year} \right) \tag{5.2}$$

where $\hat{P}_{\text{initial year}}$ $P_{\text{final year}}$ and are the proportions of workers who used the given mode to work in the initial year and final year, respectively.

For this analysis of public transportation, the proportions of workers who used public transportation to work in 2002 and 2003 are

$$P_{2002} = \frac{13,829}{314,647} = 0.0440$$

$$P_{2003} = \frac{13,299}{316,525} = 0.0420$$

The difference in the percentage of workers who used public transportation to work is given by

$$DIFF = 100\% \times \left(\hat{P}_{2003} - \hat{P}_{2002} \right) = -0.20\%$$

Now that the difference in percentages has been determined. To know whether this difference in percentages of workers who used a certain mode to work is statistically significant, the steps described below should be applied. These steps are based on the documents released by the Census Bureau on the accuracy of the data and the change profiles, and are summarized in Section 4 of this guidebook.[45]

Step 1—Compute the standard errors of the numerator $\hat{X}$ and denominator $\hat{Y}$ of the proportion $\hat{P}$, given their lower and upper bounds.

The standard error $SE(\hat{X})$ of an estimate $\hat{X}_i$ is computed as follows:

$$SE\left(\hat{X}_i \right) = \frac{\hat{X}_i - LB\left(\hat{X}_i \right)}{1.65} \tag{5.3}$$

where $LB(\hat{X}_i)$ is the lower bound of the 90 percent confidence interval for the characteristic $\hat{X}_i$, and 1.65 is the critical value of the t-statistic associated with a 90 percent confidence interval.

For example, the standard error of the number of workers who used public transportation to work in 2002 is

$$SE(\hat{X}_{2002}) = SE(\text{public transportation}_{2002}) = \frac{13,829 - 12,087}{1.65} = 1,056$$

The standard error of the total number of workers in 2002 is:

$$SE(\hat{Y}_{2002}) = SE(\text{total workers}_{2002}) = \frac{314,647 - 309,478}{1.65} = 3,133$$

Similarly, for year 2003, these standard errors are given by:

$$SE(\hat{X}_{2002}) = SE(\text{public transportation}_{2003}) = \frac{13,299 - 11,567}{1.65} = 1,050$$

and

$$SE(\hat{Y}_{2002}) = SE(\text{total workers}_{2003}) = \frac{316,525 - 312,408}{1.65} = 2,495$$

[45] See "Change Estimates" at www.census.gov/acs/www/Downloads/ACS/accuracy2002change.pdf and "Accuracy of the Data (2003)" at www.census.gov/acs/www/Downloads/ACS/accuracy2003.pdf.

Step 2—Compute the standard error $SE(\hat{P})$ of the proportion P, given the standard errors of the numerator and the denominator. The standard error $SE(\hat{P})$ is given by the following equation:

$$SE\left(\hat{P}_i\right) = \frac{1}{\hat{Y}_i}\sqrt{\left[SE\left(\hat{X}_i\right)\right]^2 - \frac{\hat{X}^2}{\hat{Y}_i^2}\left[SE\left(\hat{Y}_i\right)\right]^2} \tag{5.4}$$

If the value under the square root in Equation 5.4 is negative, the minus sign under the square root is replaced by a plus sign, which results in a conservative estimate of the standard error.

In the above example, the standard error of the proportion of workers who used public transportation to work in 2002 and in 2003 is given by

$$SE(\hat{P}_{2002}) = SE(\text{proportion public transportation}_{2002}) = \frac{1}{314,467}\sqrt{[1,056]^2 - \frac{13,829^2}{314,647^2} * [3,133]^2} = 0.00333$$

$$SE(\hat{P}_{2003}) = SE(\text{proportion public transportation}_{2003}) = \frac{1}{316,525}\sqrt{[1,050]^2 - \frac{13,299^2}{316,525^2} * [2,495]^2} = 0.00331$$

Step 3—Compute the standard error of the difference in percentages. This is given by the following equation:

$$SE(DIFF) = 100\% \times \sqrt{\left[SE\left(\hat{P}_{final\ year}\right)\right]^2 + \left[SE\left(\hat{P}_{initial\ year}\right)\right]^2} \tag{5.5}$$

In the above example, the standard error of the difference in the percentages of workers who used public transportation to work in 2002 and in 2003 is given by:

$$SE(DIFF) = 100\% \times \sqrt{\left[SE\left(\hat{P}_{2003}\right)\right]^2 + \left[SE\left(\hat{P}_{2002}\right)\right]^2}$$

$$= 100\% \times \sqrt{[0.00331]^2 + [0.00333]^2} = 0.47\%$$

Step 4—Compute the 90 percent margin of error of the difference in percentages. This is given by the following equation:

$$ME(DIFF) = 1.65 * SE(DIFF) \tag{5.6}$$

In the above example, the 90 percent margin of error of the difference in the percentages of workers who used public transportation to work is given by:

$$ME(DIFF) = 1.65 * 0.47\% = 0.77\%$$

Step 5—Compute lower and upper bounds of the difference in percentages. These bounds are given by the following equations:

$$LB(DIFF) = DIFF - ME(DIFF) \tag{5.7}$$

$$UB(DIFF) = DIFF + ME(DIFF) \tag{5.8}$$

In the above example, the lower and upper bounds of the 90 percent confidence interval corresponding to the difference in the percentages of workers who used public transportation to work are given by:

$$LB(DIFF) = -0.20\% - 0.77\% = -0.97\%$$

$$UB(DIFF) = -0.20\% + 0.77\% = 0.57\%$$

Step 6—Determine the statistical significance of the difference in percentages according to the following rules:

- If either the lower bound or upper bound is equal to zero, then the difference is not statistically significant;
- If the lower bound is negative and the upper bound is positive, then the difference is not statistically significant;
- If both the lower and upper bounds have the same sign (that is both are positive or both are negative), then the difference is statistically significant; and
- If *ME(DIFF)* is undetermined (e.g., due to an estimate of zero for the denominator (universe) or if the numerator and denominator estimates are controlled), then the significance cannot be computed.

For the above example, since the lower bound is negative (-0.97 percent) and the upper bound is positive (0.57 percent), the change in the percentage of workers who used public transportation to work from 2002 to 2003 is not statistically significant at the 90 percent level of confidence. The difference in the percentages is attributed to sampling error.

The computation details for the full set of commuting variables are shown below. Tables 5.2 and 5.3 show the calculations of the standard errors of the estimates, proportions, and standard errors of the proportions for the 2002 and 2003 data, respectively.

Table 5.4 shows the calculations related to the difference between the 2002 and 2003 percentages. Specifically, it shows the 2002 and 2003 percentages, difference in percentages, standard error of the difference, margin of error of the difference, lower and upper bounds of the 90 percent confidence interval, and whether the difference is statistically significant at the 90 percent level of confidence.

5.3.2 Analysis 2: Ranking Profile

You have been asked to produce a profile of Hypothetical Lake County showing the percentage of zero-vehicle households in year 2010 by county subdivision and how the different subdivisions compare to the county average.[46] Understanding how vehicle availability varies across the county is important, for example, for determining whether transit service is adequate in areas with higher concentrations of zero-vehicle households.

This section presents some different graphical options for presenting the results and conclusions from the analysis of the percentage of zero-household vehicles. If additional detail is needed, the actual numbers also can be shown in tabular format (as appears later in Table 5.9).

Figure 5.6 shows the ranges of the percentage of zero-vehicle households in each of the county subdivisions, where each range is colored differently. Figure 5.7 compares the county subdivi-

[46] This case study relies on synthetic data similar to what will be available from future ACS data releases. These synthetic data are used because actual full-implementation ACS data with three- and five-year averaging are not available at the time that this report is being written.

Table 5.2. 2002 calculations worksheet.

	Given Data			Calculations		
	Estimate	Lower Bound	Upper Bound	Standard Error of Estimate	Proportion	Standard Error of Proportion
Total Population	654,067	*****	*****			
Total Households	222,841	221,092	224,590	1,063		
Mode to Work						
Total Workers 16+	314,647	309,478	319,816	3,142		
Car, Truck, or Van:	282,426	276,882	287,970	3,370	0.8976	0.0059
Drove Alone	252,516	247,114	257,918	3,284	0.8025	0.0067
Carpooled	29,910	27,176	32,644	1,662	0.0951	0.0052
Public Transportation:	13,829	12,087	15,571	1,059	0.0440	0.0033
Bus or Trolley Bus	1,860	1,114	2,606	453	0.0059	0.0014
Streetcar or Trolley Car	117	0	307	71	0.0004	0.0002
Subway or Elevated	541	241	841	182	0.0017	0.0006
Railroad	11,110	9,508	12,712	974	0.0353	0.0031
Ferryboat	39	0	103	24	0.0001	0.0001
Taxicab	162	0	330	98	0.0005	0.0003
Motorcycle	249	72	426	108	0.0008	0.0003
Bicycle	728	314	1,142	252	0.0023	0.0008
Walked	3,459	2,390	4,528	650	0.0110	0.0021
Other Means	1,315	804	1,827	311	0.0042	0.0010
Worked at Home	12,641	10,994	14,288	1,001	0.0402	0.0032
Departure Time to Work						
Total Workers 16+	314,647	309,478	319,816	3,142		
Did Not Work at Home:	302,006	296,960	307,052	3,067	0.9598	0.0018
12:00 a.m. to 4:59 a.m.	8,499	6,950	10,048	942	0.0270	0.0030
5:00 a.m. to 5:29 a.m.	11,426	9,827	13,025	972	0.0363	0.0031
5:30 a.m. to 5:59 a.m.	17,732	15,472	19,993	1,374	0.0564	0.0043
6:00 a.m. to 6:29 a.m.	29,941	27,374	32,508	1,560	0.0952	0.0049
6:30 a.m. to 6:59 a.m.	38,229	35,096	41,362	1,905	0.1215	0.0059
7:00 a.m. to 7:29 a.m.	50,545	47,247	53,843	2,005	0.1606	0.0062
7:30 a.m. to 7:59 a.m.	37,398	34,357	40,439	1,849	0.1189	0.0058
8:00 a.m. to 8:29 a.m.	31,061	28,089	34,033	1,807	0.0987	0.0057
8:30 a.m. to 8:59 a.m.	16,582	14,818	18,346	1,072	0.0527	0.0034
9:00 a.m. to 9:59 a.m.	18,903	16,639	21,167	1,376	0.0601	0.0043
10:00 a.m. to 10:59 a.m.	7,585	6,315	8,856	772	0.0241	0.0024
11:00 a.m. to 11:59 a.m.	2,227	1,595	2,859	384	0.0071	0.0012
12:00 p.m. to 3:59 p.m.	17,191	15,223	19,159	1,196	0.0546	0.0038
4:00 p.m. to 11:59 p.m.	14,687	12,893	16,481	1,091	0.0467	0.0034
Worked at Home	12,641	10,994	14,288	1,001	0.0402	0.0032

sions' percentage of zero-vehicle households to that of the entire county, using different colors to show subdivisions that have a smaller rate and those that have a larger rate.

Figure 5.8 shows another method for presenting the conclusions. For every county subdivision, this graph shows the estimate of the percentage of zero-vehicle households and its lower and upper bounds. The confidence interval for the percentage of zero-vehicle households at the county level is shown as dotted lines (lower bound, estimate, and upper bound).

It would be common to accompany these graphs with conclusions like the following:

- Waukegan has the largest percentage of zero-vehicle households (8.1 percent);
- West Deerfield has the smallest estimated percentage of zero-vehicle households (0.8 percent); and
- There are 11 county subdivisions where the percentage of zero-vehicle households is smaller than the county average (3.1 percent), and 7 county subdivisions where the percentage of zero-vehicle households is larger than the county average.

Table 5.3. 2003 calculations worksheet.

	Given Data			Calculations		
	Estimate	Lower Bound	Upper Bound	Standard Error of Estimate	Proportion	Standard Error of Proportion
Total population	663,721	*****	*****			
Total households	226,074	224,274	227,874	1,094		
Mode to work						
Total workers 16+	316,525	312,408	320,642	2,503		
Car, truck, or van:	282,407	277,642	287,172	2,897	0.8922	0.0058
Drove alone	249,687	244,713	254,661	3,024	0.7888	0.0072
Carpooled	32,720	29,361	36,079	2,042	0.1034	0.0064
Public transportation:	13,299	11,567	15,031	1,053	0.0420	0.0033
Bus or trolley bus	2,527	1,686	3,368	511	0.0080	0.0016
Streetcar or trolley car	138	6	270	80	0.0004	0.0003
Subway or elevated	776	401	1,151	228	0.0025	0.0007
Railroad	9,557	8,121	10,993	873	0.0302	0.0027
Ferryboat	43	0	115	26	0.0001	0.0001
Taxicab	258	48	468	128	0.0008	0.0004
Motorcycle	72	0	155	44	0.0002	0.0001
Bicycle	916	360	1,472	338	0.0029	0.0011
Walked	5,459	4,167	6,751	785	0.0172	0.0025
Other means	2,176	1,567	2,785	370	0.0069	0.0012
Worked at home	12,196	10,652	13,740	939	0.0385	0.0029
Departure time to work						
Total workers 16+	316,525	312,408	320,642	2,503		
Did not work at home:	304,329	300,014	308,644	2,623	0.9615	0.0033
12:00 a.m. to 4:59 a.m.	10,439	9,008	11,870	870	0.0330	0.0027
5:00 a.m. to 5:29 a.m.	11,089	9,688	12,490	852	0.0350	0.0027
5:30 a.m. to 5:59 a.m.	16,619	14,774	18,464	1,122	0.0525	0.0035
6:00 a.m. to 6:29 a.m.	36,024	33,579	38,469	1,486	0.1138	0.0046
6:30 a.m. to 6:59 a.m.	34,311	32,047	36,575	1,376	0.1084	0.0043
7:00 a.m. to 7:29 a.m.	47,632	44,422	50,842	1,951	0.1505	0.0060
7:30 a.m. to 7:59 a.m.	37,845	35,023	40,667	1,716	0.1196	0.0053
8:00 a.m. to 8:29 a.m.	30,954	28,449	33,459	1,523	0.0978	0.0047
8:30 a.m. to 8:59 a.m.	15,951	14,473	17,429	898	0.0504	0.0028
9:00 a.m. to 9:59 a.m.	19,434	17,463	21,405	1,198	0.0614	0.0038
10:00 a.m. to 10:59 a.m.	7,202	5,982	8,422	742	0.0228	0.0023
11:00 a.m. to 11:59 a.m.	3,112	2,390	3,834	439	0.0098	0.0014
12:00 p.m. to 3:59 p.m.	18,379	16,159	20,599	1,350	0.0581	0.0042
4:00 p.m. to 11:59 p.m.	15,338	13,531	17,145	1,098	0.0485	0.0034
Worked at home	12,196	10,652	13,740	939	0.0385	0.0029

However, given the sampled nature of ACS data, it is more appropriate to present the results using the confidence intervals. For instance, one could say with 90 percent confidence that

- Waukegan has the largest percentage of zero-vehicle households (7.5 percent to 8.8 percent);
- West Deerfield (0.7 percent to 0.9 percent), Ela (0.7 percent to 1.0 percent), and Newport (0.8 percent to 1.0 percent) have the smallest percentage of zero-vehicle households;
- Ten county subdivisions have a statistically significant smaller percentage of zero-vehicle households than the overall county;
- Three county subdivisions (Grant, Waukegan, and Zion) have a percentage of zero-vehicle households that is statistically higher than the overall county; and
- Five county subdivisions (Antioch, Benton, Moraine, Shields, and Wauconda) have percentages of zero-vehicle households that are statistically the same as the county percentage.

Table 5.4. 2002-2003 change calculations worksheet.

	Given Data		Calculations							
	2002 Estimate	2003 Estimate	2002 %	2003 %	Diff: 2003 % -2002 %	SE (Diff)	ME (Diff)	LB (Diff)	UB (Diff)	Statistically Significant?
Total population	654,067	663,721	100%	100%						
Total households	222,841	226,074	100%	100%						
Mode to work										
Total workers 16+	314,647	316,525								
Car, truck, or van:	282,426	282,407	89.76	89.22	-0.54	0.83	1.36	-1.90	0.82	No
Drove alone	252,516	249,687	80.25	78.88	-1.37	0.99	1.62	-2.99	0.25	No
Carpooled	29,910	32,720	9.51	10.34	0.83	0.82	1.36	-0.52	2.19	No
Public transportation:	13,829	13,299	4.40	4.20	-0.20	0.47	0.77	-0.97	0.57	No
Bus or trolley bus	1,860	2,527	0.59	0.80	0.21	0.22	0.36	-0.15	0.56	No
Streetcar or trolley car	117	138	0.04	0.04	0.01	0.03	0.06	-0.05	0.06	No
Subway or elevated	541	776	0.17	0.25	0.07	0.09	0.15	-0.08	0.23	No
Railroad	11,110	9,557	3.53	3.02	-0.51	0.41	0.68	-1.19	0.17	No
Ferryboat	39	43	0.01	0.01	0.00	0.01	0.02	-0.02	0.02	No
Taxicab	162	258	0.05	0.08	0.03	0.05	0.08	-0.05	0.11	No
Motorcycle	249	72	0.08	0.02	-0.06	0.04	0.06	-0.12	0.00	No
Bicycle	728	916	0.23	0.29	0.06	0.13	0.22	-0.16	0.28	No
Walked	3,459	5,459	1.10	1.72	0.63	0.32	0.53	0.10	1.16	Yes
Other means	1,315	2,176	0.42	0.69	0.27	0.15	0.25	0.02	0.52	Yes
Worked at home	12,641	12,196	4.02	3.85	-0.16	0.43	0.71	-0.88	0.55	No
Departure time to work										
Total workers 16+	314,647	316,525								
Did not work at home:	302,006	304,329	95.98	96.15	0.16	0.37	0.62	-0.45	0.78	No
12:00 a.m. to 4:59 a.m.	8,499	10,439	2.70	3.30	0.60	0.40	0.67	-0.07	1.26	No
5:00 a.m. to 5:29 a.m.	11,426	11,089	3.63	3.50	-0.13	0.41	0.67	-0.80	0.54	No
5:30 a.m. to 5:59 a.m.	17,732	16,619	5.64	5.25	-0.39	0.56	0.92	-1.30	0.53	No
6:00 a.m. to 6:29 a.m.	29,941	36,024	9.52	11.38	1.87	0.67	1.10	0.76	2.97	Yes
6:30 a.m. to 6:59 a.m.	38,229	34,311	12.15	10.84	-1.31	0.73	1.20	-2.51	-0.11	Yes
7:00 a.m. to 7:29 a.m.	50,545	47,632	16.06	15.05	-1.02	0.86	1.42	-2.44	0.41	No
7:30 a.m. to 7:59 a.m.	37,398	37,845	11.89	11.96	0.07	0.78	1.29	-1.22	1.36	No
8:00 a.m. to 8:29 a.m.	31,061	30,954	9.87	9.78	-0.09	0.74	1.21	-1.31	1.12	No
8:30 a.m. to 8:59 a.m.	16,582	15,951	5.27	5.04	-0.23	0.44	0.72	-0.95	0.49	No
9:00 a.m. to 9:59 a.m.	18,903	19,434	6.01	6.14	0.13	0.57	0.94	-0.81	1.08	No
10:00 a.m. to 10:59 a.m.	7,585	7,202	2.41	2.28	-0.14	0.34	0.56	-0.69	0.42	No
11:00 a.m. to 11:59 a.m.	2,227	3,112	0.71	0.98	0.28	0.18	0.30	-0.03	0.58	No
12:00 p.m. to 3:59 p.m.	17,191	18,379	5.46	5.81	0.34	0.57	0.93	-0.59	1.28	No
4:00 p.m. to 11:59 p.m.	14,687	15,338	4.67	4.85	0.18	0.49	0.80	-0.62	0.98	No
Worked at home	12,641	12,196	4.02	3.85	-0.16	0.43	0.71	-0.88	0.55	No

Available Data Table 5.5 shows synthetic ACS estimates of population for each of the county subdivisions, as well as for the entire Hypothetical Lake County in each of the years 2005 to 2009 (although these annual population estimates are not released for each county subdivision, they are shown in this table to determine which types of ACS estimates are released in a given year). The Census Bureau releases the following types of estimates based on the population of a given area:

- For areas with population greater than 65,000, annual estimates, as well as three- and five-year average estimates are available;
- For areas with population between 20,000 and 65,000, three- and five-year average estimates are available; and
- For areas with population less than 20,000, only five-year average estimates are available.

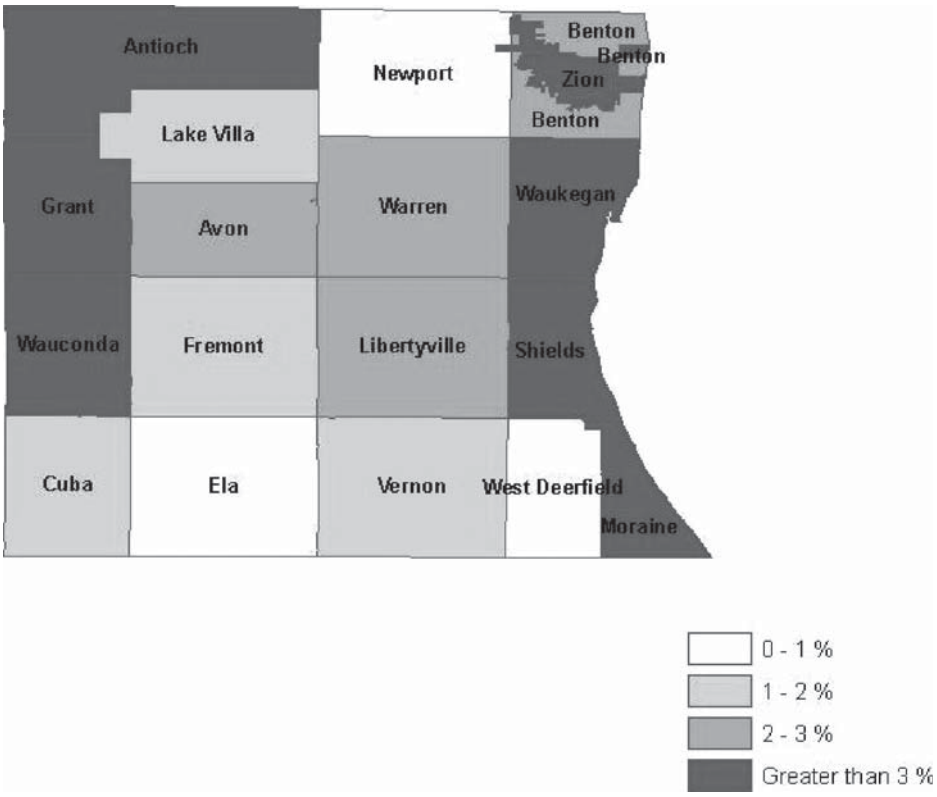

Figure 5.6. Percentage of zero-vehicle households by county subdivision based on the point estimates for Hypothetical Lake County.

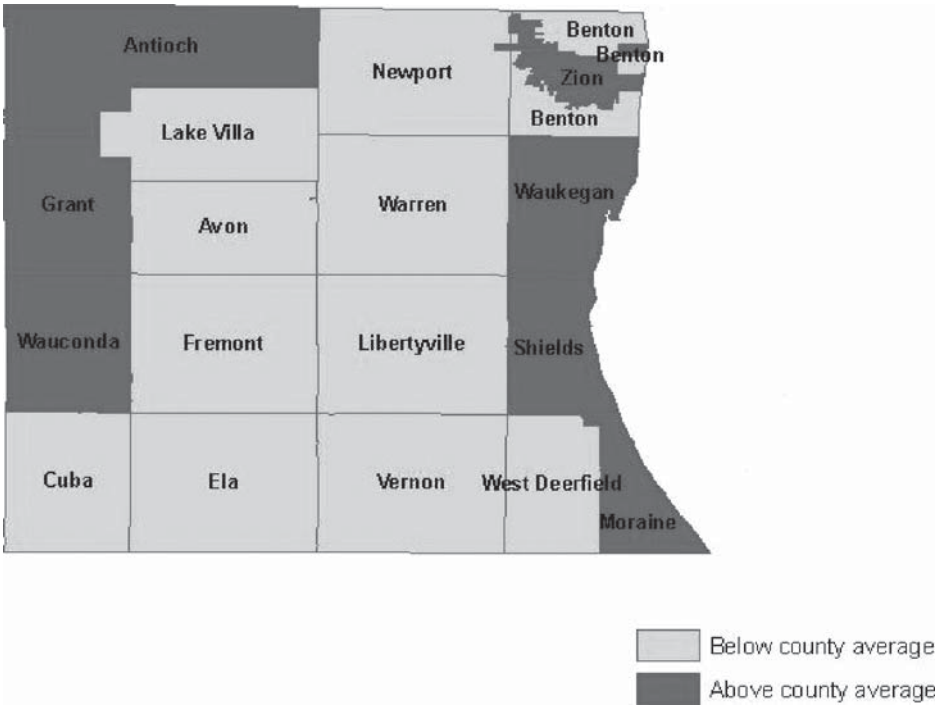

Figure 5.7. Percentage of zero-vehicle households by county subdivision as compared to the county average based on the point estimates for Hypothetical Lake County.

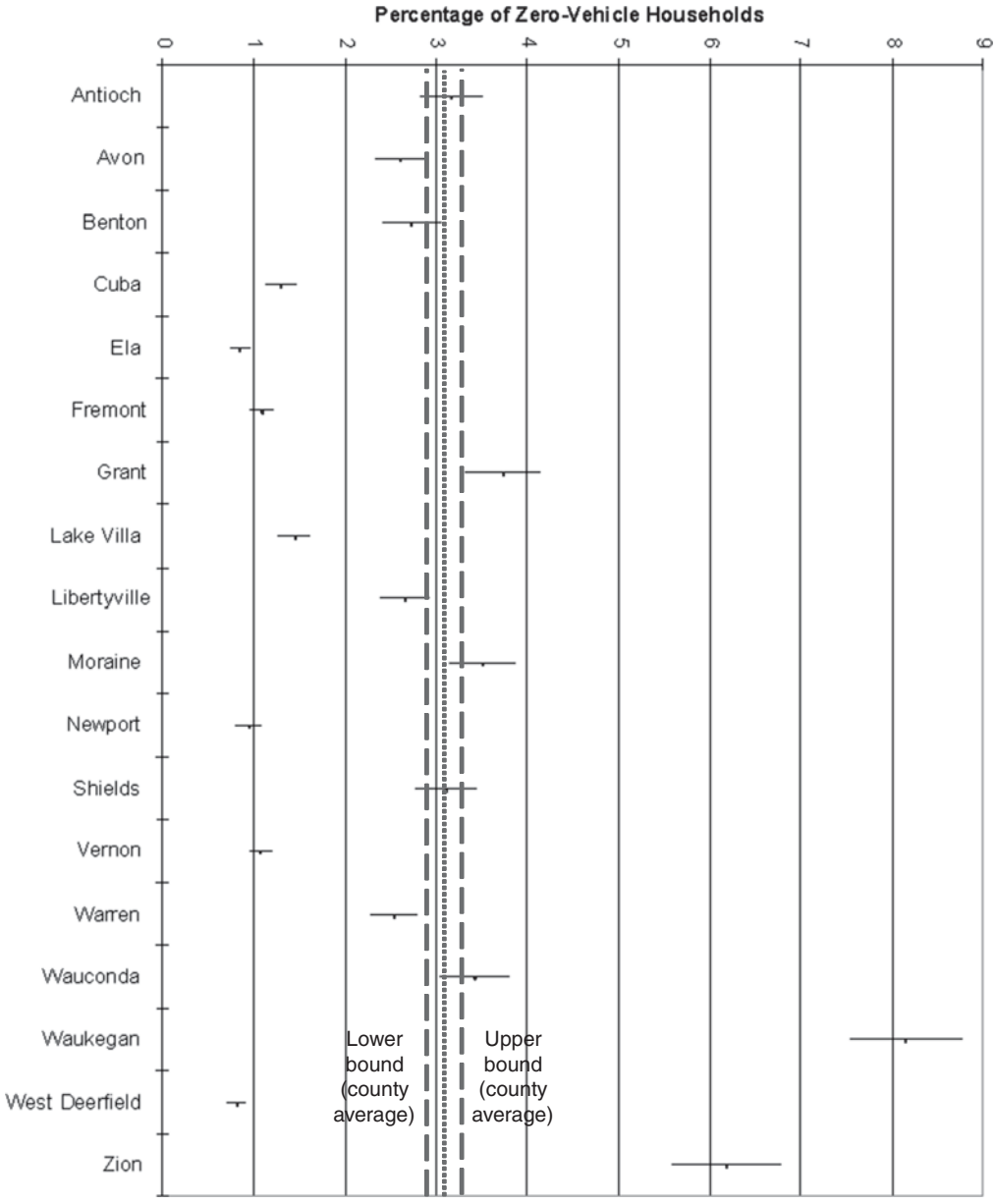

Figure 5.8. Percentage of zero-vehicle households by county subdivision: estimate, lower bound, and upper bound for Hypothetical Lake County.

This also is illustrated in Figure 5.9.

Based upon the above rules, Table 5.5 shows the types of ACS data (annual, three-year averages, and five-year averages) that are available to the analyst in year 2010 for each of the county subdivisions.

Based on data availability for each of the county subdivisions, Tables 5.6, 5.7, and 5.8 show the total number of occupied households and the number of zero-vehicle households for each of the county subdivisions using 2009 annual data, three-year average data (2007-2009), and five-year average data (2005-2009), respectively. Blank cells indicate unavailability of data for the corresponding geography and type of estimate reported.

Table 5.5. Total population by year, county subdivision, and data availability for Hypothetical Lake County.

County Subdivision	2005	2006	2007	2008	2009	Annual Data	Three-Year Data (2007-2009)	Five-Year Data (2005-2009)
Antioch Township	23,450	23,906	24,363	24,820	25,276	No	Yes	Yes
Avon Township	58,903	60,049	61,196	62,343	63,490	No	Yes	Yes
Benton Township	18,463	18,827	19,190	19,553	19,917	No	No	Yes
Cuba Township	16,880	17,208	17,537	17,866	18,194	No	No	Yes
Ela Township	42,537	43,366	44,194	45,022	45,850	No	Yes	Yes
Fremont Township	25,675	26,175	26,675	27,175	27,675	No	Yes	Yes
Grant Township	18,446	18,809	19,172	19,535	19,898	No	No	Yes
Lake Villa Township	36,142	36,846	37,549	38,253	38,957	No	Yes	Yes
Libertyville Township	52,415	53,436	54,456	55,477	56,497	No	Yes	Yes
Moraine Township	37,018	37,738	38,459	39,180	39,901	No	Yes	Yes
Newport Township	4,439	4,526	4,612	4,699	4,785	No	No	Yes
Shields Township	46,497	47,402	48,307	49,213	50,118	No	Yes	Yes
Vernon Township	70,047	71,411	72,775	74,139	75,503	Yes	Yes	Yes
Warren Township	63,690	64,930	66,171	67,411	68,651	Yes	Yes	Yes
Wauconda Township	17,563	17,905	18,247	18,589	18,931	No	No	Yes
Waukegan Township	99,468	101,405	103,341	105,278	107,215	Yes	Yes	Yes
West Deerfield Township	34,077	34,740	35,404	36,067	36,731	No	Yes	Yes
Zion Township	24,508	24,985	25,462	25,939	26,416	No	Yes	Yes
County Total	690,218	703,664	717,110	730,559	744,005	Yes	Yes	Yes

Analysis Steps Before proceeding with the analysis of zero-vehicle households, the first decision to make is which characteristic estimates should be used in the analysis when more than one type of estimate is available for a certain area. In the example shown above, all county subdivisions have five-year average data, some have both the five- and three-year average data, and a few have the annual, as well as the three- and five-year average data.

Note that there are differences in the annual, three- and five-year estimates for the areas where all the estimates are available, but that these differences are difficult to distinguish from the sampling error of the estimates. Since the purpose of this analysis is to compare the percentage of zero-vehicle households for all of the county subdivisions (and with respect to the overall county average), it is important to be consistent in the definition of the estimate that is used to avoid any bias that might result from using estimates obtained from different methods. Since the five-year average estimates are available for all county subdivisions, they are used in this analysis. Of course, the implication of this is that the analyses will not use the most current estimates for a number of subdivisions or for the county as a whole, but in comparing data, it is probably more important to maintain consistency than to use the most current estimates.

Table 5.8 shows the estimates of total households and zero-vehicle households, their lower bounds, and upper bounds for the five-year moving average data. The proportion of zero-vehicle households is computed in the same way as shown in Equation 5.1. For example, for Antioch, the percentage of zero-vehicle households is

$$304/9613 * 100 = 3.2\ \%$$

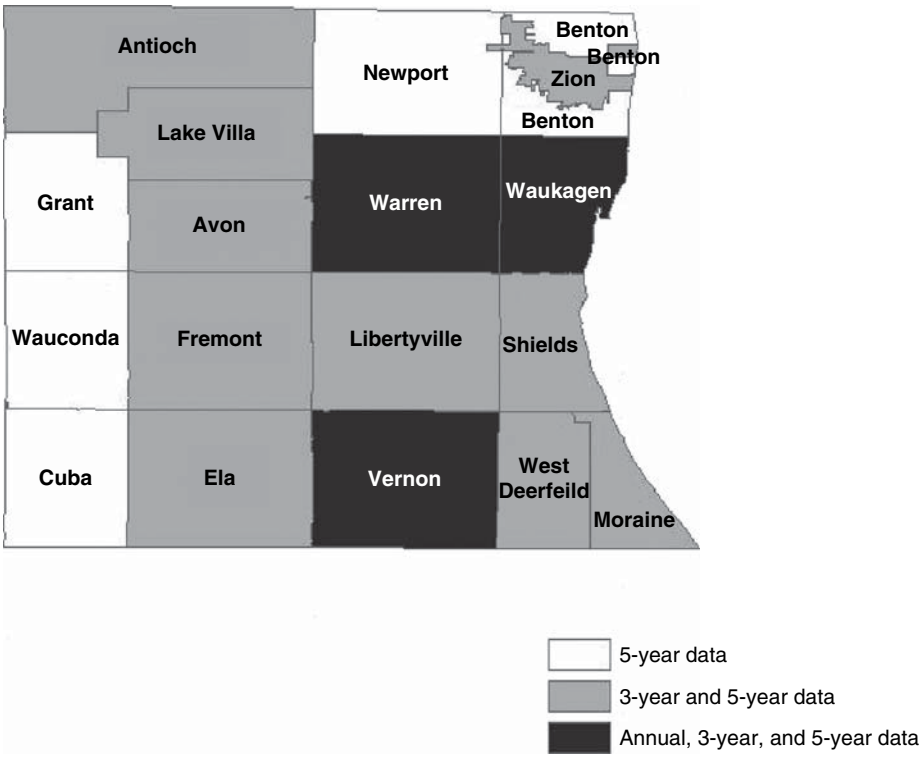

Figure 5.9. Types of ACS estimates available for each of the county subdivisions in Hypothetical Lake County.

Table 5.6. Annual 2009 acs data for Hypothetical Lake County.

County Subdivision	Total Occupied Households	Lower Bound	Upper Bound	Zero-Vehicle Households	Lower Bound	Upper Bound
Antioch Township						
Avon Township						
Benton Township						
Cuba Township						
Ela Township						
Fremont Township						
Grant Township						
Lake Villa Township						
Libertyville Township						
Moraine Township						
Newport Township						
Shields Township						
Vernon Township	26,124	23,867	28,381	248	177	319
Warren Township	25,383	23,159	27,607	570	426	714
Wauconda Township						
Waukegan Township	32,139	29,651	34,627	2,337	1,891	2,783
West Deerfield Township						
Zion Township						
County Total	249,685	248,264	251,106	6,817	5,832	7,802

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Table 5.7. Three-Year average estimate (2007-2009), ACS data for Hypothetical Lake County.

County Subdivision	Total Occupied Households	Lower Bound	Upper Bound	Zero-Vehicle Households	Lower Bound	Upper Bound
Antioch Township	9,773	9,046	10,500	291	244	338
Avon Township	19,812	18,687	20,937	485	412	558
Benton Township						
Cuba Township						
Ela Township	14,654	13,712	15,596	116	95	137
Fremont Township	9,222	8,522	9,922	94	76	112
Grant Township						
Lake Villa Township	13,199	12,316	14,082	179	148	210
Libertyville Township	19,794	18,670	20,918	493	419	567
Moraine Township	14,209	13,284	15,134	470	399	541
Newport Township						
Shields Township	11,730	10,910	12,550	343	289	397
Vernon Township	25,694	24,402	26,986	259	216	302
Warren Township	24,984	23,710	26,258	596	510	682
Wauconda Township						
Waukegan Township	31,727	30,299	33,155	2,444	2,177	2,711
West Deerfield Township	12,237	11,395	13,079	92	74	110
Zion Township	8,399	7,742	9,056	490	417	563
County Total	245,745	244,910	246,580	7,129	6,542	7,716

Table 5.8. Five-year average estimate (2005-2009), ACS data for Hypothetical Lake County.

County Subdivision	Total Occupied Households	Lower Bound	Upper Bound	Zero-Vehicle Households	Lower Bound	Upper Bound
Antioch Township	9,613	9,056	10,170	304	266	342
Avon Township	19,487	18,624	20,350	507	449	565
Benton Township	7,036	6,586	7,486	192	166	218
Cuba Township	6,709	6,273	7,145	87	74	100
Ela Township	14,388	13,666	15,110	121	104	138
Fremont Township	9,064	8,528	9,600	98	84	112
Grant Township	7,614	7,138	8,090	284	248	320
Lake Villa Township	12,969	12,292	13,646	187	162	212
Libertyville Township	19,475	18,612	20,338	515	456	574
Moraine Township	13,996	13,286	14,706	490	433	547
Newport Township	1,706	1,550	1,862	16	13	19
Shields Township	11,549	10,920	12,178	358	314	402
Vernon Township	25,265	24,273	26,257	270	236	304
Warren Township	24,586	23,607	25,565	622	553	691
Wauconda Township	6,729	6,292	7,166	230	200	260
Waukegan Township	31,314	30,214	32,414	2,551	2,337	2,765
West Deerfield Township	12,025	11,380	12,670	96	82	110
Zion Township	8,285	7,781	8,789	512	453	571
County Total	241,810	241,147	242,473	7,440	6,972	7,908

Table 5.9. Proportion and standard error computations for the example.

County Subdivision	Total Occupied HHs	Zero-Vehicle HHs	SE(Total Occupied HHs)	SE(Zero-Vehicle HHs)	Percentage of Zero-Vehicle Households			
					Estimate (%)	SE (%)	LB (%)	UB (%)
Antioch Township	9,613	304	339	23	3.2	0.2	2.8	3.5
Avon Township	19,487	507	523	35	2.6	0.2	2.3	2.9
Benton Township	7,036	192	273	16	2.7	0.2	2.4	3.1
Cuba Township	6,709	87	264	8	1.3	0.1	1.1	1.5
Ela Township	14,388	121	438	10	0.8	0.1	0.7	0.9
Fremont Township	9,064	98	325	8	1.1	0.1	1.0	1.2
Grant Township	7,614	284	288	22	3.7	0.2	3.3	4.1
Lake Villa Township	12,969	187	410	15	1.4	0.1	1.3	1.6
Libertyville Township	19,475	515	523	36	2.6	0.2	2.4	2.9
Moraine Township	13,996	490	430	35	3.5	0.2	3.1	3.9
Newport Township	1,706	16	95	2	0.9	0.1	0.8	1.1
Shields Township	11,549	358	381	27	3.1	0.2	2.8	3.4
Vernon Township	25,265	270	601	21	1.1	0.1	0.9	1.2
Warren Township	24,586	622	593	42	2.5	0.2	2.3	2.8
Wauconda Township	6,729	230	265	18	3.4	0.2	3.0	3.8
Waukegan Township	31,314	2,551	667	130	8.1	0.4	7.5	8.8
West Deerfield Township	12,025	96	391	8	0.8	0.1	0.7	0.9
Zion Township	8,285	512	305	36	6.2	0.4	5.6	6.8
County Total	241,810	7,440	402	284	3.1	0.1	2.9	3.3

The percentage of zero-vehicle households for the entire Hypothetical Lake County is 3.1 percent. Table 5.9 shows the percentage of zero-vehicle households for all county subdivisions.

The percentages of zero-vehicle households computed as shown above are point estimates. They can be compared across county subdivisions as well as with respect to the overall county percentage of zero-vehicle households. In addition to examining the point estimates, it also is important to examine the standard errors of these estimates to see whether the conclusions are significantly altered.

First, the standard errors of total occupied households and zero-vehicle households are computed given the estimates and their lower and upper bounds, using Equation 5.3. For example, for Antioch, the standard error of total occupied households is

$(9{,}613 - 9{,}056)/1.65 = 338$

The standard error of zero-vehicle households is

$(304 - 266)/1.65 = 23$

Second, the standard error of the percentage of zero-vehicle households is computed using Equation 5.4. For example, for Antioch, the standard error of the percentage of zero-vehicle households is

$$\frac{1}{9{,}613}\sqrt{[23]^2 - \frac{304^2}{9{,}613^2}[339]^2} = 0.00212 = 0.2\%$$

Third, given the estimate of the percentage of zero-vehicle households and its standard error, the lower and upper bounds of the 90 percent confidence interval are computed as follows:

$$LB = \text{Estimate} - 1.65 * SE(\text{Estimate}) \tag{5.9}$$

$$LB = \text{Estimate} + 1.65 * SE(\text{Estimate}) \tag{5.10}$$

For example, for Antioch, the lower bound of the 90 percent confidence interval is

$(3.2 - 0.2 * 1.65) = 2.8\ \%$

The upper bound is

$(3.2 + 0.2 * 1.65) = 3.5\ \%$

Computations of standard errors and confidence intervals are shown in Table 5.9. For each county subdivision, the 90 percent confidence interval means that 90 times out of 100 the true value of the percentage of zero-vehicle households for that area falls between the lower and upper bounds of an estimate derived from a sample like the one taken.

Once the percentages and standard errors of the percentages are calculated, the differences between individual subdivisions and the county as a whole can be calculated and compared using the procedures previously described. The differences in the estimates are calculated directly. Therefore, for Antioch the difference between the subdivision and county estimate is 3.2 – 3.1 = 0.1 percent.

The standard error of the difference can be calculated using a variant of Equation 5.5 from the first analysis.

$$SE(DIFF) = 100\% * \sqrt{\left[SE(\hat{P}_{county})\right]^2 + \left[SE(\hat{P}_{township})\right]} \tag{5.11}$$

The 90 percent confidence-level margin of error of the difference is

$$ME(DIFF) = 1.65 * SE(DIFF) \tag{5.12}$$

The upper and lower bounds of the difference in percentages are as follows:

$$LB(DIFF) = DIFF - ME(DIFF) \tag{5.13}$$

$$UB(DIFF) = DIFF + ME(DIFF) \tag{5.14}$$

For Antioch, the results of these calculations are

SE(DIFF) = 0.2 percent,

ME(DIFF) = 0.4 percent,

LB(DIFF) = –0.3 percent, and

UB(DIFF) = 0.5 percent.

Table 5.10 shows the results of these calculations for each of the subdivisions.

An interesting finding of this analysis is that one county subdivision, Libertyville, is found to be statistically different from the county average despite the fact that when one compares the estimates, lower bounds, and upper bounds (for instance, see Figure 5.8), the margins of error of that county subdivision and the county overlap. In order to correctly assess the statistical significance of the differences, it is necessary to calculate the standard errors of the differences, rather than to simply inspect the estimates, standard errors, and margins of error of the variable of interest.

Table 5.10. Statistical difference computation results.

County Subdivision	Difference Between Township and County Zero-Vehicle Households Percentages	SE (Diff)	ME (Diff)	LB (Diff)	UB (Diff)	Statistically Significant Difference?
Antioch Township	0.1%	0.24%	0.40%	-0.3%	0.5%	No
Avon Township	-0.5%	0.20%	0.33%	-0.8%	-0.1%	Yes
Benton Township	-0.3%	0.23%	0.38%	-0.7%	0.0%	No
Cuba Township	-1.8%	0.16%	0.26%	-2.0%	-1.5%	Yes
Ela Township	-2.2%	0.13%	0.22%	-2.5%	-2.0%	Yes
Fremont Township	-2.0%	0.14%	0.23%	-2.2%	-1.8%	Yes
Grant Township	0.7%	0.27%	0.46%	0.2%	1.1%	Yes
Lake Villa Township	-1.6%	0.16%	0.26%	-1.9%	-1.4%	Yes
Libertyville Township	-0.4%	0.20%	0.34%	-0.8%	-0.1%	Yes
Moraine Township	0.4%	0.25%	0.42%	0.0%	0.8%	No
Newport Township	-2.1%	0.16%	0.26%	-2.4%	-1.9%	Yes
Shields Township	0.0%	0.24%	0.40%	-0.4%	0.4%	No
Vernon Township	-2.0%	0.14%	0.23%	-2.2%	-1.8%	Yes
Warren Township	-0.5%	0.20%	0.33%	-0.9%	-0.2%	Yes
Wauconda Township	0.3%	0.26%	0.43%	-0.1%	0.8%	No
Waukegan Township	5.1%	0.40%	0.65%	4.4%	5.7%	Yes
West Deerfield Township	-2.3%	0.13%	0.22%	-2.5%	-2.1%	Yes
Zion Township	3.1%	0.39%	0.64%	2.5%	3.7%	Yes

5.3.3 Analysis 3: Monitoring the State of the System

You have been asked to compile various descriptive statistics related to commuting-to-work characteristics and vehicle ownership to develop a "state of the system" report for the Bay Area for the years 2000 to 2003. You were asked to use any available data sources and to track changes over time where data are available.

This section describes different options that might be used for presenting the descriptive statistics to policymakers. First, one can show some important transportation variables such as commuting mode shares by various means of transportation, percentage of zero-vehicle households, and average commute time. Table 5.11 shows a summary of these statistics using Census 2000 data and 2000 to 2003 ACS data.

Second, one can show some of these statistics graphically along with the confidence intervals for the ACS estimates. This is shown in Figure 5.10 for the number of public transportation commuters, along with information on the statistical significance of the difference estimates. Some conclusions that can be drawn from this analysis include

- Statistically, the 2000 ACS estimate is significantly larger than the Census 2000 estimate;
- Statistically, the 2001 ACS estimate is significantly smaller than the 2000 ACS estimate; and
- Statistically, the 2002 ACS estimate is not significantly different from the 2001 ACS estimate, and statistically the 2003 ACS estimate is not significantly different from the 2002 ACS estimate.

Third, one could compare trends from various data sources. For example, Figure 5.11 shows the change in the number of employed civilians over time using Census 2000, 2000-2003 ACS, and 2000-2003 Bureau of Labor Statistics-Local Area Unemployment Statistics (BLS-LAUS)

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Table 5.11. Important transportation variables for the annual MTC San Francisco Bay area "state of the system" report.

	Census	American Community Survey			
	2000	2000	2001	2002	2003
Commute Share by:					
Public Transportation	9.7%	10.7%	10.0%	9.6%	9.4%
Bicycle	1.1%	1.1%	1.0%	1.0%	1.0%
Walk	3.2%	2.8%	2.9%	3.1%	3.1%
Drive Alone	68.0%	67.5%	69.2%	69.9%	69.2%
Carpool	12.9%	12.9%	11.3%	11.1%	11.5%
Worked at Home	4.0%	4.0%	4.4%	4.4%	4.7%
Percent Zero-Vehicle Households	10.0%	9.0%	9.2%	8.9%	8.6%
Average Commute Time (Minutes)	29.4	28.5	27.7	27.5	26.7

data. The ACS and BLS-LAUS show a trend of decrease in employed civilians over this timeframe, but the BLS estimates are larger than the ACS estimates. In the analysis of ACS data, it will be important for analysts to perform validity checks using other available data sources whenever possible.

Available Data This section describes the data that were available for this analysis. Figure 5.12 shows the distribution of places in the Bay Area by population size. This has implications for the types of ACS data that will be available for each of these areas. Only five-year average ACS data will be available for 14 percent of places, three- and five-year average ACS data will be available for 24 percent of places, and annual estimates, three- and five-year average ACS data will be available for 62 percent of places. All estimates used in this case study use annual estimates.

Table 5.12 shows the distribution of number of workers by means of transportation to work using Census 2000 data and 2000-2003 annual ACS data.

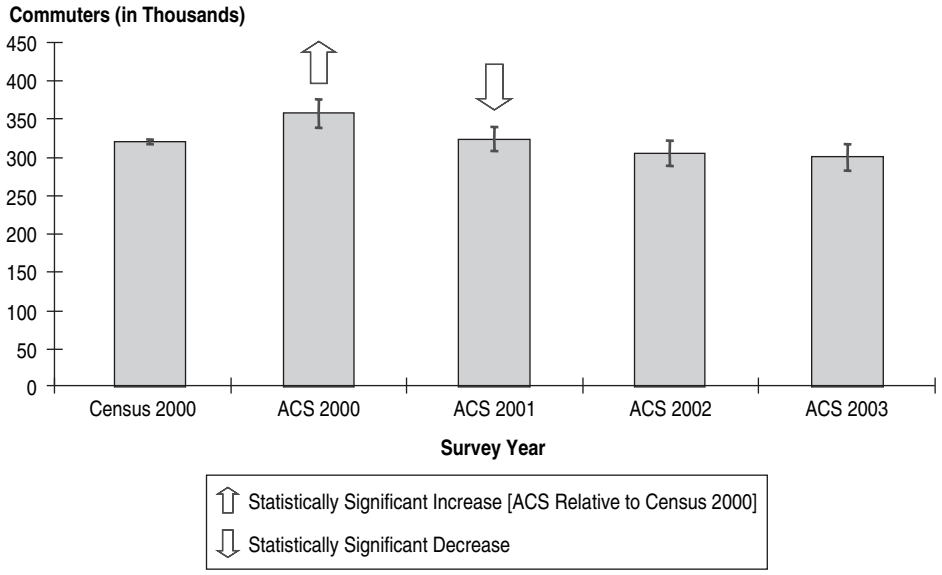

Figure 5.10. Total commuters on public transportation, Census 2000 and ACS 2000-2003.

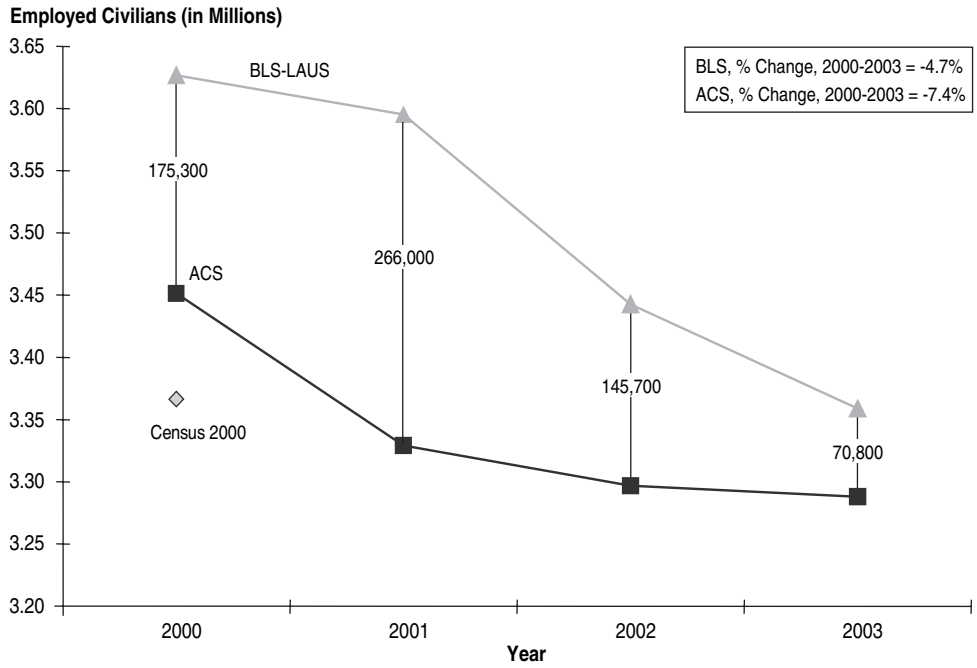

Figure 5.11 Employed civilians, Census 2000, ACS, and BLS-LAUS.

Analysis Steps This section describes the computations that were performed to reach the conclusions presented earlier. First described are the methods for working with confidence intervals when the analysis involves a geography for which ACS data are not directly available. Following this discussion is a description of how to compute the statistical significance of the difference between two estimates.

When working with ACS confidence intervals, one should note the following two important rules of thumb:

- The standard error is larger, and confidence intervals are wider (as a percentage of the estimate), for geographic areas with smaller populations and for characteristics that occur less frequently. For example, the estimate for Bay Area bicycle commuters (a relatively small percentage of total commuters) has a confidence interval that is proportionately wider than that for carpool (2+) commuters.

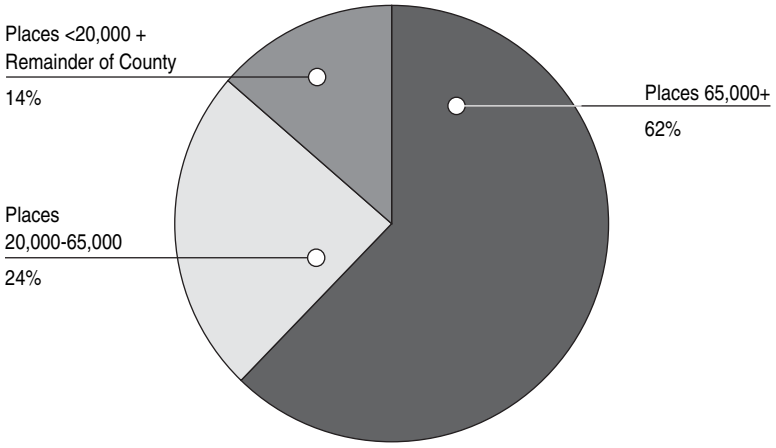

Figure 5.12. Bay area population for ACS reporting.

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Table 5.12. Means of transportation to work, Census 2000 and ACS.

	Census	American Community Survey			
	2000	2000	2001	2002	2003
Total:	3,306,100	3,337,500	3,236,400	3,203,700	3,186,900
Car, Truck, or Van:	2,674,600	2,683,800	2,604,100	2,596,300	2,571,300
Drove Alone	2,248,100	2,252,300	2,239,900	2,240,700	2,205,800
Carpooled	426,500	431,500	364,200	355,600	365,500
Public Transportation:	321,100	357,700	324,300	306,100	300,800
Bus or Trolley Bus	178,900	199,400	180,000	178,400	176,900
Streetcar or Trolley Car	14,300	14,300	15,100	12,800	10,400
Subway or Elevated	98,700	107,500	94,800	88,100	85,300
Railroad	20,100	24,600	21,900	19,000	20,400
Ferryboat	5,800	6,700	7,900	4,100	6,100
Taxicab	3,300	5,100	4,500	3,600	1,900
Motorcycle	11,900	13,700	13,800	9,400	9,400
Bicycle	36,000	36,800	31,300	33,000	31,000
Walked	106,100	92,200	92,900	100,800	100,100
Other Means	23,700	19,000	27,600	15,800	23,900
Worked at Home	132,700	134,400	142,500	142,300	150,300

- Performing fewer data calculations generally produces the tightest confidence intervals. For the Metropolitan Transportation Commission (MTC), error reporting is typically better if its 9-county ACS estimates are derived by subtracting Santa Cruz PMSA from the 10-county CMSA (fewer calculations) than by summing its 9 counties or 5 PMSAs (more calculations).

The following example demonstrates how the estimates and standard errors for different geographic areas may be combined to analyze custom geographies. In this example, we derive the ACS 2003 estimate and confidence interval for MTC's planning jurisdiction.

MTC's metropolitan planning jurisdiction, the nine-county San Francisco Bay Area, does not have a single census-equivalent geography for which published ACS datasets are available. Instead, MTC must derive study data by

- Summing ACS estimates for its nine constituent counties;
- Summing ACS estimates for its five constituent PMSAs; or
- Subtracting ACS estimates for one PMSA (Santa Cruz PMSA) from the ACS estimates for the San Francisco CMSA (which is composed of 10 counties, or equivalently, 6 PMSAs).

To accomplish any of these tasks, we must derive new standard errors and confidence intervals based on those provided in the available ACS dataset. Table 5.13 shows some of the relevant PMSA and CMSA data that are available from the American FactFinder website.

With these data, we can develop estimates for the MTC region by either subtracting the last row estimates (Santa Cruz PMSA) from the CMSA total or by summing the other five PMSA estimates.

To combine geographies, the estimates may be added or subtracted directly, but we also need to account for the confidence intervals by calculating combined standard errors from the component standard errors. The following four analysis steps are required:

1. Calculate the combined estimate by adding or subtracting the component geography estimates,
2. Calculate standard errors for the component geography estimates,
3. Calculate the standard errors of the estimates for the combined geography, and

Table 5.13. Estimated number of carpool and bicycle commuters for selected Bay Area geographic areas from 2003 ACS.

	Carpool Commuters			Bay Area Bicycle Commuters		
Geographic Area	Estimate	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
San Francisco CMSA	373,018	353,631	392,405	34,561	28,350	40,772
Oakland PMSA	148,912	134,587	163,237	11,635	7,980	15,290
San Francisco PMSA	75,418	67,238	83,598	10,149	8,007	12,291
San Jose PMSA	79,052	68,397	89,707	6,743	2,826	10,660
Santa Rosa PMSA	24,377	18,945	29,809	1,795	372	3,218
Vallejo PMSA	37,723	31,846	43,600	723	29	1,417
Santa Cruz PMSA (outside MTC area)	7,536	5,062	10,010	3,516	1,183	5,849

Source: 2003 ACS Base Table P047: Means of Transportation To Work for Workers 16 Years and Over.

4. Convert the combined geography standard errors to margins of error.

This process shown below is for the carpool estimate.

Step 1—Calculate combined estimates.

For the first approach, in which the non-MTC PMSA estimate is subtracted from the CMSA estimate, the combined estimate is:

$$\text{Carpool Commuters}_{\text{MTC Area}} = 373{,}018 - 7{,}536 = 365{,}482$$

For the second approach, in which the five MTC PMSAs are summed, the combined estimate is:

$$\text{Carpool Commuters}_{\text{MTC Area}} = 148{,}912 + 75{,}418 + 79{,}052 + 24{,}377 + 37{,}723 = 365{,}482$$

Step 2—Calculate component geography standard errors.

The standard error calculations for each component geography are similar to the previous translations from census margins of error to standard errors:

Standard error = 90 percent confidence margin of error/1.65

Margin-of-error = max(upper bound – estimate, estimate – lower bound)

Hence, the standard errors for the carpool estimates are those shown in Table 5.14.

Table 5.14. Standard error calculations for geographic areas that comprise the MTC study area.

	Carpool Commuters			Standard Error Calculation		
Geographic Area	Estimate	Lower Bound	Upper Bound	ME	Critical Value 90% Confidence	SE
San Francisco CMSA	373,018	353,631	392,405	19,387	1.65	11,750
Oakland PMSA	148,912	134,587	163,237	14,325	1.65	8,682
San Francisco PMSA	75,418	67,238	83,598	8,180	1.65	4,958
San Jose PMSA	79,052	68,397	89,707	10,655	1.65	6,458
Santa Rosa PMSA	24,377	18,945	29,809	5,432	1.65	3,292
Vallejo PMSA	37,723	31,846	43,600	5,877	1.65	3,562
Santa Cruz PMSA (outside MTC area)	7,536	5,062	10,010	2,474	1.65	1,499

Step 3—Calculate the combined standard errors.

The standard error of a sum or difference can be calculated as

$$SE(\hat{X}+\hat{Y}) = \sqrt{\left[SE(\hat{X})\right]^2 + \left[SE(\hat{Y})\right]^2}$$

Applying this equation to the two alternative approaches for developing MTC area-specific estimates, provides the following estimates. For the first approach, in which the non-MTC PMSA estimate is subtracted from the CMSA estimate, the combined standard error is

$$SE_{MTC} = \sqrt{[11{,}750]^2 + [1{,}499]^2} = 11{,}845$$

For the second approach, in which the five MTC PMSAs are summed, the combined standard error is:

$$SE_{MTC} = \sqrt{[8{,}682]^2 + [4{,}958]^2\,[6{,}458]^2 + [3{,}292]^2 + [3{,}562]^2} = 12{,}852$$

Step 4—Calculate the margins of error.

The margin of error for the 90 percent confidence level is

$$ME_{MTC} = 1.65 * SE_{MTC}$$

Therefore, for the first approach, in which the non-MTC PMSA estimate is subtracted from the CMSA estimate, the combined estimate is:

$\text{Carpool Commuters}_{\text{MTC Area}} = 365{,}482 \pm 19{,}544$

For the second approach, in which the five MTC PMSAs are summed, the combined estimate is

$\text{Carpool Commuters}_{\text{MTC Area}} = 365{,}482 \pm 21{,}206$

Although the two approaches have the same central point estimate, the first approach that combines only two ACS estimates provides a more precise estimate than the second approach where five separate estimates are combined.

If ACS data were published at the MPO level, the need to combine geographic areas like this would be obviated, but it is likely that many transportation planners will need to create custom geographic combinations, so the example will probably remain useful.

Figures 5.13 and 5.14 show the resulting confidence intervals for carpool commuters and bicycle commuters, respectively, using the two methods mentioned above for deriving the MPO-level 2003 ACS data estimates.

This section shows an example of how year-to-year statistical significance computations, such as those shown in Figure 5.10, can be accomplished. The standard errors of the individual ACS estimates are computed using Equation 5.3. For example, the standard errors of the 2000 and 2001 ACS estimates are

$$SE\left(ACS_{2000}\right) = \frac{357{,}661 - 338{,}774}{1.645} = 11{,}481$$

$$SE\left(ACS_{2001}\right) = \frac{324{,}287 - 308{,}877}{1.645} = 9{,}368$$

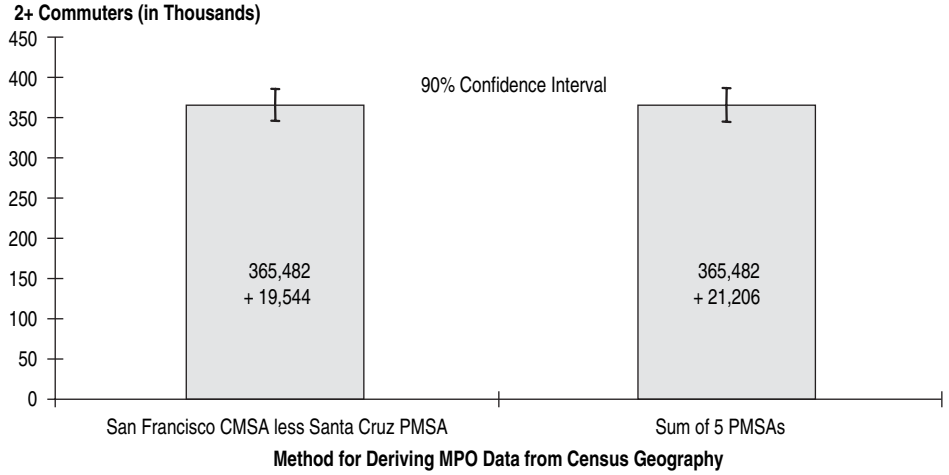

Figure 5.13. Bay Area carpool (2+) commuters, with confidence intervals, ACS 2003.

The standard error of the difference in estimates is computed using the following equation:

$$SE(DIFF) = \sqrt{\left[SE\left(\hat{X}_1\right)\right]^2 + \left[SE\left(\hat{X}_2\right)\right]^2} \tag{5.15}$$

where $\hat{X}_1$ and $\hat{X}_2$ are the estimates used to compute the difference.

For example, the standard error of the difference between the ACS 2000 and 2001 estimates is

$$SE\left(DIFF_{2001-2000}\right) = \sqrt{(11,481)^2 + (9,368)^2} = 14,818$$

The margin of error of the difference is computed using Equation 5.6 as follows:

$$ME\left(DIFF_{2001-2002}\right) = 1.645 \times 14,818 = 24,376$$

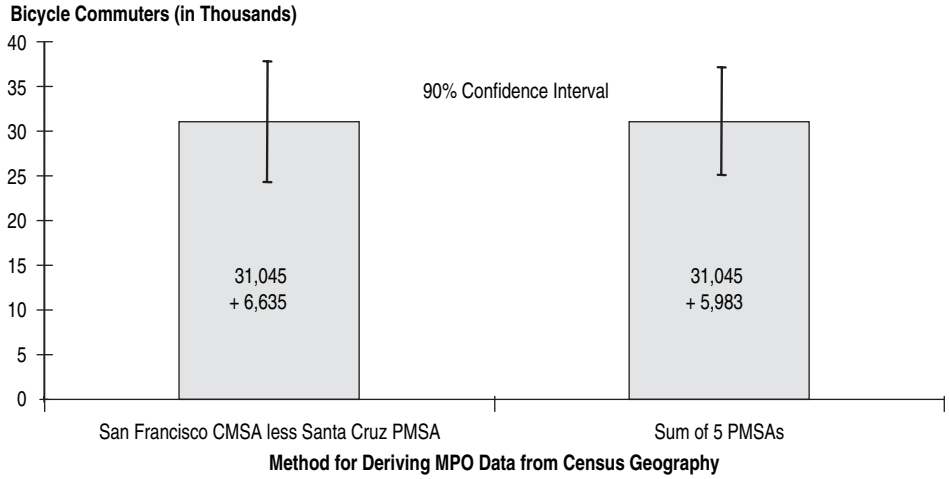

Figure 5.14. Bay Area bicycle commuters, with confidence intervals, ACS 2003.

The lower and upper bounds of the difference are computed using Equations 5.7 and 5.8 as follows:

$$LB\left(DIFF_{2001-2000}\right) = (324,287 - 357,661) - 24,376 = -57,750$$

$$UB\left(DIFF_{2001-2000}\right) = (324,287 - 357,661) + 24,376 = -8,998$$

Since both the lower bound and upper bound of the difference have the same sign, the difference between the 2000 and 2001 estimates is statistically significant.

These calculations can be performed for each successive year to track year-to-year changes or they can be performed on non-consecutive years to measure whether accumulated differences are statistically significant.

5.3.4 Conclusions from these Analysis Case Studies

Just as with the decennial census Long Form dataset, there are many different types of descriptive analyses that analysts can produce using ACS data. These case studies demonstrate how to produce change profiles and ranking profiles for a county and its subdivisions, create descriptive statistics for compiling a state-of-the-system report for a multicounty area, and interpret the results in light of the lower and upper bounds of the 90 percent confidence interval that are released with the data.

One of the clear advantages of ACS data with respect to census data is the timeliness of the data. For example, the first case study example that was described demonstrates that the availability of ACS data in years 2002 and 2003 for the county in question enabled the analyst to determine the change in a given characteristic between the two years. With census Long Form data, such an analysis would be based on data points that correspond to a difference of at least 10 years. The second case study also emphasizes the value of having ACS data in years just prior to the decennial census year (i.e., using 2005-2009 ACS data as opposed to using Census 2000 data for an analysis conducted in year 2010). The third case study also shows that ACS data will be important in the identification of key annual trends in transportation-related variables, and in supporting agencies' efforts to advocate for the transportation needs of the elderly, disabled, low-income, and youth populations. In the absence of ACS data, agencies would have to rely on the decennial census, and on non-census releases for intercensal years, which would sometimes produce data discrepancies.

As the second case study shows, one of the ACS analysis challenges is the need to deal with the varying availability of estimates. When comparing estimates across different geographic areas where multiple types of estimates are available (annual, as well as three-and five-year moving average), it is likely that users will need to use the same type of estimate for all geographic areas to maintain consistency and to avoid the bias resulting from the different periods of data accumulation.

Some further issues that users of the data should be aware of when doing similar types of analyses are the following:

- Annual estimates of change (Case Study 1) cannot be computed in cases where only multiyear average data are available if the multiyear average estimates include data from overlapping years. This is because when standard statistical procedures are used to test for significant differences between estimates over time, it is assumed that the two estimates are drawn from independent samples, an assumption that is violated in the case of two overlapping multiyear averages.
- The averaging of estimates over three or five years increases the survey sample sizes from which the estimates are derived, and thus reduces the sampling error and the size of the statistical confidence intervals. However, these statistics do not account for any bias that may

be introduced as the population and household characteristics change over the time period for which the estimates are accumulated.
- For some characteristics and small geographic areas, estimates may be unavailable due to Census Bureau limitations on estimates for small numbers of people if there is a possibility that an individual could be identified.

Some case study examples where these issues play a part in the analysis are shown in the following sections.

5.4 Other Specific Uses of Census Data for Descriptive Analyses

Some specific transportation planning examples of the use of descriptive analyses include the following:

- Southern California Association of Government's development of socioeconomic profiles, posted online.[47]
- Development of community profiles for each jurisdiction of the Baltimore Metropolitan Council.[48]
- Missouri DOT's use of Census 2000 data for developing socioeconomic profiles for planning districts. Social and economic data in the form of maps, charts, and tables were created for planning districts, regional planning commissions, and MPOs and are located on the website. A complete listing of Missouri DOT's use of census data is compiled in Lance R. Huntley et al., 2003.[49]
- A census book, containing information and profiles for each of the communities, produced every 10 years at Tulare County Association of Governments.[50]
- The use of PUMS data at MTC to produce demographic profiles of telecommuters in Marin County.

[47] See www.scag.ca.gov/economy/socioecondata.html, November 2003.
[48] See www.baltometro.org/CP/CommunityProf.html, January 12, 2004.
[49] Lance R. Huntley, Tracy Dranginis, and Ernie Perry. "Development and Use of Social and Economic Data at MoDOT," Missouri Department of Transportation, Research, Development, and Technology, August 2003, posted online at http://168.166.124.22/RDT/reports/Ri00049/RDT03011.htm.
[50] Other agencies contacted during this research that are using census data for reporting purposes include Denver Regional Council of Governments, Chicago Area Transportation Study, Hampton Roads Planning District Commission, and Yakima Valley Conference of Governments.

CHAPTER 6

Trend Analyses Using ACS Data

This section describes trend analysis as a common application of census data. It is organized as follows. Section 6.1 defines trend analysis and its uses, and provides some examples of how analysts use census data for these purposes. A detailed list of specific examples of uses of census data for this purpose is provided at the end of the section. Section 6.2 describes some benefits and limitations of shifting from census to ACS data related to trend analysis. Finally, Section 6.3 is a case study showing how to do trend analysis using ACS data.

6.1 Trend Analysis

Trend analysis is a common application of census data that consists of examining the change in a given characteristic over time to understand future needs and guide policy planning. Trend analysis requires the availability of data for multiple time periods and consistency of the question and response categories over the time period considered.

The decennial census, with its standard questions, relatively consistent data collection procedures, and comprehensive coverage, has been a good tool for performing trend analysis. Transportation planners have often used decennial census data to consistently monitor changes in population growth rates, population composition, and work trip behavior in a given area.

Trend analysis is normally performed to

- Evaluate the overall pattern of change (magnitude and direction) in a characteristic over time;
- Compare the levels of a characteristic between particular time periods, such as before and after an event;
- Compare geographic areas across time;
- Compare different populations across time to evaluate absolute and relative changes in a characteristic; and
- Examine data over time to help in forecasting future conditions.

6.1.1 Examples of Use

Census data have been used by transportation planners and others for analyzing a variety of demographic and journey to work trends. Figures 6.1 and 6.2 show examples of how trend analyses using decennial census data have been presented. Figure 6.1 shows a national trend of zero-vehicle households,[51] and Figure 6.2 shows a national trend of means of transportation to work.[52] A list of specific examples of using census data to do trend analysis also is provided at the end of this section.

[51] Murakami, E., 2003, "Households without Vehicles, 2000." See www.fhwa.dot.gov/ctpp/sr0103.htm.
[52] N. Srinivasan, 2002, "Journey to Work Trends." See www.fhwa.dot.gov/ctpp/sr0902.htm.

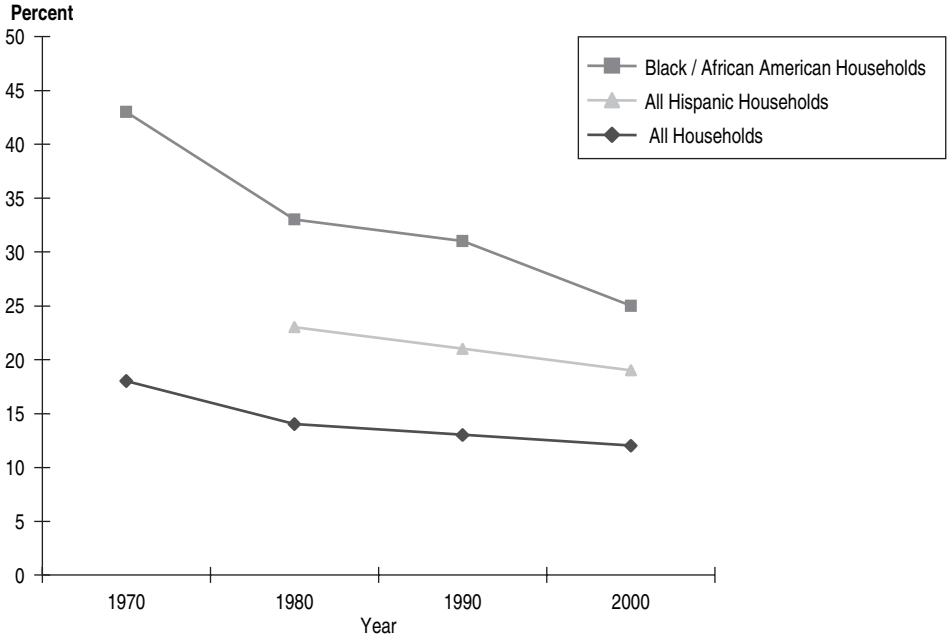

Figure 6.1. National trend of zero-vehicle households.

6.1.2 ACS for Trend Analysis

Because of the frequency of data releases, ACS has the potential to greatly improve the trend analyses that transportation planners can conduct. While the decennial census Long Form data provide the opportunity to analyze trends at 10-year intervals, ACS will allow for the analysis of trends for intervals as short as 1 year.

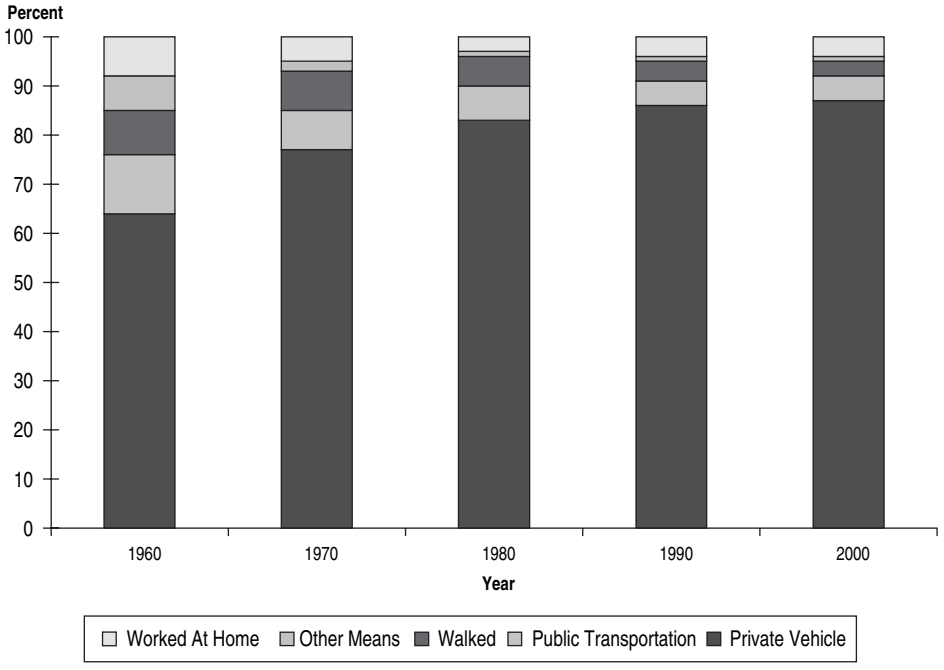

Figure 6.2. National trend of means of transportation to work.

6.2 Benefits and Limitations of ACS for Trend Analysis

This section summarizes the perceived benefits and limitations of using ACS data for trend analysis.

In our discussions with transportation planners, the following potential benefits of ACS were identified:

- The availability of regularly updated ACS data may allow for more data points for trend analysis, especially to identify a steady trend or a sudden jump or drop in a trend variable like trip distribution by time.
  - Another application identified by users is to use the more frequently reported data to validate and enhance demographic projections for use in travel demand models.[53]
- Given the lower sample sizes in ACS and the need to examine corresponding confidence intervals, however, users need to be wary of the following new issues:
  - ACS data come with a lot of variability and standard errors for each yearly estimate.
  - Because several potential data releases are possible for a particular year, (e.g.: one-year estimate, three- and five-year average), planners must pay more attention and may need to examine several numbers instead of one.[54] This issue is further illustrated in the case study included in this section.
- The time-series component of ACS may help improve the relationship between means and medians of key trend variables and the percentages of households falling into different categories.

The following ACS issues were identified as potential problems for trend analysis:

- ACS estimates will need to be based on moving averages of the trend variables. It can be problematic to evaluate year-to-year changes by using multiyear moving average estimates because some of the data are from overlapping time periods and are consequently identical. In comparing these overlapping estimates, the variances of the estimates of change will be underestimated incorrectly. Moving averages also present similar problems when used as dependent variables in statistical models (such as time-series models) and regression models, since the statistical properties of the data (such as autocorrelations) would be affected by the overlaps in the moving averages.
- The potential advantage of ACS possibly providing insights into seasonality issues will not be realized, because information by month and quarter will not be provided. In addition, the weighting of estimates to the July 1 reference date in the annual population estimates will make the analysis of data for areas with highly seasonal populations more difficult to interpret.

6.3 Trend Analysis Case Study

This section presents a case study that demonstrates how ACS estimates might be used for performing trend analyses. It shows how to analyze the change in a characteristic over recent years and whether the estimates indicate that a meaningful change has taken place. Section 3 of this guidebook has detailed instructions on downloading ACS data.

Assume that you are a transportation analyst working in a hypothetical MPO in the autumn of 2007. Your manager has asked you to examine how the percentage of workers in the central county of your region (called Central County) that use public transportation (bus or trolley bus, streetcar or trolley car, subway or elevated, railroad) to work has been changing over the period 1996-2006.

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[53] C. Alexander, 2002, "A Discussion of the Quality of Estimates from the American Community Survey for Small Population Groups," Personal correspondence with Caliper Corporation, David Hartgen, and Vermont Agency of Transportation.

[54] See, for example, C. Taeuber, 2004, "The American Community Survey: Challenges and Opportunities." See http://rnyi.cornell.edu/Overview%205-14-04.ppt.

Although aggregate ridership data are available, transit on-board survey data that provide information on riders' trip purposes and other details are only available for snapshots in time over the past decade, so it is difficult to make conclusions about how commuter ridership has changed.

This section describes some options for presenting the analysis results to policymakers. A useful way to analyze trends is to plot the indicator of interest versus time. This helps in visualizing the magnitude and direction of change in the indicator of interest, helps identify outliers, and provides insight into subsequent analysis strategies that could be used. Presentation options for two types of analysis are described. First, the trend at the county level is analyzed. Second, the county-level trend is compared to the city-level trend.

Figure 6.3 shows the percentage of workers in Central County using public transportation to work, using the annual estimates. For each year, the lower bound, upper bound, and midpoint of the 90 percent confidence interval are shown.

The following conclusions can be drawn from this analysis:

- There is no real noticeable trend in the percentage of workers using public transportation to work over the years 1996-2006; and
- The change is statistically not significant except for the change between 1996-1997, 1997-1998, and 1999-2000 (see "Analysis Steps" section).

One can alternatively show the actual percentages for each year, the difference in percentages, the confidence interval of the difference, and whether the difference is statistically significant (see, for example, Table 6.7).

Figure 6.4 shows a comparison of the trends for Central County and a smaller city in the county, called Fairview City, using the five-year moving average data for both geographies to maintain consistency of comparison.

The following conclusions can be drawn from this analysis:

- The confidence intervals at the city level are larger than at the county level, as expected, because of smaller sample sizes at smaller geographies; and
- Overall, the percentage of workers using public transportation to work is smaller in Fairview City than in Central County as a whole.

6.3.1 Available Data

For areas with population over 65,000, the Census Bureau will release annual ACS estimates as well as three- and five-year moving averages. Since the total population of the county in

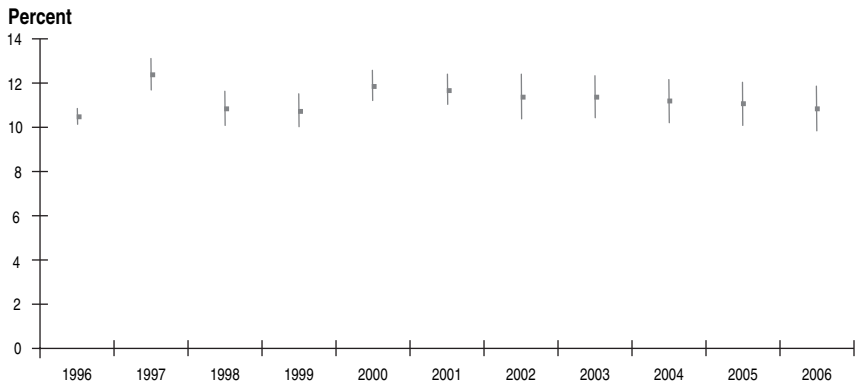

Figure 6.3. Percentage of workers in Central County using public transportation to work, using annual ACS estimates.

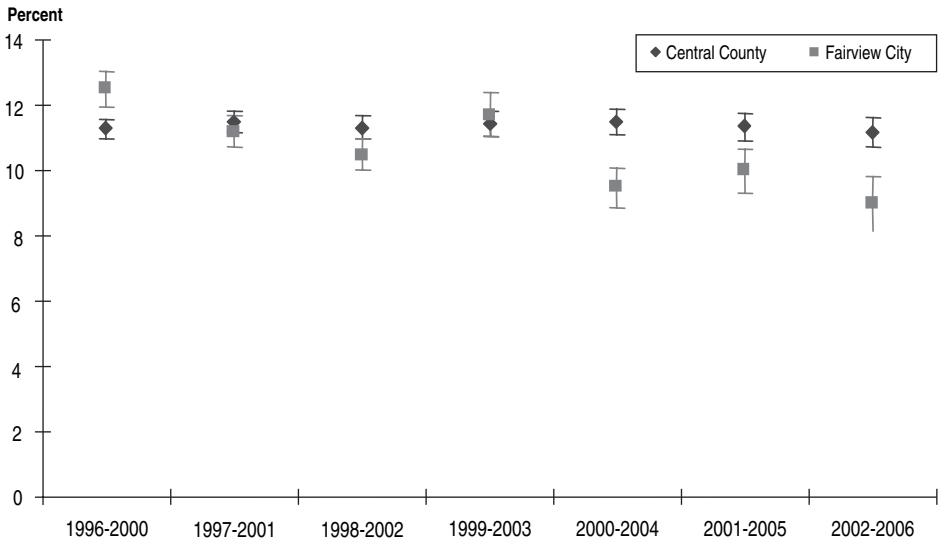

Figure 6.4. Percentage of workers in Central County and Fairview City using public transportation to work, using the five-year moving average ACS estimates.

question is greater than 65,000 in each of the years 1996-2006, all three types of ACS data are available for use.

Table 6.1 shows the number of workers using public transportation to work and the total number of workers in Central County. This table uses annual ACS data for the years 1996 through 2006. You can find the annual ACS data at the county level available online at the Census Bureau ACS website. Every estimate is associated with a lower bound and an upper bound corresponding to the 90 percent confidence interval. The 90 percent confidence interval means that 90 times out of 100 the true value of the characteristic for that area falls between the lower and upper bounds of an estimate derived from a sample like the one taken.

Tables 6.2 and 6.3 show the three-year and five-year moving averages, respectively, of the number of workers using public transportation and the total number of workers. Since the first

Table 6.1. Annual ACS data for Central County,1996-2006.

Year	Total Workers	Lower Bound	Upper Bound	Workers by Public Transportation	Lower Bound	Upper Bound
1996	305,713	303,259	308,167	32,133	31,052	33,214
1997	309,411	303,548	315,274	38,427	36,119	40,735
1998	312,609	305,785	319,433	33,883	31,365	36,401
1999	316,423	312,417	320,429	34,027	31,691	36,363
2000	330,828	327,614	334,042	39,289	36,977	41,601
2001	326,542	323,206	329,878	38,222	35,934	40,510
2002	319,537	313,896	325,178	36,333	33,076	39,590
2003	318,607	313,050	324,164	36,297	33,179	39,415
2004	318,000	312,423	323,577	35,616	32,453	38,779
2005	318,500	312,940	324,060	35,258	32,017	38,499
2006	319,000	313,407	324,593	34,580	31,314	37,845

Table 6.2. Three-year moving average data for Central County, 1996-2006.

Year	Total Workers	Lower Bound	Upper Bound	Workers by Public Transportation	Lower Bound	Upper Bound
1996-1998	309,244	306,136	312,353	34,814	33,620	36,009
1997-1999	312,814	309,532	316,097	35,446	34,066	36,825
1998-2000	319,953	317,106	322,800	35,733	34,353	37,113
1999-2001	324,598	322,556	326,639	37,179	35,844	38,514
2000-2002	325,636	323,203	328,069	37,948	36,414	39,482
2001-2003	321,562	318,698	324,426	36,951	35,265	38,636
2002-2004	318,715	315,486	321,943	36,082	34,246	37,918
2003-2005	318,369	315,156	321,582	35,724	33,891	37,556
2004-2006	318,500	315,280	321,720	35,151	33,290	37,012

Table 6.3. Five-Year moving average data for Central County, 1996-2006.

Year	Total Workers	Lower Bound	Upper Bound	Workers by Public Transportation	Lower Bound	Upper Bound
1996-2000	314,997	312,868	317,126	35,552	34,579	36,524
1997-2001	319,163	316,986	321,339	36,770	35,717	37,822
1998-2002	321,188	319,035	323,341	36,351	35,202	37,499
1999-2003	322,387	320,385	324,389	36,834	35,627	38,040
2000-2004	322,703	320,556	324,850	37,151	35,872	38,431
2001-2005	320,237	317,906	322,568	36,345	34,988	37,703
2002-2006	318,729	316,231	321,227	35,617	34,181	37,052

year of data collection is 1996, the first three-year moving average is available in 1999. Initially, the Census Bureau calculated the three-year average estimates as

(1996 Estimate + 1997 Estimate + 1998 Estimate)/3

However, for the full ACS data release beginning with 2005 data, the three-year averages will be calculated as the weighted averages of the data collected over the three-year period. Thus, the three-year average estimates are calculated in the same way as the single-year estimates, but over the course of three years. The same method is employed for five-year estimates.

Since the 1996 to 2003 data are based on the ACS demonstration phase, the three- and five-year moving average estimates and their lower and upper bounds would not be available online. Therefore, these estimates have been synthesized for this case study. All computation methods are described in the next section.

6.3.2 Analysis Steps

For this case study, two types of analyses are conducted. First, the percentage of workers using public transportation to work and its 90 percent confidence interval is computed for all three types of estimates: annual data, three-year moving average data, and five-year moving average data. Then, the difference in the percentage of workers using public transportation to work between any given two years and the statistical significance of the difference is computed. The formulas used in the analyses are based on documents released by the Census Bureau on the

accuracy of ACS data, the three-year averages, and the change profiles.[55] The formulas are presented in Section 4 of this guidebook, and also are used in the Section 5 case studies.

Annual Data In any given year, you could compute an estimate of the proportion of workers who used public transportation to work, as given in Equation 5.1. For example, using the 1996 data, the proportion of workers who used public transportation to work is equal to

$$\hat{P}_{1996} = \frac{32{,}133}{305{,}713} = 0.1051 = 10.51\%$$

To compute the confidence interval of the percentage of workers who used public transportation to work, you need to know its standard error. The steps needed to compute the standard error are similar to what is described in Sections 4 and 5.

For example, using Equation 5.3, the standard error of the number of workers who used public transportation to work in 1996 is equal to

$$SE\left(\hat{X}_{1996}\right) = \frac{32{,}133 - 31{,}052}{1.645} = 657$$

Similarly, the standard error of the total number of workers in 1996 is equal to

$$SE\left(\hat{Y}_{1996}\right) = \frac{305{,}713 - 303{,}259}{1.645} = 1{,}492$$

Using Equation 5.4, the standard error of the proportion of workers who used public transportation to work in 1996 is equal to

$$SE\left(\hat{P}_{1996}\right) = \frac{1}{305{,}713}\sqrt{\left[657\right]^2 - \frac{32{,}133^2}{305{,}713^2}\left[1{,}492\right]^2} = 0.0021 = 0.21\%$$

Finally, using Equations 5.6, 5.7, and 5.8 (page81), the lower and upper bounds of the 90 percent confidence interval for the percentage of workers who used public transportation to work in 1996 are given by

$$LB\left(\hat{P}_{1996}\right) = 0.1051 - 1.645 \times 0.0021 = 0.1017 = 10.17\%$$

$$UB\left(\hat{P}_{1996}\right) = 0.1051 + 1.645 \times 0.0021 = 0.1085 = 10.85\%$$

Similar computed values for all years from 1996-2006 are shown in Table 6.4.

Three-Year Moving Average Data Given the lower and upper bounds of the confidence intervals for the three-year average total number of workers and the number of workers using public transportation to work, the other computations of the percentage of workers using public transportation to work and its confidence interval would be the same as those described for the annual data case. As mentioned earlier, the three-year moving average data were not available for the 1996-2003 data and, therefore, are synthesized for this case study.

The lower bounds and upper bounds of the 90 percent confidence interval for the three-year moving average estimates are derived in the same way as for the single-year estimates, and were shown in Table 6.2. The computed values are summarized in Table 6.5.

[55] See "Change Estimates," at www.census.gov/acs/www/Downloads/ACS/accuracy2002change.pdf, "Accuracy of the Data (2003)," at www.census.gov/acs/www/Downloads/ACS/accuracy2003.pdf, and "Three-Year Averages," at www.census.gov/acs/www/Downloads/ACS/ThreeYrAvg.pdf.

Table 6.4. Annual data computation worksheet for the percentage of workers who used public transportation to work with 90 percent confidence interval.

	Total Workers		Number of Workers by Public Transportation		Percentage of Workers by Public Transportation			
Year	Estimate	SE	Estimate	SE	Estimate	SE	LB	UB
1996	305,713	1,492	32,133	657	10.51	0.21	10.17	10.85
1997	309,411	3,564	38,427	1,403	12.42	0.43	11.71	13.13
1998	312,609	4,148	33,883	1,531	10.84	0.47	10.07	11.61
1999	316,423	2,435	34,027	1,420	10.75	0.44	10.03	11.48
2000	330,828	1,954	39,289	1,406	11.88	0.42	11.19	12.57
2001	326,542	2,028	38,222	1,391	11.71	0.42	11.01	12.40
2002	319,537	3,429	36,333	1,980	11.37	0.61	10.37	12.37
2003	318,607	3,378	36,297	1,895	11.39	0.58	10.43	12.35
2004	318,000	3,390	35,616	1,923	11.20	0.59	10.22	12.18
2005	318,500	3,380	35,258	1,970	11.07	0.61	10.07	12.07
2006	319,000	3,400	34,580	1,985	10.84	0.61	9.83	11.85

Five-Year Moving Average Data The computed values for the five-year moving average data are similar to those for the three-year moving average data, and are shown in Table 6.6.

Computing Differences in Percentages The next step in the analysis is to compute the difference in the percentage of workers using public transportation to work between any two consecutive years and the statistical significance of the differences.

It is important to note that statistically valid annual estimates of change cannot be computed from the difference of two moving averages if the two moving averages are based on overlapping data. Table 6.7 summarizes the three-year estimates that can be validly compared with each other. For the series involving data from 11 years (1996 to 2006), a maximum of three time periods (assuming three-year moving averages) that do not include overlapping years should be statistically compared to each other. For example, moving averages of 1996-1998, 1999-2001, and 2002-2004 can all be compared to each other without the effects of the overlapping data. Using five-year moving averages, a maximum of two time periods that do not include overlapping years can be compared to each other (e.g., moving averages of 1996-2000, 2001-2005).

Table 6.5. Three-Year moving average data computation worksheet for the percentage of workers who used public transportation to work with 90 percent confidence interval.

	Total Workers		Number of Workers by Public Transportation		Percentage of Workers by Public Transportation			
Year	Estimate	SE	Estimate	SE	Estimate	SE	LB	UB
1996-1998	309,244	1,890	34,814	726	11.26	0.22	10.89	11.63
1997-1999	312,814	1,996	35,446	839	11.33	0.26	10.91	11.76
1998-2000	319,953	1,731	35,733	839	11.17	0.26	10.75	11.59
1999-2001	324,598	1,241	37,179	812	11.45	0.25	11.05	11.86
2000-2002	325,636	1,479	37,948	933	11.65	0.28	11.19	12.12
2001-2003	321,562	1,741	36,951	1,025	11.49	0.31	10.98	12.01
2002-2004	318,715	1,963	36,082	1,116	11.32	0.34	10.76	11.89
2003-2005	318,369	1,953	35,724	1,114	11.22	0.34	10.66	11.79
2004-2006	318,500	1,957	35,151	1,131	11.04	0.35	10.46	11.61

Table 6.6. Five-Year moving average data computation worksheet for the percentage of workers who used public transportation to work with 90 percent confidence interval.

	Total Workers		Number of Workers by Public Transportation		Percentage of Workers by Public Transportation			
Year	Estimate	SE	Estimate	SE	Estimate	SE	LB	UB
1996-2000	314,997	1,294	35,552	591	11.29	0.18	10.99	11.59
1997-2001	319,163	1,323	36,770	640	11.52	0.19	11.20	11.84
1998-2002	321,188	1,309	36,351	698	11.32	0.21	10.97	11.67
1999-2003	322,387	1,217	36,834	733	11.43	0.22	11.06	11.79
2000-2004	322,703	1,305	37,151	778	11.51	0.24	11.12	11.90
2001-2005	320,237	1,417	36,345	825	11.35	0.25	10.93	11.77
2002-2006	318,729	1,519	35,617	872	11.17	0.27	10.73	11.62

The difference in the percentage of workers using public transportation to work between two years is given by Equation 5.2. For example, this difference between 1996 and 1997 is

$$DIFF_{1996-1997} = 100\% \times \left(\hat{P}_{1997} - \hat{P}_{1996}\right) = 100\% \times \left(0.1242 - 0.1051\right) = 1.91\%$$

The steps needed to compute the statistical significance of this difference are similar to what was described in Section 5. The standard error of the difference in the percentage of workers who used public transportation to work between 1996 and 1997 is given by Equation 5.5 and is equal to

$$SE\left(DIFF_{1996-1997}\right) = 100\% \times \sqrt{\left[SE\left(\hat{P}_{1997}\right)\right] + \left[SE\left(\hat{P}_{1996}\right)\right]}$$

$$= 100\% \times \sqrt{\left[0.0043\right]^2 + \left[0.0021\right]^2} = 0.48\%$$

The 90 percent margin of error of the difference in the percentage of workers who used public transportation to work between 1996 and 1997 is given by Equation 5.6 and is equal to:

$$ME\left(DIFF_{1996-1997}\right) = 1.645 \times 0.48 = 0.79\%$$

The lower and upper bounds of the 90 percent confidence interval of the 1996-1997 difference in percentages are given by Equations 5.7 and 5.8, respectively, and are equal to

$$LB\left(DIFF_{1996-1997}\right) = 1.91 - 0.79 = 1.12\%$$

Table 6.7. Valid comparisons of ACS three-year average estimates.

Year	1996-1998	1997-1999	1998-2000	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006
1996-1998				✓	✓	✓	✓	✓	✓
1997-1999					✓	✓	✓	✓	✓
1998-2000						✓	✓	✓	✓
1999-2001	✓						✓	✓	✓
2000-2002	✓	✓						✓	✓
2001-2003	✓	✓	✓						✓
2002-2004	✓	✓	✓	✓					
2003-2005	✓	✓	✓	✓	✓				
2004-2006	✓	✓	✓	✓	✓	✓			

Table 6.8. Difference in percentages of workers using public transportation to work using annual ACS data.

	Percentage of Workers Using Public Transportation to Work							
Year	Estimate	SE (Estimate)	Difference	SE (Diff)	ME (Diff)	LB (Diff)	UB (Diff)	Significant?
1996	10.51	0.21						
1997	12.42	0.43	1.91	0.48	0.79	1.12	2.70	Yes
1998	10.84	0.47	-1.58	0.64	1.05	-2.63	-0.53	Yes
1999	10.75	0.44	-0.09	0.64	1.06	-1.14	0.97	No
2000	11.88	0.42	1.12	0.61	1.00	0.12	2.12	Yes
2001	11.71	0.42	-0.17	0.59	0.98	-1.15	0.80	No
2002	11.37	0.61	-0.33	0.74	1.21	-1.55	0.88	No
2003	11.39	0.58	0.02	0.84	1.38	-1.36	1.41	No
2004	11.20	0.59	-0.19	0.83	1.37	-1.56	1.17	No
2005	11.07	0.61	-0.13	0.85	1.40	-1.53	1.27	No
2006	10.84	0.61	-0.23	0.86	1.42	-1.65	1.19	No

$$UB\left(DIFF_{1996-1997}\right) = 1.91 + 0.79 = 2.70\%$$

Finally, the statistical significance of the difference in percentages is determined according to the rules described in Section 5. For example, since both the lower and upper bounds of the 90 percent confidence interval of the difference in percentage of workers who used public transportation to work between 1996 and 1997 are positive, it can be concluded with 90 percent certainty that this difference is statistically significant.

Similar computed values for the years 1996 through 2006 are shown in Table 6.8.

6.4 Conclusions from the Case Study

As described, one can plot the trend versus time. Figures 6.5 and 6.6 show these plots for the three- and five-year moving average data.

Similar to the conclusions drawn from the analysis of annual estimates, Figures 6.5 and 6.6 indicate that the change in the percentage of workers using public transportation to work was minimal; the plots of the three- and five-year moving averages are almost flat. This also illustrates that estimates based on the moving averages tend to smooth out any sudden changes in the indicator of interest. For example, even though there is a significant increase (around 2 percent) in the percentage of workers using public transportation to work between years 1996 and 1997 in the annual data plot, the increase occurs at a slower rate using the three- and five-year moving average data analysis. The drop in the rate in 1998 dampens the effect of the one-year variation. Even if there were a more pronounced increase from one year to the next, the multiyear estimates would have shown the increase at a slower rate. The dampening is desirable in the case of year-to-year minor fluctuations (noise), but means that trends that occur for smaller geographic areas will not be detectable for some time.

The confidence intervals become narrower (i.e., more stable estimates) for the three-year moving average data than for the annual data, and narrower for the five-year moving average data than for the three-year moving average data. This reflects the larger sample sizes, but the seemingly increased precision comes at the cost of the more difficult interpretation of the multiyear averages.

For the second analysis comparing the trends at the county level and at the city level for Fairview City, only five-year moving average data would be available for Fairview City, a small

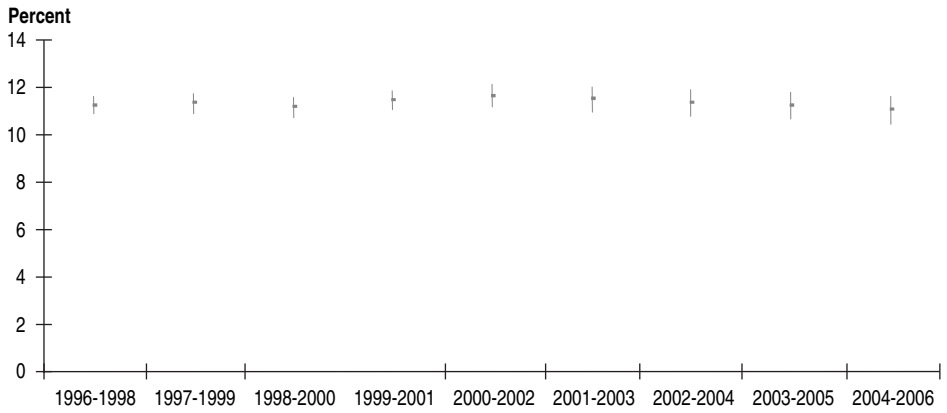

Figure 6.5. Percentage of workers in Central County using public transportation to work, using three-year moving average data.

area with population less than 20,000. Therefore, for comparison purposes, since only the five-year data are available for the small area, the five-year average estimates for the county also should be used. The confidence intervals at each of the two geographic levels can then be plotted, as was shown in Figure 6.4.

The confidence intervals at the city level are larger than at the county level, as expected, because of smaller sample sizes at smaller geographies. For any given time period, one can then compare the two moving average estimates (county and city levels) using the difference calculations described in Sections 4 and 5. Often, when the confidence intervals for the areas being compared are significantly different and not overlapping, an analyst will know that the difference is statistically significant without calculating the standard errors of the differences. For example, the confidence interval at the city level corresponding to the 2001-2005 moving average does not overlap with the confidence interval at the county level. The upper bound of the confidence interval at the city level is smaller than the lower bound of the confidence interval at the county level. Therefore, one can be pretty certain that the percentage of workers using public transportation to work is smaller in Fairview City than in Central County as a whole. To determine the statistical significance of the difference, an analyst could apply the differences analysis described in Section 5.

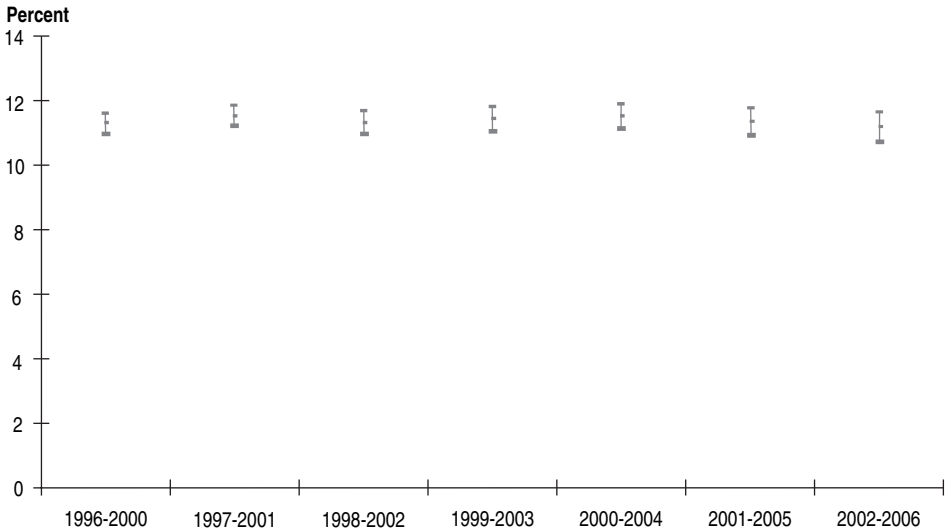

Figure 6.6. Percentage of workers in Central County using public transportation to work, using five-year moving average data.

This case study has shown how some elements of trend analysis can be accomplished using ACS data. Some of the issues that data users should be aware of when analyzing ACS data for the purpose of trend analysis are summarized below.

6.4.1 When to Use Each Type of Estimate

When more than one type of estimate is available (either in the form of annual and moving average estimates or in the form of moving average estimates of different lengths), as in the case of geographic areas with 65,000+ population, the choice of estimate to use depends on the purpose of the analysis.

Consistency If the characteristics of two populations in areas of similar geographic scales (e.g., populations of two counties or two states) are compared over time, it is important to use the same type of estimate to ensure consistency. For example, if County A has a 65,000+ population and County B has a population less than 65,000, then it is recommended to use the moving average estimate from County A (rather than the single-year estimate, which is available) to compare it to the moving average estimate from County B (where annual estimates are unavailable).

Reduction in Lag Time If the timeliness of the data is important for the analysis, and if the single-year estimates are deemed reliable (e.g., with reasonable standard errors and without too many fluctuations), the analyst could use the single-year estimates rather than the moving average estimates to reduce the lag time between the analysis year and data collection year.

Reliability If the trend analysis focuses on a certain sub-population for whom three- and five-year moving averages are available, and if greater reliability is desired, the five-year moving averages would be more stable to use.

Reducing Correlations As was discussed in the example above, moving averages that include overlapping years are correlated. Therefore, when modeling a trend using ordinary least squares regression or Poisson regression (see below), or testing for the significance of an annual rate of change, it is recommended that annual estimates be used rather than moving average estimates that include overlapping years.

6.4.2 Correlation between Moving Average Data

When three- or five-year moving average data are used for computing differences in estimates between different years, users should be aware of the correlation between these estimates.

For example, annual estimates of change cannot be computed from the difference of two moving averages if the two moving averages are based on data from overlapping years (e.g., a moving average of years 1996-1998 and a moving average of years 1997-1999). This is because when standard statistical procedures are used to test for significant differences between estimates over time, it is assumed that the two estimates are drawn from independent samples, an assumption that is violated in the case of two consecutive moving averages. One can, for example, compare a moving average of data from years 1996-1998 with a moving average of data from years 1999 and beyond, because these two intervals do not include overlapping years.

6.4.3 Modeling the Trend

In addition to visually observing the pattern of change in the percentage of workers using public transportation to work and computing differences in percent distributions, statistical meth-

ods can be used to model the trend and help in forecasting future values. Regression analysis (e.g., ordinary least squares [OLS] regression) is one such tool that also allows for the inclusion of other variables that could affect the indicator of interest.

When using a regression to model a trend, it is preferable to use the actual annual rates rather than the moving averages because of the high correlations between moving averages from overlapping years. The dependent variable can be the actual percentage of workers using public transportation, as in the following model:

$$\text{Percentage of workers using public transportation}_t = \text{Intercept} + \text{Slope} * \text{Year}_t$$

where $Year_t$ has the values 1 to N (number of years for which annual data are available).

Alternatively, the dependent variable can be the natural logarithm of the percentage of workers using public transportation to work. A log transformation of the data does not change the overall direction of the trend, but it flattens the percentages and might give more realistic results. For example, applying a decreasing linear trend that uses the actual percentages, the percentage of workers using public transportation will equal zero in some future year. With a logarithmic transformation, however, it approaches zero but does not exactly equal zero. The logarithmic regression is of the following form:

$$\text{Ln}(\text{Percentage of workers using public transportation}_t) = \text{Intercept} + \text{Slope} * \text{Year}_t$$

The regression equations can then be used to predict the percentage of workers using public transportation in any given future year.

In this case study, the trends are not modeled because the number of datapoints available for estimation is very small.

Other statistical techniques that can be used to model trends are Poisson regressions and time series analyses, which require more specialized software packages than those that perform OLS regression. Also, note that time series models allow for correlation in the error terms of the modeled observations, unlike OLS or Poisson regressions, which assume that the error terms are independent.

6.5 Specific Uses of Census Data for Trend Analyses

6.5.1 Demographic Trends

Transportation planners and demographers need to monitor how a region's population has changed over time to better understand how the region's transportation system has evolved in order to inform forecasts of future regional growth. Some examples include

- Use of census data to understand demographic and economic growth in Lake, Porter, and LaPorte counties in Northwestern Indiana (Northwestern Indiana Regional Planning Commission).[56]
- Development of growth and regional change projections by TAZ for the Johnson City (Tennessee) MPO Long-Range Transportation Plan.[57]
- Use of census data by several counties in preparation of their comprehensive plans to understand trends and project these trends into the future. For example, Broward County, Florida, uses census data for economic and population modeling.

[56] See www.nirpc.org/Census-DemoIntro.html. Last accessed November 8, 2004.

[57] Johnson City MPO Long-Range Transportation Plan, "Section 2: Growth and Regional Change." See www.jcmpo.org/lrtp/chap2.pdf (August 15, 2001).

- Use of CTPP 2000 data by the Maryland State Data Center to create a CD-ROM containing selected items from Part 1 and Part 2 for mapping via ArcView. Place-of-work data were used as part of an analysis of 10 military bases in Maryland in preparation for base realignment and closure, 2005.[58]
- Use of census data to examine the aging of population and racial diversity, determine future transportation needs, evaluate travel behavior based on age and/or race groups, develop highway projects to add capacity, develop and support policies (e.g., access control on identified corridors in anticipated high-growth areas), and support public involvement/outreach purposes.[59]
- Use of census data to develop population growth factors and demographic forecasts for transportation planning development work and modeling efforts.[60]
- Use of 150 years of census data to study trends in the race and ethnicity history of Utah (especially focusing on minority groups) and construct a historical county-level race/ethnicity database for Utah spanning 1850 through 2000. [61]

6.5.2 Journey-to-Work Trends

Trends of intercounty commuting are being classified at three levels: at the national level, for long-distance commuting, and for metropolitan commuting. Cervera and Hartgen,[62] and Soot, DiJohn, and Christopher[63] provide examples of recent efforts to review journey-to-work trends. Additional examples of published reports on journey-to-work trends include the following:

- FHWA's Journey-to-Work Trends Report[64] that describes commuting trends at the national level, as well as for large metropolitan areas, using data from 1960 to 2000.
- North Jersey Transportation Planning Authority's (NJTPA) use of county-to-county commuter flow data from 1980 to 2000 to depict commute patterns for residents in Northern New Jersey.[65] The report analyzed changes in trip mode shares to work, travel times, and vehicle availability from 1990 to 2000 at the county level in Northern New Jersey.
- Metropolitan Council of Twin Cities' use of county-to-county commuter flows to analyze regional changes in commute behavior in the Minneapolis-St. Paul Region.[66]
- Puget Sound Regional Council's analysis of trends in the Central Puget Sound Region using 1980, 1990, and 2000 Census data.[67]
- Northwest Michigan Council of Government's use of census data to map trends in population, employment, and commute for the 10 counties constituting Northwest Michigan.[68]

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[58] Personal correspondence with Jane Traynham, Maryland State Data Center. For an example of the application, see www.mdp.state.md.us/msdc/military/military_site.htm. November 10, 2004.
[59] Personal correspondence with Minnesota DOT, Indiana DOT, Pioneer Valley Regional Planning Commission, Tulare County Association of Governments.
[60] Personal correspondence with Nebraska Department of Roads, Denver Regional Council of Governments (DRCOG), Southeast AR Regional Planning Commission (Arkansas).
[61] P.S. Perlich, *Utah Minorities: The Story Told by 150 Years of Census Data*. University of Utah, 2002.
[62] E.D. Cervera and D.T. Hartgen, "Trends in North Carolina's Inter-County and Intra-County Commuting, 1990-2000," Submitted to the Transportation Research Board, National Research Council, Washington, D.C., 2003.
[63] Siim Soot, Joseph DiJohn, and Ed Christopher, 2003, "Chicago-Area Commuting Patterns and Emerging Trends," Urban Transportation Center, March 28, 2003. See www.berwyned.com/papers/co2cochgo.pdf.
[64] N. McGuckin and N. Srinivasan, "Journey to Work Trends in the United States and its Major Metropolitan Areas, 1960-2000." Federal Highway Administration, 2003.
[65] North Jersey Transportation Planning Authority, "Journey-to-Work Data: Census 2000 County-to-County Worker Flow Data for the NJTPA Region," November 2003. See www.njtpa.org/planning/census2000/2000JTWAnalysis2.pdf.
[66] Robert Paddock, "County-County Commute Flow in the Minneapolis-St. Paul Region" *CTPP 2000 Status Report*, May 2003. See www.trbcensus.com/newsltr/sr0503.pdf.
[67] Puget Sound Regional Council, "Puget Trends," No. T1, April 2003.
[68] Northwest Michigan Council of Governments, "Transportation to Work Characteristics and Trends for Northwest Michigan," August 2002.

- Commuting patterns in Utah and county trends for 1980, 1990, and 2000.[69]
- Trends in 1970 through 1990 county-to-county commuter flows by means of transportation, "desire line" maps, reverse commuting, and interregional commuting in the Philadelphia region.[70]
- Analysis of commuting to downtown in the San Francisco Bay Area.[71]
- San Francisco Bay Area MTC's study of county-to-county commuters from 1960 to 1990 and the change in household vehicle availability since 1960.[72]
- Other reports by the Chicago Area Transportation Study,[73] the San Diego Association of Governments, the Puget Sound Regional Council in the Seattle region, the Maryland Department of Transportation.[74]

In addition, through interviews and personal correspondence with transportation planners at state departments of transportation and metropolitan planning organizations, it was evident that journey-to-work trends analysis (e.g., modal split, households without vehicles, locality-to-locality commute flows, average commute) is a common application of the decennial census data (e.g., at Minnesota DOT, Indiana DOT, Mass Highway, Hampton Roads Planning District Commission, Yakima Valley Conference of Governments, Denver Regional Transit District). For example, at Indiana DOT, available census employment data were compared to previous data in order to identify changes in employment type, primary industry, and occupation. Identified trends were used to forecast travel demand, evaluate access to jobs, study the movement of goods, and develop/evaluate transportation projects or policies designed to encourage future economic expansion.

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[69] P. Perlich, "Commuting Patterns in Utah: County Trends for 1980, 1990, and 2000." *Utah Economic and Business Review*, 2003.

[70] Delaware Valley Regional Planning Commission, "Journey to Work Trends in the Delaware Valley Region, 1970-1990." *Direction 2020 Report 5,* Philadelphia, June 1993.

[71] C. Purvis, 2004, "Commuting to Downtown." See www.mtc.ca.gov/datamart/census/ctpp2000/ (May 6, 2004).

[72] C. Purvis, 1994, "The Decennial Census and Transportation Planning: Planning for Large Metropolitan Areas," Transportation Research Board, Decennial Census Data for Transportation Planning, *Conference Proceedings 4*, Irvine, California, March 13-16, 1994.

[73] Ed Christopher, 1996, "Census Data Use in Illinois by a Large Metropolitan Planning Organization," Transportation Research Board, Decennial Census Data for Transportation Planning, Case Studies and Strategies for 2000, *Conference Proceedings 13*, April 28-May 1, 1996.

[74] *TCRP Report 28: Transit Markets of the Future: The Challenge of Change,* Transportation Research Board, National Research Council, Washington, D.C., 1998. See http://gulliver.trb.org/publications/tcrp/tcrp_rpt_28-a.pdf.

CHAPTER 7

Transportation Market Analyses Using ACS Data

Transportation planners at different types of agencies perform a wide range of transportation market analyses using census data and other sources.

This Section describes how ACS is likely to be used for transportation market analyses. Section 7.1 defines transportation market analysis and describes why transportation planners conduct transportation market analyses. This section also provides some examples of uses of census data for this purpose. A more detailed list of specific uses is provided at the end of this section. Section 7.2 describes some of the benefits and limitations of shifting from census to ACS data related to transportation market analysis. Section 7.3 provides a case study example of transportation market analysis. The case study shows how to compute the index of dissimilarity (an application of environmental justice analysis) using ACS data and how the results compare to those using census data.

7.1 Transportation Market Analysis

Transportation market analysis consists of a variety of methods used to support the analysis of transportation demand. Transportation planners have used decennial census data for many types of transportation market analyses, including studies on transit market, non-motorized commuting, and travel model market segmentation.

Transportation market analysis is performed for different purposes. For example, transit market studies can be used to perform the following analyses:[75]

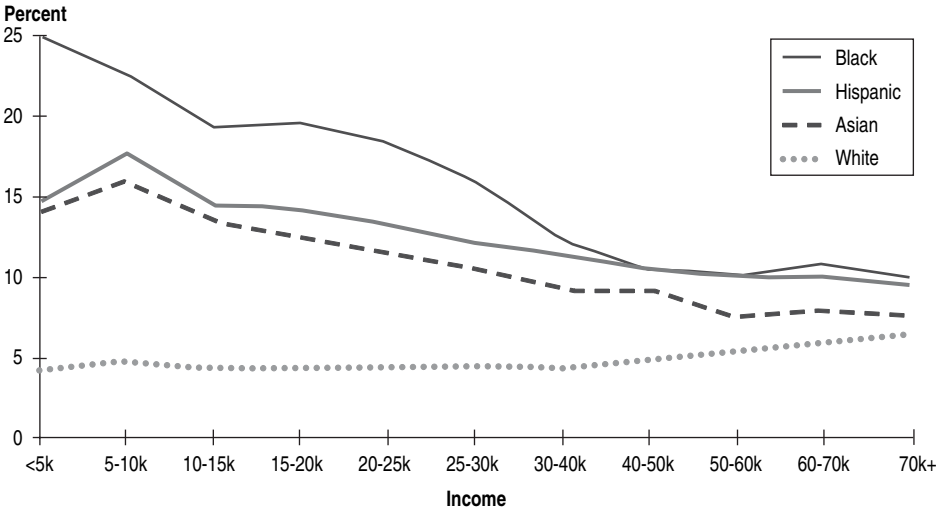
- Study of captive and choice transit riders to identify potential transit markets;
- Performance evaluation, which is important for addressing Title VI federal requirements, environmental justice, and for identifying needs for extended transit service;
- Demand projections and market evaluations; and
- Route planning to improve current service and plan future service extensions.

7.1.1 Examples of Use

This section provides some examples of presenting market analyses that are based on census data. Figure 7.1 shows transit usage by income and race.[76] Figure 7.2 is a thematic map showing

[75] R. Cervero, 1994, "Use of Census Data for Transit, Multimodal, and Small-Area Analyses." Transportation Research Board, Decennial Census Data for Transportation Planning, *Conference Proceedings 4*, Irvine, California, March 13-16, 1994.

[76] *TCRP Report 28: Transit Markets of the Future: The Challenge of Change,* Transportation Research Board, National Research Council, Washington, D.C., 1998. See http://gulliver.trb.org/publications/tcrp/tcrp_rpt_28-a.pdf.



Source: Unpublished tape readable data from the 1990 U.S. Census, 5% PUMS.

Figure 7.1. Transit use to work in metropolitan areas, by race, ethnicity, and household income, 1990.

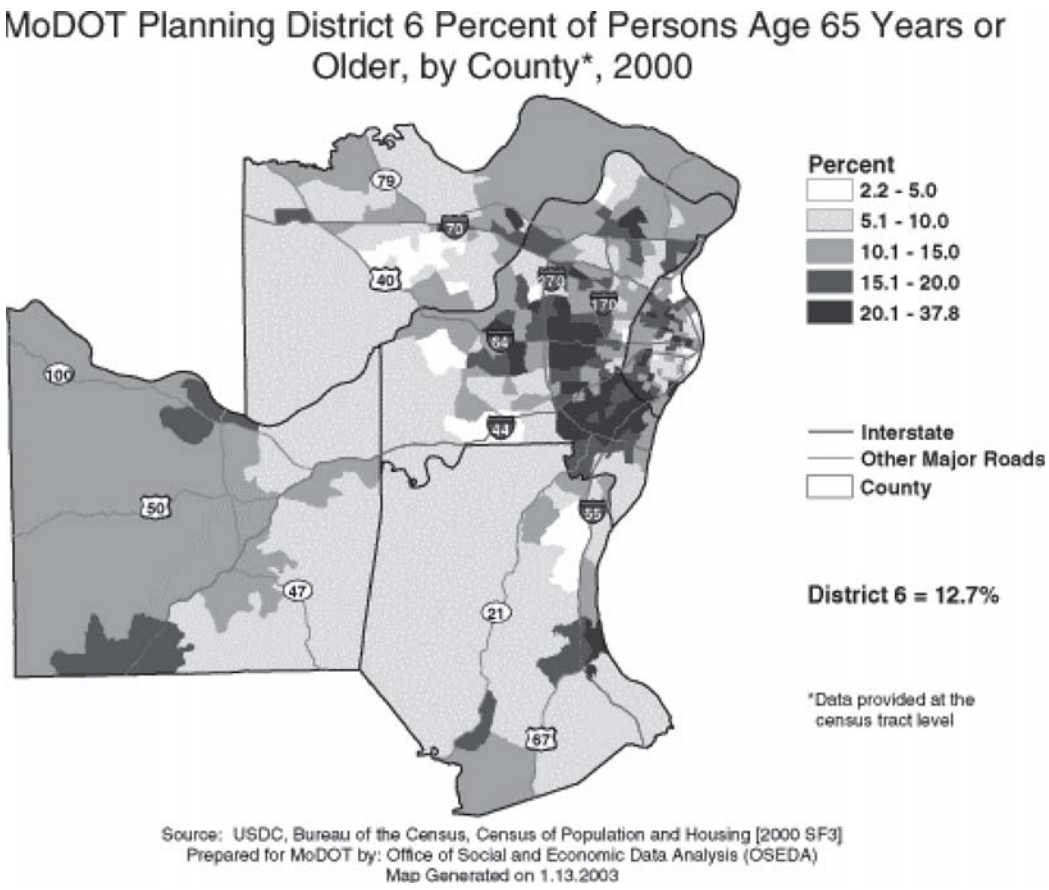


Figure 7.2. Percent of persons age 65 years or older by county.

the distribution of elderly people by county,[77] an analysis which is commonly done within environmental justice analyses. A list of specific examples of using census data to do market analysis also is provided at the end of this section.

7.2 Benefits and Limitations of ACS for Transportation Market Analysis

This section summarizes the perceived benefits and limitations of using ACS data for transportation market analysis.

Transportation planners contacted about the implications of ACS felt that the availability of ACS data on a continuous basis would allow for more timely analysis of route and service planning, as well as environmental justice issues.

In contrast, the variability of ACS data at small area geography may severely limit some of the applications. In many cases (e.g., environmental justice analysis, corridor analysis, etc.), planners seemed more interested in obtaining a firm quantitative assessment, even if it used point-in-time data rather than qualitative "moving average" data. Concerns were raised that in small areas where moving averages are used, some variables needed for many types of transit analyses—especially environmental justice analyses—would be hard to interpret.

7.3 Transportation Market Analysis: Environmental Justice Case Study

The following case study illustrates how a data user might do transportation market analysis using ACS data. The case study provides a step-by-step description of how one might obtain the data, do the computations, and present the results.

For this purpose, assume that you are a transportation analyst working in an MPO. In this analysis, your manager has asked you to perform an environmental justice analysis by computing an index of dissimilarity (ID) for your area. Section 3 of this guidebook has detailed instructions on downloading ACS data, and Section 4 and the previous case studies describe many of the generic ACS analyses that will be used in these analyses.

You were asked to compute the ID, which often is used in planning to measure the evenness of sub-population groups across specific geographic areas,[78] at different geographic levels for a target population consisting of non-Hispanic whites ("white" hereafter), non-Hispanic blacks ("black" hereafter) and Hispanic residents of Broward County, Florida. You have been asked to do the computations using both the 2000 ACS and census data. The goal of this analysis strategy is to ascertain the differential impact of moving from census to ACS data on this given measure of importance to public policy; transportation; and municipal, community, and regional planning personnel.

In this case study exercise, begin by treating both the ACS estimates and the census counts as point estimates, without regard to the ACS sampling error. This will always be an option for analysts and,

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[77] Missouri Department of Transportation Socio-Economic Indicator Resource, "The Relationship of Environmental Justice Populations to Key Socio-Economic Indicators in the St. Louis Area District," 2003. See http://oseda.missouri.edu/modot/planning/stlouis_analysis.shtml.

[78] *NCHRP Report 532: Effective Methods for Environmental Justice Assessment.* Transportation Research Board, National Research Council, Washington, D.C., 2004.

for complex analyses, may be the only logical way to make use of ACS estimates. However, the Census Bureau recommends including the sampling uncertainty in any calculations using ACS estimates, so a discussion of including this uncertainty in the calculations follows the initial discussion.

The ID measures the evenness with which two mutually exclusive groups are distributed across the geographic units that comprise a larger geographic entity. An example is the distribution of blacks and whites across the census tracts that define a metropolitan region, county, or state. The key considerations are: 1) the total population of two particular groups at a higher-level geography (i.e., whites and blacks in Broward County) and 2) the proportion of each group's population within a particular areal unit. In this process, "areal unit" is used to describe smaller geographic areas within the larger study area. This can be a census tract, block group, or TAZ.

The ID has a minimum value of zero and a maximum value of 100. It can be defined as

$$ID = 100 \times \tfrac{1}{2} \bullet (\left| a_i / A - b_i / B \right|)$$

where

a_i = the population of Group A within the i^{th} areal unit, e.g., census tract;
A = the total population of Group A within the larger geographic entity for which the ID is being calculated, e.g., county;
b_i = the population of Group B within the i^{th} areal unit, e.g., census tract; and
B = the total population of Group B within the larger geographic entity for which the ID is being calculated, e.g., county.

The calculation of ID values involves specifying both the overall geographic unit of analysis as well as the areal units that form the basis for the index. Depending on the goals and needs of a project, this step is essential to achieving efficient and robust results. In this study, the ID will measure the overall race/ethnic residential composition at the county level for Broward County, Florida.

The next decision of importance is the identification of the areal unit—the lowest level of geography where race/ethnic residential composition will be measured and then compared to the target area (i.e., Broward County). Traditional analyses over the last half-century have focused on utilizing census tract-level data as the preferred areal unit of analysis. The use of tracts was prompted by convenience more than theoretical requirements. The average U.S. census tract in 2000 included approximately 4,200 residents and was neither initially developed nor intended to represent an average residential neighborhood. Unfortunately, very few generalizable data sources included units of analyses smaller than a census tract. This, combined with the relatively low level of computational resources needed to analyze a small number of areal units, resulted in the census tract becoming the standard reference areal unit in most geographic area analyses. As computer power has increased, many analysts prefer and can support analysis at the level of census block groups (about 1,300 residents) and census blocks (about 34 residents). Ideally, the smallest areal unit will "uncover" the truest picture of residential segregation in any given geographic unit.

One can present the ID computed values at different geographic levels and using both ACS and census, as shown in Table 7.1.

The lowest levels of race/ethnic segregation for all groups studied was at the PUMA level. This is to be expected because the PUMA represents the most aggregated data (aside from county level), with only 13 areal comparison units in the county.

At the PUMA level, the following conclusions can be made:

- The first column of values shows that, on average, roughly 35 percent (ID value at 35.1) of all blacks would have to move from their current PUMA residence in order to be proportionally

Table 7.1. Index of dissimilarity values for Broward County, Florida, by area, data source, and race/ethnicity.

	PUMA			Tract			TAZ			Block Group			Block		
	W/B	W/H	B/H	W/B	W/H	B/H	W/B	W/H	B/H	W/B	W/H	B/H	W/B	W/H	B/H
Data Source															
Census 2000	35.1	17.5	32.9	62.7	31.5	53.5	66.0	35.0	56.6	64.5	33.2	54.8	70.4	41.5	60.2
ACS 1999-2001	35.3	18.0	33.0	63.0	32.5	55.5	66.2	36.9	58.7	--	--	--	--	--	--
Net Difference	0.2	0.5	0.1	0.3	1.1	2.0	0.2	1.9	2.1	--	--	--	--	--	--
% Difference	0.6	3.0	0.4	0.5	3.3	3.7	0.3	5.1	3.6	--	--	--	--	--	--
N	13			279			777			689			20,136		

*Source: Census 2000 & American Community Survey, 1999-2001 (weighted) – Broward County, Florida.

*Note: W/B = White/Black, W/H = White/Hispanic, B/H = Black/Hispanic.

distributed within all PUMAs in the county in the same way as whites. The converse relationship holds as well.

- The percentage of segregation between whites and Hispanics is roughly half the white/black value at 18. black/Hispanic segregation resides at approximately the same level as black/white difference, with ID value equaling 33. At this level of analysis, the percentage differences between the census and ACS are relatively small, with the highest value being within white/Hispanic residents at 3 percent.

Moving to higher numbers of smaller population area units creates a resultant increase in ID values. This is to be expected as larger areal units can, and often do, mask greater race/ethnic neighborhood segregation. For the 279 tracts in the county, the following conclusions can be made:

- Both higher ID values and greater differences between the census and ACS are noted, particularly for the black/Hispanic comparison. ID values have approximately doubled for all groups.
- White/black ID value equals 63, thereby indicating a much higher residential segregation than previously detailed. Minority group data comparisons show about 3.7 percent difference between ACS and Census 2000.

At the TAZ level (777 TAZs in the county), the following conclusions can be made:

- There is only a slight increase in overall ID values and percentage differences by data as compared to tract data.
- The highest percentage difference between ACS and Census 2000 detailed is among the white/Hispanic comparison, at 5.1 percent.

7.3.1 Available Data

Selection of Geography For this case study, ID values were calculated for several subcounty areal units available in Census 2000 and ACS data. These include

- PUMA—a geographic area with a minimum population of 100,000 residents. From within these PUMA areas, the census extracts a 5 percent sample of census Long Form data for public use. In Census 2000, there were 13 PUMAs within Broward County;
- Census tract;
- TAZ;
- Census block group; and
- Census block.

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Table 7.2. Areal unit characteristics, Census 2000 Broward County, Florida.

Areal Unit	Average Population	Average Area (Miles^2)	N
County	1,623,018	1,320.0	1
PUMA	124,848	101.1	13
Tract	5,817	37.5	279
TAZ	2,089	13.5	777
Block Group	2,356	15.2	689
Block	81	0.5	20,136

*Source: Census 2000.

The Census 2000 data could be used at all of the listed geographies, but the ACS estimates do not contain information at the block group or block levels. Therefore, data comparisons for this study will concentrate on the levels that are possible in both datasets: PUMA, TAZ, and tract.[79] However, data at the block group and block levels will be presented in order to assess the impact of how much detail may be lost due to the lack of small area geography in the ACS. Table 7.2 summarizes the characteristics of the areal units for this case study.

Identification of Required Data Tables The analysis relied on custom Census 2000 and 1999-2001 ACS data tables provided by the Census Bureau in the Statistical Analysis System (SAS). ACS data with similar levels of geographic detail will be available for full ACS implementation. Given the race/ethnic groups under study, the following tables in both the ACS and census custom tables were identified as relevant for this case study:

- Total Hispanic population,
- Total non-Hispanic white population, and
- Total non-Hispanic black population.

If accessing the census data using American FactFinder, the appropriate tables would be as follows:

- ACS—P003: Hispanic or Latino by race; and
- Census (Summary File 1)—P4: Hispanic or Latino, and not Hispanic or Latino by race.

Within each table, all of the included geographic variables and their associated documentation should be retained. This includes Sumlev, State, County, Place2, TAZ, Tract, and Puma5.

7.3.2 Analysis Steps

The ID measures the evenness with which two mutually exclusive groups are distributed across the geographic units that comprise a larger geographic entity. As will be detailed later in this case study, the values for each areal unit are transformed into absolute values. They are then summed for the specific areal units under study (e.g., census tracts or block groups). The resultant statistic (the ID) theoretically indicates the extent to which the sub-population groups of interest are evenly distributed and, if not, identifies the proportion of either group that would

[79] It should be noted that the ACS data used in this analysis are custom tables prepared from 1999-2001 average data, where the sampling rate has been increased so that the three-year data would possess the level of accuracy obtained from five-year data under normal sampling rates. Thus, when analysts compute the ID at the tract or TAZ level, they should be aware that multiple-year data are needed.

have to move from their current areal unit to another in order for both groups to be proportionally distributed within the larger geographic unit of interest.

The following basic steps undertaken to calculate an ID for Broward County are:

1. Following the index formula of $ID = 100 \times \frac{1}{2} \Sigma (| a_i/A - b_i/B |)$, calculate the necessary parameters (columns) for formula completion. This is done for each group pair (white/black, white/Hispanic, and black/Hispanic).
   a) For the two groups to be compared, calculate the proportion of each group within each areal unit *i* you have chosen to utilize (tracts, TAZs, etc.). Every row in the data file is a particular level of *i*, or areal unit. Divide each *a* or *b* value within the i^{th} row by the corresponding total population (*A* or *b*) for the geographic unit you are studying (the county in this case).
   b) Subtract a/A from b/B within the i^{th} row.
   c) Take the absolute value of Step 1b.
   d) Sum the column values from Step 1c for the i^{th} rows that make up areal units you are utilizing (i.e., all tracts, TAZs, etc.)
   e) Multiply summed values from Step 1d by 0.5.
2. The summed result multiplied by 100 is the ID value for Broward County.

Table 7.3 is a worksheet that shows the ACS data used in the Broward County ID calculations involving the comparison of non-Hispanic whites (Groups a and A) and non-Hispanic blacks (groups b and B). Column and row letters/numbers are shown in the table to help guide the reader through the calculation steps. Within this table, data rows consist of population totals and counts by the 13 PUMAs. The columns represent summary variables such as geography (B = PUMA5), and race/ethnicity (C = white, D = black). Note that

- Row 1 represents the county population totals for both whites and blacks.

Table 7.3. ID calculations utilizing five percent of PUMA for non-Hispanic whites and non-Hispanic blacks in Broward County, Florida.

	A	B	C	D	E	F	G	H
	SUMLEV	PUMA5	WHITE	BLACK	wh/WH	blk/BLK	|a/A-b/B|	0.5*sum (|a/A-b/B|)
1	50		929090	337925				PUMA ID
2	795	03601	94565	12415	0.10	0.04	0.07	35.3
3	795	03602	74905	13555	0.08	0.04	0.04	
4	795	03603	72855	21185	0.08	0.06	0.02	
5	795	03604	74620	18940	0.08	0.06	0.02	
6	795	03605	75560	44945	0.08	0.13	0.05	
7	795	03606	85775	52435	0.09	0.16	0.06	
8	795	03607	31270	59930	0.03	0.18	0.14	
9	795	03608	89740	25955	0.10	0.08	0.02	
10	795	03609	73680	11155	0.08	0.03	0.05	
11	795	03610	90910	4095	0.10	0.01	0.09	
12	795	03611	72195	13735	0.08	0.04	0.04	
13	795	03612	23150	40585	0.02	0.12	0.10	
14	795	03613	69865	18990	0.08	0.06	0.02	

*Data source: American Community Survey: 1999-2001.

- Rows 2 through 14 show the population counts for each group within the 13 Broward County PUMAs (This example assumed the calculation of ID at the PUMA level).
- Column A shows the summary level of the data. SUMLEV = 50 is the row with county data, SUMLEV = 795 identifies the rows with PUMA-level data.
- Column B represents the unique identifier of each PUMA in Broward County, Florida.
- Beginning with the data in Rows 2 through 14, Columns E, F, and G show the construction of the PUMA-level components of the ID.
  c) Column E shows the outcome of dividing the white population in each PUMA by the total white population in Broward County (for example, E2 is the result of dividing C2 by C1).
  d) Column F repeats this exact same calculation for the black population (for example, F2 = D2/D1).
  e) Column G calculates the absolute value of the difference between Columns E and F (|E2-F2| – with rounding).
  f) Lastly, Column H, Row 2 sums the values in column G and then multiplies that value by 0.5. This is the ID value for this areal unit (PUMA) for the selected geography (Broward County, Florida).

The process outlined above was repeated for the white/Hispanic and black/Hispanic groups in order to develop an overall ID for the region. The results are shown in Table 7.1, discussed previously. In this table

- The columns show the different areal units (PUMA, tract, TAZ, block group, and block).
- The subcolumns show the ID for each comparison group pair (W/B is white/black, W/H is white/Hispanic, and B/H is black/Hispanic).
- The first two rows (Data Source) show the ID for each comparison group pair calculated first using the Census 2000 data, then using the ACS data. Given data availability, there is no block group or block data available through the ACS, so those cells are blank.
- The next two rows (Net Difference and % Difference) are calculated differences in magnitude between the ID calculated using Census 2000 data versus that calculated using ACS data for the same geographic unit and comparison group pairing.
- The final row provides the number of areal units used in the calculations for each geographic unit.

There are substantial differences between the results of the ID calculations at the PUMA level and those at the tract level, indicating that the PUMA level of geography is probably too large to do meaningful environmental justice analyses. However, there are only moderate differences between the tract-level results and the TAZ-level results, and the TAZ-level results are quite similar to the block group and block-level analyses. This would indicate that, at least for Broward County, analyses at the tract or TAZ level are probably adequately capturing the overall level of dissimilarity in the county. Since the block-level analyses do not vary by a large amount from the analyses for which ACS data will be available, such analyses using ACS data (and supplemented with decennial census Short Form data) would appear to be valuable and useful.

Accounting for the Uncertainty of ACS Estimates Analysts can reflect the ACS sampling in the ID calculations by applying the equations that have been presented above. The following discussion describes these calculations for the PUMA level of geography.

The actual reported ACS estimates would include lower and upper bounds such as the representative figures shown in the columns on the left of Tables 7.4 and 7.5. The 90 percent confidence level margin of error of the estimates can be calculated by finding the differences between these estimates and the lower and upper bounds. The standard errors of the estimates can then be calculated by dividing the margins of error by 1.65, as has been previously shown. The margin of error and standard error calculations are shown in the middle columns of the two tables.

Table 7.4. Estimates of non-Hispanic white population of Broward County.

PUMA	Estimate	LB	UB	ME	SE	PUMA	a/A	SE(a/A)
County Total	929090	921936	936244	7154	4336			
3601	94565	89487	99643	5078	3078	3601	0.102	0.0033
3602	74905	72321	77489	2584	1566	3602	0.081	0.0017
3603	72855	69737	75973	3118	1890	3603	0.078	0.0021
3604	74620	72075	77165	2545	1542	3604	0.080	0.0017
3605	75560	73271	77849	2289	1387	3605	0.081	0.0015
3606	85775	82327	89223	3448	2090	3606	0.092	0.0023
3607	31270	29853	32687	1417	859	3607	0.034	0.0009
3608	89740	85459	94021	4281	2595	3608	0.097	0.0028
3609	73680	70409	76951	3271	1982	3609	0.079	0.0022
3610	90910	90210	91610	700	424	3610	0.098	0.0006
3611	72195	69560	74830	2635	1597	3611	0.078	0.0018
3612	23150	22458	23842	692	419	3612	0.025	0.0005
3613	69865	67070	72660	2795	1694	3613	0.075	0.0019

The next step in the previous point estimate analysis was to develop the (a_i/A) and (b_i/B) factors. The formula for calculating the standard error of this type of ratio was provided previously in Section 4.

$$SE\left(\frac{\hat{X}}{\hat{Y}}\right)=\frac{1}{\hat{Y}}\sqrt{\left[SE\left(\hat{X}\right)\right]^2+\frac{\hat{X}^2}{\hat{Y}^2}\left[SE(\hat{Y})\right]^2}$$

The results of applying this calculation for the estimates of (a_i/A) and (b_i/B) are shown in the rightmost column of Tables 7.4 and 7.5.

The next step in the ID calculation is to calculate the differences between (a_i/A) and (b_i/B), and then to sum these differences. Table 7.6 shows the results of performing these steps and calculating the corresponding standard errors.

Table 7.5. Estimates of non-Hispanic black population of Broward County.

PUMA	Estimate	LB	UB	ME	SE	PUMA	b/B	SE(b/B)
County Total	337925	335086	340764	2839	1721			
3601	12415	12039	12791	376	228	3601	0.037	0.0007
3602	13555	13010	14100	545	330	3602	0.040	0.0010
3603	21185	20225	22145	960	582	3603	0.063	0.0018
3604	18940	18037	19843	903	547	3604	0.056	0.0016
3605	44945	42949	46941	1996	1210	3605	0.133	0.0036
3606	52435	52031	52839	404	245	3606	0.155	0.0011
3607	59930	57743	62117	2187	1325	3607	0.177	0.0040
3608	25955	25179	26731	776	470	3608	0.077	0.0014
3609	11155	10709	11601	446	270	3609	0.033	0.0008
3610	4095	3875	4315	220	133	3610	0.012	0.0004
3611	13735	13261	14209	474	287	3611	0.041	0.0009
3612	40585	38848	42322	1737	1053	3612	0.120	0.0032
3613	18990	18342	19638	648	393	3613	0.056	0.0012

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Table 7.6. Calculation of index of dissimilarity with confidence intervals.

PUMA	a/A	SE(a/A)	b/B	SE(b/B)	a/A-b/B	SE(a/A-b/B)	ID
							35.34
3601	0.102	0.0033	0.037	0.0007	0.065	0.0034	
3602	0.081	0.0017	0.040	0.0010	0.041	0.0020	SE(ID)
3603	0.078	0.0021	0.063	0.0018	0.016	0.0027	0.51
3604	0.080	0.0017	0.056	0.0016	0.024	0.0024	
3605	0.081	0.0015	0.133	0.0036	0.052	0.0040	ME(ID)
3606	0.092	0.0023	0.155	0.0011	0.063	0.0025	0.84
3607	0.034	0.0009	0.177	0.0040	0.144	0.0041	
3608	0.097	0.0028	0.077	0.0014	0.020	0.0032	
3609	0.079	0.0022	0.033	0.0008	0.046	0.0023	
3610	0.098	0.0006	0.012	0.0004	0.086	0.0008	
3611	0.078	0.0018	0.041	0.0009	0.037	0.0020	
3612	0.025	0.0005	0.120	0.0032	0.095	0.0032	
3613	0.075	0.0019	0.056	0.0012	0.019	0.0022	

The differences in (a_i/A) and (b_i/B) are calculated directly. To obtain the standard error of this difference in estimates, apply the following formula (again, from Section 4 and Census Bureau guidance) as follows:

In this case, *X* and *Y* refer to the (a_i/A) and (b_i/B) estimates.

The differences in (a_i/A) and (b_i/B) are then summed, divided by two, and multiplied by 100 to obtain the ID. The standard error of this summation can be calculated using an extension of the same formula with 13 addends. The final standard error of the calculation can then be multiplied by 1.65 to obtain the 90 percent confidence level margin of error, so the ID in this case is 35.34 ± 0.84.

$$SE\left(\hat{X}+\hat{Y}\right)=\sqrt{\left[SE\left(\hat{X}\right)\right]^2+\left[SE\left(\hat{Y}\right)\right]^2}$$

Calculating a confidence interval on a measure like the ID becomes a useful exercise when the IDs for different geographies (e.g., one county compared to another), areal units (e.g., PUMA-level analysis versus tract-level analysis), or combinations of population groups (non-Hispanic white compared to non-Hispanic black versus non-Hispanic compared to Hispanic) are compared.

7.4 Conclusions from the Case Study

This case study has demonstrated how to calculate the ID, which is one application of environmental justice analysis. The power of this measure is in its ability to be calculated for specific areal units, then imported into a geographic information system (GIS) for mapping and displaying the uniformity or diversity of a region. The ID plays an important role in estimating impacts within the environmental justice process and is also applicable to specific transportation projects.

There are two important notes regarding weaknesses of this measure. The first issue involves the "aspatial" nature of this measure. Although the ID does represent a summary measure of spatial "evenness," it does so only in a very simplified, non-spatial way for a particular areal unit.

A calculated ID value does not indicate the *type* of spatial patterns that are present in the geographic unit of interest. An ID value of 50 could represent a situation where half of the geographic unit is composed of 100 percent Group A concentrated in particular census tracts and the other half is composed of 100 percent Group B in different census tracts (such as when one group settles to the east of the railroad tracks and another group is west of the railroad tracks). Alternatively, an ID value of 50 also could represent a case where every other areal unit (e.g., census tract) is composed of alternating 100 percent populations of Group A and B (a checkerboard scenario). Both patterns of residential segregation differ widely in both scope and policy recommendations. For the purposes of this case study, this issue was not paramount as our goals involved making comparisons of the same measure by data source.

The second issue is that the ID only measures two groups at a time. Historically, this has not been as much of an issue as our society was dominated by segregation patterns between two distinct groups: non-Hispanic whites and non-Hispanic blacks. Given the increasingly divergent and diverse nature of numerous U.S. communities, this weakness means that only two groups can be compared at a time. Here, we have analyzed the Broward County population in terms of the three race/ethnic groups that represent the overwhelming majority of residents (about 95 percent): whites, blacks, and Hispanics.

As shown in Table 7.1, the ACS data compare favorably with the census data, as evidenced by no resultant large percentage difference in ID values between the two data sources for any race/ethnic comparison group. However, the ACS data do not include block data but the Census Summary File 1 data do. For the analysis of Broward County, the Census 2000 data indicate that the most detailed geography is not needed to understand the racial separation in the county.

The ID calculations using ACS estimates can be performed in the same way as for the census data by treating the estimates as point estimates, but the analyses can be improved by accounting for the statistical uncertainty of the ACS estimates due to sampling. By keeping track of the standard errors of estimates as they are calculated in the analysis process, data users are able to obtain an estimate of the margin of error of the results. This allows one to better compare the results to other similar results for which confidence intervals also are calculated.

7.5 Specific Uses of Census Data for Market Analyses

CTPP Part 1 data on households and commuters and CTPP Part 3 commute flow data are often used for transit market studies. Several specific examples are provided below.

7.5.1 Study of Captive Riders

Census data can be used to study transit-dependent populations by observing characteristics such as workers from households without vehicles, household income, age, etc. The analysis is often done within a GIS context to isolate populations within the service area of a transit route. Examples of some studies include the following:

- The Chicago Transit Authority[80] periodically conducts a travel behavior and attitude survey. Combined, and weighted using the decennial census, these data have been instrumental in understanding the changing profile of the Chicago transit user, from the captive rider in the earlier decades to the choice rider in the last decade.

[80] Personal correspondence with Mary Kay Christopher, General Manager, Service Planning, Chicago Transit Authority, November 17, 2004.

- Sandra Rosenbloom (Transit Cooperative Research Program, Report 28) studied future transit markets by using data from the decennial census, Nationwide Personal Transportation Survey, and the American Housing Survey.[81]
- Dowell Myers studied the changing commuting behavior of immigrants and their dependence on transit in Southern California using 1980, 1990, and 2000 census data.[82]
- The MTC's research on the attitudes and level of dependence of California commuters on transit, through the stratification of workers by number of vehicles.
- Other studies of primary transit riders include the analysis done by the planners at Iowa Northland Regional Council, Hampton Roads Planning District Commission, and Denver Regional Transit District (based on interviews and correspondence with agency planners).

7.5.2 Performance Evaluation

Examples of performance evaluation studies include Title VI and environmental justice analysis (see examples below), accessibility studies (e.g., studies conducted by Massachusetts Bay Transportation Authority), and corridor density analysis (e.g., analysis conducted by the Municipality of Anchorage, Alaska).

Most of these analyses rely heavily on demographic and socioeconomic data from the census (especially related to race, income, and minority areas). This analysis is frequently done at small area geography such as TAZs, census block groups or tracts. The GIS spatial analysis is often used to identify and display sensitive areas. Analysis results can be used to develop policies and procedures, identify expansion projects within or near sensitive areas, and for public involvement/outreach purposes.

Many transportation planners contacted in the development of this guidebook have performed environmental justice analyses.[83] Some specific examples include the following:

- Missouri DOT's environmental justice analysis utilized structural equation modeling/cluster analysis to ascertain the quality of life in neighborhoods comprised of protected populations (minorities, low-income, disabled, and elderly).[84] The geographic detail used for the structural equation models was census block group.
- An Atlanta benefits and burdens study examined journey-to-work travel patterns (mode, travel time, origin/destination) by race/ethnicity and income, by matching characteristics of workers at residence locations with characteristics of workers at work locations; the study also examined vehicle availability by race/ethnicity, income, and geography.[85]
- Chicago Transit Agency has used decennial census data on minority status and income as a primary source of quantitative analyses to ensure that transit service is fairly distributed, and any cuts in service (due to budget constraints) do not disproportionately affect low-income or minority populations.[86]

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[81] Sandra Rosenbloom, *TCRP Report 28: Transit Markets for the Future: The Challenge of Change,* Transportation Research Board, National Research Council, Washington, D.C., 1998. See http://gulliver.trb.org/publications/tcrp/tcrp_rpt_28-a.pdf.

[82] See, for example, D. Myers, 1996, "Changes Over Time in Transportation Mode for Journey to Work: Effects of Aging and Immigration," Transportation Research Board, Decennial Census Data for Transportation Planning, Case Studies and Strategies for 2000, *Conference Proceedings 13,* April 28-May 1, 1996.

[83] Examples include: Minnesota DOT, Hampton Roads Planning District Commission, Chittenden County MPO, Mid-Ohio Regional Planning Commission, Municipality of Anchorage, Chicago Area Transportation Study, Iowa Northland Regional Council, Pima Association of Governments, Yakima Valley Conference of Governments, King County Transit, METRA, and Denver Regional Transit District.

[84] See http://oseda.missouri.edu/modot/planning/stlouis_analysis.shtml, August 2003.

[85] Personal correspondence with Chris Porter, Cambridge Systematics, Inc., November 17, 2004.

[86] Personal correspondence with Mary Kay Christopher, General Manager, Service Planning, Chicago Transit Authority, November 17, 2004.

- An NCHRP (Project 8-36, Task 11) report[87] on "Technical Methods to Support Analysis of Environmental Justice Issues" prescribed the use of census data at small geography.

7.5.3 Demand Projections and Market Evaluations

Examples of the use of census data in this category include the following:

- Utah Transit Authority's[88] use of Census 2000 and PUMS data in attitude models linking traveler attitudes to existing socioeconomic and demographic data. This makes it possible to relate traveler attitudinal factors that were used to create the market segments to the socioeconomic data in the census and to identify the spatial distribution of the segments in the population.
- The I-287/TZB project and the impacts of transit and land use in Rockland County, New York.[89]
- Transit market research studies[90] using census and CTPP data in structural equations modeling work performed for the Utah Transit Authority, San Diego Association of Governments, SamTrans Strategic Plan, I-580 BART study, and the San Francisco Water Transit Authority.
- Various studies in the Chicago region, such as bus service market analysis (using on-board travel survey results and demographic data from the census) conducted by the Chicago Transportation Authority to define appropriate marketing strategies; and analysis of non-CBD work trip origins by the Regional Transportation Authority to evaluate suburban transit feasibility.
- The use of 1980 UTPP, 1990 CTPP, and 2000 CTPP data by the Delaware Valley Regional Planning Commission to assess the ridership potential for several different potential transit improvements, including high-speed rail, express bus and park-and-ride service, and local bus service.
- Projection of the additional rail ridership induced by the introduction of congestion pricing on the Bay Bridge. Planners also evaluated latent demand for rail, through the examination of demographic profiles (based on CTPP, Part 1) and economic profiles (based on CTPP, Part 2) of non-rail users who reside close to rail stations, availability of free workplace parking, and adequacy of feeder bus services.
- Other work done by the Central Transportation Planning Staff and METRA defining distance-based marketsheds for each station (personal correspondence).

7.5.4 Route Planning

Examples of route planning efforts done using census data include

- Chicago Transit Authority's use of population density and other variables at small area geography to plan their Night Owl service (buses that run all night);[91]
- A study of the differences in origin-destination patterns between drive-alone automobile and streetcar modes in an effort to improve feeder services at major stations by Baltimore transit planners;
- Commuter rail feasibility studies (Central Transportation Planning Staff), and other work by the Delaware Valley Regional Planning Commission, where route planning was supplemented

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[87] Cambridge Systematics, Inc., "Technical Methods to Support Analysis of Environmental Justice Issues," prepared for NCHRP Project 8-36 (11) support to the AASHTO Standing Committee on Planning, April 2002.
[88] Cambridge Systematics Inc., "Attitudinal-Based Market Research," Prepared for Utah Transportation Authority, December 2003.
[89] Personal correspondence with Michael D'Angelo, Department of Planning, County of Rockland, New York, November 13, 2004.
[90] Personal correspondence with Chris Wornum, Cambridge Systematics, Inc., November 10, 2004.
[91] Personal correspondence with Mary Kay Christopher, General Manager, Service Planning, Chicago Transit Authority. November 17, 2004.

by on-board ridership surveys because journey-to-work data might be too coarse for detailed route-level transit planning; and
- Minnesota DOT, Pioneer Valley Planning Commission, King County Transit, and Denver Regional Transit District where population and employment densities were used to determine types and frequency of service needed.

7.5.5 Non-Motorized Commuting

Examples of studies where census data have been used in this context include:

- The use of census data by the City of Portland[92] to evaluate bicycle commuting in relation to the city's bicycle policies and benchmarks, as well as to test whether there is a statistical relationship between the percentage of bicycle commuters and the bicycle network through a regression analysis performed at the tract level. For this analysis, socioeconomic variables and number of commuters by bicycle were derived from the 1990 and 2000 Census, as well as the 1996 ACS.
- Rockland County, New York's use of census data in ride sharing and ride matching.[93]
- MTC's analysis of means of transportation to work in California by various market segments, using 2000 PUMS data supplemented by 1990 PUMS data to examine shifts in travel patterns.

7.5.6 Other Market Analyses

Other examples of market analyses using census data include:

- Travel model market segmentation derived from the use of PUMS data by MTC to adjust zonal household size averages to averages stratified by household income level. Household size is then used as an input to a nested workers-in-household-automobile-ownership choice model.[94]
- The development of a proprietary segmentation product by Claritas, called Workplace PRIZM. PRIZM uses journey-to-work flows, and links characteristics of workers at place of work to their residential attributes. It classifies block groups into lifestyle "clusters" based on key demographic characteristics. These clusters then serve as an efficient way to identify the distribution of demand for specific products and services (and media usage) across the landscape. Use was made of a special tabulation of the Census Bureau's journey-to-work data.

[92] M. Leclerc, 2002, "Bicycle Planning in the City of Portland: Evaluation of the City's Master Plan and Statistical Analysis of the Relationship between the City's Bicycle Network and Bicycle Commute."
[93] Personal correspondence with Michael D'Angelo, Department of Planning, County of Rockland, New York, November 13, 2004.
[94] C. Purvis, 1996, "Uses of Census Data in Transportation Planning: San Francisco Bay Area Case Study," Transportation Research Board, Decennial Census Data for Transportation Planning, Case Studies and Strategies for 2000, *Conference Proceedings 13*, April 28-May 1, 1996.

CHAPTER 8

Survey Development and Analysis Using ACS Data

This section describes survey development and analysis as common applications of Census Bureau data and shows the potentially important transportation planning uses of ACS. Section 8.1 defines the different components of survey development and analysis, describes how census data can be used for survey development, and presents some specific examples of census data used for this purpose. Section 8.2 describes some benefits and limitations of shifting from census to ACS data related to survey development and analysis. Finally, Section 8.3 provides a case study that shows how to do survey expansion using ACS data and how the results compare to survey expansion using Census data.

8.1 Survey Development and Analysis

Census data are used in multiple aspects of household travel survey development efforts, including sample design, survey expansion, and survey validation.

- Sample design is the process of determining the sample size needed to achieve a certain level of confidence, and/or the categories that should be used in a stratified sample design.
- Survey expansion is the process of creating weights for survey responses and applying these weights to expand the survey to the entire population of a given area so as to adjust for sampling and non-sampling errors.
- Survey validation is the process of checking variables that were not controlled in the sample design (or expansion) for biases (e.g., checking whether income groups are well represented in a sample designed by vehicle ownership and household size.[95])

8.1.1 Using Census Data for Survey Development

Census data assist in survey development and analysis in several ways, including the following:

- Census data are used to estimate the incidence of households with certain characteristics within a geographic area, so that the cost of reaching less common groups and completing certain minimum numbers of households within those groups can be assessed. Census data also help determine the number of categories needed in a stratified sample design. For example, analysts use the data to determine which auto ownership categorization makes the most sense for sample stratification and modeling.
- Census data are critical for providing control totals needed in survey expansion efforts. Survey expansion based on variables such as population or households is often performed using

[95] U.S. DOT and Bureau of Transportation Statistics, 1996, "Implications of Continuous Measurement for the Uses of Census Data in Transportation Planning."

the decennial census Short Form data. If variables such as auto ownership or income are used in the expansion (as is usually the case), they are obtained from census products based on the Long Form (such as SF3 or CTPP).
- Census data also are used in validating travel surveys by providing information on the distributions of various socioeconomic, demographic, and journey-to-work characteristics that can be used for the validation of an expanded survey.

8.1.2 Specific Examples of Use

Almost all household travel surveys have been expanded using census data. Among the sample expansion variables that have been used in some recent surveys are the following:

- Year 2000 home interview survey conducted by the Metropolitan Council, St. Paul-Minneapolis, Minnesota, was expanded by number of households, household size, and vehicle availability.
- Year 2000 home interview survey conducted by Memphis MPO was expanded by auto availability, income, and household size.
- Year 1990 household travel survey conducted by the Chicago Area Transportation Study was expanded by household size and vehicle availability.
- Year 1990 San Francisco Bay Area household travel survey was expanded by superdistrict of residence, household size, vehicle availability, and tenure.
- Household travel survey conducted by the Central Transportation Planning Staff, Boston, was expanded by vehicles available, household income, and workers in household.
- The household survey conducted by the Denver Regional Council of Governments was expanded using household size and income variables at the county level from the census.

Many household travel survey efforts also have relied on census data to confirm and validate the results of the surveys. One example of household travel survey validation is the validation done at the Metropolitan Council (St. Paul-Minneapolis,), where CTPP Part 1 data were used to check the mode split from the home interview survey done concurrently with the census, and CTPP Part 3 data were used to validate the survey home-based-work trip distribution.

8.2 Benefits and Limitations of ACS for Survey Development and Analysis

This section summarizes the perceived benefits and limitations of using ACS data for survey design, expansion, and validation.

Transportation planners who were asked about the potential use of ACS estimates to support travel survey efforts envisioned that because measurement is done continuously with ACS, it will be easier to conduct surveys and expand them using more recent data at any point in time (e.g., mid-decade) since they can be expanded by the large-area data from ACS. With the decennial census, the data used for sample design and expansion are often either extrapolated or out of date.

Although ACS can potentially provide more current data for survey expansion, the use of multiyear averaged variables for survey expansion could pose problems. It is expected that the multiyear ACS estimates for household income will be particularly difficult to interpret. If household characteristics change over a five-year period as household income is likely to, then ACS average data might be inconsistent with other demand-side data sources and with household travel surveys conducted during fixed periods of a few weeks.

In addition, the higher sampling error associated with ACS estimates will increase the level of uncertainty in the development of household survey expansion targets.

8.3 Case Study

The purpose of this section is to illustrate how ACS data may be used to weight data collected through a typical household travel survey process. The case study is based on an actual recent regional travel survey conducted in 1999 by a national survey firm for the Mid-Ohio Regional Planning Council (MORPC).

There are three sections to this case study, as follows:

1. The weighting process used to adjust the 1999 Mid-Ohio Regional Travel Survey data is summarized. A significant drawback of using decennial census data for analyses like the weighting of surveys is the infrequency of the data releases. When the 1999 survey was conducted, the agency needed to initially rely on census data from 1990 for the weighting.
2. The application of new weights based on Census 2000 data are summarized. Once the 2000 data became available, the survey data could be reweighted to better reflect the population at the time of the survey in 1999.
3. Finally, the weights for Franklin County, Ohio are recalculated, using both the Census 2000 data as well as ACS data.[96]

Assume that you have been asked to develop new weights for the 1999 household travel survey using Census 2000 data and 2000 ACS data and to compare the two sets of weights.

This survey sampled 5,418 households to provide data for the continuing development and refinement of the region's travel demand forecasting model, as well as to provide a better understanding of travel behavior in the Central Ohio region. Resultant data were used to fulfill the model's functions of estimating trip generation and distribution, mode choice, and assignments.

The 1999 Mid-Ohio Household Travel Survey, like many recent household travel surveys, relied on the willingness of area residents to record their daily travel for a specific 24-hour period. Households were recruited into the study by telephone, then were mailed personalized materials to aid in recording travel details, and finally were recontacted by telephone for retrieval of the travel data.

The survey was conducted from February through June 1999 in seven Central Ohio counties: Delaware, Fairfield, Franklin, Licking, Madison, Pickaway, and Union. During this time, 7,333 households agreed to participate in the study and 5,418 actually provided travel details for all household members.[97] Although the household travel survey sample was considered to be a fairly good representation of households from the seven-county region, weights were developed and applied to adjust the data for unequal response rates for households of different types across the study area and to account for coverage bias resulting from the use of a telephone survey method.

Key demographic variables used to weight the household survey data to better reflect the full population of households in the survey area included household size, vehicle ownership, telephone ownership, and county populations.

Table 8.1 shows weighting factors based on Census 2000 data. The weights shown are factors that analysts would apply to the households with the different characteristics in the table in order to have the household survey sample better reflect the population of interest. For example, the weights in Table 8.1 indicate that the household travel survey sample included slightly more

[96] Of the seven counties in the MORPC study, Franklin County was the only county to be surveyed as part of the ACS pilot program.

[97] The study included an additional oversample of households in Licking County, for use in building a model specific to that county. This case study focuses only on the households comprising the main sample, collected for MORPC.

Table 8.1. Census 2000 weighting factor to adjust for probability of selection, Franklin County.

HH Vehicles	HH Size			
	1 Person	2 Persons	3 Persons	4+ Persons
0 Vehicles	0.95000	1.55263	2.72727	2.57143
1 Vehicle	1.00000	0.94720	1.36842	1.57333
2 Vehicles	1.47143	1.01101	0.90146	0.79736
3 Vehicles	0.94118	0.93750	0.85714	1.11570
4+ Vehicles	0.85714	0.75000	0.70588	0.95652

Table 8.2. ACS weighting factor to adjust for probability of selection, Franklin County.

HH Vehicles	HH Size			
	1 Person	2 Persons	3 Persons	4+ Persons
0 Vehicles	0.91111	1.36842	2.27273	1.78571
1 Vehicle	1.04805	0.89441	1.32632	1.52000
2 Vehicles	1.40000	1.07390	0.85036	0.75551
3 Vehicles	0.70588	1.06250	0.87143	1.14876
4+ Vehicles	0.57143	0.67857	0.76471	1.00000

one-person, zero-vehicle households than a fully representative sample of the study area would include. In frequencies and summaries of the household travel survey, these households would be weighted by a factor of 0.95. Conversely, three-person and four-or-more-person households with no vehicles were under represented in the household travel survey. Therefore, in summaries and frequency tabulations, these households would be multiplied by factors of more than 2.5.

Table 8.2 shows the same types of weighting factors when ACS estimates are used to represent the target population.

This remainder of this section is organized as follows. First, a background of the original weighting process is provided, including a brief description of the different weighting elements. Second, the steps and computations needed to reapply the weighting using Census 2000 data are described. Finally, the reweighting is performed using 2000 ACS data, and the results are compared to the Census 2000 weighting process.

8.3.1 Original Weighting Process[98]

The Mid-Ohio Survey employed a probability sample selection process to select households for inclusion in the study. This means that the relative probability (or chance) that any particular household in the universe would be sampled is known. The actual sampling process employed in the study was a "stratified sample" in which households were randomly selected at the county level. The number of households sampled within a particular county was based on the proportion of households within that county compared to the total number of households in the seven-county

[98] This section draws largely from the Mid-Ohio Household Travel Survey Final Report written by NuStats. The numbers were adjusted to reflect the final distribution of households only in the original seven-county sample and excluding the Licking County over-sample.

region (based on 1990 Census data). Once the proportion of households within each county was determined, households within each county were randomly sampled from a universe of all telephone exchanges in the study area.

Upon completion of data collection efforts, the final distribution of households was not proportionate to that of the survey universe. This is common in survey research and can be attributed to two main causes: coverage bias and unequal response rates. Coverage bias refers to the fact that as a telephone survey, the households randomly sampled for inclusion in the study were limited to only those with telephones.

Secondly, not all types of households that were contacted participated in equal proportions. The survey requirements biased the sample toward smaller households and those in specific counties. The exact reasons why there are variations in response rates are not always clear, but respondent burden and interest in transportation issues does vary based on factors such as household size and household location.

Because of these reasons, the final distribution of households in the survey dataset did not match that of the 1990 Census. Thus, a weighting factor was developed to adjust the data, thereby minimizing these potential sources of bias in the data and subsequent analysis. The weighting factors for the 1999 Mid-Ohio Household Travel Survey data were developed through a four-step process. Each step produced an adjustment factor and the final weight represents the product of those four factors. These steps adjust the data for the following:

- Probability of selection,
- Episodic telephone ownership,
- County weight, and
- Normalization of weights.

Probability of Selection The first step in the weighting process was to account for differential probabilities of selection in the sample generation stage. The natural or proportionate distribution of households by household size and number of vehicles based on 1990 decennial census estimates was determined, and this distribution was compared to the actual distribution of households that completed the survey.

The weighting factor that was calculated to bring the final distribution of surveyed households in line with the actual distribution of households as expressed in the 1990 census, thereby adjusting for probability of selection, is shown in Table 8.3. In that table, the value 1.0 would mean that the sampled elements accurately reflected the population at large; a value less than 1.0 meant there was an over representation and a value greater than 1.0 meant there was an under representation of that particular population subgroup in the survey data. As shown in Table 8.3, the survey included fewer zero-vehicle households as compared to the census estimates, but proportionally more large households and households with three or more vehicles.

Table 8.3. Weighting factor to adjust for probability of selection (factor 1).

HH Vehicles	HH Size			
	1 Person	2 Persons	3 Persons	4+ Persons
0 Vehicles	1.2671	1.6872	3.9310	← combined
1 Vehicle	0.9357	1.0250	1.4085	2.0036
2 Vehicles	0.9845	0.9263	1.1295	0.9415
3+ Vehicles	0.4383	0.6682	0.8472	0.9429

Episodic Telephone Ownership Except in large urban areas with mature, multimodal transportation infrastructures, most zero-vehicle households tend to be associated with lower-income households. These same households often have difficulties consistently paying their telephone bills and will experience episodic telephone service (service is discontinued due to non-payment, the household pays the outstanding bill and has service reconnected, only to have troubles paying the bill again a few months later). Thus, it is very difficult to achieve a representative random sample of lower-income/zero-vehicle households in a telephone survey.

To account for the coverage bias introduced by excluding non-telephone households from the telephone sample, the survey team developed an adjustment technique that used a series of questions to separate respondents into two groups: those with steady or continuous telephone service and those with episodic service. The characteristics of those households reporting episodic telephone ownership were used as proxies to represent other non-telephone-owning households within the region. Fifty of the surveyed households reported being without a telephone for two weeks or longer. These households were used to represent other non-telephone households in the region.

To determine the weighting factor required in adjusting for episodic telephone ownership, the data were compared to non-telephone ownership as reported by the Census Bureau. In 1990, four percent of households in the seven-county study area were identified as non-telephone households. Since the Census Bureau defines non-telephone households simply as those not having service on the census date (regardless of reason), this census proportion includes both households with episodic ownership as well as those who never had telephone service.

In reality, only about half of the non-telephone households documented as such in the decennial census are episodic. This rate is determined based on a general pattern observed in anecdotal evidence collected through in-person interviews and postcard follow-up surveys conducted with non-telephone households on other studies. Based on the survey team's experience, the distribution of non-telephone households was adjusted so that the proportion of surveyed episodic households could be compared with the census estimates. This allowed for the calculation of the second weight adjustment factor, as shown in Table 8.4.

County Weight In addition to ensuring that the survey data are weighted to represent households on the key characteristics of household size and vehicles, as well as minimizing the coverage bias introduced through using a telephone survey method, there also was the issue of geographic coverage to consider. The sample was drawn proportionately from within each county. However, differing response rates and data collection goals resulted in a disproportionate distribution of households at the conclusion of the study. Table 8.5 compares the distribution of the survey responses by county with the 1990 Census household counts.

Normalization of Weights If only Factors 1, 2, and 3 were used to create the final weights for the dataset, the weighted data would represent 5,512 households rather than the 5,418 households actually contained in the dataset. To account for this and still maintain the relative contribution to the dataset of each household after weighting, all households were given a Factor 4 value of 0.9829. The final weight then was the product of each of the four factors for each household.

Table 8.4. Episodic telephone ownership factor (factor 2).

Is Phone Service Episodic?	Survey Respondents	Survey Proportion	Census %	Census Adjusted for Episodicity	Factor 2
No	5,368	0.991	0.9600	0.980	0.989
Yes	50	0.009	0.0400	0.020	2.222
Total	5,418	1.000	1.000	1.000	

Table 8.5. County weights based on 1990 census (factor 3).

County	Survey %	Census %	Weight
Franklin	63.7%	79.7%	1.25118
Licking	32.2%	10.2%	0.31677
Delaware	1.4%	5.6%	4.00000
Union	0.7%	1.7%	2.42857
Pickaway	0.6%	0.5%	0.83333
Fairfield	1.0%	1.9%	1.90000
Madison	0.4%	0.4%	1.00000
Total	100%	100%	

8.3.2 Impact of Census 2000 on Original Weights

The Mid-Ohio Regional Household Travel Survey was conducted in 1999, with the development of the weighting factors (as described above) shortly thereafter. Since Census 2000 data were not available, the 1990 Census counts and estimates were used to develop the sampling goals and data weights. Thus, any analyses done with the initial household travel survey data would reflect the application of 1999 travel patterns on the 1990 population. Once the year 2000 Long Form census data became available in 2002, the survey data could be reweighted and improved by applying the same weighting process with the updated data.

Probability of Selection Table 8.6 shows the new weighting factors for the adjustment related to the probability of selection.

The proportion of zero-vehicle households from the 2000 decennial census estimates was lower than that of the 1990 decennial census, while Census 2000 estimates showed significantly more vehicles per household in most categories. This suggests that the original weights (created by applying the 1990 Census estimates, which was the only source available at the time of the 1999 survey) overstated the proportions of zero-vehicle households in the region. One advantage to the continuous design of ACS is that analysts will have access to updated population parameters on a more regular basis.

Episodic Telephone Ownership Census 2000 estimated that two percent of regional households were non-telephone households, as compared to four percent in the 1990 census. As shown in Table 8.7, after accounting for episodic telephone service, there is no need for a weighting factor any longer.

County Weight Table 8.8 shows the distribution of the survey respondents by county of residence as compared to Census 2000 counts and the resulting weight factor to adjust for

Table 8.6. Weighting factor to adjust for probability of selection with year 2000 census data (factor 1).

HH Vehicles	HH Size			
	1 Person	2 Persons	3 Persons	4+ Persons
0 Vehicles	1.04813	1.54261	2.91486	Comb ←
1 Vehicle	1.02104	0.96947	1.41404	1.75862
2 Vehicles	1.29074	0.97264	1.04311	0.90120
3+ Vehicles	0.78530	0.77689	0.78967	0.91137

Table 8.7. Episodic telephone ownership factor (factor 2).

Is Phone Service Episodic?	Survey Respondents	Survey Proportion	Census %	Census Adjusted for Episodicity	Factor2
No	5,368	0.991	0.9800	0.990	1
Yes	50	0.009	0.0200	0.010	1
Total	5,418	1.000	1.000	1.000	

Table 8.8. County weights based on Census 2000 (factor 3).

County	Survey %	1990 Census %	2000 Census %	Old Weight	New Weight
Franklin	63.7%	79.7%	70.2%	1.25118	1.10204
Licking	32.2%	10.2%	8.9%	0.31677	0.27640
Delaware	1.4%	5.6%	6.4%	4.00000	4.57143
Union	0.7%	1.7%	2.3%	2.42857	3.28571
Pickaway	0.6%	0.5%	2.8%	0.83333	4.66667
Fairfield	1.0%	1.9%	7.3%	1.90000	7.30000
Madison	0.4%	0.4%	2.2%	1.00000	5.50000
Total	100%	100%	100%		

geographic representation. The 1990 Census proportions also are included in this table. When originally weighted using the 1990 Census data, the resulting weights adjusted the survey households to reduce the proportion of households from Licking County and, at the same time, increase the representation of Franklin, Delaware, and Union County households.

The new weighting factor, based on Census 2000, still adjusts for an over-representation of Licking County households and under-representation elsewhere. However, the population growth seems less in Franklin and Licking Counties and more in the surrounding counties. Fairfield County in particular grew from 1.9 percent of the population distribution in 1990 to 7.3 percent in 2000. Again, having more frequent updates in terms of population growth from ACS will greatly aid in these types of data adjustments.

Normalization of Weights Again, because a weight created only on Factors 1, 2, and 3 would result in the 5,418 households representing 5,364 households when weighted, all households were given a Factor4 value of 0.9829 to normalize the data.

Not surprisingly, at each phase of the recalculation, one can see evidence that the household survey data were much more in line with the Census 2000 estimates than the 1990 Census estimates. This comparison supports the supposition that using ACS estimates for a time period corresponding to the household travel surveys will benefit the survey process.

8.3.3 Weighting Using ACS Data

Many recent household travel surveys were planned to roughly correspond to decennial census years to allow for the application of relevant weights. As for the mid-Ohio case, this has meant that planners have had to rely on preliminary weights based on older census data until the newer, more relevant, data became available. ACS will provide planners with the ability to develop survey sample weights that better correspond to the survey data collection period. With annual estimates available less than a year after the reference period, planners will be able to apply accurate sample weights much more quickly than previously.

As for other analyses, survey analysts need to understand the ACS data availability constraints. For larger census areas of more than 65,000 population, annual estimates will be available. If a survey study area is composed of a group of counties that all have large populations, then annual ACS estimates can be used in geographic-based weighting. If one or more of the geographic areas is smaller than 65,000 people, but all are larger than 20,000, then three-year estimates will be available for use in weighting. If the survey area includes geographic areas that are smaller than that, five-year estimates would be required.

To maintain consistency in the estimates, it will usually be best to use common types of estimates (e.g., all three-year averages or all annual estimates), but for many larger metropolitan areas, some outlying counties will require the five-year average. Analysts will need to weigh the benefit of fully consistent estimates (from using the five-year estimates throughout the study area) against obtaining more accuracy and timeliness for the core counties (by using one- or three-year estimates where possible and five-year averages where necessary).

One of the seven counties in the Columbus region, Franklin County, was included as part of the ACS pilot. We can review the weighting process using ACS estimates and focusing on Franklin County with the objective of understanding how Franklin County weights developed using Census 2000 might differ from those developed using ACS pilot data. Of the 5,418 households surveyed, 3,451 were from Franklin County.

As for the weighting based on Census 2000, there was no need to adjust for telephone ownership. In addition, since the focus of the ACS analysis was on only one county (Franklin County), the data do not need to be adjusted for geographic representation. Thus, the Franklin County weights focused on the probability of selection—the distribution of households by size and vehicle ownership. Tables 8.1 and 8.2 show the Franklin County weights using Census 2000 and the ACS as the control totals. The survey data were closer to Census 2000 in terms of the smaller households (or those with fewer vehicles). However, for the larger households, and those with more vehicles, the survey data were more in line with the ACS data.

These analyses have ignored two complications of using ACS estimates in analyses. First, the example did not need to consider ACS multiyear averaging because the specific geography studied would have single-year estimates. As discussed above, if survey analysts need to consider geographic areas for which single-year estimates are not available (household travel survey strata could include separate small counties, county subdivisions, or census places), then it will be best to use the multiyear estimates for developing estimates for all the survey strata, regardless of whether single-year estimates are available. Prior to developing a survey stratification scheme and weighting plan, it will make sense for survey analysts to consider which ACS reporting category the geographic areas within the survey region fall into, and then to define the geographic strata based on this information.

Second, the reported analyses did not include any mention of confidence intervals or statistical uncertainty in the ACS estimates. These analyses (and virtually any other analyses that have been previously performed using decennial census Long Form estimates) can be accomplished using the ACS estimates, without consideration of the uncertainty. The ACS estimates, although less precise than decennial census estimates, will still almost always represent the best available estimates of the population characteristics under study, so for analyses that require a single target estimate, such as household survey weighting, the analyst will need to rely on the reported estimate.

The analyst could calculate or obtain margins of error for the ACS estimates used as weighting targets, but because household survey response biases tend toward certain directions (underrepresentation of larger households and zero vehicle households), many of the resulting weights would be set at the extreme ends of the confidence intervals. Although not all the midpoint

estimates will be as close to the actual (but unknown) characteristic count or average as the ends of the 90 percent confidence intervals, on average, the midpoint estimates are a better estimate of the actual characteristic.

In cases where ACS estimates will be used without the formal calculation of margins of error, it will be important that the analyst validate, to the extent possible, the reasonableness of the ACS estimates that are being used. This can be accomplished by comparing the ACS estimates

- To independent data sources (also referred to as "administrative records" by the Census Bureau);
- For specific geographic areas with those for nearby areas, larger areas for which the areas of interest are a component, and smaller geographic areas that comprise the areas of interest; and
- For specific time periods with previous (and perhaps subsequent) time periods and multiyear estimates that include the time period of interest.

These validation efforts will help identify potential issues with the specific ACS estimates that would be used to inform the survey stratification and weighting processes. Based on these evaluations, analysts may choose to use different multiyear average estimates or to define geographic strata differently.

CHAPTER 9

Travel Demand Modeling Analyses Using ACS Data

This section describes travel demand modeling as a common application of census data. Section 9.1 defines travel demand modeling and describes how census data can be used to support it. This section also provides some examples of uses of census data for this purpose. A more detailed list of specific uses is provided at the end of this section. Section 9.2 describes some benefits and limitations of shifting from census to ACS data related to travel demand modeling. Section 9.3 provides two case study examples. The first case study shows how to estimate an auto ownership model using ACS PUMS data. The second case study describes how ACS data may be used in the validation of a trip distribution model. Finally, Section 9.4 details the specific uses of census data for travel demand modeling.

9.1 Travel Demand Modeling

Travel demand modeling consists of a variety of mathematical models developed to support long-range transportation plans and policy planning analyses. Transportation planners have used decennial census data for different components of travel demand modeling, including trip generation, trip distribution, mode choice, traffic assignment, demographic and auto ownership models, and microsimulation. The specific ways in which census data can assist in travel demand modeling are described next.

9.1.1 Trip Generation

Traditional trip generation models relate the number of trips produced and attracted in TAZs to the characteristics of those zones. Census data are generally the best source of zonal estimates.

9.1.2 Model Input for the Base Year

Transportation planners rely heavily on census data as a primary source of socioeconomic and demographic data needed as base-year input to travel demand models. Almost all transportation planners contacted during this research use census data in this context and have updated (or are in the process of updating) their travel demand models to include the 2000 socioeconomic data. Where CTPP data were still unavailable at the time that the planners provided their opinions, these planners were often using Summary Files 1 and 3 to support modeling applications. Many MPOs participated in the TAZ-Update Program to define/transfer their local TAZ structure into TIGER/Line 2000. Some MPOs aggregate block or block group level data to define TAZs. CTPP 2000 provides data at the TAZ, census tract, and—in some cases—block group geography. MPOs are able to use these data easily in their models.

9.1.3 Trip Generation Rates

Since data on trip frequency per household or worker are not available from the census, trip generation models cannot be estimated using census data. However, observed work trip travel patterns could be used to calibrate work trip generation models. Trip attraction models might be more difficult to calibrate and validate due to various issues associated with the way the census estimates employment.

9.1.4 Trip Distribution

Aggregate calibration of friction factors used in gravity work trip distribution models is being done using observed flows from the census, by monitoring average commute and commute time frequency distribution.[99]

9.1.5 Work Trip Mode Choice Modeling

Mode choice models cannot be estimated using census data, but the data can be used to calibrate and validate existing work-based mode choice models.

9.1.6 Traffic Assignment Modeling

Census travel time data are used to calibrate and adjust speeds and travel times in traffic assignment models.

9.1.7 Demographic and Auto Ownership Models

Estimation and validation of demographic (e.g., household income distribution models, distribution models for households by number of workers/persons/vehicles available in household) and auto ownership models are being performed using census data. For example, disaggregate models are being estimated using PUMS data.[100] Aggregate validation of those models could be done using CTPP Part 1 (CTPP also can be used for aggregate estimation of models).

9.1.8 Microsimulation

In addition to the traditional modeling steps, census data are being used for more advanced model components as well, such as using PUMS data for population synthesis for microsimulation models.

9.1.9 Examples of Use

This section provides some examples of presenting travel demand modeling analyses. Figure 9.1 shows a home-based work trip length frequency distribution,[101] and Figure 9.2 shows out-of-county

[99] Examples of DOTs/MPOs where trip distribution calibration efforts were done using Census data are: Indiana DOT, Vermont Agency of Transportation, Mass Highway, Chicago Area Transportation Study (personal correspondence).

[100] Travel Model Improvement Program, U.S. DOT, "Model Validation and Reasonableness Checking Manual." See http://tmip.fhwa.dot.gov/clearinghouse/docs/mvrcm/ch1.stm. November 4, 2004.

[101] A. Noelting, 2005. "U.S. Census, CTPP, and NHTS Data Used in the Des Moines Area MPO's Travel Demand Model." See www.fhwa.dot.gov/ctpp/sr0105.htm.

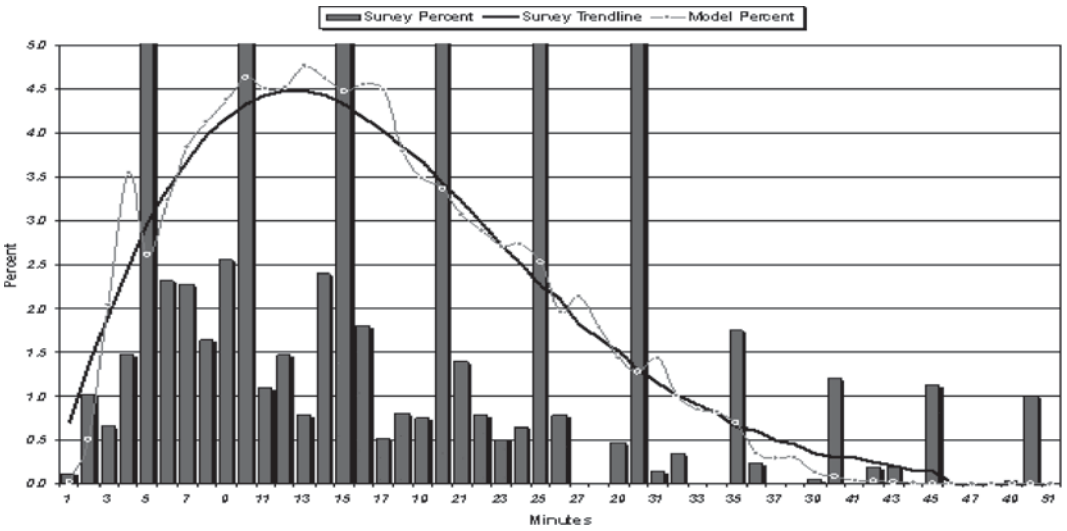

Figure 9.1. Home-based work trip length frequency distribution.

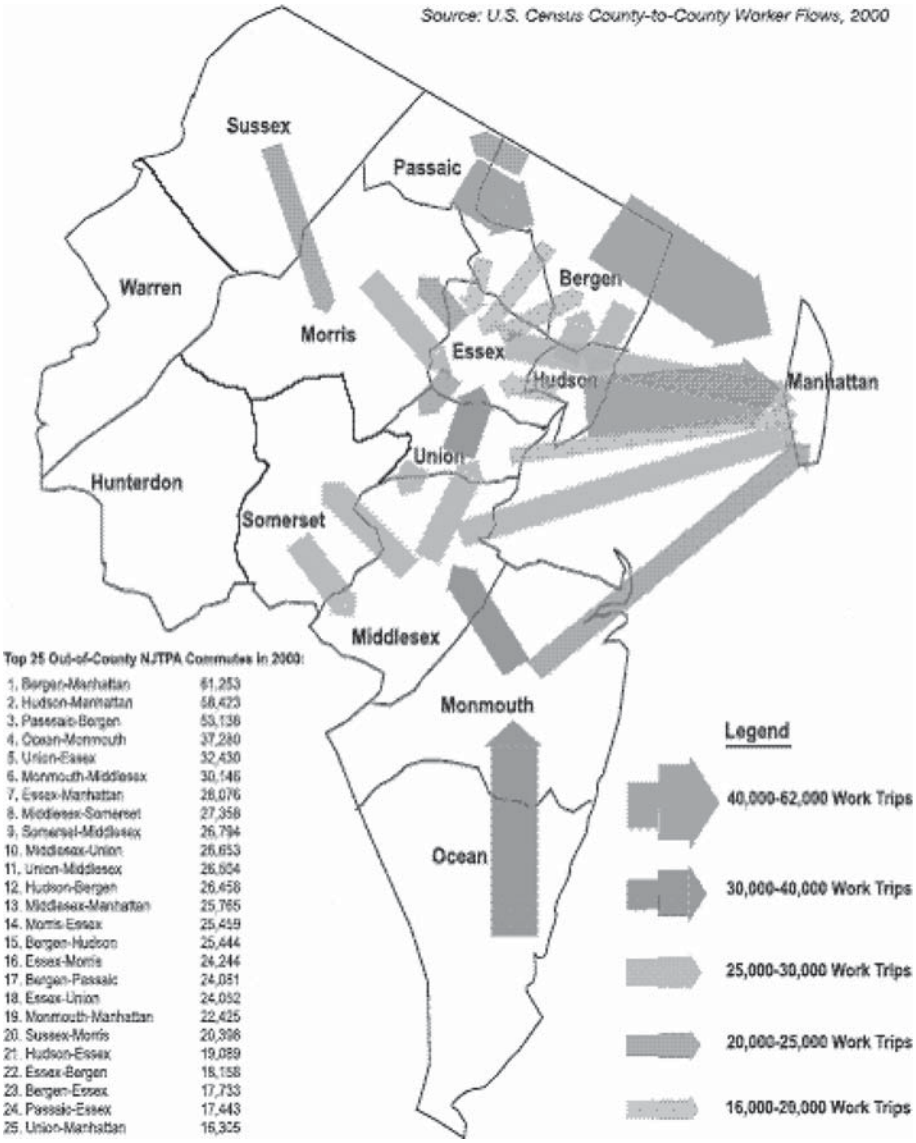

Figure 9.2. Out-of-county commute map.

commutes.[102] See Section 9.4 for specific examples that illustrate how census data have been used to do travel demand modeling.

9.2 Benefits and Limitations of ACS for Travel Demand Modeling

In discussions with transportation planners, the following potential benefits of ACS were identified:

- The availability of data on a continuous basis provides opportunities for more frequent updates of travel demand models (in particular, the base-year socioeconomic and demographic data). Again, the sparse sample size and resulting standard errors in the data during any particular year could limit the potential opportunities.
- If PUMS data are made available from ACS on a continuous basis, this has positive implications for tracking regional changes taking place in regions experiencing accelerated growth.
- In selecting demographic variables for use in developing models, usually these variables are restricted to those found in the census databases, so that the models can be applied to the full population using the joint distributions from the census data. Because ACS will enhance trend analysis and ACS data are available continuously, more variables could be forecast into the future, and it is likely that more demographic variables could then be included in travel demand models.
- ACS should not cause problems with model estimation since decennial census data (except for PUMS) are generally not used for parameter estimation of work trip travel models due to the aggregate nature of the data.

The following ACS issues were identified as limitations for travel demand modeling:

- Theoretically, five-year cumulative averages are inconsistent with models that are used to predict at a point in time (such as trip distribution models or mode choice models), and model calibration/validation could be problematic. However, practical ways could be found to overcome this limitation. For example, the validation of work mode choice models occurs at a coarse level of geography, and changes in household characteristics and mode choices over five years would probably not be very significant.
- As discussed above, the cumulative averaging of ACS model inputs is inconsistent with most travel demand models in use. In addition, the larger standard errors associated with ACS parameters, compared to decennial census Long Form parameters, increase the variability and error of models that rely on these data. In most instances, travel demand modelers treat census Long Form data as simple point estimates and do not acknowledge in their model systems that these data are subject to sampling and non-sampling error. In migrating to using ACS data, it will be more difficult to make these simplifying assumptions.
- Origin-destination matrices developed from journey-to-work data can be problematic. Problems include: sparse data from a single year for small geographies, seasonality if data are averaged over a year, and changes in development of new housing and business locations over three to five years if rolling averages are used.

9.3 Travel Demand Modeling Case Studies

The following case studies illustrate how a data user might use ACS data to support travel demand modeling efforts. The case studies provide a step-by-step description of how one might obtain the data, do the computations, and present the results.

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[102] North Jersey Transportation Planning Authority, 2003. "Journey-to-Work Data: Census 2000 County-to-County Worker Flow Data for the NJTPA Region."

For this purpose, assume that you are a transportation analyst working in an MPO. In the first analysis, your manager has asked you to estimate an auto ownership model. In the second analysis, you are asked to validate a trip distribution model. Section 3 of this guidebook has detailed instructions on downloading ACS data.

9.3.1 Analysis 1—Estimation of Auto Ownership Model

This case study illustrates how an auto availability model can be estimated using ACS data. Auto availability models can be estimated using disaggregate household data. The ACS PUMS is a great source of disaggregate detailed household data with information on household income, size, workers, type, etc. One limitation of the data is that the household residence is not available at a geographic level fine enough to allow the use of accessibility measures and land-use density in the model. The geographic level that is normally reported is the PUMA, but the ACS PUMS that currently are available on the American FactFinder website have state-level data. The model estimated in this case study builds on the work done previously[103] to estimate automobile ownership models for the Bay Area and the San Diego region.

This exercise requires estimating an auto availability model for the state of California using recent ACS PUMS data from years 2000 to 2003. To present the results of the auto availability model exercise, it is important to show the alternatives modeled, explanatory variables used, parameter estimates, statistical significance of the variables, and model fit. This information is displayed in Table 9.1.

NOTE: T-statistics appear in parentheses; parameters are set to zero in the model specification.

Table 9.1. Magnitudes of variable coefficients.

Variable	Alternative		
	0-Vehicle	1-Vehicle	2+ Vehicles
Constant	-0.75 (t = -37.13)	- –	-2.74 (t = -132.18)
Persons in household	--	--	0.34 (t = 54.42)
Workers in household	--	0.17 (t = 10.23)	0.93 (t = 52.73)
Income: $ 35,000 ≤ Income < $ 70,000	--	1.03 (t = 33.0)	1.61 (t = 49.66)
Income ≥ $ 70,000	--	0.93 (t = 22.48)	2.26 (t = 54.82)
One-family house	--	0.66 (t = 27.06)	1.89 (t = 73.20)
Model Statistics			
Likelihood with Zero Coefficients	-151,351.42		
Likelihood with Constants only	-118,021.73		
Final value of Likelihood	-87,412.02		
"Rho-Squared" with respect to Zero	0.4225		
"Rho-Squared" with respect to Constants	0.2594		

Note: - – Parameters set to zero in the model specification. Rho-squared is a goodness-of-fit measure for discrete choice models that is analogous to R-squared in regression analysis.

[103] C. Purvis, "Using 1990 Census Public Use Microdata Sample to Estimate Demographic and Automobile Ownership Models," *Transportation Research Record 1443*, TRB, National Research Council, Washington, D.C., 1994.

In addition, the following conclusions can be associated with this analysis:

- The alternative-specific constants of the zero and two-plus alternatives are negative, which indicates that, if all else is the same, households are more likely to have one vehicle available. Moreover, a household is more likely to have zero than two vehicles.
- As household size increases, a household is more likely to have two or more vehicles available.
- The presence of workers in the household increases the utility of having one or more vehicles available, and the effect is stronger for the two-plus vehicle category.
- Relative to low-income households, medium- and high-income households are more likely to have one or more vehicles available, and the effect is stronger for the two-plus vehicle category.
- Finally, the effect of dwelling type on vehicle availability is that one-family houses are more likely to have one or more vehicles available than zero vehicles, and are more likely to have two-plus vehicles than one vehicle.

Available Data The auto availability model that is estimated in this case study is for the state of California. Four years of ACS data, 2000 through 2003, are pooled to increase the sample size. Note that the pooling of the household records from these four years does not cause any correlation problems in the estimation since the four samples will not have overlapping housing units.[104]

The ACS PUMS data are composed of a household file and a person file. Even though the vehicle availability model is estimated at the household level, the person file also provides some characteristics that can be used in the model, such as number of workers in the household.

To download the data, the user should follow the steps below:

- Go to the American FactFinder website at http://factfinder.census.gov/home/saff/main.html?_lang=en,
- Click on the Datasets tab,
- Select the "2000-2003 American Community Survey" tab,
- Click on the link leading to "Public Use Microdata Sample (PUMS)", and
- Click on a certain year (e.g., 2003) and then download the person records ("P" records) and household records ("H" records) for a selected state.

Analysis Steps The 2000-2003 household records are pooled into one sample for estimation, removing those records that correspond to vacant units or to group quarters. The following variables from the household file are retained for use in the estimation: number of vehicles in the household (variable is VEH), number of persons in household (variable is NP), household income (variable is HINCP), and type of residence (variable is BLD). In addition, the person files are used to obtain the number of workers in the household (variable is COW). Two types of adjustment factors are applied to the income variable, as follows:[105]

- For a given ACS PUMS year, the first adjustment factor is a value that is applied to all observations obtained from that year. This factor is included in the PUMS datasets and is called ADJUST. The reason this adjustment is needed is because interviews in the ACS were conducted throughout the year. Application of the adjustment factor will convert dollar amounts to July (of the given year) dollars.[106]
- The second adjustment factor is needed because ACS PUMS data from years 2000-2003 are used in this case study. When working with dollar amounts from different years, it is necessary to convert the amounts into dollars from a common year (after applying the adjustment factor

[104] No housing unit will be sampled more than once in a five-year period.
[105] Correspondence with Nicholas Spanos of the Census Bureau, May 27, 2005.
[106] Note that the value of ADJUST is the same for all sample cases. This is for disclosure avoidance reasons, that is, so that the month of interview cannot be identified by the adjustment factor. The original dollar amounts were adjusted so that one value of ADJUST could be used for all sample cases.

described in the previous paragraph). The CPI-U-RS adjustment factors from the Bureau of Labor Statistics are used.[107]

The number of household observations used in the estimation is equal to 137,766. The alternatives are zero, one, and two-plus vehicles. The model estimation exercise consists of iteratively selecting explanatory variables; running the model through model estimation software; examining the magnitudes, signs, and t-statistics of the coefficients and overall model fit; and adjusting the selected variables accordingly.

9.3.2 Analysis 2—Validation of a Trip Distribution Model

This exercise requires validating the trip distribution gravity model of a county-level travel demand model system by comparing model results to observed data.

To present the results of this model validation exercise, it is useful to show two types of comparison. The first is a comparison of number/percentage of trips from a given origin to all destinations (e.g., at the district level). The second is a comparison of county-level mean travel time and travel time distribution. Each of these comparisons can assist in adjusting the coefficients of the gravity model if large discrepancies exist between modeled and observed travel times.

For example, Table 9.2 shows the number and percentage of trips from District 1 to all other districts using the 2000 ACS and the gravity model, as well as the difference between the two sources. The table shows that

- Overall, the number of trips originating from District 1 is under simulated.
- In terms of distribution of trips, the largest discrepancies occur with the intradistrict flow (to District 1 at −4.5 percent) and the flow to District 2 (at 5.4 percent).

Figure 9.3 compares the travel time distribution obtained from the gravity model to the ACS reported travel time distribution. The figure shows that the model under predicts short trips and over predicts long trips.

Available Data Two data sources are available to do this analysis. The first data source is the trip distribution model outputs in terms of number of trips and travel time skims by origin-destination pair. The second data source is ACS, which provides data on worker flows between every origin-destination pair (assuming a CTPP-like product from ACS is available) and reported travel time data for these origin-destination pairs.

Table 9.2. Comparison of worker trips from a given district to all other districts using ACS and the gravity model.

Origin: District 1	ACS		Gravity Model		Gravity Model – ACS	
To District	Flow	Percentage	Flow	Percentage	Flow	Percentage
1	36,545	63.0	30,000	58.5	-6,545	-4.5
2	14,945	25.8	16,000	31.2	1,055	5.4
3	2,705	4.7	2,000	3.9	-705	-0.8
4	1,750	3.0	1,500	2.9	-250	-0.1
5	2,070	3.6	1,800	3.5	-270	-0.1
Total	58,015	100	51,300	100	-6,715	-0.1

[107] These factors can be found at the following URL: http://www.bls.gov/cpi/cpiurstx.htm. [For example, to express year 2000 dollars in terms of 2003 dollars, multiply the 2000 dollars by 267.9/250.8 = 1.06818182].

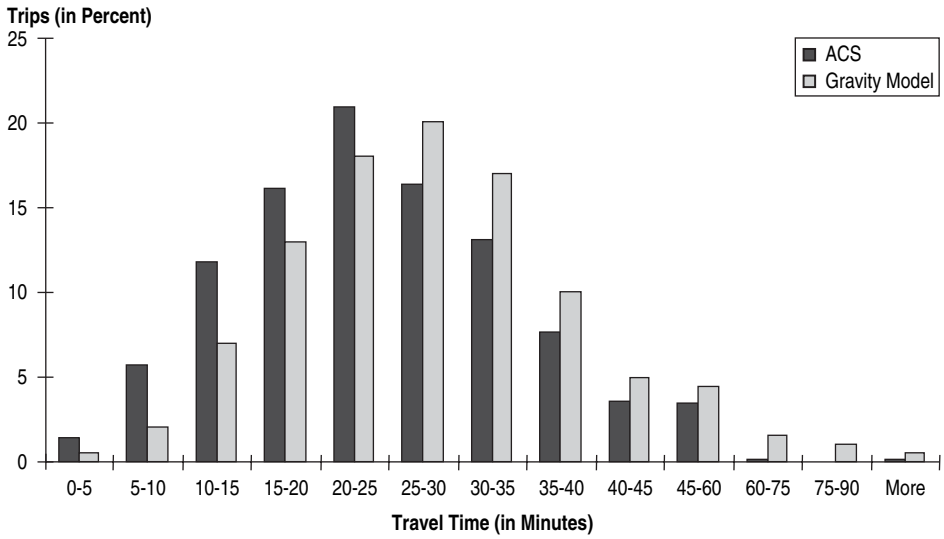

Figure 9.3. Travel time distributions from ACS and the gravity model.

Note that in addition to these data sources, one also can use the household travel survey, where respondents' trip origins and destinations can be geocoded and the corresponding travel time skims used to derive an observed travel time distribution. An origin-destination survey, if available, also can be a valuable data source for validating trip interchanges.

For this case study, the available ACS data (obtained from San Francisco County records) were at the tract-to-tract flow level. They were aggregated to the district level producing the flows in Table 9.3. Note that the gravity model numbers presented in this case study are fictitious.

Analysis Steps The following four steps are involved in conducting this analysis:

1. Select the level of geography at which the validation of flows should be conducted. The selection depends on the model type (e.g., statewide model, countywide model, etc.) and the desired level of accuracy. For this analysis, the validation of flows is conducted at the district-to-district level.
2. Aggregate the flows from the available geographic level detail to the desired geographic level. For example, the ACS flow data are available for this case study at the tract-to-tract level. A correspondence table between tracts and districts is used to derive the district-to-district flows presented in Table 9.3.
3. Since ACS flows correspond to the home-to-work direction only, the model home-based work flows, which combine both the home-to-work and work-to-home directions, should be divided in half to be comparable to the ACS data.
4. Use the tract-to-tract reported travel times to derive a travel time distribution from ACS and compare it to the model distribution.

The following caveats regarding using ACS data for the validation of trip distribution should be noted:

- The ACS travel times are reported travel times; hence they inherently suffer from respondent rounding and inaccuracy.
- Because of confidentiality issues, ACS flow data might be suppressed for origin-destination pairs that do not meet the threshold for data tabulation. This might cause inaccuracies when comparing ACS flows to model flows.
- ACS measures worker flows rather than trips; ACS does not account for absenteeism or for multiple job locations. These factors can cause additional differences between ACS and model results.

Table 9.3. Available ACS flow (workers) data.

	Destination District					
Origin District	1	2	3	4	5	Total
1	36,545	14,945	2,705	1,750	2,070	58,015
2	15,433	18,385	3,680	1,584	2,405	41,487
3	23,805	25,423	21,954	5,110	5,549	81,841
4	16,020	15,455	5,700	13,650	4,275	55,100
5	10,160	8,105	1,790	1,955	5,245	27,255
Total	101,963	82,313	35,829	24,049	19,544	263,698

9.4 Specific Uses of Census Data for Travel Demand Modeling

This section provides a list of specific examples of uses of census data by transportation planners to do travel demand modeling.

9.4.1 Trip Generation

Model input for base year is being performed at Indiana DOT. Census Bureau variables used in the statewide travel demand model include number of households, number of household units, population size, population age, number of children, average income, household income, total employment, occupation, number of autos per household, journey-to-work data, and land use information (residential density, accessibility, and urbanized area boundaries). Similar variables are used by other DOTs and MPOs.[108]

Efforts involving trip generation rates include the following:

- The 1990 CTPP data were used by the Gainesville Urbanized Area to calibrate home-based work trip rates since its travel demand model was under assigning trips.[109] The last available trip rates were from 1971.
- The Chicago Area Transportation Study, Vermont Agency of Transportation, and MTC (using PUMS data to create county-level calibration files) also have used census data to corroborate trip generation rates.[110]

9.4.2 Work Trip Mode Choice Modeling

Examples of work trip mode choice modeling efforts include the following:

- Work done by the Denver Regional Council of Governments (where geographic market segments were identified and mode choice models were calibrated separately for each),

[108] The DOTs and MPOs that have indicated the use of Census data in this context include: Des Moines MPO, Minnesota DOT, Vermont Agency of Transportation, Mass Highway, Broward County MPO, Hampton Roads Planning District Commission, Chittenden County MPO, Mid-Ohio Regional Planning Commission, Pioneer Valley Planning Commission, Tulare County Association of Governments, Pima Association of Governments, Yakima Valley Conference of Governments, and Caliper Corporation.

[109] W. Blanton, 1996, "Small-Area Applications Using 1990 Census Transportation Planning Package: Gainesville, Florida." Proceedings of a Conference on Decennial Census Data for Transportation Planning: Case Studies and Strategies for 2000.

[110] C. Purvis, "Uses of PUMS 2000 Data at the Metropolitan Transportation Commission," Transportation Research Board, National Research Council, Washington, D.C., 2004.

Central Transportation Planning Staff, Chicago Area Transportation Study, and Caliper Corporation;[111]
- The use of PUMS data at MTC to create county-level calibration files for an auto ownership model; and
- The use of PUMS data and CTPP flow data at King County Transit to assess whether vanpool usage as inferred from the census matches with actual observations, in which case census data are used for further analysis.

9.4.3 Traffic Assignment Modeling

An example of using census data to calibrate and adjust speeds and travel times in a traffic assignment model includes the analysis of New Jersey counties in the DVRPC region.

9.4.4 Demographic and Auto Ownership Models

Examples of agencies/researchers using census data for demographic and auto ownership models include the following:

- Mid-Ohio Regional Planning Commission estimating models, using variables such as income and area type, for predicting the distribution of households by household size;
- Municipality of Anchorage, Central Transportation Planning Staff auto ownership model;
- Caliper Corporation auto ownership and employment models;
- Cambridge Systematics[112] vehicle availability model for New Hampshire; and
- Auto ownership model for Honolulu, Hawaii.[113]

9.4.5 Microsimulation

Examples of agencies/researchers using census data for microsimulation include the following:

- Census data are used at Caliper Corporation to validate aggregate employment shares.
- PUMS data are used for population synthesis for microsimulation models at Caliper Corporation. Synthetic population estimates can be input to very disaggregate travel behavior models.
- Citilabs currently is building a tool for developing synthetic populations (e.g., demographic data for use in models) through sample enumeration using PUMS data. The developed population estimates will be controlled to full counts from the census.
- TRANSIMS[114] creates synthetic household information using PUMS data. The "Population Synthesizer" routine in TRANSIMS takes in various types of census data at the census block and census block group level to generate synthetic households, individuals, and vehicles through a series of six steps.

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[111] At Caliper Corporation, CTPP data also are used for calibrating a time-of-day model and a destination choice gravity model related to work trips.

[112] Cambridge Systematics, Inc., 1997, "Vehicle Availability Modeling." Prepared for FHWA.

[113] J.M. Ryan and G. Han, "Vehicle-Ownership Model Using Family Structure and Accessibility Application to Honolulu, Hawaii." *Transportation Research Record 1676*, TRB, National Research Council, Washington, D.C., 1999.

[114] Travel Model Improvement Program, U.S. DOT, 1998 "TRANSIMS: The Dallas Case Study." See http://tmip.fhwa.dot.gov/clearinghouse/browse, November 4, 2004.

APPENDIX A

Housing and Population Questions From ACS and Census Long Form

Table A.1. Housing and population questions-comparing the 2003 american community survey (acs) questionnaires.

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Housing Questions						
Which best describes this building? A mobile home, a one-family house detached from an other house, a one-family house attached to one or more houses, a building with two apartments, a building with three or four apartments, a building with five to nine apartments, a building with 10 to 19 apartments, a building with 20 to 49 apartments, a building with 50 or more apartments, boat, RV, van, etc.	Units in Structure	Identical to current ACS	First answer category – A mobile home "or trailer." Last category was "Other" rather than "Boat, RV, van, etc."	1940	Identical to current ACS	Identical to LF 1990
About when was this building first built? 2000 or later, 1995 to 1999, 1990 to 1994, 1980 to 1989, 1970 to 1979, 1960 to 1969, 1950 to 1959, 1940 to 1949, 1939 or earlier.	Year Structure Built	First answer category is: 1999 or 2000, remaining categories are identical	Included "Don't Know" response category	1940	First answer category is: 1999 or later	Response area was write-in space
When did Person 1 (listed in the List of Residents on page 2) move into this house, apartment, or mobile home? Month/Year (write-in space).	Year Householder Moved In	Answer categories provided	Question did not include "or mobile home"; answer categories provided	1960	Identical to current ACS	Identical to LF 1990
How many acres is this house or mobile home on? Less than one acre, one to 9.9 acres, 10 or more acres.	Acreage	Identical to current ACS	"Is this house on less than one acre"	1970	Identical to current ACS	Identical to LF 1990
In the past 12 months, what were the actual sales of all agricultural products from this property? None, $1 to $999; $1,000 to $2,499; $2,500 to $4,999; $5,000 to $9,999; and $10,000 or more.	Agricultural Sales	Census uses "In 1999" rather than "In past 12 months"	Identical to LF 2000	1970	Identical to current ACS	"In the past 12 months, were the sales of all agricultural products form this property $1,000 or more?"
Is there a business (such as a store or barber shop) or a medical office on this property? Yes/No.	Business or Medical Office on Property	Identical to current ACS	Identical to LF 2000	1970	Identical to current ACS	No parenthesis
How many rooms are in this house, apartment, or mobile home? One room, two rooms, three rooms, four rooms, five rooms, six rooms, seven rooms, eight rooms, nine or more rooms.	Number of Rooms	Census uses "do you have" rather than "are in"	Question did not include "or mobile home"; otherwise identical to LF 2000	1940	Identical to current ACS	Did not include "or mobile home"; response area was write-in

Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
How many bedrooms are in this house, apartment, or mobile home; that is, how many bedrooms would you list if this house, apartment or mobile home were on the market for sale or rent? No bedroom, one bedroom, two bedrooms, three bedrooms, four bedrooms, five or more bedrooms.	Bedrooms	Census uses "do you have" rather than "does this house"	Question did not include"or mobile home"; otherwise identical to LF 2000	1960	Identical to current ACS	Identical to LF 1990
Does this house, apartment, or mobile home have complete plumbing facilities; that is, 1) hot and cold piped water, 2) a flush toilet, and 3) a bathtub or shower? Yes has all three facilities/No.	Plumbing	Census uses "do you have" rather than "does this house"	Question did not include"or mobile home"; otherwise identical to LF 2000	1980	Identical to current ACS	Identical to LF 1990
Does this house, apartment, or mobile home have complete kitchen facilities; that is, 1) a sink with piped water, 2) a stove or range, and 3) a refrigerator? Yes has all three facilities/No.	Kitchen Facilities	Census uses "do you have" rather than "does this house"	Answer categories – Yes, No	1960	Identical to current ACS	Did not include "or mobile home"; otherwise identical to current ACS
Is there telephone service available in this house, apartment, or mobile home from which you can both make and receive calls? Yes/No.	Telephone Services	Identical to current ACS	"Do you have a telephone in this house or apartment?"	1980	Identical to current ACS	Identical to LF 1990
How many automobiles, vans, and trucks of one-ton capacity or less are kept at home for use by members of this household? None, one, two, three, four, five, six or more.	Vehicles Available	Identical to current ACS	Upper limit category "seven or more" instead of "six or more"	1960	Identical to current ACS	Response area was write-in space
Which fuel is used most for heating this house, apartment, or mobile home? Gas from underground pipes serving the neighborhood; gas: bottled, tank, or LP; electricity; fuel oil, kerosene, etc.; coal or coke; wood; solar energy; other fuel; no fuel used.	House Heating Fuel	Identical to current ACS	Question did not include"or mobile home"; otherwise identical to LF 2000	1940	Identical to current ACS	Did not include "or mobile home"; otherwise identical to current ACS
Last month, what was the cost of electricity (gas; water and sewer; oil, coal, kerosene, wood, etc.) for this house, apartment, or mobile home? Last month' s cost – dollars (write-in space).	Cost of Utilities	Census uses" What are the annual costs"	"What are yearly costs…"	1980	Identical to current ACS	Did not include "or mobile home"; otherwise identical to current ACS
At any time during the past 12 months, did anyone in this household receive food stamps? Yes – what was the value of the food stamps received in the past 12 months? (write-in space); no.	Food Stamps	Not in Census	Missing	2000	Identical to current ACS	Identical to current ACS
Is this house, apartment, or mobile home part of a condominium? Yes – what is the monthly condominium fee? Monthly amount – dollars (write-in space); no.	Condominiums	Instruction given, answer only if this is a condominium – "What is the…"	Question did not include"or mobile home"; otherwise identical to LF 2000	1980	Identical to current ACS	Did not include "or mobile home"; otherwise identical to current ACS

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Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Is this house, apartment, or mobile home? Owned by you or someone in this household with a mortgage or loan; owned by you or someone in this household free and clear (without a mortgage or loan); rented for cash rent; occupied without payment of cash rent.	Tenure	Identical to current ACS	Question did not include"or mobile home"; otherwise identical to LF 2000	1890	Identical to current ACS	Did not include "or mobile home"; otherwise identicalto current ACS
What is the monthly rent for this house, apartment, or mobile home? Monthly amount – dollars (write-in space). **Does monthly rent include any meals?** Yes/No.	Rent	Identical to current ACS	Answer categories provided; second part of question identical	1930	Identical to current ACS	Did not include "or mobile home"; Otherwise identical to current ACS
What is the value of this property; that is, how much do you think this house and lot, apartment, or mobile home and lot, would sell for if it were for sale? Less than $10,000; $10,000 to $14,999; $15,000 to $24,999; $25,000 to $29,999; $30,000 to $34,999; $35,000 to $39,999; $40,000 to $49,999; $50,000 to $59,999; $60,000 to $69,000; $70,000 to $79,999; $80,000 to $89,999; $90,000 to $99,999; $100,000 to $124,999; $125,000 to $149,999; $150,000 to $174,999; $175,000 to $199,999; $200,000 to $249,999, $250,000 or more specify.	Value	Answer categories include: $250,000 to $299,999; $300,000 to $399,999; $400,000 to $499,999; $500,000 to $749,999; $750,000 to $999,999; $1,000,000 or more	Answer categories include: $250,000 to $299,999; $300,000 to $399,999; $400,000 to $499,999; $500,000 or more	1980	Identical to current ACS	Write-in space
What are the annual real estate taxes on this property? Annual amount – dollars (write-in space).	Real Estate Taxes	"What were the real estate taxes on this property last year"	Identical to LF 2000	1980	Identical to current ACS	Identical to current ACS
What is the annual payment for fire, hazard, and flood insurance on this property? Annual amount – dollars (write-in space).	Insurance	"What was the annual payment…"	Identical to LF 2000	1980	Identical to current ACS	Identical to current ACS
Do you or any member of this household have a mortgage, deed of trust, contract to purchase, or similar debt on this property? Yes – Mortgage, deed of trust, or similar debt; yes – contract to purchase; no. **How much is your regular monthly mortgage payment on this property?** Monthly amounts – dollars (write-in space). **Does your regular monthly mortgage payment include payments for real estate taxes?** Yes – taxes included in mortgage payment; no – taxes paid separately or taxes not required.	Mortgages	Identical to current ACS	Identical to LF 2000	1980	Identical to current ACS	Identical to current ACS

Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Does your regular monthly mortgage payment include payments for fire, hazard, or flood insurance on this property? Yes – insurance included in mortgage payment; no – insurance paid separately or no insurance.						
Do you or any member of this household have a second mortgage or a home equity loan on this property? Yes – home equity loan; yes – second mortgage; yes – second mortgage and home equity loan; no.	Mortgages	Identical	"junior mortgage" included in first question	1980	Identical to current ACS	Identical to current ACS
How much is the regular monthly payment on all second or junior mortgages and all home equity loans on this property? Monthly amount – dollars (write-in space).	Mortgages	Identical	"junior mortgage" included in first question	1980	Identical to current ACS	Identical to current ACS
What are the total annual costs for personal property taxes, site rent, registration fees, and license fees on this mobile home and its site? Annual costs – dollars (write-in space).	Mobile Home Costs	Two-part question. Instruction given, answer only if this is a mobile home. "Do you have an installment loan or contract on this mobile home?: If yes – what was the total cost for the installment loan payments, personal property taxes, site rent, registration fees, license fees on this mobile home and its site last year?"	"What was the total cost for personal …"	1980	Identical to current ACS	Identical to current ACS
Do you or any member of this household live or stay at this address year round? Yes/No. **How many months a year do members of this household stay at this address?** Months (write-in space). **What is the main reason members of this household are staying at this address?** This is their permanent address; this is their seasonal or vacation address; to be close to work; to attend school or college; looking for permanent housing; other reasons.	Verification of Residence Status (Seasonal Residence)	Missing	Missing	2003	"Do all persons listed on pages two and three live at this address year round? Of the persons listed how many live somewhere else part of the year? Do you consider this house, apartment, or mobile home, that uses the address on the front cover, your…"	"Do all persons staying in this house or apartment usually spend more than two consecutive months of the year at another residence? Where is that residence located? How long does this household usually spend at that address?"

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Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Population Questions						
What is the person's sex? Male/Female.	Sex	Not matrix; answer categories identical	Identical to LF 2000	1790	Identical to current ACS	Identical to current ACS
What is this person's age and what is this person's date of birth? Age (in years) month/day/year of birth (write-in space).	Age	Not matrix; age on April 1, 2000, month, day, year of birth (write-in space)	Age at last birthday; year of birth. Write-in and also needed to fill in answer circles	1790	Identical to current ACS	Identical to current ACS
How is this person related to Person 1? Husband or wife; son or daughter; brother or sister; father or mother; grandchild; in-law; other relative; roomer, boarder; housemate, roommate; unmarried partner; foster child; other non-relative.	Relationship	Not matrix; answer categories: husband/wife, natural-born son/daughter; adopted son/daughter; stepson/stepdaughter; parent-in-law, son-in-law/daughter-in-law, other relative	Answer categories: husband/wife; natural-born/adopted son/daughter; stepson/stepdaughter; brother/sister; father/mother; grandchild; other relative; roomer, boarder, or foster child; housemate, roommate; unmarried partner; other non-relative	1880	Identical to current ACS	Identical to current ACS
What is this person's marital status? Now married; widowed; divorced; separated; never married.	Marital Status	Identical to current ACS	Identical to LF 2000	1880	Identical to current ACS	Identical to current ACS
Is this person Spanish/Hispanic/Latino? No – not Spanish/Hispanic/Latino; yes – Mexican, Mexican American, Chicano; yes – Puerto Rican; yes – Cuban; yes – other Spanish/Hispanic/Latino – print group (write-in space).	Hispanic Origin	Identical to current ACS	"Is this person of Spanish/Hispanic origin?"	1970	Identical to current ACS	Identical to current ACS
What is this person's race? One or more races. White; Black or African American, American Indian or Alaskan Native (print name of enrolled or principal tribe); Asian Indian; Chinese; Filipino; Japanese; Korean; Vietnamese; other Asian – print race; Native Hawaiian; Guamanian or Chamorro; Samoan; other Pacific Islander – print race.	Race	Identical to current ACS	Instructed to "Fill ONE circle for the race that the person considers himself/herself to be."	1790	Identical to current ACS	Instructed to "Mark one box."
Where was this person born? In the United States – print name of state; outside the United States – print name of foreign country.	Place of Birth	Identical to current ACS	"In what U.S. state or foreign country was this person born?" Write-in space	1850	Identical to current ACS	"In what U.S. state, territory, commonwealth, or foreign country was this person born?" Write-in space

Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Is this person a citizen of the United States? Yes – born in the United States; yes – born in Puerto Rico, Guam, U.S. Virgin Islands, or Northern Marianas; yes – born abroad of American parent or parents; yes – U.S. citizen by naturalization; no – not a citizen of the United States.	Citizenship	Identical to current ACS	Identical	1820	Identical to current ACS	Identical to current ACS
When did this person come to live in the United States? Year (write-in space)	Year of Entry	Identical to current ACS	Answer categories provided	1890	Identical to current ACS	Identical to current ACS
At any time in the last three months, has this person attended regular school or college? No – has not attended in the last three months; yes – public school, public college; yes – private school, private college. **What grade or level was this person attending?** Nursery school, preschool, kindergarten, grade 1 to grade 4; grade 5 to grade 8; grade 9 to grade 12; college undergraduate years (freshman to senior); graduate or professional school.	School Enrollment	"At any time since February 1, 2000…"	Identical to LF 2000; second part of question missing	1850	Identical to current ACS	Did not contain second part of question
What is the highest degree or level of school this person has completed? No schooling completed; nursery school to fourth grade; fifth grade or sixth grade; seventh grade or eighth grade; ninth grade; 10th grade; 11th grade; 12th grade – no diploma; high school graduate; some college credit, but less than one year; one or more years of college, no degree; Associate degree; Bachelor's degree; Master's degree; Professional degree; Doctorate degree.	Educational Attainment	Identical to current ACS	"How much school has this person completed?"	1940	Identical to current ACS	Identical to current ACS
What is this person's ancestry or ethnic origin? Write-in space.	Ancestry	Identical to current ACS	Identical	Pre 1980	Identical to current ACS	Identical to current ACS
Does this person speak a language other than English at home? Yes/No. **What is this language?** Write-in space. **How well does this person speak English?** Very well, well, not well, not at all.	Language Spoken at Home	Identical to current ACS	Identical to LF 2000	1890	Identical to current ACS	Identical to current ACS
Did this person live in this house or apartment one year ago? Person is under one year old; yes – this house; no – outside the United States; no – different house in the United States. **Where did this person live one year ago?** Name of city, town, or post office.	Residence One Year Ago	"Did this person live in this house or apartment five years ago (on April 1, 1995)?" Person is under five years old; remaining answer categories identical.	Question wording the same as LF 2000, slightly different format for capturing address information	Pre 1980	Identical to current ACS	Identical to LF 1990

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Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Did this person live inside the limits of the city of town? Yes/No – outside the city/town limits. Name of county, name of state, zip code (write-in space)		"Where did this person live five years ago?"				
Does this person have any of the following long-lasting conditions? Blindness, deafness, or a severe vision or hearing impairment; a condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying. **Because of a physical, mental, or emotional condition lasting six months or more, does this person have any difficulty in doing any of the following activities?** Learning, remembering, or concentrating; dressing, bathing or getting around inside the home. **Because of a physical, mental, or emotional condition lasting six months or more, does this person have any difficulty in doing any of the following activities?** Going outside the home alone to shop or visit a doctor's office; working at a job or business.	Disability	Question has two parts not three as in ACS. Second and third parts of ACS combined into one item	"Does this person have a physical mental, or other health condition that has lasted for six or more months and which – limits the amount of work this person can do at a job? Prevents this person from working at job?" "Because of a health condition that has lasted for six or more months, does this person have any difficulty – going outside the home alone, for example, to shop or visit a doctor's office? Taking care of his or her own personal needs such as bathing, dressing, or getting around inside the home?"	1830	Identical to current ACS	"If this person has difficulty seeing, hearing, or walking, mark [X] the appropriate boxes"; otherwise the same as current ACS
Has this person given birth to any children in the past 12 months? Yes/No.	Children born last 12 months	Missing	How many babies has she had not counting stillbirths?	2000	Identical to current ACS	Identical to LF 1990
Does this person have any of his/her own grandchildren under the age of 18 living in this house or apartment? Yes/No. **Is this grandparent currently responsible for most of the basic needs of any grandchildren under the age of 18 who lives in this house or apartment?** Yes/No.	Grandparents as Caregivers	Identical to current ACS	Missing	2000	Identical to current ACS	Identical to current ACS

Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
How long has this grandparent been responsible for the(se) grandchildren? Less than six months; six to 11 months; one or two years; three or four years; five or more years.						
Has this person ever served on active duty in the U.S. Armed Forces, military Reserves, or National Guard? Yes – now on active duty; yes – on active duty during the last 12 months, but not now; yes – on active duty in the past, but not during the last 12 months; no – training for Reserves or National Guard only; no – never served in the military. **When did this person serve on active duty in the U.S. Armed Forces?** September 2001 or later; August 1990 to August 2001; September 1980 to July 1990; Vietnam era (August 1964 to April 1975); March 1961 to July 1964; February 1955 to February 1961; Korean War (July 1950 to January 1955); January 1947 to June 1950; World War II (December 1941 to December 1946); November 1941 or earlier. **In total, how many years of active-duty military service has this person had?** Less than two years; two years or more.	Veteran Status	For second part of question, first answer category is "April 1995 or later" and slightly different remaining categories	"Has this person ever been on active-duty military service in the Armed Forces of the United States or ever been in the United States military Reserves or the National Guard?" Yes – now on active duty; yes – on active duty in past but not now, yes – service in Reserves or National Guard, no; write-in space for how many years of active-duty military service	1840	Identical to current ACS	Identical to LF 1990
Last week, did this person do any work for either pay or profit? Yes/No.	Labor Force Status	Identical to current ACS	"Did this person work at any time last week?"	1970	Identical to current ACS	Identical to current ACS
At what location did this person work last week? Address; city, town, or post office (write-in space). **Is the work location inside the limits of that city or town?** Yes – name of county, name of U.S. state or foreign country, zip code; no – outside the city/town limits.	Place of Work	Identical to current ACS	Identical to LF 2000	1960	Identical to current ACS	Identical to current ACS
How did this person usually get to work last week? Car, truck, or van; bus or trolley bus; streetcar or trolley car; subway or elevated; railroad; ferryboat; taxicab; motorcycle; bicycle; walked; worked at home; other method.	Means of Transportation to Work	Identical to current ACS	Identical to LF 2000	1960	Identical to current ACS	Identical to current ACS
How many people, including this person, usually rode to work in the car, truck, or van last week? Person(s) (write-in space).	Carpooling	Answer categories provided	Upper limit category "10 or more" instead of "seven or more"	1960	Identical to current ACS	Identical to current ACS

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Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
What time did this person usually leave home to go to work last week? Hour, minute a.m., p.m. (write-in space).	Departure Time	Identical to current ACS	Identical to LF 2000	1960	Identical to current ACS	Identical to current ACS
How many minutes did it usually take this person to get from home to work last week? Minutes (write-in space)						
Last week, was this person on layoff from a job? Yes/No. **Last week, was this person temporarily absent from a job or business?** Yes/No. **Has this person been informed that he or she will be recalled to work within the next six months or been given a date to return to work?** Yes/No.	Absence From Work	Identical to current ACS	"Was this person temporarily absent or on layoff from a job or business last week?"	1970	Identical to current ACS	Identical to current ACS
Has this person been looking for work during the last four weeks? Yes/No.	Looking for work	Subpart of question above	"Has this person been looking for work during the last four weeks?"	1970	Identical to current ACS	Identical to current ACS
Last week, could this person have started a job if offered one, or returned to work if recalled? Yes – could have gone to work; no – because of temporary illness; no – because of all other reasons (in school, etc.).	Availability for Work	Subparts of question above	"Could this person have taken a job last week if one had been offered?"	1970	Identical to current ACS	"Last week, could this person have gone to work?"
When did this person last work even for few days? Within the past 12 months; one to five years ago; over five years ago or never worked.	Work History	Identical to current ACS	Identical to LF 2000	1970	Identical to current ACS	Identical to current ACS
During the past 12 months, how many weeks did this person work? Weeks (write-in space).	Work Last Year	"Last year, 1999, did this person work at a job or business at any time? How many weeks did this person work in 1999?"	Identical to LF 2000	1970	Identical to current ACS	Identical to current ACS
During the past 12 months, in the weeks worked, how many hours did this person usually work each week? Usual hours worked each week (write-in space).	Hours Worked Per Week	Subpart of question above."During the weeks worked in 1999, how many hours did this person usually work each week?"	"How many hours did this work last week?"	1970	Identical to current ACS	Identical to current ACS

Table A.1. (Continued).

2003 ACS	Description	Census 2000 Long Form	Census 1990 Long Form	First Used	ACS 1999-2002	ACS 1996-1998
Current or most recent job activity. Was this person…an employee of a private for profit company or business, or of an individual, for wages, salary, or commissions; an employee of a private not for profit tax-exempt, or charitable organization; a local government employee (city, county, etc.), a state government employee; a Federal government employee; self-employed in own not incorporated business, professional practice, or farm; self-employed in own incorporated business, professional practice, or farm; working without pay in a family business or farm.	Class	Identical to current ACS	Identical to LF 2000	1910	Identical to Current ACS	Identical to Current ACS
For whom did this person work? Name of company, business, or other employer (Write-in space) What kind of business or industry was this in? (Write-in space)	Industry	A third question part: Is this mainly – manufacturing, wholesale trade, retail trade, other	Identical to LF 2000	1850	Identical to LF 2000	Identical to LF 2000
What kind of work was this person doing? (Write-in space) **What were this person's most important activities or duties?** (Write-in space)	Occupation	Identical to current ACS	Identical to LF 2000	1850	Identical to current ACS	Identical to current ACS
Income in the past 12 months. Separate items for: Wages, salary, commissions, bonuses, or tips from all jobs. Self-employment income from own non-farm businesses or farm businesses, including proprietorships and partnerships. Interest, dividends, net rental income, royalty income, or income from estates and trusts. Social security or railroad retirement. Supplemental security income. Any public assistance or welfare payments from the state or local welfare office. Retirement, survivor, or disability pensions. Any other sources of income received regularly such as Veterans (VA) payments, unemployment compensation, child support or alimony. Yes – total amount for past 12 months (write-in space); no.	Income	Identical to current ACS	Identical to LF 2000	1940	Identical to current ACS	Identical to current ACS
What was this person's total income during the past 12 months? None or total amount for past 12 months (write-in space).	Total Income	What was this person's total income in 1999?	Identical to LF 2000	1940	Identical to current ACS	Identical to current ACS

APPENDIX B

ACS Base Tables

Table B.1. ACS base tables available for 2004.

Base Table Number		Table Definition
B01001	**	Sex by Age
B01002	**	Median Age by Sex
B01003		Total Population
B02001		Race
B02003		Race
B02005		American Indian and Alaska Native Alone With One Tribe Reported For Selected Tribes
B02006		Asian Alone By Selected Groups
B02007		Native Hawaiian and Other Pacific Islander Alone By Selected Groups
B02008		White Alone Or In Combination With One Or More Other Races
B02009		Black Or African American Alone Or In Combination With One Or More Other Races
B02010		American Indian And Alaska Native Alone Or In Combination With One Or More Other Races
B02011		Asian Alone Or In Combination With One Or More Other Races
B02012		Native Hawaiian And Other Pacific Islander Alone Or In Combination With One Or More Other Races
B02013		Some Other Race Alone Or In Combination With One Or More Other Races
B03001		Hispanic or Latino by Specific Origin
B03002		Hispanic or Latino by Race
B04001		First Ancestry Reported
B04002		Second Ancestry Reported
B04003		Total Ancestry Reported
B04004		People Reporting Single Ancestry
B04005		People Reporting Multiple Ancestry
B04006		People Reporting Ancestry
B04007		Ancestry
B05001		Citizenship Status
B05002		Place Of Birth by Citizenship Status
B05003	**	Sex By Age By Citizenship Status
B05004		Median Age By Citizenship Status By Sex
B05005		Year of Entry by Citizenship Status
B05006		Place Of Birth for The Foreign-born Population
B05007		Place Of Birth by Year of Entry by Citizenship Status for the Foreign-born Population
B05008		Sex by Place Of Birth By Year Of Entry for The Foreign-born Population
B06001		Place Of Birth By Age
B06002		Median Age By Place Of Birth
B06003		Place Of Birth By Sex
B06004	*	Place Of Birth By Race
B06007		Place Of Birth By Language Spoken At Home and Ability To Speak English
B06008		Place Of Birth By Marital Status
B06009		Place Of Birth By Educational Attainment
B06010		Place Of Birth By Individual Income in The Past 12 Months (in 2004 Inflation-adjusted Dollars)
B06011		Median Income in The Past 12 Months (in 2004 Inflation-adjusted Dollars) By Place Of Birth
B06012		Place Of Birth By Poverty Status in The Past 12 Months
B06013		Place Of Birth By Tenure
B06014		Place Of Birth By Household Type

Table B.1. (Continued).

Base Table Number		Table Definition
B07001		Residence 1 Year Ago By Age
B07002		Median Age By Residence 1 Year Ago
B07003		Residence 1 Year Ago By Sex
B07004	*	Residence 1 Year Ago By Race
B07007		Residence 1 Year Ago By Citizenship Status
B07008		Residence 1 Year Ago By Marital Status
B07009		Residence 1 Year Ago By Educational Attainment
B07010		Residence 1 Year Ago By Individual Income in The Past 12 Months (in 2004 Inflation-adjusted Dollars)
B07011		Median Income in The Past 12 Months (in 2004 Inflation-adjusted Dollars) By Residence 1 Year Ago
B07012		Residence 1 Year Ago By Poverty Status in The Past 12 Months
B07013		Residence 1 Year Ago By Tenure
B07014		Residence 1 Year Ago By Household Type
B07101		Movers Between Regions
B07202		Residence 1 Year Ago for the Population 1 Year and over – State, County and Place Level
B08006		Sex Of Workers By Means Of Transportation
B08007		Sex Of Workers By Place Of Work, State, and County Level
B08008		Sex Of Workers By Place Of Work-Place Level
B08009		Sex Of Workers By Place Of Work-MCD Level For 12 Selected States (CT, ME, MA, MI, MN, NH, NJ, NY, PA, RI, VT, WI)
B08011		Sex Of Workers By Time Leaving Home To Go To Work
B08012		Sex Of Workers By Travel Time To Work
B08013		Aggregate Travel Time To Work (in Minutes) Of Workers By Sex
B08014		Sex Of Workers By Vehicles Available
B08101		Means Of Transportation To Work By Age
B08102		Aggregate Travel Time To Work (in Minutes) Of Workers By Age
B08103		Median Age By Means Of Transportation To Work
B08105	*	Means Of Transportation To Work
B08106	*	Aggregate Travel Time To Work (in Minutes) Of Workers
B08111		Means Of Transportation To Work By Citizenship Status
B08112		Aggregate Travel Time To Work (in Minutes) Of Workers By Citizenship Status
B08113		Means Of Transportation To Work By Language Spoken At Home and Ability To Speak English
B08114		Aggregate Travel Time to Work (in Minutes) of Workers by Language Spoken at Home and Ability to Speak English
B08115		Means Of Transportation To Work By Marital Status
B08116		Aggregate Travel Time To Work (in Minutes) Of Workers By Marital Status
B08117		Means Of Transportation To Work By Educational Attainment
B08118		Aggregate Travel Time To Work (in Minutes) Of Workers By Educational Attainment
B08119		Means Of Transportation To Work By Workers' Earnings In The Past 12 Months (in 2004 Inflation-adjusted Dollars)
B08120		Aggregate Travel Time to Work (In Minutes) of Workers by Workers' Earnings in the Past 12 Months
B08121		Median Earnings In The Past 12 Months (in 2004 Inflation-adjusted Dollars) By Means Of Transportation To Work
B08122		Means Of Transportation To Work By Poverty Status in The Past 12 Months
B08123		Aggregate Travel Time To Work (in Minutes) Of Workers By Poverty Status in The Past 12 Months
B08124		Means Of Transportation To Work By Occupation
B08125		Aggregate Travel Time To Work (in Minutes) Of Workers By Occupation
B08126		Means Of Transportation To Work By Industry

Table B.1. (Continued).

Base Table Number		Table Definition
B08127		Aggregate Travel Time To Work (in Minutes) Of Workers By Industry
B08128		Means Of Transportation To Work By Class Of Worker
B08129		Aggregate Travel Time To Work (in Minutes) Of Workers By Class Of Worker
B08130		Means of Transportation to Work by Place of Work-State and County Level
B08131		Aggregate Travel Time To Work (in Minutes) Of Workers By Place Of Work-State and County Level
B08132		Means Of Transportation To Work By Time Leaving Home To Go To Work
B08133		Aggregate Travel Time To Work (in Minutes) Of Workers By Time Leaving Home To Go To Work
B08134		Means of Transportation to Work by Travel Time to Work
B08135		Aggregate Travel Time To Work (in Minutes) Of Workers By Travel Time To Work
B08136		Aggregate Travel Time To Work (In Minutes) of Workers By Means Of Transportation To Work
B08137		Means Of Transportation To Work By Tenure
B08138		Aggregate Travel Time To Work (in Minutes) Of Workers By Tenure
B08139		Means Of Transportation To Work By Household Type
B08140		Aggregate Travel Time To Work (in Minutes) Of Workers By Household Type
B08141		Means Of Transportation To Work By Vehicles Available
B08142		Aggregate Travel Time To Work (in Minutes) Of Workers By Vehicles Available
B08201		Household Size by Vehicles Available
B08202		Household Size by Number of Workers in Household
B08203		Number of Workers in Household by Vehicles Available
B08406		Sex of Workers by Means of Transportation for Workplace Geography
B08412		Sex of Workers by Travel Time to Work for Workplace Geography
B08501		Means of Transportation to Work by Age for Workplace Geography
B08503		Median Age by Means of Transportation to Work for Workplace Geography
B08505	*	Means of Transportation to Work for Workplace Geography
B08511		Means of Transportation to Work by Citizenship Status for Workplace Geography
B08513		Means of Transportation to Work by Language Spoken at Home and Ability to Speak English for Workplace Geography
B08515		Means of Transportation to Work by Marital Status for Workplace Geography
B08517		Means of Transportation to Work by Educational Attainment for Workplace Geography
B08519		Means of Transportation to Work by Workers' Earnings in the Past 12 Months for Workplace Geography
B08521		Median Earnings in the Past 12 Months by Means of Transportation to Work for Workplace Geography
B08522		Means of Transportation to Work by Poverty Status in the Past 12 Months for Workplace Geography
B08524		Means of Transportation to Work by Occupation for Workplace Geography
B08526		Means of Transportation to Work by Industry for Workplace Geography
B08528		Means of Transportation to Work by Class of Worker for Workplace Geography
B08532		Means of Transportation to Work by Time Arriving at Work From Home for Workplace Geography
B08534		Means of Transportation to Work by Travel Time to Work for Workplace Geography
B08536		Aggregate Travel Time to Work (in Minutes) of Workers by Means of Transportation to Work for Workplace Geography
B08537		Means of Transportation to Work by Tenure for Workplace Geography
B08539		Means of Transportation to Work by Household Type for Workplace Geography
B08541		Means of Transportation to Work by Vehicles Available for Workplace Geography
B09001		Household Type By Age Of Children Under 18 Years in Households
B09002		Own Children Under 18 Years by Family Type and Age
B09003		Household Type and Relationship To Householder For Children Under 18 Years in Households
B09008		Presence Of Unmarried Partner By Household Type For Children Under 18 Years in Households

(*continued on next page*)

Table B.1. (Continued).

Base Table Number		Table Definition
B09010		Receipt of SSI, Public Assistance Income, or Food Stamps in the Past 12 Months by Hhld Type for Children < 18 in Hhlds
B09016		Household Type (including Living Alone) by Relationship for the Population in Households
B09017		Relationship by Household Type (including Living Alone) for the Population 65 Years and over
B10001		Grandchildren Under 18 Years Living With Grandparent Householder By Age Of Grandchildren
B10050		Grandparents Livingwith Own Grandchildren < 18 by Responsibility, Length of Time Responsible, and Age of Grandparents
B10051	*	GrndPrnts Living With Own GrndChldrn Und 18 Yrs By Responsibility For Own GrndChldrn and Age Of GrndPrnt
B10053		Citizenship Status By Grandparents Responsible For Own Grandchildren Under 18 Years By Age Of Grandparent
B10054		Lang and Ability To Speak Eng By GrndParnts Living With Own GrndChldrn Und 18 Yrs By Rspnblty For Own GrndChldrn
B10055		Disability Status of GrndParnts Living with Own GrndChldrn < 18 Yrs by Rspnblty for Own GrndChldrn and Age Of GrndParnts
B10056		Sex By GrndParnts Living With Own GrndChldrn Under 18 Yrs By Responsibility For Own GrndChldrn and Age Of GrndPrnt
B10057		Marital Status By GrndParnts Living With Own GrndChldrn Under 18 Yrs By Rspnblty For Own GrndChldrn and Age Of GrndPrnt
B10058		Employment Status by GrndParnts Living With Own GrndChldrn < 18 Yrs by Rspnblty For Own GrndChldrn and Age Of GrndPrt
B10059		Pov Status in The Past 12 Mth Of GrndParnts Living With Own GrndChldrn Und 18 Yrs By Rspnblty For Own GrndChldrn
B10060		Units in Structure By GrndParnts Living With Own GrndChldrn < 18 Yrs By Rspnblty For Own GrndChldrn and Age Of GrndPrn
B10061		Tenure By GrndParnts Living With Own GrndChldrn Under 18 Yrs By Responsibility For Own GrndChldrn and Age Of GrndParnts
B10063		Grandparents Living With Own Grandchildren Under 18 Years
B11001	**	Household Type (including Living Alone)
B11002	**	Household Type By Relatives and Nonrelatives For Population in Households
B11003		Family Type by Presence and Age of Own Children Under 18 Years by Age of Own Children
B11004		Family Type by Presence and Age of Related Children
B11005		Households by Presence of People Under 18 Years by Household Type
B11006		Presence Of People 60 Years and Over By Household Type For Households
B11007		Households by Presence of People 65 Years and over by Household Size by Household Type
B11009		Unmarried-partner Households and Household Type By Sex Of Partner
B11010		Nonfamily Households by Sex of Householder by Living Alone by Age of Householder
B11011		Household Type By Units in Structure
B11012		Household Type By Tenure
B11013		Subfamily Type by Presence of Own Children under 18 Years
B11014		Population in Subfamilies by Subfamily Type by Relationship
B11015		Households by Presence of Nonrelatives
B11016		Household Type by Household Size
B12001		Sex by Marital Status for the Population 15 Years and over
B12002	**	Sex By Marital Status By Age For The Population 15 Years and Over
B12005		Marital Status By Citizenship Status
B12006		Marital Status By Sex By Labor Force Participation
B12007	**	Median Age At First Marriage
B13001		Marital Status by Age for Women 15 To 50 Years
B13002		Number of Women 15 to 50 Years Who Had a Birth in the past 12 Months by Marital Status by Age

Table B.1. (Continued).

Base Table Number		Table Definition
B13004	**	Women 15 To 50 Years Who Had A Birth in The Past 12 Months By Marital Status
B13008		Women 15 To 50 Years Who Had A Birth in The Past 12 Months By Marital Status and Citizenship Status
B13010		Women 15 To 50 Years Who Had A Birth in The Past 12 Months By Marital Status and Poverty Status in The Past 12 Months
B13012		Women 15 To 50 Years Who Had A Birth in The Past 12 Months By Marital Status and Labor Force Status
B13014		Women 15 To 50 Years Who Had A Birth in The Past 12 Months By Marital Status and Educational Attainment
B14001	**	School Enrollment by Level of School for the Population 3 Years and over
B14002		Sex by School Enrollment by Level of School by Type of School for the Population 3 Years and over
B14003		Sex By School Enrollment By Type Of School By Age For The Population 3 Years and Over
B14004		Sex By College Or Graduate School Enrollment By Type Of School By Age For The Population 15 Years and Over
B14005		Sex By School Enrollment By Educational Attainment By Employment Status For The Population 16 To 19 Years
B14006		Poverty Status in The Past 12 Months By School Enrollment By Level Of School For The Population 3 Years and Over
B15001		Sex by Age by Educational Attainment for the Population 18 Years and over
B15002	**	Sex by Educational Attainment for the Population 25 Years and over
B15004		Poverty Status in The Past 12 Months By Sex By Educational Attainment For The Population 25 Years and Over
B16001		Language Spoken At Home By Ability To Speak English For The Population 5 Years and Over
B16002		Household Language by Linguistic Isolation
B16004		Age by Language Spoken at Home by Ability to Speak English for the Population 5 Years and over
B16005	**	Nativity by Language Spoken at Home by Ability to Speak English for the Population 5 Years and over
B16006		Language Spoken at Home by Ability to Speak English for Population 5+ Over (Hispanic or Latino)
B16007		Age By Language Spoken At Home For The Population 5 Years and Over
B16008		Citizenship Status By Age By Language Spoken At Home For The Population 5 Years and Over
B16009		Poverty Status in The Past 12 Months By Age By Language Spoken At Home For The Population 5 Years and Over
B16010		Educational Attainment and Employment Status By Language Spoken At Home For The Population 25 Years and Over
B17001	**	Poverty Status in the past 12 Months by Sex by Age
B17002		Ratio of Income in the past 12 Months to Poverty Level
B17003		Poverty Status in The Past 12 Months Of Individuals By Sex By Educational Attainment
B17004		Poverty Status in The Past 12 Months Of Individuals By Sex By Work Experience
B17005		Poverty Status in The Past 12 Months Of Individuals By Sex By Employment Status
B17006		Poverty Status of Related Children under 18 Years by Family Type by Age of Related Children Under 18 Years
B17007		Poverty Status in the past 12 Months of Unrelated Individuals 15 Years and over by Sex by Age
B17008		Aggregate Income Deficit (Dollars) in the past 12 Months of Unrelated Individuals by Sex
B17009		Poverty Status by Work Experience of Unrelated Individuals by Householder Status
B17010	**	Poverty Status of Families by Family Type by Presence and Age of Related Children under 18 Years
B17011		Aggregate Income Deficit (Dollars) in the past 12 Months for Families by Family Type
B17012		Poverty Status in The Past 12 Months Of Families By Household Type By Number Of Related Children Under 18 Years
B17013		Poverty Status in The Past 12 Months Of Families By Household Type By Number Of Persons in Family

(*continued on next page*)

Table B.1. (Continued).

Base Table Number		Table Definition
B17014		Poverty Status in The Past 12 Months Of Families By Household Type By Number Of Workers in Family
B17015		Poverty Status of Families by Family Type by Soc Sec Inc by Suppl Sec Inc (SSI) and Pub Assist Inc
B17016		Poverty Status in the past 12 Months of Families by Family Type by Work Experience of Householder and Spouse
B17017		Poverty Status in the past 12 Months by Household Type by Age of Householder
B17018		Poverty Status in The Past 12 Months Of Families By Household Type By Educational Attainment Of Householder
B17019		Poverty Status in The Past 12 Months Of Families By Household Type By Tenure
B17020	*	Poverty Status in the past 12 Months by Age
B17021		Poverty Status in The Past 12 Months Of Individuals By Household Type
B17022		Ratio Of Income To Poverty Level Of Families By Family Type By Presence Of Related Children
B18001		Sex By Age By Number Of Disabilities For The Civilian Noninstitutionalized Population 5 Years and Over
B18002		Sex By Age By Disability Status For The Civilian Noninstitutionalized Population 5 Years and Over
B18003		Sex By Age By Sensory Disability For The Civilian Noninstitutionalized Population 5 Years and Over
B18004		Sex By Age By Physical Disability For The Civilian Noninstitutionalized Population 5 Years and Over
B18005		Sex By Age By Mental Disability For The Civilian Noninstitutionalized Population 5 Years and Over
B18006		Sex By Age By Self-care Disability For The Civilian Noninstitutionalized Population 5 Years and Over
B18007		Sex By Age By Go-outside-home Disability For The Civilian Noninstitutionalized Population 16 Years and Over
B18008		Sex By Age By Employment Disability For The Civilian Noninstitutionalized Population 16 To 64 Years
B18010		Disability Status By Sex By School Enrollment By Educational Attainment For The Civ Noninst Pop 18 To 34 Years
B18011		Sensory Disability By Sex By School Enrollment By Educational Attainment For The Civ Noninst Pop 18 To 34 Years
B18012		Physical Disability By Sex By School Enrollment By Educational Attainment For The Civ Noninst Pop 18 To 34 Years
B18013		Mental Disability By Sex By School Enrollment By Educational Attainment For The Civ Noninst Pop 18 To 34 Years
B18020	**	Disability Status By Sex By Age By Employment Status For The Civilian Noninstitutionalized Population 16 To 64 Years
B18021		Sensory Disability By Sex By Age By Employment Status For The Civilian Noninstitutionalized Population 16 To 64 Years
B18022		Physical Disability By Sex By Age By Employment Status For The Civilian Noninstitutionalized Population 16 To 64 Years
B18023		Mental Disability By Sex By Age By Employment Status For The Civilian Noninstitutionalized Population 16 To 64 Years
B18025		Go-outside-home Disability By Sex By Age By Employment Status For The Civ Noninst Pop 16 Years and Over
B18026		Sex By Age By Employment Disability By Employment Status For The Civ Noninst Pop 16 To 64 Years
B18030		Disability Status By Sex By Age By Poverty Status For The Civilian Noninstitutionalized Population 5 Years and Over
B18031		Sensory Disability By Sex By Age By Poverty Status For The Civilian Noninstitutionalized Population 5 Years and Over
B18032		Physical Disability By Sex By Age By Poverty Status For The Civilian Noninstitutionalized Population 5 Years and Over
B18033		Mental Disability By Sex By Age By Poverty Status For The Civilian Noninstitutionalized Population 5 Years and Over
B19001	**	Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19013	**	Median Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)

Table B.1. (Continued).

Base Table Number		Table Definition
B19019		Median Household Income (in 2004 Inflation-adjusted Dollars) By Household Size
B19025	**	Aggregate Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19037	**	Age of Householder by Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19049		Median Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) by Age of Householder
B19050		Aggregate Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) by Age of Householder
B19051		Earnings in the past 12 Months for Households
B19052		Wage or Salary Income in the past 12 Months for Households
B19053		Self-Employment Income in the past 12 Months for Households
B19054		Interest, Dividends, or Net Rental Income in the past 12 Months for Households
B19055		Social Security Income in the past 12 Months for Households
B19056		Supplemental Security Income (SSI) in the past 12 Months for Households
B19057		Public Assistance Income in the past 12 Months for Households
B19058		Public Assistance Income Or Food Stamps in The Past 12 Months For Households
B19059		Retirement Income in the past 12 Months for Households
B19060		Other Types of Income in the past 12 Months for Households
B19061		Aggregate Earnings in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19062		Aggregate Wage or Salary Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19063		Aggregate Self-Employment Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19064		Aggregate Interest, Dividends, or Net Rental Income (In 2004 Inflation-adjusted Dollars) for Households
B19065		Aggregate Social Security Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19066		Aggregate Supplemental Security Income (SSI) (In 2004 Inflation-adjusted Dollars) for Households
B19067		Aggregate Public Assistance Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19069		Aggregate Retirement Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19070		Aggregate Other Types of Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B19101	**	Family Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19113	**	Median Family Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19119		Median Family Income (in 2004 Inflation-adjusted Dollars) By Family Size
B19121		Median Family Income (in 2004 Inflation-adjusted Dollars) By Number of Earners in Family
B19125		Median Family Income (In 2004 Inflation-adjusted Dollars) by Presence of Own Children Under 18 Years
B19126		Median Family Income (In 2004 Inflation-adjusted Dollars) by Family Type by Presence of Own Children Under 18 Years
B19127		Aggregate Family Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19128		Aggregate Family Income (In 2004 Inflation-adjusted Dollars) by Family Type by Presence of Own Children Under 18 Years
B19129		Aggregate Family Income (In 2004 Inflation-adjusted Dollars) by Number of Workers in Family
B19130		Aggregate Family Income (In 2004 Inflation-adjusted Dollars) by Family Type by Age of Householder
B19131		Family Type by Presence of Own Children under 18 Years by Family Income (In 2004 Inflation-adjusted Dollars)
B19201		Nonfamily Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19202	**	Median Nonfamily Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)

(*continued on next page*)

Table B.1. (Continued).

Base Table Number		Table Definition
B19214		Aggregate Nonfamily Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19215		Median Nonfamily Household Income (In 2004 Inflation-adjusted Dollars) by Sex of Hhldr by Living Alone by Age of Hhldr
B19216		Aggregate Nonfamily Household Income (In 2004 Inflation-Adjusted Dollars) by Sex of Hhldr by Living Alone by Age of Hhld
B19301	**	Per Capita Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19313	**	Aggregate Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B19325		Sex by Work Experience by Income (In 2004 Inflation-adjusted Dollars) for the Population 15+ Years
B19326		Median Income (In 2004 Inflation-adjusted Dollars) by Sex by Work Experience for the Population 15+ Years
B20001		Sex by Earnings in the Past 12 Months (In 2004 Inflation-adjusted Dollars) for the Population 16+ Years with Earnings
B20002		Median Earnings in past 12 Months (In 2004 Inflation-adjusted Dollars) by Sex for the Population 16+ Years with Earnings
B20003		Aggregate Earnings (In 2004 Inflation-adjusted Dollars) by Sex for Full-time, Year-round Workers 16+ Years
B20004		Median Earnings in The Past 12 Months By Sex By Educational Attainment For The Pop 25 Yrs and Older
B20005	**	Sex by Work Experience by Earnings (In 2004 Inflation-adjusted Dollars) for the Population 16+ Years
B20017	**	Median Earnings (In 2004 Inf-adj Dollars) by Sex by Work Experience for the Pop 16+ Years with Earnings
B21001	**	Sex By Age By Armed Forces Status By Veteran Status For The Population 18 Years and Over
B21002		Period of Military Service for Civilian Veterans 18 Years and over
B21003		Veteran Status By Educational Attainment For The Population 25 To 64 Years
B21004		Median Income in The Past 12 Months (in 2004 Inf-Adj dlars) By Veteran Status For The Pop 18 Yrs and Over With Income
B21005		Age By Veteran Status By Employment Status For The Population 18 Years and Over
B21006		Age By Veteran Status By Poverty Status in The Past 12 Months By Disability Status For The Population 18 Years and Over
B22001		Receipt of Food Stamps in the past 12 Months by Presence of People 60 Years and over for Households
B22002		Receipt of Food Stamps by Presence of Children Under 18 Years by Household Type for Households
B22003		Receipt Of Food Stamps in The Past 12 Months By Poverty Status in The Past 12 Months For Households
B22004		Receipt Of Food Stamps in The Past 12 Months By Disability Status For Households
B22005	*	Receipt Of Food Stamps in The Past 12 Months By Race Of Householder
B22007		Receipt Of Food Stamps in The Past 12 Months By Family Type By Number Of Workers in Family in The Past 12 Months
B22008		Median Income Of Householder in The Past 12 Months By Receipt Of Food Stamps in The Past 12 Months
B22009		Aggregate Food Stamp Benefits in the past 12 Months (In 2004 Inflation-adjusted Dollars) for Households
B23001		Sex by Age by Employment Status for the Population 16 Years and over
B23002	*	Sex by Age by Employment Status for the Population 16 Years and over
B23003		Presence Of Own Chldrn Under 18 Yrs By Age Of Own Chldrn Under 18 Yrs By Employment Status For Females 16 Yrs and Over
B23004		Work Status in The Past 12 Months By Age By Employment Status For The Population 65 Years and Over
B23005		Poverty Status in The Past 12 Months By Disability Status By Employment Status For The Population 16 Years and Over
B23006		Educational Attainment By Employment Status For The Population 25 Years and Over
B23007		Presence and Age Of Own Children By Family Type By Employment Status

Table B.1. (Continued).

Base Table Number		Table Definition
B23008		Age of Own Children Under 18 Years in Families and Subfamilies by Living Arrangements by Employment Status of Parents
B23009		Presence and Age Of Own Children By Family Type By Number Of Workers in The Family in The Past 12 Months
B23010		Presence Of Children Under 18 Years in Married-couple Families By Work Experience Of Householder and Spouse
B23011		Sex By Dsblty Status By Work Status By Usual Hours Worked Per Week By Weeks Worked For The Pop 16 To 64 Yrs
B23013		Median Age By Sex For The Working Population 16 To 64 Years
B23014		Mean Earnings in the Past 12 Mths by Sex by Work Experience in the Past 12 Mths for the Pop 16+ with Earnings
B23017		Aggregate Earnings in The Past 12 Months By Sex By Work Experience For The Pop 16 Yrs and Over With Earnings
B23018		Aggregate Hours Worked By Sex For Workers 16 To 64 Years
B23019		Aggregate Weeks Worked By Sex For Workers 16 To 64 Years
B23020		Mean Hours Worked For The Working Population 16 To 64 Years
B23021		Mean Weeks Worked For The Working Population 16 To 64 Years
B24010	**	Sex By Occupation For The Civilian Employed Population 16 Years and Over
B24011		Sex By Occupation and Median Earnings For The Civilian Employed Population 16 Years and Over
B24020		Sex By Occupation For The Full-time, Year-round Civilian Employed Population 16 Years and Over
B24021		Sex By Occupation and Median Earnings For The Full-time, Year-round Civilian Employed Population 16 Years and Over
B24030		Sex By Industry For The Civilian Employed Population 16 Years and Over
B24031		Sex By Industry and Median Earnings For The Civilian Employed Population 16 Years and Over
B24040		Sex By Industry For The Full-time, Year-round Civilian Employed Population 16 Years and Over
B24041		Sex By Ind and Median Earnings in The Past 12 Months For The Full-time, Year-round Civilian Empld Pop 16 Yrs and Over
B24050		Industry By Occupation For The Civilian Employed Population 16 Years and Over
B24060		Occupation By Class Of Worker For The Civilian Employed Population 16 Years and Over
B24070		Industry By Class Of Worker For Civilian Employed Population 16 Years and Over
B24080		Sex By Class Of Worker For The Civilian Employed Population 16 Years and Over
B24081		Sex By Class Of Worker and Median Earnings For The Full-time, Year-round Civilian Employed Population 16 Years and Over
B25001		Housing Units
B25002		Occupancy Status
B25003	**	Tenure
B25004		Vacancy Status
B25005		Vacant – Current Residence Elsewhere
B25006		Race of Householder
B25007		Tenure by Age of Householder
B25008		Total Population in Occupied Housing Units by Tenure
B25009		Tenure by Household Size
B25010		Average Household Size of Occupied Housing Units by Tenure
B25011		Tenure by Household Type (including Living Alone) and Age of Householder
B25012		Tenure By Families And Presence Of Own Children
B25013		Tenure By Educational Attainment Of Householder
B25014	**	Tenure by Occupants per Room
B25015		Tenure by Age of Householder by Occupants per Room
B25016		Tenure by Plumbing Facilities by Occupants per Room

(*continued on next page*)

Table B.1. (Continued).

Base Table Number		Table Definition
B25017		Rooms
B25018		Median Number of Rooms
B25019		Aggregate Number of Rooms
B25020		Tenure by Rooms
B25021		Median Number of Rooms by Tenure
B25022		Aggregate Number of Rooms by Tenure
B25023		Aggregate Number of Rooms by Vacancy Status
B25024		Units in Structure
B25025		Units In Structure By Vacancy Status
B25026		Units In Structure By Residence Status
B25027		Units In Structure By Year Structure Built
B25028		Units In Structure By Rooms
B25029		Unit In Structure By Bedrooms
B25030		Unit In Structure By Plumbing Facilities
B25031		Unit In Structure By Kitchen Facilities
B25032	**	Tenure By Units In Structure
B25033		Total Population in Occupied Housing Units by Tenure by Units in Structure
B25034		Year Structure Built
B25035		Median Year Structure Built
B25036		Tenure by Year Structure Built
B25037		Median Year Structure Built by Tenure
B25038	**	Tenure by Year Householder Moved into Unit
B25039		Median Year Householder Moved into Unit by Tenure
B25040		House Heating Fuel
B25041		Bedrooms
B25042		Tenure by Bedrooms
B25043	**	Tenure by Telephone Service Available by Age of Householder
B25044	**	Tenure by Vehicles Available
B25045		Tenure by Vehicles Available by Age of Householder
B25046		Aggregate Number of Vehicles Available by Tenure
B25047		Plumbing Facilities
B25048	**	Plumbing Facilities
B25049		Tenure by Plumbing Facilities
B25050		Plumbing Facilities by Occupants per Room by Year Structure Built
B25051		Kitchen Facilities
B25052	**	Kitchen Facilities
B25053		Tenure by Kitchen Facilities
B25054		Kitchen Facilities by Meals Included in Rent
B25055		Age of Householder by Meals Included in Rent
B25056		Contract Rent
B25057		Lower Contract Rent Quartile (Dollars)
B25058		Median Contract Rent (Dollars)
B25059		Upper Contract Rent Quartile (Dollars)
B25060		Aggregate Contract Rent (Dollars)
B25061		Rent Asked
B25062		Aggregate Rent Asked (Dollars)

Table B.1. (Continued).

Base Table Number	Table Definition
B25063	Gross Rent
B25064	Median Gross Rent (Dollars)
B25065	Aggregate Gross Rent (Dollars)
B25066	Aggregate Gross Rent (Dollars) by Units in Structure [8]
B25067	Aggregate Gross Rent (Dollars) by Meals Included in Rent
B25068	Bedrooms by Gross Rent
B25069	Inclusion of Utilities in Rent
B25070	Gross Rent as a Percentage of Household Income in the past 12 Months
B25071	Median Gross Rent As A Percentage of Household Income in the past 12 Months (Dollars)
B25072	Age of Householder by Gross Rent as a Percentage of Household Income in the past 12 Months
B25073	Units in Structure by Gross Rent as a Percentage of Household Income in the past 12 Months
B25074	Household Income by Gross Rent as a Percentage of Household Income in the past 12 Months
B25075	Value for Owner-Occupied Housing Units
B25076	Lower Value Quartile (Dollars) for Owner-Occupied Housing Units
B25077	Median Value (Dollars) for Owner-Occupied Housing Units
B25078	Upper Value Quartile (Dollars) for Owner-Occupied Housing Units
B25079	Aggregate Value (Dollars) for Owner-Occupied Housing Units by Age of Householder
B25080	Aggregate Value (Dollars) for All Owner-Occupied Housing Units by Units in Structure
B25081	Mortgage Status
B25082	Aggregate Value (Dollars) by Mortgage Status
B25083	Median Value (Dollars) for Mobile Homes
B25085	Price Asked
B25086	Aggregate Price Asked (Dollars)
B25087	Mortgage Status and Selected Monthly Owner Costs for Owner-Occupied Housing Units
B25088	Median Selected Monthly Owner Costs (Dollars) by Mortgage Status
B25089	Aggregate Selected Monthly Owner Costs (Dollars) for Owner-Occupied Housing Units by Mortgage Status
B25091	Mortgage Status by Selected Monthly Owner Costs as a Percentage of Household Income in the past 12 Months
B25092	Median Selected Monthly Owner Costs As A Percentage of Household Income in the past 12 Months
B25093	Age of Householder by Selected Monthly Owner Costs as a Percentage of Household Income in the past 12 Months
B25094	Selected Monthly Owner Costs For Owner-occupied Housing Units
B25096	Mortgage Status By Value For Owner-occupied Housing Units
B25097	Mortgage Status By Median Value (dollars) For Owner-occupied Housing Units
B25098	Mortgage Status By Household Income In The Past 12 Months (in 2004 Inflation Adjusted Dollars)
B25099	Mortgage Status By Median Household Income In The Past 12 Months (in 2004 Inflation Adjusted Dollars)
B25100	Mortgage Status By Ratio Of Value To Current Household Income In The Past 12 Months
B25101	Mortgage Status By Monthly Housing Costs As A Percentage Of Household Income In The Past 12 Months
B25102	Mortgage Status By Real Estate Taxes Paid
B25103	Mortgage Status By Median Real Estate Taxes Paid (dollars)
B25104	Monthly Housing Cost
B25105	Mortgage Status By Median Monthly Housing Costs (dollars)
B25106	Tenure By Housing Costs As A Percentage Of Household Income In The Past 12 Months
B25107	Median Value For Owner-occupied Housing Units By Year Structure Built

(*continued on next page*)

Table B.1. (Continued).

Base Table Number	Table Definition
B25108	Aggregate Value For Owner-occupied Housing Units By Year Structure Built
B25109	Median Value For Owner-occupied Housing Units By Year Householder Moved Into Unit
B25110	Aggregate Value For Owner-occupied Housing Units By Year Householder Moved Into Unit
B25111	Median Gross Rent For Renter-occupied Housing Units By Year Structure Built
B25112	Aggregate Gross Rent For Renter-occupied Housing Units By Year Structure Built
B25113	Median Gross Rent For Renter-occupied Housing Units By Year Householder Moved Into Unit
B25114	Aggregate Gross Rent For Renter-occupied Housing Units By Year Householder Moved Into Unit
B25115	Tenure by Household Type and Presence and Age of Own Children
B25116	Tenure by Household Size by Age of Householder
B25117	Tenure by House Heating Fuel
B25118	Tenure by Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars)
B25119	Median Household Income the past 12 Months (In 2004 Inflation-adjusted Dollars) by Tenure
B25120	Aggregate Household Income (In 2004 Inflation-adjusted Dollars) by Tenure and Mortgage Status
B25121	Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) by Value
B25122	Household Income in the past 12 Months (In 2004 Inflation-adjusted Dollars) by Gross Rent
B25123	Tenure by Selected Physical and Financial Conditions
B99011	Imputation of Sex
B99012	Imputation of Age
B99021	Imputation of Race
B99031	Imputation of Hispanic or Latino
B99051	Imputation of Citizenship Status
B99052	Imputation of Year of Entry for Population born outside the United States
B99061	Imputation of Place of Birth
B99071	Imputation of Mobility Status for the Population 1 Year and over
B99072	Imputation of Residence 1 Year Ago for the Population 1 Year and over
B99081	Imputation of Means of Transportation to Work Workers 16 Years and over
B99082	Imputation of Place of Work for Workers 16 Years and over
B99083	Imputation of Private Vehicle Occupancy for Workers 16 Years and over
B99084	Imputation of Time Leaving Home to Go to Work for Workers 16 Years and over
B99085	Imputation of Travel Time to Work for Workers 16 Years and over
B99086	Imputation Of Vehicles Available For Workers
B99087	Imputation of Time Arriving at Work from Home
B99092	Imputation Of Relationship
B99093	Imputation Of Age For Teenagers 15 To 18 Years
B99102	Imputation of Grandparent Status Living with Own Grandchildren Under 18 Years for the Pop 30+ Years in Households
B99103	Imputation Of Grandparents Responsible For Grandchildren Under 18 Years
B99104	Imputation of Length of Time Grandparent Responsible for Own Grandchildren Under 18 Yrs for the Pop 30+ Yrs in Hhld
B99121	Imputation of Marital Status for the Population 15 Years and over
B99131	Imputation Of Marital Status For Females 15 To 50 Years
B99132	Imputation of Fertility of Women 15 to 50 Years Old
B99141	Imputation of School Enrollment for the Population 3 Years and over
B99142	Imputation of Grade Enrolled for the Population 3 Years and over Enrolled in School
B99151	Imputation of Educational Attainment for the Population 25 Years and over
B99161	Imputation of Language Status for the Population 5 Years and over

Table B.1. (Continued).

Base Table Number	Table Definition
B99162	Imputation of Language Spoken at Home for the Population 5 Years and over
B99163	Imputation of Ability to Speak English for the Population 5 Years and over
B99171	Imputation of Poverty Status in the Past 12 Months for Unrelated Individuals
B99172	Imputation of Poverty Status in the past 12 Months for Families
B99181	Imputation of Disability Items for the Civilian Noninstitutionalized Population 5 Years and over
B99182	Imputation of Sensory Disability for the Civilian Noninstitutionalized Population 5 Years and over
B99183	Imputation of Physical Disability for the Civilian Noninstitutionalized Population 5 Years and over
B99184	Imputation of Mental Disability for the Civilian Noninstitutionalized Population 5 Years and over
B99185	Imputation of Self-care Disability for the Civilian Noninstitutionalized Population 5 Years and over
B99186	Imputation of Go-outside-home Disability for the Civilian Noninstitutionalized Population 16 Years and over
B99187	Imputation of Employment Disability for the Civilian Noninstitutionalized Population 16 to 64 Years
B99191	Imputation of Individuals' Income – Percent of Income Imputed for the Population 15 Years and over
B99192	Imputation of Household Income in the past 12 Months – Percent of Income Imputed
B99193	Imputation of Family Income in the past 12 Months – Percent of Income Imputed
B99194	Imputation of Nonfamily Household Income in the past 12 Months – Percent of Income Imputed
B99201	Imputation of Earnings in the past 12 Months for the Population 16 Years and over – Percent of Earnings Imputed
B99211	Imputation of Veteran Status for the Population 18 Years and over
B99212	Imputation of Period of Military Service for Civilian Veterans 18 Years and over
B99213	Imputation of Length of Military Service for Civilian Veterans 18 Years and over
B99214	Imputation of Employment Status for the Population 16 Years and over
B99215	Imputation of When Person Last Worked for the Population 16 Years and over
B99216	Imputation of Usual Hours Worked per Week in the past 12 Months for the Population 16 Years and over
B99217	Imputation of Weeks Worked in the past 12 Months for the Population 16 Years and over
B99218	Imputation of Food Stamps Receipt
B99241	Imputation Of Industry For The Civilian Employed Population 16 Years and Over
B99242	Imputation Of Occupation For The Civilian Employed Population 16 Years and Over
B99243	Imputation Of Class Of Worker For The Civilian Employed Population 16 Years and Over
B99244	Imputation Of Industry For The Full-time, Year-round Employed Civilian Population 16 Years and Over
B99245	Imputation Of Occupation For The Full-time, Year-round Employed Civilian Population 16 Years and Over
B99246	Imputation Of Class Of Worker For The Full-time, Year-round Employed Civilian Population 16 Years and Over
B99252	Imputation of Tenure
B99253	Imputation of Vacancy Status
B99254	Imputation of Rooms
B99255	Imputation of Units in Structure
B99256	Imputation of Year Structure Built
B99257	Imputation of Year Householder Moved into Unit
B99258	Imputation of Bedrooms
B99259	Imputation of Plumbing Facilities
B992510	Imputation of Kitchen Facilities
B992511	Imputation of House Heating Fuel
B992512	Imputation of Vehicles Available
B992513	Imputation of Telephone Service Available

(*continued on next page*)

Table B.1. (Continued).

Base Table Number	Table Definition
B992514	Imputation of Meals Included in Rent
B992515	Imputation of Contract Rent
B992516	Imputation of Rent Asked
B992518	Imputation Of Gross Rent For Renter-occupied Housing Units
B992519	Imputation of Value for Owner-Occupied Housing Units
B992520	Imputation of Price Asked for Vacant-For-Sale-Only Housing Units
B992521	Imputation of Mortgage Status for Owner-Occupied Housing Units
B992522	Imputation of Mortgage Status and Selected Monthly Owner Costs
B992523	Imputation Of Selected Monthly Owner Costs For Owner-occupied Housing Units

Source: Census Bureau American Fact Finder Web Site, accessed January 2006.

Notes: * indicates that the table is available as nine separate race/ethnicity-specific tables:
White alone
Black or African American Alone
American Indian and Alaska Native Alone
Asian Alone
Native Hawaiian and Other Pacific Islander Alone
Some Other Race Alone
Two or more races
White Alone, Not Hispanic or Latino
Hispanic or Latino

** indicates that the table is available for the overall population as well as separately for the specific race/ethnicity categories listed above

Table B.2. ACS Journey-to-work base tables by place of residence.

	Title	Universe	Cells
B08006	Sex of Workers 3) by Means of Transportation (21)	Workers 16 years and over	63
B08007	Sex of Workers 3) by Place of Work – State and County Level (5)	Workers 16 years and over	15
B08008	Sex of Workers 3) by Place of Work – Place Level (5)	Workers 16 years and over	15
B08009	Sex of Workers 3) by Place of Work – Minor Civil Division Level for 12 Selected States (Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Wisconsin) (5)	Workers 16 years and over	15
B08011	Sex of Workers 3) by Time Leaving Home to Go to Work (15)	Workers 16 years and over who did not work at home	45
B08012	Sex of Workers 3) by Travel Time to Work (13)	Workers 16 years and over who did not work at home	39
B08013	Aggregate Travel Time to Work (in Minutes) of Workers by Sex (3)	Workers 16 years and over who did not work at home	3
B08014	Sex of Workers 3) by Vehicles Available (7)	Workers 16 years and over in households	21
B08101	Means of Transportation to Work 7) by Age (9)	Workers 16 years and over	63
B08102	Aggregate Travel Time to Work (in Minutes) of Workers by Age (9)	Workers 16 years and over who did not work at home	9
B08103	Median Age by Means of Transportation to Work (7)	Workers 16 years and over	7
B08105	Means of Transportation to Work 7) (White Alone)	Race/ethnicity-specific workers 16 years and over	7
B08106	Aggregate Travel Time to Work (in Minutes) of Workers (White Alone)	Race/ethnicity-specific workers 16 years and over who did not work at home	1
B08111	Means of Transportation to Work 7) by Citizenship Status (5)	Workers 16 years and over	35
B08112	Aggregate Travel Time to Work (in Minutes) of Workers by Citizenship Status (5)	Workers 16 years and over who did not work at home	5
B08113	Means of Transportation to Work 7) by Language Spoken at Home and Ability to Speak English (8)	Workers 16 years and over	56
B08114	Aggregate Travel Time to Work (in Minutes) of Workers by Language Spoken at Home and Ability to Speak English (8)	Workers 16 years and over who did not work at home	8
B08115	Means of Transportation to Work 7) by Marital Status (6)	Workers 16 years and over	42
B08116	Aggregate Travel Time to Work (in Minutes) of Workers by Marital Status (6)	Workers 16 years and over who did not work at home	6
B08117	Means of Transportation to Work 7) by Educational Attainment (6)	Workers 25 years and over	42
B08118	Aggregate Travel Time to Work (in Minutes) of Workers by Educational Attainment (6)	Workers 25 years and over who did not work at home	6
B08119	Means of Transportation to Work 7) by Earnings in the Past 12 Months 9) (in 2004 Inflation-Adjusted Dollars) for Workers	Workers 16 years and over with earnings	63
B08120	Aggregate Travel Time to Work (in Minutes) of Workers by Earnings in the Past 12 Months 9) (in 2004 Inflation-Adjusted Dollars)	Workers 16 years and over who did not work at home with earnings	9
B08121	Median Earnings in the Past 12 Months 9 in 2004 Inflation-Adjusted Dollars) by Means of Transportation to Work (7)	Workers 16 years and over with earnings	7
B08122	Means of Transportation to Work 7) by Poverty Status in the Past 12 Months	Workers for whom poverty status is determined	28
B08123	Aggregate Travel Time to Work (in Minutes) of Workers by Poverty Status in the Past 12 Months (4)	Workers for whom poverty status is determined who did not work at home	4
B08124	Means of Transportation to Work 7) by Occupation (8)	Workers 16 years and over	56
B08125	Aggregate Travel Time to Work (in Minutes) of Workers by Occupation (8)	Workers 16 years and over who did not work at home	8
B08126	Means of Transportation to Work 7) by Industry (15)	Workers 16 years and over	105

(*continued on next page*)

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Table B.2. (Continued).

	Title	Universe	Cells
B08127	Aggregate Travel Time to Work (in Minutes) of Workers by Industry (15)	Workers 16 years and over who did not work at home	15
B08128	Means of Transportation to Work 7) by Class of Worker (10)	Workers 16 years and over	70
B08129	Aggregate Travel Time to Work (in Minutes) of Workers by Class of Worker (10)	Workers 16 years and over who did not work at home	10
B08130	Means of Transportation to Work 7) by Place of Work – State and County Level (5)	Workers 16 years and over	35
B08131	Aggregate Travel Time to Work (in Minutes) of Workers by Place of Work – State and County Level (5)	Workers 16 years and over who did not work at home	5
B08132	Means of Transportation to Work 6) by Time Leaving Home to Go to Work (15)	Workers 16 years and over who did not work at home	90
B08133	Aggregate Travel Time to Work (in Minutes) of Workers by Time Leaving Home to Go to Work (15)	Workers 16 years and over who did not work at home	15
B08134	Means of Transportation to Work (12) by Travel Time to Work (10)	Workers 16 years and over who did not work at home	120
B08135	Aggregate Travel Time to Work (in Minutes) of Workers by Travel Time to Work (10)	Workers 16 years and over who did not work at home	10
B08136	Aggregate Travel Time to Work (in Minutes) of Workers by Means of Transportation to Work (12)	Workers 16 years and over who did not work at home	12
B08137	Means of Transportation to Work 7) by Tenure (3)	Workers 16 years and over in households	21
B08138	Aggregate Travel Time to Work (in Minutes) of Workers by Tenure (3)	Workers 16 years and over in households who did not work at home	3
B08139	Means of Transportation to Work 7) by Household Type (3)	Workers 16 years and over in households	21
B08140	Aggregate Travel Time to Work (in Minutes) of Workers by Household Type (3)	Workers 16 years and over in households who did not work at home	3
B08141	Means of Transportation to Work 7) by Vehicles Available (7)	Workers 16 years and over in households	49
B08142	Aggregate Travel Time to Work (in Minutes) of Workers by Vehicles Available (7)	Workers 16 years and over in households who did not work at home	7
B08201	Household Size 5) by Vehicles Available (6)	Households	30
B08202	Household Size 5) by Number of Workers in Household (5)	Households	25
B08203	Number of Workers in Household 5) by Vehicles Available (6)	Households	30
B99081	Imputation of Means of Transportation to Work (3)	Workers 16 years and over	3
B99082	Imputation of Place of Work (5)	Workers 16 years and over	5
B99083	Imputation of Private Vehicle Occupancy (5)	Workers 16 years and over	5
B99084	Imputation of Time Leaving Home to Go to Work (5)	Workers 16 years and over	5
B99085	Imputation of Travel Time to Work (5)	Workers 16 years and over	5
B99086	Imputation of Vehicles Available (3)	Workers 16 years and over in households	3

Source: Phillip Salopek (Chief of Census Bureau Journey-to-Work and Migration Statistics Branch), *ACS Data Products for Use in Transportation Planning*, Presentation at the Transportation Research Board's Census Data for Transportation Planning: Preparing for the Future (May 11, 2005).

Table B.3. ACS journey-to-work base tables by place of work.

	Title	Universe	Cells
B08406	Sex of Workers 3) by Means of Transportation (21) for Workplace Geography	Workers 16 years and over	63
B08412	Sex of Workers 3) by Place of Work (13) for Workplace Geography	Workers 16 years and over who did not work at home	39
B08501	Means of Transportation to Work 7) by Age 9) for Workplace Geography	Workers 16 years and over	63
B08503	Median Age by Means of Transportation to Work 7) for Workplace Geography	Workers 16 years and over	7
B08505	Means of Transportation to Work 7) (White Alone) for Workplace Geography	Race/ethnicity-specific workers 16 years and over	7
B08511	Means of Transportation to Work 7) by Citizenship Status 5) for Workplace Geography	Workers 16 years and over	35
B08513	Means of Transportation to Work 7) by Language Spoken at Home and Ability to Speak English 8) for Workplace Geography	Workers 16 years and over	56
B08515	Means of Transportation to Work 7) by Marital Status 6) for Workplace Geography	Workers 16 years and over	42
B08517	Means of Transportation to Work 7) by Educational Attainment 6) for Workplace Geography	Workers 25 years and over	42
B08519	Means of Transportation to Work 7) by Earnings in the Past 12 Months 9) (in 2004 Inflation-Adjusted Dollars) for Workplace Geography	Workers 16 years and over with earnings	63
B08521	Median Earnings In the Past 12 Months (in 2004 Inflation-Adjusted Dollars) by Means of Transportation to Work 7) for Workplace	Workers 16 years and over with earnings	7
B08522	Means of Transportation to Work 7) by Poverty Status in the Past 12 Months 4) for Workplace Geography	Workers for whom poverty status is determined	28
B08524	Means of Transportation to Work 7) by Occupation 8) for Workplace Geography	Workers 16 years and over	56
B08526	Means of Transportation to Work 7) by Industry (15) for Workplace Geography	Workers 16 years and over	105
B08528	Means of Transportation to Work 7) by Class of Worker 10) for Workplace Geography	Workers 16 years and over	70
B08532	Means of Transportation to Work 7) by Time Arriving at Work from Home (15) for Workplace Geography	Workers 16 years and over who did not work at home	90
B08534	Means of Transportation to Work (12) by Travel Time to Work 10) for Workplace Geography	Workers 16 years and over who did not work at home	120
B08536	Aggregate Travel Time to Work (in Minutes) of Workers by Means of Transportation to Work (12) for Workplace Geography	Workers 16 years and over who did not work at home	12
B08537	Means of Transportation to Work 7) by Tenure 3) for Workplace Geography	Workers 16 years and over in households	21
B08539	Means of Transportation to Work 7) by Household Type 3) for Workplace Geography	Workers 16 years and over in households	21
B08541	Means of Transportation to Work 7) by Vehicles Available 7) for Workplace Geography	Workers 16 years and over in households	49
B99087	Imputation of Time Arriving at Work from Home 3) for Workplace Geography	Workers 16 years and over	3

Source: Phillip Salopek (Chief of Census Bureau Journey-to-Work and Migration Statistics Branch), *ACS Data Products for Use in Transportation Planning*, Presentation at the Transportation Research Board's Census Data for Transportation Planning: Preparing for the Future (May 11, 2005).

Table B.4. Variable categories for acs transportation tables.

Variable and Number of Categories	Category	Category Description
Age (9 Categories)	1	Total, All Ages
	2	16 to 19 years
	3	20 to 24 years
	4	25 to 44 years
	5	45 to 54 years
	6	55 to 59 years
	7	60 to 61 years
	8	62 to 64 years
	9	65 years and over
Citizenship Status (5 Categories)	1	Total, All Citizenship Statuses
	2	Native
	3	Foreign born
	4	Foreign-born: Naturalized U.S. Citizen
	5	Foreign-born: Not a U.S. Citizen
Class of Worker (10 Categories)	1	Total, All Classes of Workers
	2	Private For-profit Wage and Salary Workers
	3	Private For-profit Workers: Private Company Workers
	4	Private For-profit Workers: Self-employed in Incorporated Business
	5	Private Not-for-profit Wage and Salary Workers
	6	Local Government Workers
	7	State Government Workers
	8	Federal Government Workers
	9	Self-employed in Unincorporated Business
	10	Unpaid Family Workers
Earnings in the Past 12 Months for Workers (9 Categories)	1	Total, All Levels of Earnings in the Past 12 Months
	2	Less than $10,000 or loss
	3	$10,000 to $14,999
	4	$15,000 to $24,999
	5	$25,000 to $34,999
	6	$35,000 to $49,999
	7	$50,000 to $64,999
	8	$65,000 to $74,999
	9	$75,000 or more
Educational Attainment (6 Categories)	1	Total, All Educational Attainment Levels
	2	Less than High School Graduate
	3	High School Graduate (including GED)
	4	Some College or Associate's Degree
	5	Bachelor's Degree
	6	Graduate or Professional Degree
Household Size (5 Categories)	1	Total, All Household Size Categories
	2	1-Person Households
	3	2-Person Households
	4	3-Person Households
	5	4 or more Person Households
Household Type (3 Categories)	1	Total, Both Household Types
	2	In Married-Couple Family Households
	3	In Other Households
Imputation of Means of Transportation to Work (3 Categories)	1	Total, Means of Transportation With Imputation Level Known
	2	Imputed
	3	Not Imputed
Imputation of Place of Work (5 Categories)	1	Total, Place of Work With Imputation Level Known
	2	Imputed
	3	Imputed: One or More (But Not All) Geographic Parts Imputed
	4	Imputed: All Geographic Parts Imputed
	5	Not Imputed
Imputation of Private Vehicle Occupancy (5 Categories)	1	Total, Private Vehicle Occupancy Imputation
	2	Car, Truck, or Van
	3	Car, Truck, or Van: Vehicle Occupancy Imputed
	4	Car, Truck, or Van: Vehicle Occupancy Imputed
	5	Other Means (including Those Who Worked At Home)
Imputation of Time Arriving at Work from Home (3 Categories)	1	Total, Arrival Time With Imputation level Known
	2	Imputed
	3	Not Imputed

Table B.4. (Continued).

Variable and Number of Categories	Category	Category Description
Imputation of Time Leaving Home to go to Work (5 Categories)	1	Total, Departure Time With Imputation Level Known
	2	Did Not Work At Home
	3	Departure Time Imputed
	4	Departure Time Not Imputed
	5	Worked At Home
Imputation of Travel Time to Work (5 Categories)	1	Total, Travel Time With Imputation Level Known
	2	Did Not Work At Home
	3	Travel Time Imputed
	4	Travel Time Not Imputed
	5	Worked At Home
Imputation of Vehicles Available (3 Categories)	1	Total, Vehicle Availability Level Known
	2	Imputed
	3	Not Imputed
Industry (15 Categories)	1	Total, All Industries
	2	Agriculture, forestry, fishing, hunting, mining
	3	Construction
	4	Manufacturing
	5	Wholesale trade
	6	Retailtrade
	7	Transportation, warehousing, and utilities
	8	Information
	9	Finance, insurance, real estate and rental/leasing
	10	Professional, scientific, management, administrative
	11	Educational, health care, and social services
	12	Arts, entertainment, recreation, accommodation, food
	13	Other services (except public administration)
	14	Public administration
	15	Armed Forces
Language Spoken at Home (8 Categories)	1	Total, Language Spoken At Home
	2	Speak Only English
	3	Speak Spanish
	4	Speak Spanish: Speak English "Very Well"
	5	Speak Spanish: Speak English Less Than "Very Well"
	6	Speak Other Languages
	7	Speak Other Languages: Speak English "Very Well"
	8	Speak Other Languages: Speak English Less Than "Very Well"
Marital Status (6 Categories)	1	Total, All Marital Statuses
	2	Never Married
	3	Now Married, Except Separated
	4	Divorced
	5	Separated
	6	Widowed
Means of Transportation (6 Categories)	1	Total, Means of Transportation
	2	Car, Truck, or Van: Drove Alone
	3	Car, Truck, or Van: Carpooled
	4	Public Transportation (Excluding Taxicab)
	5	Walked
	6	Taxicab, Motorcycle, Bicycle, or Other Means
Means of Transportation (7 Categories)	1	Total, Means of Transportation
	2	Car, Truck, or Van: Drove Alone
	3	Car, Truck, or Van: Carpooled
	4	Public Transportation (Excluding Taxicab)
	5	Walked
	6	Taxicab, Motorcycle, Bicycle, or Other Means
	7	Worked At Home

(*continued on next page*)

Table B.4. (Continued).

Variable and Number of Categories	Category	Category Description
Means of Transportation (12 Categories)	1	Total, Means of Transportation
	2	Car, Truck, or Van
	3	Car, Truck, or Van: Drove Alone
	4	Car, Truck, or Van: Carpooled
	5	Car, Truck, or Van: In 2-Person Carpool
	6	Car, Truck, or Van: In 3-or-more Person Carpool
	7	Public Transportation (Excluding Taxicab)
	8	Public Transportation: Bus or Trolley Bus
	9	Public Transportation: Streetcar, Trolley Car, Subway or Elevated
	10	Public Transportation: Railroad or Ferryboat
	11	Walked
	12	Taxicab, Motorcycle, Bicycle, or Other Means
Means of Transportation (21 Categories)	1	Total, Means of Transportation
	2	Car, Truck, or Van
	3	Car, Truck, or Van: Drove Alone
	4	Car, Truck, or Van: Carpooled
	5	Car, Truck, or Van: In 2-Person Carpool
	6	Car, Truck, or Van: In 3-Person Carpool
	7	Car, Truck, or Van: In 4-Person Carpool
	8	Car, Truck, or Van: In 5- or 6-Person Carpool
	9	Car, Truck, or Van: In 7-or-More-Person Carpool
	10	Public Transportation (excluding Taxicab)
	11	Public Transportation: Bus or Trolley Bus
	12	Public Transportation: Streetcar or Trolley Car
	13	Public Transportation: Subway or Elevated
	14	Public Transportation: Railroad
	15	Public Transportation: Ferryboat
	16	Taxicab
	17	Motorcycle
	18	Bicycle
	19	Walked
	20	Other Means
	21	Worked at Home
Number of Workers in Household (5 Categories)	1	Total, Number of Workers in Household
	2	No Workers
	3	One Worker
	4	Two Workers
	5	Three or More Workers
Occupation (8 Categories)	1	Total, All Occupations
	2	Management, Professional, and Related Occupations
	3	Service Occupations
	4	Sales and Office Occupations
	5	Farming, Fishing, and Forestry Occupations
	6	Construction and Extraction, and Maintenance Occupations
	7	Production, Transportation, and Material Moving Occupations
	8	Armed Forces
Place of Work – State and County Levels (5 Categories)	1	Total, Place of Work – State and County Level
	2	Worked in State of Residence
	3	Worked in State of Residence: Worked in County of Residence
	4	Worked in State of Residence: Worked Outside County of Residence
	5	Worked Outside State of Residence
Poverty Status in the Past 12 Months (4 Categories)	1	Total, All Poverty Status Levels
	2	Below 100 Percent of the Poverty Level
	3	100 to 149 Percent of the Poverty Level
	4	At or Above 150 Percent of the Poverty Level
Sex of Workers (3 Categories)	1	Total, Sex of Workers
	2	Male
	3	Female
Tenure (3 Categories)	1	Total, Tenure
	2	Householder Lived in Owner-Occupied Housing Unit
	3	Householder Lived in Renter-Occupied Housing Unit

Table B.4. (Continued).

Variable and Number of Categories	Category	Category Description
Time Arriving at Work from Home/Time Leaving Home to Go To Work (15 Categories)	1	Total, Time Arriving/Departing
	2	12:00 a.m. to 4:59 a.m.
	3	5:00 a.m. to 5:29 a.m.
	4	5:30 a.m. to 5:59 a.m.
	5	6:00 a.m. to 6:29 a.m.
	6	6:30 a.m. to 6:59 a.m.
	7	7:00 a.m. to 7:29 a.m.
	8	7:30 a.m. to 7:59 a.m.
	9	8:00 a.m. to 8:29 a.m.
	10	8:30 a.m. to 8:59 a.m.
	11	9:00 a.m. to 9:59 a.m.
	12	10:00 a.m. to 10:59 a.m.
	13	11:00 a.m. to 11:59 a.m.
	14	12:00 p.m. to 3:59 p.m.
	15	4:00 p.m. to 11:59 p.m.
Travel Time to Work (10 Categories)	1	Total, Travel Time to Work
	2	Less than 10 Minutes
	3	10 to 14 Minutes
	4	15 to 19 Minutes
	5	20 to 24 Minutes
	6	25 to 29 Minutes
	7	30 to 34 Minutes
	8	35 to 44 Minutes
	9	45 to 59 Minutes
	10	60 or More Minutes
Travel Time to Work (13 Categories)	1	Total, Travel Time to Work
	2	Less Than 5 Minutes
	3	5 to 9 Minutes
	4	10 to 14 Minutes
	5	15 to 19 Minutes
	6	20 to 24 Minutes
	7	25 to 29 Minutes
	8	30 to 34 Minutes
	9	35 to 39 Minutes
	10	40 to 44 Minutes
	11	45 to 59 Minutes
	12	60 to 89 Minutes
	13	90 or More Minutes
Vehicles Available (6 Categories)	1	Total, Vehicles Available
	2	No Vehicle Available
	3	1 Vehicle Available
	4	2 Vehicles Available
	5	3 Vehicles Available
	6	4 or More Vehicles Available
Vehicles Available (7 Categories)	1	Total, Vehicles Available
	2	No Vehicle Available
	3	1 Vehicle Available
	4	2 Vehicles Available
	5	3 Vehicles Available
	6	4 Vehicles Available
	7	5 or More Vehicles Available

Source: Phillip Salopek (Chief of Census Bureau Journey-to-Workand Migration Statistics Branch), *ACS Data Products for Use in Transportation Planning*, Presentation at the TransportationResearch Board's Census Data for Transportation Planning: Preparing for the Future (May 11, 2005).

B19001. HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2004 INFLATION-ADJUSTED DOLLARS) –
Universe: HOUSEHOLDS
Data Set: 2004 American Community Survey

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Milwaukee County, Wisconsin	Estimate	Lower Bound	Upper Bound
Total:	371,678	365,457	377,899
Less than $10,000	51,404	44,373	58,435
$10,000 to $14,999	27,228	21,566	32,890
$15,000 to $19,999	23,978	19,173	28,783
$20,000 to $24,999	21,987	16,896	27,078
$25,000 to $29,999	25,682	21,563	29,801
$30,000 to $34,999	23,678	19,129	28,227
$35,000 to $39,999	17,475	13,781	21,169
$40,000 to $44,999	16,723	12,944	20,502
$45,000 to $49,999	17,933	14,170	21,696
$50,000 to $59,999	34,028	28,612	39,444
$60,000 to $74,999	36,566	31,289	41,843
$75,000 to $99,999	35,310	31,256	39,364
$100,000 to $124,999	21,976	18,075	25,877
$125,000 to $149,999	8,820	6,347	11,293
$150,000 to $199,999	5,024	3,303	6,745
$200,000 or more	3,866	2,516	5,216

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a confidence interval. The interval shown here is a 90 percent confidence interval. The stated range can be interpreted roughly as providing a 90 percent probability that the interval defined by the lower and upper bounds contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

The number of householders does not necessarily equal the number of households because of differences in the weighting schemes for the population and occupied housing units.

Explanation of Symbols:

1. An '*' entry in the lower and upper bound columns indicates that too few sample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
2. An '**' entry in the lower and upper bound columns indicates that no sample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
3. An '-' entry in the estimate column indicates that no sample observations were available to compute an estimate.
4. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
5. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
6. An '***' entry in the lower and upper bound columns indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
7. An '*****' entry in the lower and upper bound columns indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.

Figure B.1. Example of an ACS base table (or detailed table).

APPENDIX C

ACS Data Profiles

DP: General Characteristics: 2004
Data Set: 2004 American Community Survey
Geographic Area: Hudson County, New Jersey

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology

General Demographic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Total population	596,790	*****	*****
SEX AND AGE			
Male	291,685	288,898	294,472
Female	305,105	302,318	307,892
Under 5 years	42,883	*****	*****
5 to 9 years	36,289	31,715	40,863
10 to 14 years	39,812	35,168	44,456
15 to 19 years	34,669	31,166	38,172
20 to 24 years	37,365	33,663	41,067
25 to 34 years	99,893	96,238	103,548
35 to 44 years	107,814	103,303	112,325
45 to 54 years	80,215	76,318	84,112
55 to 59 years	30,193	25,132	35,254
60 to 64 years	23,485	19,317	27,653
65 to 74 years	33,741	31,267	36,215
75 to 84 years	19,957	17,004	22,910
85 years and over	10,474	8,048	12,900
Median age (years)	35.8	35.2	36.4
18 years and over	456,334	*****	*****
21 years and over	435,689	431,169	440,209
62 years and over	76,101	71,690	80,512
65 years and over	64,172	61,471	66,873

Figure C.1. Example of an ACS data profile, general characteristics.

General Demographic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
18 years and over	456,334	*****	*****
Male	221,090	*****	*****
Female	235,244	*****	*****
65 years and over	64,172	61,471	66,873
Male	25,923	24,057	27,789
Female	38,249	37,014	39,484
RACE			
One race	590,437	587,536	593,338
Two or more races	6,353	3,452	9,254
Total population	596,790	*****	*****
One race	590,437	587,536	593,338
White	298,602	285,049	312,155
Black or African American	78,638	75,394	81,882
American Indian and Alaska Native	1,072	0	2,480
Cherokee tribal grouping	N	N	N
Chippewa tribal grouping	N	N	N
Navajo tribal grouping	N	N	N
Sioux tribal grouping	N	N	N
Asian	64,783	63,913	65,653
Asian Indian	28,345	21,642	35,048
Chinese, except Taiwanese	9,563	5,231	13,895
Filipino	16,139	10,228	22,050
Japanese	719	0	1,880
Korean	3,659	988	6,330
Vietnamese	5,705	1,304	10,106
Other Asian	653	0	1,752
Native Hawaiian and Other Pacific Islander	0	0	538
Native Hawaiian	N	N	N
Guamanian or Chamorro	N	N	N
Samoan	N	N	N
Other Pacific Islander	N	N	N

Figure C.1. (Continued).

(*continued on next page*)

General Demographic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Some other race	147,342	133,523	161,161
Two or more races	6,353	3,452	9,254
White and Black or African American	588	0	1,346
White and American Indian and Alaska Native	0	0	538
White and Asian	926	56	1,796
Black or African American and American Indian and Alaska Native	890	0	2,360
Race alone or in combination with one or more other races:			
Total population	596,790	*****	*****
White	303,500	289,876	317,124
Black or African American	80,732	77,955	83,509
American Indian and Alaska Native	N	N	N
Asian	65,845	65,614	66,076
Native Hawaiian and Other Pacific Islander	N	N	N
Some other race	151,291	137,476	165,106
HISPANIC ORIGIN AND RACE			
Total population	596,790	*****	*****
Hispanic or Latino (of any race)	247,792	*****	*****
Mexican	13,886	7,329	20,443
Puerto Rican	40,321	29,113	51,529
Cuban	29,432	23,314	35,550
Other Hispanic or Latino	164,153	151,153	177,153
Not Hispanic or Latino	348,998	*****	*****
White alone	205,170	204,715	205,625
Black or African American alone	75,431	73,156	77,706
American Indian or Alaska Native alone	247	0	672
Asian alone	64,783	63,913	65,653
Native Hawaiian and Other Pacific Islander alone	0	0	538
Some other race alone	818	0	1,840
Two or more races:	2,549	414	4,684
Two races, including Some other race	145	0	398

Figure C.1. (Continued).

General Demographic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Two races, excluding Some other race, and Three or more races	2,404	299	4,509
RELATIONSHIP			
Household population	596,790	*****	*****
Householder	233,191	223,646	242,736
Spouse	99,945	92,196	107,694
Child	168,363	158,603	178,123
Other relatives	53,799	41,297	66,301
Nonrelatives	41,492	34,117	48,867
Unmarried partner	16,956	12,716	21,196
HOUSEHOLDS BY TYPE			
Total households	223,946	219,175	228,717
Family households (families)	133,121	125,383	140,859
With own children under 18 years	63,642	56,962	70,322
Married-couple families	92,567	84,281	100,853
With own children under 18 years	44,567	38,037	51,097
Female householder, no husband present	30,809	25,857	35,761
With own children under 18 years	17,133	13,122	21,144
Nonfamily households	90,825	83,474	98,176
Householder living alone	68,611	61,570	75,652
65 years and over	18,451	14,387	22,515
Households with one or more people under 18 years	71,146	64,101	78,191
Households with one or more people 65 years and over	46,013	42,211	49,815
Average household size	2.66	2.60	2.72
Average family size	3.46	3.33	3.59

Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a confidence interval. The interval shown here is a 90 percent confidence interval. The stated range can be interpreted roughly as providing a 90 percent probability that the interval defined by the lower and upper bounds contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:

· The number of householders does not necessarily equal the number of households because of differences in the weighting schemes for the population and occupied housing units.

· For more information on understanding race and Hispanic origin data, please see the Census 2000 Brief entitled, http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf, issued March 2001. (pdf format)

Explanation of Symbols:

1. An '*' entry in the lower and upper bound columns indicates that too few sample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
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8. An 'N' entry in the estimate, lower bound, and upper bound columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure C.1. (Continued).

DP: Social Characteristics: 2004
Data Set: 2004 American Community Survey
Geographic Area: Hudson County, New Jersey

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Selected Social Characteristics: 2004	Estimate	Lower Bound	Upper Bound
SCHOOL ENROLLMENT			
Population 3 years and over enrolled in school	148,663	142,192	155,134
Nursery school, preschool	14,231	10,183	18,279
Kindergarten	5,637	2,962	8,312
Elementary school (grades 1-8)	65,300	61,462	69,138
High school grade (grades 9-12)	28,211	25,707	30,715
College or graduate school	35,284	29,539	41,029
EDUCATIONAL ATTAINMENT			
Population 25 years and over	405,772	402,500	409,044
Less than 9th grade	44,600	37,116	52,084
9th to 12th grade, no diploma	43,044	36,321	49,767
High school graduate (including equivalency)	125,122	114,005	136,239
Some college, no degree	55,787	47,770	63,804
Associate degree	13,407	9,527	17,287
Bachelor's degree	89,399	79,051	99,747
Graduate or professional degree	34,413	27,666	41,160
Percent high school graduate or higher	78.4	76.0	80.8
Percent bachelor's degree or higher	30.5	27.4	33.6
MARITAL STATUS			
Males 15 years and over	232,660	231,154	234,166
Never married	87,915	81,326	94,504
Now married, except separated	107,904	99,549	116,259
Separated	5,855	3,436	8,274
Widowed	9,185	5,379	12,991

Figure C.2. Example of an ACS data profile, social characteristics.

Selected Social Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Divorced	21,801	16,222	27,380
Females 15 years and over	245,146	243,582	246,710
Never married	83,349	75,419	91,279
Now married, except separated	106,252	98,603	113,901
Separated	4,903	2,363	7,443
Widowed	24,552	20,683	28,421
Divorced	26,090	20,935	31,245
FERTILITY			
Number of women 15 to 50 years old who had a birth in the past 12 months	6,083	3,297	8,869
Unmarried women (widowed, divorced, and never married)	1,679	466	2,892
Per 1,000 unmarried women	18	5	31
Per 1,000 women 15 to 50 years old	37	20	54
Per 1,000 women 15 to 19 years old	0	0	38
Per 1,000 women 20 to 34 years old	65	27	103
Per 1,000 women 35 to 50 years old	20	6	34
GRANDPARENTS			
Number of grandparents living with own grandchildren under 18 years in households	8,595	5,318	11,872
Responsible for grandchildren	3,958	1,742	6,174
Years responsible for grandchildren			
Less than 1 year	1,755	74	3,436
1 or 2 years	550	0	1,208
3 or 4 years	895	62	1,728
5 or more years	758	0	1,720
Characteristics of grandparents responsible for own grandchildren under 18 years			
Who are female	70.2	39.0	100.0
Who are married	55.1	23.6	86.6
Who are in labor force	56.9	31.7	82.1
Who are in poverty	32.7	0.0	67.8

Figure C.2. (Continued).

(*continued on next page*)

Selected Social Characteristics: 2004	Estimate	Lower Bound	Upper Bound
VETERAN STATUS			
Civilian population 18 years and over	456,334	456,331	456,337
Civilian veterans	18,687	14,900	22,474
DISABILITY STATUS of the civilian noninstitutionalized population			
Population 5 years and over	553,907	553,903	553,911
With a disability	63,712	55,093	72,331
Population 5 to 15 years	82,384	79,941	84,827
With a disability	2,633	1,090	4,176
Population 16 to 64 years	407,351	403,600	411,102
With a disability	40,232	33,171	47,293
Population 65 years and over	64,172	61,471	66,873
With a disability	20,847	17,199	24,495
RESIDENCE 1 YEAR AGO			
Population 1 year and over	590,133	586,738	593,528
Same house	516,605	501,974	531,236
Different house in the U.S.	70,205	55,914	84,496
Same county	46,424	33,146	59,702
Different county	23,781	16,718	30,844
Same state	12,749	6,759	18,739
Different state	11,032	7,177	14,887
Abroad	3,323	968	5,678
PLACE OF BIRTH			
Total population	596,790	*****	*****
Native	368,835	353,344	384,326
Born in United States	347,256	332,263	362,249
State of residence	259,359	246,088	272,630
Different state	87,897	77,063	98,731
Born in Puerto Rico, U.S. Island areas, or born abroad to American parent(s)	21,579	14,187	28,971
Foreign born	227,955	212,464	243,446

Figure C.2. (Continued).

Selected Social Characteristics: 2004	Estimate	Lower Bound	Upper Bound
U.S. CITIZENSHIP STATUS			
Foreign-born population	227,955	212,464	243,446
Naturalized U.S. citizen	113,499	101,703	125,295
Not a U.S. citizen	114,456	102,247	126,665
YEAR OF U.S. ENTRY			
Population born outside the United States	249,534	234,541	264,527
Native	21,579	14,187	28,971
Foreign Born	227,955	212,464	243,446
Native	21,579	14,187	28,971
Entered U.S. 2000 or later	833	0	1,725
Entered U.S. before 2000	20,746	13,543	27,949
Foreign Born	227,955	212,464	243,446
Entered U.S. 2000 or later	38,970	28,153	49,787
Entered U.S. before 2000	188,985	176,790	201,180
WORLD REGION OF BIRTH OF FOREIGN BORN			
Foreign-born population excluding population born "At sea"	227,955	212,464	243,446
Europe	25,464	17,926	33,002
Asia	41,213	35,104	47,322
Africa	10,027	5,123	14,931
Oceania	691	0	1,427
Latin America	147,974	133,601	162,347
Northern America	2,586	0	5,282
LANGUAGE SPOKEN AT HOME			
Population 5 years and over	553,907	*****	*****
English only	242,408	228,480	256,336
Language other than English	311,499	297,571	325,427
Speak English less than "very well"	159,281	144,585	173,977
Spanish	214,460	207,526	221,394
Speak English less than "very well"	115,277	105,845	124,709
Other Indo-European languages	58,476	45,448	71,504
Speak English less than "very well"	27,883	19,272	36,494

Figure C.2. (Continued).

(*continued on next page*)

Selected Social Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Asian and Pacific Islander languages	28,329	22,151	34,507
Speak English less than "very well"	9,661	5,888	13,434
Other languages	10,234	4,488	15,980
Speak English less than "very well"	6,460	2,126	10,794
ANCESTRY (TOTAL REPORTED)			
Total Population	596,790	*****	*****
American	4,012	1,834	6,190
Arab	7,827	3,183	12,471
Czech	1,158	66	2,250
Danish	155	0	418
Dutch	2,555	475	4,635
English	10,431	7,278	13,584
French (except Basque)	4,842	2,060	7,624
French Canadian	210	0	587
German	28,369	23,134	33,604
Greek	3,067	1,170	4,964
Hungarian	3,170	1,333	5,007
Irish	44,941	38,238	51,644
Italian	69,983	59,002	80,964
Lithuanian	773	128	1,418
Norwegian	990	253	1,727
Polish	28,135	19,229	37,041
Portuguese	14,252	7,978	20,526
Russian	9,389	4,940	13,838
Scotch-Irish	4,156	2,064	6,248
Scottish	2,644	1,221	4,067
Slovak	1,600	547	2,653
Sub-Saharan African	4,509	0	9,073
Swedish	2,567	1,234	3,900
Swiss	1,034	0	2,315
Ukrainian	1,639	153	3,125
Welsh	730	22	1,438
West Indian (excluding Hispanic origin groups)	6,569	3,168	9,970

Source: U.S. Census Bureau, 2004 American Community Survey.

Figure C.2. (Continued).

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a confidence interval. The interval shown here is a 90 percent confidence interval.The stated range can be interpreted roughly as providing a 90 percent probability that the interval defined by the lower and upper bounds contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:

· Ancestry listed in this table refers to the total number of people who responded with a particular ancestry; for example, the estimate given for Russian represents the number of people who listed Russian as either their first or second ancestry. This table lists only the largest ancestry groups; see the Detailed Tables for more categories. Race and Hispanic origin groups are not included in this table because official data for those groups come from the Race and Hispanic origin questions rather than the ancestry question (see Demographic Table).

· The Census Bureau introduced a new skip pattern for the disability questions in the 2003 ACS questionnaire. This change mainly affected two individual items – go-outside-home disability and employment disability – and the recode for disability status, which includes the two items. Accordingly, comparisons of data from 2003 or later with data from prior years are not recommended for the relevant questions. For more information, see the http:/www./census.goc/acs/www.UseData/Def.htm for Disability.

· Data for year of entry of the native population reflect the year of entry into the U.S. by people who were born in Puerto Rico, U.S. Island Areas or born outside the U.S. to a U.S. citizen parent and who subsequently moved to the United States.

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8. An 'N' entry in the estimate, lower bound, and upper bound columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure C.2. (Continued).

DP: Economic Characteristics: 2004
Data Set: 2004 American Community Survey
Geographic Area: Hudson County, New Jersey

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Selected Economic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
EMPLOYMENT STATUS			
Population 16 years and over	471,523	469,080	473,966
In labor force	312,313	303,085	321,541
Civilian labor force	312,313	303,085	321,541
Employed	291,831	282,051	301,611
Unemployed	20,482	15,861	25,103
Armed Forces	0	0	538
Not in labor force	159,210	149,940	168,480
Civilian labor force	312,313	303,085	321,541
Unemployed	6.6	5.1	8.1
Females 16 years and over	242,827	241,327	244,327
In labor force	139,040	131,422	146,658
Civilian labor force	139,040	131,422	146,658
Employed	131,001	123,311	138,691
Own children under 6 years	47,250	44,295	50,205
All parents in family in labor force	25,578	20,131	31,025
Own children 6 to 17 years	83,586	78,790	88,382
All parents in family in labor force	49,705	42,423	56,987
Population 16 to 19 years	28,386	24,516	32,256
Not enrolled in school and not a H.S. graduate	1,052	0	2,114
Unemployed or not in the labor force	511	0	1,157

Figure C.3. Example of an ACS data profile, economic characteristics.

Selected Economic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
COMMUTING TO WORK			
Workers 16 years and over	286,893	276,867	296,919
Car, truck, or van – drove alone	113,303	102,200	124,406
Car, truck, or van – carpooled	20,660	15,130	26,190
Public transportation (excluding taxicab)	114,630	103,401	125,859
Walked	22,744	16,969	28,519
Other means	2,659	873	4,445
Worked at home	12,897	8,085	17,709
Mean travel time to work (minutes)	31.0	29.3	32.7
Employed civilian population 16 years and over	291,831	282,051	301,611
OCCUPATION			
Management, professional, and related occupations	97,131	86,127	108,135
Service occupations	48,007	40,465	55,549
Sales and office occupations	75,847	66,711	84,983
Farming, fishing, and forestry occupations	246	0	634
Construction, extraction, maintenance and repair occupations	27,656	21,372	33,940
Production, transportation, and material moving occupations	42,944	34,813	51,075
INDUSTRY			
Agriculture, forestry, fishing and hunting, and mining	0	0	538
Construction	21,471	15,497	27,445
Manufacturing	21,092	15,955	26,229
Wholesale trade	10,152	6,183	14,121
Retail trade	27,353	20,106	34,600
Transportation and warehousing, and utilities	23,350	18,149	28,551
Information	12,605	8,844	16,366
Finance and insurance, and real estate and rental and leasing	35,880	28,274	43,486
Professional, scientific, and management, and administrative and waste management services	36,708	30,299	43,117
Educational services, and health care, and social assistance	61,914	51,679	72,149

Figure C.3. (Continued).

(*continued on next page*)

Selected Economic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Arts, entertainment, and recreation, and accommodation, and food services	19,016	13,499	24,533
Other services, except public administration	12,108	8,512	15,704
Public administration	10,182	6,724	13,640
CLASS OF WORKER			
Private wage and salary workers	236,769	226,524	247,014
Government workers	38,872	32,704	45,040
Self-employed workers in own not incorporated business	16,190	12,176	20,204
Unpaid family workers	0	0	538
INCOME AND BENEFITS (IN 2004 INFLATION-ADJUSTED DOLLARS)			
Total households	223,946	219,175	228,717
Less than $10,000	18,273	13,953	22,593
$10,000 to $14,999	16,344	11,508	21,180
$15,000 to $24,999	23,318	18,689	27,947
$25,000 to $34,999	22,337	18,100	26,574
$35,000 to $49,999	35,741	30,144	41,338
$50,000 to $74,999	42,760	35,549	49,971
$75,000 to $99,999	27,032	22,185	31,879
$100,000 to $149,999	24,310	19,374	29,246
$150,000 to $199,999	8,809	6,196	11,422
$200,000 or more	5,022	3,147	6,897
Median household income (dollars)	48,142	44,575	51,709
Mean household income (dollars)	61,153	57,641	64,665
With earnings	185,107	179,237	190,977
Mean earnings (dollars)	64,963	61,321	68,605
With Social Security	47,418	42,598	52,238
Mean Social Security income (dollars)	11,693	10,768	12,618
With retirement income	23,628	19,470	27,786
Mean retirement income (dollars)	13,235	10,577	15,893
With Supplemental Security Income	12,014	8,181	15,847
Mean Supplemental Security Income (dollars)	7,009	6,170	7,848
With cash public assistance income	5,304	3,197	7,411

Figure C.3. (Continued).

Selected Economic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Mean cash public assistance income (dollars)	4,585	2,815	6,355
With Food Stamp benefits in the past 12 months	9,135	5,914	12,356
Families	133,121	125,383	140,859
Less than $10,000	4,528	2,024	7,032
$10,000 to $14,999	6,507	3,425	9,589
$15,000 to $24,999	13,082	9,450	16,714
$25,000 to $34,999	16,416	12,450	20,382
$35,000 to $49,999	20,010	15,290	24,730
$50,000 to $74,999	26,025	20,487	31,563
$75,000 to $99,999	19,722	15,541	23,903
$100,000 to $149,999	17,083	13,286	20,880
$150,000 to $199,999	6,520	4,041	8,999
$200,000 or more	3,228	1,547	4,909
Median family income (dollars)	52,958	47,240	58,676
Mean family income (dollars)	68,186	63,545	72,827
Per capita income (dollars)	24,275	23,033	25,517
Nonfamily households	90,825	83,474	98,176
Median nonfamily income (dollars)	38,550	32,221	44,879
Mean nonfamily income (dollars)	48,700	43,722	53,678
Median earnings:	31,622	30,371	32,873
Male full-time, year-round workers (dollars)	41,380	39,753	43,007
Female full-time, year-round workers (dollars)	35,692	33,105	38,279
PERCENTAGE OF FAMILIES AND PEOPLE WHOSE INCOME IN THE PAST 12 MONTHS IS BELOW THE POVERTY LEVEL			
All families	10.3	7.3	13.3
With related children under 18 years	13.9	9.1	18.7
With related children under 5 years only	12.7	0.9	24.5
Married couple families	7.7	4.7	10.7
With related children under 18 years	8.6	3.8	13.4
With related children under 5 years only	9.1	0.0	21.4
Families with female householder, no husband present	19.0	10.4	27.6
With related children under 18 years	26.0	13.8	38.2
With related children under 5 years only	20.6	0.0	49.2

Figure C.3. (Continued).

(*continued on next page*)

Selected Economic Characteristics: 2004	Estimate	Lower Bound	Upper Bound
All people	14.6	11.6	17.6
Under 18 years	20.7	14.2	27.2
Related children under 18 years	20.4	13.8	27.0
Related children under 5 years	27.8	16.3	39.3
Related children 5 to 17 years	17.0	10.5	23.5
18 years and over	12.7	10.2	15.2
18 to 64 years	12.0	9.3	14.7
65 years and over	17.3	12.4	22.2
People in families	13.2	9.5	16.9
Unrelated individuals 15 years and over	21.3	17.7	24.9

Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a confidence interval. The interval shown here is a 90 percent confidence interval.The stated range can be interpreted roughly as providing a 90 percent probability that the interval defined by the lower and upper bounds contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:

The number of householders does not necessarily equal the number of households because of differences in the weighting schemes for the population and occupied housing units.
Employment and unemployment estimates may vary from the official labor force data released by the Bureau of Labor Statistics because of differences in survey design and data collection. For guidance on differences in employment and unemployment estimates from different sources go tohttp://www.census.gov/hhes/www/aborfprlaborguideance0825004.html

Workers include members of the Armed Forces and civilians who were at work last week.

Occupation codes are four-digit codes, but are still based on Standard Occupational Classification 2000.

Industry codes are four-digit codes and are based on the North American Industry Classification System 2002. However, the Industry categories adhere to the guidelines issued in Clarification Memorandum No. 2, "NAICS Alternate Aggregation Structure for Use By U.S. Statistical Agencies," issued by the Office of Management and Budget.

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8. An 'N' entry in the estimate, lower bound, and upper bound columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure C.3. (Continued).

DP: Housing Characteristics: 2004
Data Set: 2004 American Community Survey
Geographic Area: Hudson County, New Jersey

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Selected Housing Characteristics: 2004	Estimate	Lower Bound	Upper Bound
HOUSING OCCUPANCY			
Total housing units	244,332	*****	*****
Occupied housing units	223,946	219,175	228,717
Vacant housing units	20,386	15,615	25,157
Homeowner vacancy rate	1.2	0.0	2.4
Rental vacancy rate	5.5	3.3	7.7
UNITS IN STRUCTURE			
1-unit, detached	26,287	21,929	30,645
1-unit, attached	14,267	9,686	18,848
2 units	57,125	50,237	64,013
3 or 4 units	35,637	29,278	41,996
5 to 9 units	25,518	20,064	30,972
10 to 19 units	23,505	18,853	28,157
20 or more units	61,837	54,399	69,275
Mobile home	156	0	420
Boat, RV, van, etc.	0	0	538
YEAR STRUCTURE BUILT			
2000 or later	12,888	9,236	16,540
1995 to 1999	7,919	5,143	10,695
1990 to 1994	5,158	3,018	7,298
1980 to 1989	11,361	8,124	14,598
1970 to 1979	17,308	13,182	21,434

Figure C.4. Example of an ACS Data Profile, housing characteristics.

(*continued on next page*)

Selected Housing Characteristics: 2004	Estimate	Lower Bound	Upper Bound
1960 to 1969	19,844	15,765	23,923
1950 to 1959	19,676	15,559	23,793
1940 to 1949	23,341	18,827	27,855
1939 or earlier	126,837	119,362	134,312
ROOMS			
1 room	6,920	4,102	9,738
2 rooms	20,463	15,481	25,445
3 rooms	53,342	46,305	60,379
4 rooms	60,870	52,728	69,012
5 rooms	49,009	42,118	55,900
6 rooms	26,782	21,049	32,515
7 rooms	9,762	6,876	12,648
8 rooms	5,122	3,237	7,007
9 rooms or more	12,062	9,147	14,977
Median (rooms)	4.2	4.0	4.4
BEDROOMS			
No bedroom	8,620	5,270	11,970
1 bedroom	66,603	59,584	73,622
2 bedrooms	91,992	83,335	100,649
3 bedrooms	56,007	48,733	63,281
4 bedrooms	11,934	8,565	15,303
5 bedrooms or more	9,176	6,293	12,059
Occupied housing units	223,946	219,175	228,717
HOUSING TENURE			
Owner-occupied	78,820	71,565	86,075
Renter-occupied	145,126	137,301	152,951
Average household size of owner-occupied unit	3.08	2.91	3.25
Average household size of renter-occupied unit	2.44	2.32	2.56

Figure C.4. (Continued).

Selected Housing Characteristics: 2004	Estimate	Lower Bound	Upper Bound
YEAR HOUSEHOLDER MOVED INTO UNIT			
2000 or later	107,072	99,089	115,055
1995 to 1999	38,042	32,431	43,653
1990 to 1994	23,599	19,366	27,832
1980 to 1989	25,008	20,702	29,314
1970 to 1979	15,767	12,415	19,119
1969 or earlier	14,458	11,122	17,794
VEHICLES AVAILABLE			
No vehicles available	71,893	64,025	79,761
1 vehicle available	95,555	87,906	103,204
2 vehicles available	43,147	36,798	49,496
3 or more vehicles available	13,351	9,753	16,949
HOUSE HEATING FUEL			
Utility gas	160,554	154,070	167,038
Bottled, tank, or LP gas	2,438	1,228	3,648
Electricity	28,375	24,066	32,684
Fuel oil, kerosene, etc.	30,451	25,601	35,301
Coal or coke	0	0	538
Wood	0	0	538
Solar energy	0	0	538
Other fuel	753	137	1,369
No fuel used	1,375	240	2,510
SELECTED CHARACTERISTICS			
Lacking complete plumbing facilities	183	0	498
Lacking complete kitchen facilities	890	163	1,617
No telephone service available	14,539	10,495	18,583

Figure C.4. (Continued).

(*continued on next page*)

Selected Housing Characteristics: 2004	Estimate	Lower Bound	Upper Bound
OCCUPANTS PER ROOM			
1.00 or less	211,731	205,668	217,794
1.01 to 1.50	8,352	5,093	11,611
1.51 or more	3,863	1,850	5,876
Owner-occupied units	78,820	71,565	86,075
VALUE			
Less than $50,000	885	118	1,652
$50,000 to $99,999	2,729	1,312	4,146
$100,000 to $149,999	5,217	3,018	7,416
$150,000 to $199,999	8,428	5,714	11,142
$200,000 to $299,999	20,333	16,167	24,499
$300,000 to $499,999	35,270	29,630	40,910
$500,000 to $999,999	5,641	3,182	8,100
$1,000,000 or more	317	0	684
Median (dollars)	307,045	290,180	323,910
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS			
Housing units with a mortgage	56,206	49,607	62,805
Less than $300	0	0	538
$300 to $499	223	0	588
$500 to $699	551	0	1,104
$700 to $999	3,206	1,858	4,554
$1,000 to $1,499	10,237	7,705	12,769
$1,500 to $1,999	13,015	9,823	16,207
$2,000 or more	28,974	23,853	34,095
Median (dollars)	2,030	1,913	2,147

Figure C.4. (Continued).

Selected Housing Characteristics: 2004	Estimate	Lower Bound	Upper Bound
Housing units without a mortgage	22,614	18,381	26,847
Less than $100	164	0	441
$100 to $199	0	0	538
$200 to $299	299	0	666
$300 to $399	274	0	624
$400 or more	21,877	17,588	26,166
Median (dollars)	809	729	889
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME			
Housing unit with a mortgage	56,206	49,607	62,805
Less than 20.0 percent	14,109	10,596	17,622
20.0 to 24.9 percent	6,854	4,288	9,420
25.0 to 29.9 percent	4,635	2,956	6,314
30.0 to 34.9 percent	4,414	1,993	6,835
35.0 percent or more	25,088	19,597	30,579
Not computed	1,106	0	2,358
Housing unit without a mortgage	22,614	18,381	26,847
Less than 10.0 percent	4,545	2,464	6,626
10.0 to 14.9 percent	4,718	2,840	6,596
15.0 to 19.9 percent	2,382	1,101	3,663
20.0 to 24.9 percent	2,471	1,139	3,803
25.0 to 29.9 percent	1,295	229	2,361
30.0 to 34.9 percent	771	103	1,439
35.0 percent or more	6,432	3,877	8,987
Not computed	0	0	538
Renter-occupied units	145,126	137,301	152,951

Figure C.4. (Continued).

(*continued on next page*)

Selected Housing Characteristics: 2004	Estimate	Lower Bound	Upper Bound
GROSS RENT			
Less than $200	5,692	3,515	7,869
$200 to $299	3,145	1,358	4,932
$300 to $499	13,032	9,235	16,829
$500 to $749	32,030	27,235	36,825
$750 to $999	43,863	37,459	50,267
$1,000 to $1,499	25,082	20,977	29,187
$1,500 or more	18,678	14,429	22,927
No cash rent	3,604	1,438	5,770
Median (dollars)	852	820	884
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME			
Less than 15.0 percent	20,550	16,434	24,666
15.0 to 19.9 percent	24,047	19,354	28,740
20.0 to 24.9 percent	21,867	16,815	26,919
25.0 to 29.9 percent	13,620	10,059	17,181
30.0 to 34.9 percent	9,460	5,932	12,988
35.0 percent or more	48,948	41,410	56,486
Not computed	6,634	3,740	9,528

Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a confidence interval. The interval shown here is a 90 percent confidence interval. The stated range can be interpreted roughly as providing a 90 percent probability that the interval defined by the lower and upper bounds contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:
The median gross rent excludes no cash renters.

Explanation of Symbols:
1. An '*' entry in the lower and upper bound columns indicates that too fewsample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
2. An '**' entry in the lower and upper bound columns indicates that no sample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
3. An '-' entry in the estimate column indicates that no sample observations were available to compute an estimate.
4. An '-' following a median estimate means the median fallsin the lowest interval of an open-ended distribution.
5. An '+' following a median estimate means the median falls in the upper intervalof an open-ended distribution.
6. An '***' entry in the lower and upper bound columns indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
7. An '*****' entry in the lower and upper bound columns indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
8. An 'N' entry in the estimate, lower bound, and upper bound columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure C.4. (Continued).

APPENDIX D

ACS Multiyear Profiles

MYP: 2004 Multiyear Profile
Data Set: 2004 American Community Survey
Geographic Area: Alameda County, California

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

An * indicates that the estimate is significantly different (at a 90 percent confidence level) than the estimate from the most current year. A 'c' indicates the estimates for that year and the current year are both controlled; a statistical test is not appropriate.

General Demographic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
Total population	1,427,827	1,433,586	c	1,444,656	c	1,430,686	c	1,416,006	c
SEX AND AGE									
Male	48.8%	49.3%	*	49.0%		49.2%	*	49.2%	*
Female	51.2%	50.7%	*	51.0%		50.8%	*	50.8%	*
Under 5 years	7.3%	7.1%	*	7.2%	*	7.3%		6.9%	*
5 to 9 years	6.8%	6.6%		7.5%		7.0%		7.4%	
10 to 14 years	7.2%	7.2%		6.7%		7.8%		6.8%	
15 to 19 years	6.2%	6.1%		5.9%		6.0%		6.4%	
20 to 24 years	5.8%	6.3%	*	6.6%	*	6.9%	*	6.7%	*
25 to 34 years	14.9%	15.6%	*	16.2%	*	15.8%	*	16.7%	*
35 to 44 years	16.8%	16.8%		17.0%		17.1%	*	17.4%	*
45 to 54 years	14.9%	14.9%		14.4%	*	14.2%	*	13.9%	*
55 to 59 years	5.5%	6.2%	*	5.1%		5.0%	*	4.2%	*
60 to 64 years	4.4%	3.2%	*	3.5%	*	3.2%	*	3.6%	*
65 to 74 years	5.3%	5.2%		5.0%	*	5.1%	*	5.4%	
75 to 84 years	3.7%	3.7%		3.7%		3.5%		3.2%	*
85 years and over	1.1%	1.0%		1.1%		1.1%		1.3%	
Median age (years)	36.0	35.6	*	34.9	*	34.4	*	34.3	*
18 years and over	74.7%	75.2%	*	74.9%	*	74.0%	*	75.1%	*
21 years and over	71.1%	71.9%	*	71.5%		70.6%		71.1%	
62 years and over	12.6%	11.6%	*	11.7%	*	11.5%	*	11.7%	*
65 years and over	10.1%	9.9%	*	9.9%	*	9.7%	*	9.9%	*
18 years and over	1,066,403	1,078,445	*	1,081,545	*	1,059,253	*	1,062,830	*
Male	48.4%	48.6%		48.3%		48.5%		48.5%	
Female	51.6%	51.4%	*	51.7%		51.5%		51.5%	
65 years and over	143,811	141,344	*	142,465		139,294	*	139,646	*
Male	42.0%	42.1%		41.8%		42.0%		41.9%	
Female	58.0%	57.9%		58.2%		58.0%		58.1%	

Figure D.1. Example of an ACS Multiyear Profile, general characteristics.

General Demographic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
RACE									
One race	1,369,719	1,386,407	*	1,367,922		1,353,040		1,352,226	
Two or more races	58,108	47,179		76,734	*	77,646	*	63,780	
Total population	1,427,827	1,433,586	c	1,444,656	c	1,430,686	c	1,416,006	c
One race	95.9%	96.7%		94.7%	*	94.6%	*	95.5%	
White	48.8%	52.0%	*	51.1%	*	48.7%		51.6%	*
Black or African American	13.8%	13.8%		14.3%		15.4%	*	14.9%	*
American Indian and Alaska Native	0.5%	0.5%		0.5%		0.6%		0.7%	
Cherokee tribal grouping	N	N		N		N		N	
Chippewa tribal grouping	N	N		N		N		N	
Navajo tribal grouping	N	N		N		N		N	
Sioux tribal grouping	N	N		N		N		N	
Asian	25.2%	24.2%	*	24.0%	*	22.5%	*	22.2%	*
Asian Indian	13.6%	19.9%	*	15.8%		18.1%		13.4%	
Chinese, except Taiwanese	37.2%	32.6%		34.4%		33.2%		44.7%	
Filipino	24.2%	20.4%		24.5%		22.5%		24.4%	
Japanese	4.4%	4.0%		4.8%		3.0%		4.3%	
Korean	2.8%	5.4%	*	3.8%		6.3%	*	3.5%	
Vietnamese	8.3%	9.9%		9.0%		9.0%		4.0%	*
Other Asian	9.4%	7.8%		7.8%		7.9%		5.7%	
Native Hawaiian and Other Pacific Islander	0.8%	0.6%	*	0.7%		0.5%	*	0.7%	
Native Hawaiian	26.1%	5.5%	*	N		N		9.7%	
Guamanian or Chamorro	12.9%	0.0%		N		N		5.4%	
Samoan	12.7%	20.6%		N		N		13.6%	
Other Pacific Islander	48.3%	73.8%		N		N		71.3%	
Some other race	10.9%	8.9%	*	9.4%		12.3%		10.0%	
Two or more races	4.1%	3.3%		5.3%	*	5.4%	*	4.5%	
White and Black or African American	15.1%	23.1%		19.4%		8.0%		15.5%	
White and American Indian and Alaska Native	8.1%	11.3%		15.0%		10.0%		7.6%	
White and Asian	40.9%	29.5%		18.1%	*	26.7%		20.1%	*
Black or African American and American Indian and Alaska Native	4.8%	3.5%		4.0%		0.7%	*	5.2%	
Race alone or in combination with one or more races:									
Total population	1,427,827	1,433,586	c	1,444,656	c1	,430,686	c	1,416,006	c
White	50.4%	52.9%	*	52.5%	*	50.3%		52.8%	*
Black or African American	14.3%	14.8%		15.3%	*	15.8%	*	15.8%	*
American Indian and Alaska Native	1.2%	1.2%		1.5%		1.5%		1.5%	
Asian	26.1%	24.8%	*	24.4%	*	23.6%	*	22.8%	*
Native Hawaiian and Other Pacific Islander	1.0%	0.8%		1.3%		1.0%		1.1%	
Some other race	11.2%	9.0%	*	10.6%		13.7%	*	11.1%	

Figure D.1. (Continued).

(*continued on next page*)

General Demographic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
HISPANIC ORIGIN AND RACE									
Total population	1,427,827	1,433,586	c	1,444,656	c	1,430,686	c	1,416,006	c
Hispanic or Latino (of any race)	20.6%	20.3%	c	20.2%	c	19.7%	c	19.1%	c
Mexican	15.1%	16.0%		16.0%		14.9%		13.6%	
Puerto Rican	0.5%	0.2%	*	0.6%		0.6%		1.1%	*
Cuban	0.1%	0.4%		0.2%		0.2%		0.1%	
Other Hispanic or Latino	4.9%	3.7%		3.5%	*	4.0%		4.3%	
Not Hispanic or Latino	79.4%	79.7%	c	79.8%	c	80.3%	c	80.9%	c
White alone	38.4%	38.9%	*	39.1%	*	40.3%	*	41.4%	*
Black or African American alone	12.9%	13.1%		13.2%		14.3%	*	14.1%	*
American Indian and Alaska Native alone	0.3%	0.4%		0.2%		0.3%		0.5%	
Asian alone	24.0%	23.4%		22.6%	*	21.1%	*	20.9%	*
Native Hawaiian and Other Pacific Islander alone	0.8%	0.5%	*	0.6%	*	0.4%	*	0.6%	
Some other race alone	0.3%	0.8%	*	0.5%		0.4%		0.4%	
Two or more races:	2.7%	2.4%		3.6%		3.4%		3.0%	
Two races, including Some other race	0.1%	0.1%		0.3%	*	0.3%	*	0.3%	*
Two races, excluding Some other race, and Three or more races	2.7%	2.3%		3.2%		3.1%		2.7%	
RELATIONSHIP									
Household population	1,427,827	1,433,586	c	1,444,656	c	1,430,686	c	1,416,006	c
Householder	38.8%	37.9%		38.8%		38.4%		37.4%	*
Spouse	18.2%	18.0%		17.4%		16.6%	*	16.7%	*
Child	29.6%	28.6%		28.8%		29.4%		28.8%	
Other relatives	7.8%	8.7%		8.2%		8.1%		9.3%	*
Nonrelatives	5.6%	6.8%	*	6.9%	*	7.5%	*	7.8%	*
Unmarried partner	2.0%	2.3%		2.5%		2.0%		2.4%	
HOUSEHOLDS BY TYPE									
Total households	509,301	518,471	*	518,114		521,994	*	514,705	
Family households (families)	63.9%	64.6%		64.6%		62.5%		63.1%	
With own children under 18 years	32.5%	32.1%		31.8%		31.1%		32.6%	
Married-couple families	46.7%	47.5%		45.2%		43.9%		43.9%	
With own children under 18 years	24.7%	23.5%		20.9%	*	20.9%	*	23.1%	
Female householder, no husband present	12.5%	12.0%		14.1%		13.0%		13.1%	
With own children under 18 years	5.9%	7.0%		8.8%	*	7.4%		7.1%	
Nonfamily households	36.1%	35.4%		35.4%		37.5%		36.9%	
Householder living alone	28.3%	26.0%		26.1%		28.4%		27.6%	
65 years and over	7.2%	6.9%		7.2%		8.2%		8.0%	
Households with one or more people under 18 years	36.2%	35.7%		35.7%		35.2%		36.9%	
Households with one or more people 65 years and over	20.0%	19.3%		19.1%		19.9%		21.4%	*

Figure D.1. (Continued).

General Demographic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
Average household size	2.80	2.77		2.79		2.74	*	2.75	
Average family size	3.54	3.42	*	3.43		3.43		3.41	*

Source: U.S. Census Bureau, 2004 American Community Survey.

Estimates from two years are "significantly different" if their difference is large enough to infer that there was a less than 10 percent chance that the difference came entirely from random variation.

Notes:

· The number of householders does not necessarily equal the number of households because of differences in the weighting schemes for the population and occupied housing units.

·For more information on understanding race and Hispanic origin data, please see the Census 2000 Brief entitled, Overview of Race and Hispanic Origin., issued March 2001 (pdf format)

Explanation of Symbols:

1. An '-' entry in an Estimate column indicates that no sample observations were available to compute an estimate.
2. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
3. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
4. An 'N' entry in an Estimate column indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure D.1. (Continued).

MYP: 2004 Multiyear Profile
Data Set: 2004 American Community Survey
Geographic Area: Alameda County, California

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

An * indicates that the estimate is significantly different (at a 90% confidence level) than the estimate from the most current year. A 'c' indicates the estimates for that year and the current year are both controlled; a statistical test is not appropriate.

Selected Social Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
SCHOOL ENROLLMENT									
Population 3 years and over enrolled in school	405,753	401,108		418,626		418,096		411,396	
Nursery school, preschool	6.0%	6.3%		6.7%		5.4%		6.6%	
Kindergarten	4.9%	4.2%		5.3%		4.2%		5.5%	
Elementary school (grades 1-8)	39.9%	39.1%		38.1%	*	43.3%	*	38.2%	
High school (grades 9-12)	20.2%	20.7%		18.5%		17.3%	*	18.3%	*
College or graduate school	29.0%	29.7%		31.3%		29.8%		31.3%	
EDUCATIONAL ATTAINMENT									
Population 25 years and over	950,129	954,685	*	954,906	*	930,226	*	931,578	*
Less than 9th grade	7.1%	7.4%		6.5%		6.3%		7.0%	
9th to 12th grade, no diploma	7.2%	6.7%		9.9%	*	11.4%	*	8.3%	
High school graduate (including equivalency)	19.6%	21.1%		18.1%		18.4%		19.9%	
Some college, no degree	19.7%	19.7%		19.6%		20.9%		21.4%	
Associate degree	6.6%	5.8%		6.3%		7.0%		6.8%	
Bachelor's degree	24.5%	23.7%		24.4%		21.0%	*	21.9%	*
Graduate or professional degree	15.4%	15.6%		15.2%		15.1%		14.6%	
Percent high school graduate or higher	85.6	85.9		83.6	*	82.4	*	84.6	
Percent bachelor's degree or higher	39.8	39.3		39.6		36.1	*	36.5	*
MARITAL STATUS									
Males 15 years and over	544,244	551,916	*	549,489	*	542,138		543,530	
Never married	34.2%	36.4%		36.0%		36.5%		37.7%	*
Now married, except separated	53.5%	53.4%		52.1%		49.0%	*	49.0%	*
Separated	1.8%	1.4%		1.6%		1.7%		2.3%	
Widowed	2.0%	1.9%		1.8%		2.9%	*	2.5%	
Divorced	8.5%	7.0%	*	8.4%		9.9%		8.4%	

Figure D.2. Example of an ACS Multiyear Profile, social characteristics.

Selected Social Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
Females 15 years and over	577,912	581,186	*	586,593	*	572,669	*	573,408	*
Never married	29.1%	28.4%		29.0%		30.4%		28.6%	
Now married, except separated	48.4%	49.6%		47.0%		46.6%		45.8%	
Separated	2.3%	2.5%		3.1%		2.5%		2.8%	
Widowed	8.8%	8.2%		7.7%		8.1%		9.6%	
Divorced	11.5%	11.3%		13.1%		12.4%		13.2%	
FERTILITY									
Number of women 15 to 50 years old who had a birth in the past 12 months	19,873	20,289		23,226		24,615		20,532	
Unmarried women (widowed, divorced, and never married)	15.5%	23.0%		25.3%		29.7%	*	9.0%	
Per 1,000 unmarried women	16	25		29		36	*	9	
Per 1,000 women 15 to 50 years old	53	52		58		63		52	
Per 1,000 women 15 to 19 years old	0	13		5		22		5	
Per 1,000 women 20 to 34 years old	105	110		101		87		83	
Per 1,000 women 35 to 50 years old	24	13		33		51	*	35	
GRANDPARENTS									
Number of grandparents living with own grandchildren under 18 years in households	37,965	40,314		34,278		34,780		36,733	
Responsible for grandchildren	28.0%	22.5%		28.9%		37.7%		24.5%	
Years responsible for grandchildren									
Less than 1 year	4.1%	3.0%		4.4%		5.3%		7.0%	
1 or 2 years	1.0%	7.1%		2.5%		11.5%	*	9.5%	*
3 or 4 years	6.7%	5.7%		4.6%		3.2%		1.8%	*
5 or more years	16.0%	6.8%	*	17.4%		17.8%		6.3%	*
Characteristics of grandparents responsible for own grandchildren under 18 years									
Who are female	65.0	60.0		56.9		47.5	*	66.7	
Who are married	58.0	80.7	*	68.1		74.5		63.5	
Who are in labor force	47.3	71.9	*	52.5		67.8	*	55.4	
Who are in poverty	22.2	10.5		5.6*		14.0		15.0	
VETERAN STATUS									
Civilian population 18 years and over	1,065,205	1,078,063	*	1,080,288	*	1,057,327	*	1,062,639	*
Civilian veterans	80,159	76,031		98,344	*	93,657	*	105,363	*
DISABILITY STATUS of the civilian noninstitutionalized population									
Population 5 years and over	1,321,819	1,331,067	*	N		N		N	
With a disability	12.6%	11.0%	*	N		N		N	
Population 5 to 15 years	223,737	216,400	*	N		N		N	
With a disability	5.5%	5.2%		N		N		N	

Figure D.2. (Continued).

(*continued on next page*)

Selected Social Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
Population 16 to 64 years	954,271	973,323	*	N		N		N	
With a disability	10.5%	8.1%	*	N		N		N	
Population 65 years and over	143,811	141,344	*	N		N		N	
With a disability	37.6%	39.5%		N		N		N	
RESIDENCE 1 YEAR AGO									
Population 1 year and over	1,405,378	1,413,191	*	1,423,906	*	1,406,322		1,397,934	*
Same house	81.7%	83.3%		86.8%	*	84.4%	*	84.9%	*
Different house in the U.S.	17.1%	15.3%		12.5%	*	14.1%	*	14.0%	*
Same county	11.9%	11.1%		7.9%	*	9.6%	*	8.1%	*
Different county	5.3%	4.2%		4.6%		4.5%		5.9%	
Same state	4.1%	3.3%		3.3%		3.0%		3.9%	
Different state	1.2%	0.9%		1.3%		1.5%		2.0%	*
Abroad	1.1%	1.4%		0.7%		1.5%		1.1%	
PLACE OF BIRTH									
Total population	1,427,827	1,433,586	c	1,444,656	c	1,430,686	c	1,416,006	c
Native	70.1%	69.5%		70.6%		71.4%		72.8%	*
Born in United States	68.7%	68.6%		69.2%		70.3%		71.7%	*
State of residence	48.8%	47.1%		49.1%		48.8%		47.8%	
Different state	19.9%	21.5%	*	20.1%		21.6%	*	23.9%	*
Born in Puerto Rico, U.S. Island areas, or born abroad to American parent(s)	1.4%	0.9%	*	1.4%		1.1%		1.1%	
Foreign born	29.9%	30.5%		29.4%		28.6%		27.2%	*
U.S. CITIZENSHIP STATUS									
Foreign-born population	427,416	436,863		425,313		408,472		385,337	*
Naturalized U.S. citizen	48.9%	43.3%	*	48.6%		43.0%	*	41.1%	*
Not a U.S. citizen	51.1%	56.7%	*	51.4%		57.0%	*	58.9%	*
YEAR OF U.S. ENTRY									
Population born outside the United States	447,613	450,330		445,660		424,332		400,578	*
Native	4.5%	3.0%	*	4.6%		3.7%		3.8%	
Foreign Born	95.5%	97.0%		95.4%		96.3%		96.2%	
Native	20,197	13,467	*	20,347		15,860		15,241	
Entered U.S. 2000 or later	11.7%	7.4%		5.6%		0.0%	*	0.0%	*
Entered U.S. before 2000	88.3%	92.6%		94.4%		100.0%		100.0%	
Foreign Born	427,416	436,863		425,313		408,472		385,337	*
Entered U.S. 2000 or later	17.0%	16.5%		8.0%	*	6.2%	*	2.1%	*
Entered U.S. before 2000	83.0%	83.5%		92.0%	*	93.8%	*	97.9%	*

Figure D.2. (Continued).

Selected Social Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
WORLD REGION OF BIRTH OF FOREIGN BORN									
Foreign-born population excluding population born "At sea"	427,416	436,863		425,313		408,472		385,337	*
Europe	7.2%	6.5%		8.8%		7.8%		8.8%	
Asia	55.5%	53.4%	*	54.5%		56.0%		56.4%	
Africa	2.6%	2.7%		2.7%		3.4%		3.5%	
Oceania	1.1%	1.5%		1.1%		2.6%	*	1.6%	
Latin America	32.3%	34.5%		31.9%		28.7%		29.0%	
Northern America	1.1%	1.3%		1.0%		1.5%		0.7%	
LANGUAGE SPOKEN AT HOME									
Population 5 years and over	1,323,017	1,331,449	*	1,340,852	*	1,325,838	*	1,318,496	*
English only	59.5%	60.2%		62.4%	*	62.9%	*	63.3%	*
Language other than English	40.5%	39.8%		37.6%	*	37.1%	*	36.7%	*
Speak English less than "very well"	19.0%	19.1%		17.1%		16.2%	*	17.0%	
Spanish	15.5%	16.0%		14.9%		14.1%		13.6%	*
Speak English less than "very well"	8.7%	9.4%		7.6%		6.8%	*	7.0%	*
Other Indo-European languages	5.7%	6.9%		6.6%		6.4%		6.5%	
Speak English less than "very well"	1.5%	2.1%		1.7%		1.4%		2.0%	
Asian and Pacific Islander languages	18.0%	16.0%	*	15.2%	*	15.3%	*	15.4%	*
Speak English less than "very well"	8.3%	7.1%		7.4%		7.7%		7.7%	
Other languages	1.4%	1.0%		0.9%		1.3%		1.2%	
Speak English less than "very well"	0.4%	0.5%		0.4%		0.3%		0.4%	
ANCESTRY (TOTAL REPORTED)									
Total Population	1,427,827	1,433,586	c	1,444,656	c	1,430,686	c	1,416,006	c
American	1.6%	1.0%	*	1.9%		1.8%		1.5%	
Arab	0.9%	0.4%		0.6%		0.9%		0.9%	
Czech	0.2%	0.5%	*	0.4%		0.3%		0.2%	
Danish	0.7%	0.6%		0.7%		0.5%		0.6%	
Dutch	0.5%	1.3%	*	1.2%	*	1.0%	*	1.2%	*
English	6.7%	6.6%		6.7%		7.1%		6.5%	
French (except Basque)	2.3%	1.9%		2.5%		2.2%		2.4%	
French Canadian	0.3%	0.5%		0.3%		0.3%		0.3%	
German	8.8%	8.8%		8.8%		8.5%		8.8%	
Greek	0.7%	0.7%		0.3%		0.2%		0.4%	
Hungarian	0.2%	0.2%		0.3%		0.3%		0.3%	
Irish	7.0%	5.9%	*	6.7%		7.8%		7.2%	
Italian	4.8%	4.6%		4.4%		4.6%		4.2%	
Lithuanian	0.2%	0.3%		0.2%		0.2%		0.2%	
Norwegian	1.5%	1.2%		1.2%		1.3%		1.3%	
Polish	1.7%	1.5%		1.4%		1.2%		1.6%	
Portuguese	2.2%	2.3%		2.5%		2.8%		3.1%	

Figure D.2. (Continued).

(*continued on next page*)

Selected Social Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
Russian	1.1%	1.2%		1.5%		1.1%		1.2%	
Scotch-Irish	1.6%	1.2%		1.4%		1.2%		1.0%	
Scottish	1.4%	1.8%		1.7%		1.4%		1.5%	
Slovak	0.1%	0.1%		0.1%		0.1%		0.1%	
Sub-Saharan African	1.2%	2.1%	*	1.6%		2.3%	*	1.6%	
Swedish	1.2%	1.3%		1.4%		0.9%		1.5%	
Swiss	0.3%	0.1%		0.4%		0.4%		0.3%	
Ukrainian	0.2%	0.1%		0.1%		0.2%		0.3%	
Welsh	0.5%	0.4%		0.5%		0.9%	*	0.5%	
West Indian (excluding Hispanic origin groups)	0.2%	0.4%		0.2%		0.1%		0.2%	

Source: U.S. Census Bureau, 2004 American Community Survey.

Estimates from two years are "significantly different" if their difference is large enough to infer that there was a less than 10 percent chance that the difference came entirely from random variation.

Notes:

Ancestry listed in this table refers to the total number of people who responded with a particular ancestry; for example, the estimate given for Russian represents the number of people who listed Russian as either their first or second ancestry. This table lists only the largest ancestry groups; see the Detailed Tables for more categories. Race and Hispanic origin groups are not included in this table because official data for those groups come from the Race and Hispanic origin questions rather than the ancestry question (see Demographic Table).

The Census Bureau introduced a new skip pattern for the disability questions in the 2003 ACS questionnaire. This change mainly affected two individual items – go-outside-home disability and employment disability – and the recode for disability status, which includes the two items. Accordingly, comparisons of data from 2003 or later with data from prior years are not recommended for the relevant questions. For more information, see the **ACS Subject Definitions** for Disability.

Data for year of entry of the native population reflect the year of entry into the U.S. by people who were born in Puerto Rico, U.S. Island Areas or born outside the U.S. to a U.S. citizen parent and who subsequently moved to the United States.

Explanation of Symbols:

1. An '-' entry in an Estimate column indicates that no sample observations were available to compute an estimate.
2. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
3. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
4. An 'N' entry in an Estimate column indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure D.2. (Continued).

MYP: 2004 Multiyear Profile
Data Set: 2004 American Community Survey
Geographic Area: Alameda County, California

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

An * indicates that the estimate is significantly different (at a 90% confidence level) than the estimate from the most current year. A 'c' indicates the estimates for that year and the current year are both controlled; a statistical test is not appropriate.

Selected Economic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
EMPLOYMENT STATUS									
Population 16 years and over	1,099,280	1,115,049	*	1,118,277	*	1,096,458		1,097,658	
In labor force	68.0%	69.1%		69.7%	*	69.4%		68.3%	
Civilian labor force	67.9%	69.0%		69.6%	*	69.3%		68.3%	
Employed	61.9%	63.0%		63.7%		64.5%	*	65.0%	*
Unemployed	5.9%	6.1%		5.9%		4.8%	*	3.3%	*
Armed Forces	0.1%	0.1%		0.1%		0.2%		0.1%	
Not in labor force	32.0%	30.9%		30.3%		30.6%		31.7%	
Civilian labor force	745,991	769,865	*	778,112	*	759,397		749,692	
Unemployed	8.8	8.8		8.5		6.9	*	4.9	*
Females 16 years and over	563,539	573,051	*	578,556	*	563,860		563,407	
In labor force	61.0%	62.3%		61.8%		62.7%		61.9%	
Civilian labor force	61.0%	62.3%		61.8%		62.6%		61.9%	
Employed	55.3%	57.2%		56.4%		57.7%		58.9%	*
Own children under 6 years	117,859	112,550		124,359		109,314	*	110,263	*
All parents in family in labor force	55.4%	58.8%		55.8%		58.7%		63.3%	
Own children 6 to 17 years	222,143	225,984		221,866		229,416		215,305	
All parents in family in labor force	65.8%	66.2%		68.3%		69.8%		71.4%	
Population 16 to 19 years	65,996	69,688		68,098		67,520		70,762	
Not enrolled in school and not a H.S. graduate	3.8%	3.6%		6.5%		8.1%		7.0%	
Unemployed or not in the labor force	1.4%	2.0%		2.4%		3.5%		2.5%	

Figure D.3. Example of an ACS multiyear profile, economic characteristics.

(*continued on next page*)

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Selected Economic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
COMMUTING TO WORK									
Workers 16 years and over	657,500	684,239	*	693,844	*	686,246	*	688,889	*
Car, truck, or van – drove alone	67.5%	66.7%		68.8%		66.9%		66.2%	
Car, truck, or van – carpooled	10.8%	11.7%		12.5%		12.2%		12.7%	
Public transportation (excluding taxicab)	12.2%	11.2%		9.9%	*	11.9%		12.3%	
Walked	2.3%	3.5%	*	3.5%	*	2 .5%		2.7%	
Other means	2.9%	2.7%		1.9%	*	2.4%		2.8%	
Worked at home	4.3%	4.2%		3.4%		4.0%		3.3%	
Mean travel time to work (minutes)	27.5	27.2		28.3		28.5		29.9	*
Employed civilian population 16 years and over	680,607	702,213	*	712,222	*	707,265	*	712,960	*
OCCUPATION									
Management, professional, and related occupations	43.8%	44.2%		45.0%		42.6%		40.9%	*
Service occupations	12.5%	13.0%		12.2%		11.1%		13.7%	
Sales and office occupations	25.0%	25.1%		25.3%		26.3%		24.7%	
Farming, fishing, and forestry occupations	0.1%	0.1%		0.0%		0.1%		0.1%	
Construction, extraction, maintenance and repair occupations	7.7%	7.4%		7.5%		8.5%		7.3%	
Production, transportation, and material moving occupations	10.9%	10.2%		9.9%		11.4%		13.1%	*
INDUSTRY									
Agriculture, forestry, fishing and hunting, and mining	0.1%	0.3%		0.1%		0.2%		0.2%	
Construction	6.3%	6.1%		5.3%		5.9%		4.5%	*
Manufacturing	11.5%	10.5%		14.1%	*	14.5%	*	14.1%	*
Wholesale trade	4.6%	3.8%		3.6%		3.7%		4.0%	
Retail trade	9.6%	10.7%		12.1%	*	11.5%	*	10.5%	
Transportation and warehousing, and utilities	5.2%	4.3%		5.6%		6.9%	*	6.2%	
Information	3.3%	4.0%		4.2%		4.2%		5.3%	*
Finance and insurance, and real estate and rental and leasing	7.3%	8.1%		4.5%	*	5 .7%	*	7.5%	
Professional, scientific, and management, and administrative and waste management services	15.4%	14.8%		15.8%		15.1%		14.2%	
Educational services, and health care, and social assistance	20.4%	21.5%		19.8%		18.3%	*	17.8%	*

Figure D.3. (Continued).

Selected Economic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
Arts, entertainment, and recreation, and accommodation, and food services	7.5%	7.5%		7.5%		6.3%		7.8%	
Other services, except public administration	4.9%	4.1%		4.6%		4.4%		3.8%	
Public administration	3.7%	4.2%		2.9%		3.4%		4.0%	
CLASS OF WORKER									
Private wage and salary workers	76.9%	74.9%		78.4%		79.2%	*	78.1%	
Government workers	15.0%	15.8%		14.1%		13.5%		14.6%	
Self-employed workers in own not incorporated business	7.7%	9.1%		7.3%		7.1%		7.2%	
Unpaid family workers	0.4%	0.2%		0.2%		0.2%		0.2%	
INCOME AND BENEFITS (IN 2004 INFLATION-ADJUSTED DOLLARS)									
Total households	509,301	518,471	*	518,114		521,994	*	514,705	
Less than $10,000	8.1%	6.8%		6.6%		6.6%		7.2%	
$10,000 to $14,999	3.7%	3.9%		3.7%		4.5%		4.6%	
$15,000 to $24,999	9.1%	8.7%		8.3%		9.0%		8.9%	
$25,000 to $34,999	6.7%	7.6%		7.8%		8.6%		8.9%	*
$35,000 to $49,999	15.0%	13.9%		12.7%	*	11.2%	*	11.8%	*
$50,000 to $74,999	18.6%	17.0%		19.1%		19.0%		18.4%	
$75,000 to $99,999	13.3%	14.1%		13.6%		15.5%	*	13.4%	
$100,000 to $149,999	13.7%	16.4%	*	16.7%	*	15.8%		14.6%	
$150,000 to $199,999	6.5%	6.7%		6.5%		5.6%		6.4%	
$200,000 or more	5.3%	5.0%		5.0%		4.2%		5.9%	
Median household income (dollars)	59,325	63,191		63,722	*	62,611		59,773	
Mean household income (dollars)	77,459	79,215		79,987		77,296		80,460	
With earnings	83.7%	85.3%	*	85.0%		84.0%		84.7%	
Mean earnings (dollars)	78,830	81,070		81,855		79,674		81,182	
With Social Security	20.9%	20.2%		19.7%		19.0%	*	20.7%	
Mean Social Security income (dollars)	12,205	12,790		12,345		13,116	*	11,305	*
With retirement income	14.7%	13.7%		14.3%		15.0%		14.6%	
Mean retirement income (dollars)	19,151	19,886		20,345		18,453		18,596	
With Supplemental Security Income	4.2%	3.6%		3.6%		3.9%		4.0%	
Mean Supplemental Security Income (dollars)	8,180	7,573		8,265		7,865		7,749	
With cash public assistance income	3.5%	1.9%	*	2.1%	*	2.6%		3.9%	
Mean cash public assistance income (dollars)	4,048	4,917		5,658	*	6,033	*	4,414	

Figure D.3. (Continued).

(*continued on next page*)

Selected Economic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
With Food Stamp benefits in the past 12 months	3.3%	2.2%	*	3.2%		2.6%		2.9%	
Families	325,251	334,719		334,711		326,209		324,523	
Less than $10,000	5.0%	5.1%		3.8%		2.8%	*	3.8%	
$10,000 to $14,999	2.3%	3.2%		2.4%		2.3%		2.3%	
$15,000 to $24,999	6.8%	6.9%		6.3%		8.0%		5.8%	
$25,000 to $34,999	6.9%	7.3%		7.3%		7.7%		7.6%	
$35,000 to $49,999	14.2%	12.5%		10.9%	*	11.5%	*	11.4%	*
$50,000 to $74,999	17.3%	16.8%		19.3%		19.5%		18.7%	
$75,000 to $99,999	15.8%	15.6%		15.3%		15.9%		16.2%	
$100,000 to $149,999	16.4%	18.3%		20.1%	*	20.0%	*	18.8%	
$150,000 to $199,999	8.5%	8.0%		8.3%		6.6%	*	8.2%	
$200,000 or more	6.8%	6.5%		6.3%		5.7%		7.2%	
Median family income (dollars)	71,910	72,495		75,065		72,367		75,552	
Mean family income (dollars)	90,253	87,757		91,563		88,664		93,232	
Per capita income (dollars)	30,203	29,948		30,931		29,823		30,162	
Nonfamily households	184,050	183,752		183,403		195,785		190,182	
Median nonfamily income (dollars)	41,077	44,398		41,965		42,839		37,074	
Mean nonfamily income (dollars)	52,046	59,915	*	53,937		53,846		54,756	
Median earnings:	36,062	34,193		36,078		35,015		33,599	*
Male full-time, year-round workers (dollars)	52,031	50,994		53,967		48,111		49,666	
Female full-time, year-round workers (dollars)	43,855	45,033		43,748		41,268		42,706	
PERCENTAGE OF FAMILIES AND PEOPLE WHOSE INCOME IN THE PAST 12 MONTHS IS BELOW THE POVERTY LEVEL									
All families	8.7	8.9		7.2		6.6		6.9	
With related children under 18 years	12.7	12.3		10.9		10.5		9.4	
With related children under 5 years only	11.5	8.4		4.7		5.9		2.1	*
Married couple families	5.5	5.1		3.7		3.7		4.4	
With related children under 18 years	7.9	6.0		5.9		5.7		5.8	
With related children under 5 years only	5.5	2.2		3.1		1.3		0.9	
Families with female householder, no husband present	20.7	20.2		18.7		14.2		16.7	
With related children under 18 years	30.5	27.3		22.1		20.8	*	21.1	
With related children under 5 years only	29.3	32.8		11.9		7.8	*	15.1	

Figure D.3. (Continued).

Selected Economic Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
All people	11.4	10.9		10.6		9.6		10.8	
Under 18 years	17.1	13.9		15.1		13.7		11.4	*
Related children under 18 years	16.0	13.8		14.9		13.4		10.6	*
Related children under 5 years	16.0	12.6		11.8		15.3		8.4	*
Related children 5 to 17 years	16.0	14.2		16.2		12.7		11.4	
18 years and over	9.5	10.0		9.1		8.1		10.6	
18 to 64 years	10.0	10.2		9.3		8.3		10.6	
65 years and over	6.7	8.5		7.9		7.3		10.4	*
People in families	10.6	9.8		9.0		8.3		8.3	
Unrelated individuals 15 years and over	17.8	18.4		18.9		16.5		22.9	*

Source: U.S. Census Bureau, 2004 American Community Survey.

Estimates from two years are "significantly different" if their difference is large enough to infer that there was a less than 10 percent chance that the difference came entirely from random variation.

Notes:

The number of householders does not necessarily equal the number of households because of differences in the weighting schemes for the population and occupied housing units.

Employment and unemployment estimates may vary from the official labor force data released by the Bureau of Labor Statistics because of differences in survey design and data collection. For guidance on differences in employment and unemployment estimates from different sources go to http://www.census.gov/hhes/www/laborfor/laborguidance082504.html.

Workers include members of the Armed Forces and civilians who were at work last week.

Occupation codes are four-digit codes, but are still based on Standard Occupational Classification 2000.

Industry codes are four-digit codes and are based on the North American Industry Classification System 2002. However, the Industry categories adhere to the guidelines issued in Clarification Memorandum No. 2, "NAICS Alternate Aggregation Structure for Use By U.S. Statistical Agencies," issued by the Office of Management and Budget.

Explanation of Symbols:

1. An '-' entry in an Estimate column indicates that no sample observations were available to compute an estimate.
2. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
3. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
4. An 'N' entry in an Estimate column indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure D.3. (Continued).

MYP: 2004 Multiyear Profile
Data Set: 2004 American Community Survey
Geographic Area: Alameda County, California

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

An * indicates that the estimate is significantly different (at a 90% confidence level) than the estimate from the most current year. A 'c' indicates the estimates for that year and the current year are both controlled; a statistical test is not appropriate.

Selected Housing Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
HOUSING OCCUPANCY									
Total housing units	552,258	549,102	c	546,795	c	543,670	c	540,183	c
Occupied housing units	92.2%	94.4%	*	94.8%	*	96.0%	*	95.3%	*
Vacant housing units	7.8%	5.6%	*	5.2%	*	4.0%	*	4.7%	*
Homeowner vacancy rate	1.5	0.4	*	1.1		1.3		0.3	*
Rental vacancy rate	7.5	6.1		4.4	*	2.8	*	4.0	*
UNITS IN STRUCTURE									
1-unit, detached	56.4%	56.3%		54.1%		54.1%		54.3%	
1-unit, attached	5.7%	6.8%		6.8%		5.7%		6.4%	
2 units	3.8%	3.7%		6.0%	*	5.2%	*	4.4%	
3 or 4 units	7.0%	6.3%		6.1%		8.4%		6.8%	
5 to 9 units	6.7%	6.9%		6.6%		6.1%		7.0%	
10 to 19 units	5.0%	6.0%		4.4%		5.6%		5.5%	
20 or more units	14.4%	12.7%		14.6%		13.6%		14.3%	
Mobile home	0.9%	1.2%		1.3%		1.2%		1.3%	
Boat, RV, van, etc.	0.1%	0.1%		0.1%		0.0%		0.1%	
YEAR STRUCTURE BUILT									
1995 or later	7.1%	7.0%		7.4%		5.7%		4.9%	*
1990 to 1994	4.4%	5.1%		5.5%		3.5%		4.8%	
1980 to 1989	11.5%	11.5%		11.6%		12.8%		12.5%	
1970 to 1979	13.7%	15.0%		14.0%		15.2%		17.6%	*
1960 to 1969	15.7%	15.9%		14.5%		14.8%		14.5%	
1950 to 1959	15.8%	15.0%		14.4%		15.4%		14.6%	
1940 to 1949	7.9%	7.9%		9.4%		9.9%	*	9.8%	*
1939 or earlier	24.0%	22.6%		23.2%		22.7%		21.3%	*

Figure D.4. Example of an ACS Multiyear Profile, housing characteristics.

Selected Housing Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
ROOMS									
1 room	1.6%	3.1%	*	3.3%	*	3.6%	*	3.4%	*
2 rooms	5.2%	5.6%		6.9%	*	5.8%		6.9%	*
3 rooms	14.1%	13.7%		13.5%		13.9%		14.7%	
4 rooms	18.8%	19.9%		20.1%		19.1%		18.4%	
5 rooms	20.7%	18.8%		20.2%		19.6%		19.5%	
6 rooms	16.1%	16.3%		14.3%		17.9%		15.9%	
7 rooms	11.6%	10.6%		10.8%		10.6%		10.9%	
8 rooms	6.3%	6.5%		6.1%		5.4%		6.4%	
9 rooms or more	5.7%	5.4%		4.8%		4.1%	*	3.9%	*
Median (rooms)	5.0	4.9		4.8	*	4.9		4.8	
BEDROOMS									
No bedroom	2.9%	4.7%	*	4.7%	*	4.6%	*	5.2%	*
1 bedroom	19.1%	17.0%	*	18.9%		17.4%		18.9%	
2 bedrooms	28.5%	30.7%		28.8%		31.2%		29.8%	
3 bedrooms	30.0%	28.0%		30.9%		29.2%		28.9%	
4 bedrooms	15.2%	15.1%		12.7%	*	13.9%		13.9%	
5 bedrooms or more	4.3%	4.6%		3.9%		3.7%		3.2%	*
Occupied housing units	509,301	518,471	*	518,114		521,994	*	514,705	
HOUSING TENURE									
Owner-occupied	58.1%	57.5%		55.8%		52.6%	*	54.8%	*
Renter-occupied	41.9%	42.5%		44.2%		47.4%	*	45.2%	*
Average household size of owner-occupied unit	2.98	2.88		2.94		2.87		3.01	
Average household size of renter-occupied unit	2.55	2.61		2.60		2.59		2.44	
YEAR HOUSEHOLDER MOVED INTO UNIT									
2000 or later	43.9%	37.2%	*	28.5%	*	21.5%	*	8.8%	*
1995 to 1999	19.4%	22.3%	*	31.4%	*	35.5%	*	44.3%	*
1990 to 1994	11.6%	10.9%		12.1%		12.2%		16.1%	*
1980 to 1989	10.8%	14.2%	*	11.9%		14.8%	*	14.7%	*
1970 to 1979	7.2%	8.3%		8.2%		8.5%		8.4%	
1969 or earlier	7.2%	7.0%		7.9%		7.5%		7.7%	
VEHICLES AVAILABLE									
No vehicles available	8.6%	7.9%		8.9%		11.0%	*	10.4%	*
1 vehicle available	34.1%	36.0%		34.0%		34.1%		34.7%	
2 vehicles available	37.2%	35.9%		38.2%		35.6%		35.3%	
3 or more vehicles available	20.0%	20.2%		19.0%		19.4%		19.5%	

Figure D.4. (Continued).

(*continued on next page*)

Selected Housing Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
HOUSE HEATING FUEL									
Utility gas	77.8%	76.7%		71.9%	*	72.8%	*	70.9%	*
Bottled, tank, or LP gas	1.1%	1.1%		0.6%	*	1.2%		1.6%	
Electricity	19.6%	20.4%		25.6%	*	24.1%	*	25.9%	*
Fuel oil, kerosene, etc.	0.1%	0.0%		0.1%		0.1%		0.1%	
Coal or coke	0.0%	0.1%		0.0%		0.0%		0.0%	
Wood	0.7%	0.4%		0.6%		0.5%		0.5%	
Solar energy	0.0%	0.0%		0.0%		0.0%		0.0%	
Other fuel	0.1%	0.3%		0.1%		0.3%		0.1%	
No fuel used	0.5%	1.2%	*	1.1%		1.0%		1.0%	
SELECTED CHARACTERISTICS									
Lacking complete plumbing facilities	0.6%	0.2%		0.4%		0.4%		0.1%	*
Lacking complete kitchen facilities	0.7%	0.3%		0.6%		0.4%		0.8%	
No telephone service available	1.4%	1.3%		2.0%		1.0%		1.3%	
OCCUPANTS PER ROOM									
1.00 or less	93.8%	92.0%	*	92.1%		92.0%	*	91.6%	*
1.01 to 1.50	4.9%	4.8%		4.7%		5.2%		5.1%	
1.51 or more	1.3%	3.2%	*	3.2%	*	2.8%	*	3.3%	*
Owner-occupied units	295,955	297,878		288,982		274,395	*	282,070	
VALUE									
Less than $50,000	1.2%	0.9%		1.7%		1.9%		2.8%	*
$50,000 to $99,999	2.0%	2.3%		1.7%		3.4%	*	3.3%	*
$100,000 to $149,999	1.1%	2.1%	*	2.8%	*	3.9%	*	7.2%	*
$150,000 to $199,999	1.7%	2.7%		3.7%	*	6.9%	*	11.2%	*
$200,000 to $299,999	7.6%	10.9%	*	15.9%	*	16.3%	*	24.2%	*
$300,000 to 499,999	36.7%	43.1%	*	46.8%	*	43.4%	*	36.0%	
$500,000 to $999,999	44.7%	33.1%	*	24.0%	*	21.6%	*	13.8%	*
$1,000,000 or more	4.9%	4.9%		3.5%	*	2.6%	*	1.6%	*
Median (dollars)	498,227	455,821	*	419,003	*	388,362	*	336,073	*
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS									
Housing units with a mortgage	230,242	231,859		229,043		211,854	*	219,187	
Less than $300	0.1%	0.1%		0.5%		0.2%		0.6%	*
$300 to $499	0.4%	1.4%	*	1.0%		1.0%		1.3%	*
$500 to $699	2.5%	2.0%		2.1%		2.2%		3.6%	
$700 to $999	3.7%	8.8%	*	5.6%	*	6.4%	*	5.4%	*
$1,000 to $1,499	17.4%	14.1%		16.4%		19.1%		22.9%	*

Figure D.4. (Continued).

Selected Housing Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
$1,500 to $1,999	22.5%	21.5%		21.7%		21.4%		21.8%	
$2,000 or more	53.4%	52.0%		52.7%		49.7%		44.4%	*
Median (dollars)	2,085	2,050		2,069		1,994		1,896	*
Housing units without a mortgage	65,713	66,019		59,939		62,541		62,883	
Less than $100	2.3%	2.0%		1.6%		1.1%		1.6%	
$100 to $199	10.8%	11.3%		10.9%		10.2%		14.4%	
$200 to $299	23.6%	21.7%		30.3%		19.8%		28.0%	
$300 to $399	15.9%	22.2%	*	23.4%	*	23.5%	*	19.3%	
$400 or more	47.4%	42.7%		33.8%	*	45.3%		36.7%	*
Median (dollars)	379	368		333		371		329	*
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME									
Housing unit with a mortgage	230,242	231,859		229,043		211,854	*	219,187	
Less than 20.0 percent	25.3%	27.7%		28.4%		27.6%		31.3%	*
20.0 to 24.9 percent	13.9%	15.3%		18.2%	*	15.9%		15.7%	
25.0 to 29.9 percent	12.5%	11.6%		12.7%		15.9%	*	13.9%	
30.0 to 34.9 percent	7.6%	11.9%	*	8.8%		11.1%	*	11.5%	*
35.0 percent or more	40.6%	33.5%	*	31.9%	*	29.6%	*	27.6%	*
Not computed	580	900		1,129		297		211	
Housing unit without a mortgage	65,713	66,019		59,939		62,541		62,883	
Less than 10.0 percent	56.1%	51.2%		57.8%		45.6%	*	57.5%	
10.0 to 14.9 percent	14.6%	19.0%		13.0%		18.1%		17.4%	
15.0 to 19.9 percent	7.9%	7.5%		10.9%		10.2%		9.2%	
20.0 to 24.9 percent	8.5%	6.7%		4.0%	*	7.4%		3.5%	*
25.0 to 29.9 percent	2.2%	4.3%		3.7%		4.9%	*	2.3%	
30.0 to 34.9 percent	1.8%	1.7%		1.5%		1.6%		1.6%	
35.0 percent or more	9.0%	9.7%		9.0%		12.1%		8.5%	
Not computed	1,494	357		763		466		817	
Renter-occupied units	213,346	220,593		229,132	*	247,599	*	232,635	*
GROSS RENT									
Less than $200	1.5%	0.9%		0.7%		0.9%		2.1%	
$200 to $299	2.7%	2.7%		3.5%		2.0%		3.6%	
$300 to $499	4.0%	2.4%		3.8%		4.9%		6.0%	
$500 to $749	14.8%	12.0%		14.1%		15.1%		17.0%	
$750 to $999	26.7%	18.2%	*	20.1%	*	21.2%	*	26.7%	
$1,000 to $1,499	36.0%	44.6%	*	37.3%		32.5%		30.6%	*
$1,500 or more	14.4%	19.3%	*	20.4%	*	23.3%	*	14.0%	
No cash rent	6,712	3,080	*	3,512	*	7,779		3,627	
Median (dollars)	1,005	1,130	*	1,091	*	1,070	*	953	*

Figure D.4. (Continued).

(*continued on next page*)

Selected Housing Characteristics	2004 Percent Distribution	2003 Percent Distribution		2002 Percent Distribution		2001 Percent Distribution		2000 Percent Distribution	
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME									
Less than 15.0 percent	11.8%	11.7%		12.5%		11.8%		14.0%	
15.0 to 19.9 percent	12.3%	14.7%		13.2%		15.3%		17.1%	*
20.0 to 24.9 percent	11.8%	14.1%		15.5%		12.5%		13.4%	
25.0 to 29.9 percent	10.7%	11.3%		12.0%		12.2%		10.0%	
30.0 to 34.9 percent	10.0%	8.5%		6.0%	*	7.6%		7.6%	
35.0 percent or more	43.4%	39.6%		40.8%		40.7%		38.0%	*
Not computed	9,745	6,649		6,034		11,608		5,932	

Source: U.S. Census Bureau, 2004 American Community Survey.

Estimates from two years are “significantly different” if their difference is large enough to infer that there was a less than 10 percent chance that the difference came entirely from random variation.

Notes:

Value is the only dollar amount collected in specified intervals (checkboxes). The category boundaries are not adjusted for inflation. The median value forprevious years is adjusted for inflation by multiplying a factor equal to the average annual CPI-U-RS factor.

For the characteristic Selected Monthly Owner Costs as a Percentage of Household Income, the percent distributions are calculated based on the total number of Owner-occupied Housing Units with a Mortgage and Owner-occupied Housing Units without a Mortgage minus the number of Owner-occupied Housing Units in the not computed category.

For the characteristic Gross Rent as a Percentage of Household Income, the percent distributions are calculated based on the total number of Renter-occupied Units minus the number of Units in the not computed category.

For the characteristic Gross Rent, the percent distributions and medians are calculated based on the total number of Renter-occupied Units minus the number of Units in the no cash rent category.

Explanation of Symbols:

1. An ‘-’ entry in an Estimate column indicates that no sample observations were available to compute an estimate.
2. An ‘-’ following a median estimate means the median falls in the lowest interval of an open-ended distribution.
3. An ‘+’ following a median estimate means the median falls in the upper interval of an open-ended distribution.
4. An ‘N’ entry in an Estimate column indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure D.4. (Continued).

APPENDIX E

ACS Ranking Tables

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Table E.1. ACS ranking tables available for 2004.

Ranking Table Number	Ranking Table Definition
R0101	Median Age
R0102	Sex Ratio
R0103	Percent of People Who are 65 Years and Over
R0104	Percent of People Who are 85 Years and Over
R0105	Age Dependency Ratio
R0201	Percent of People Who are White Alone
R0202	Percent of People Who are Black or African American Alone
R0203	Percent of People Who are American Indian and Alaska Native Alone
R0204	Percent of People Who are Asian Alone
R0205	Percent of People Who are Native Hawaiian and Other Pacific Islander Alone
R0206	Percent of People Who are Some Other Race Alone
R0207	Percent of People Who are Two or More Races
R0208	Percent of People Who are Two or More Races Excluding Some Other Race
R0209	Percent of People Who are White Alone, Not Hispanic or Latino
R0501	Percent of People Who are Foreign Born
R0502	Percent of People Born in Europe
R0503	Percent of People Born in Asia
R0504	Percent of People Born in Latin America
R0505	Percent of People Born in Mexico
R0601	Percent of the Native Population Born in their State of Residence
R0701	Percent of People Who Lived in a Different House 1 Year Ago
R0702	Percent of People Who Lived in a Different House Within the Same State 1 Year Ago
R0703	Percent of People Who Lived in a Different State 1 Year Ago
R0801	Mean Travel Time to Work
R0802	Percent of Workers Who Traveled to Work by Car, Truck, or Van Alone
R0803	Percent of Workers Who Traveled to Work by Carpool
R0804	Percent of Workers Who Traveled to Work by Public Transportation
R0805	Percent of Workers Who Worked Outside County of Residence
R1001	Percent of Grandparents Responsible for their Grandchildren
R1101	Percent of Households That are Married-Couple Families
R1102	Percent of Households That are Married-Couple Families With Own Children Under 18 Years
R1103	Percent of Households With One or More People Under 18 Years
R1104	Percent of Households With One or More People 65 Years and Over
R1105	Average Household Size
R1201	Percent of Men Who Never Married
R1202	Percent of Women Who Never Married
R1303	Women (Per 1,000) Who Had a Birth in the Past 12 Months
R1401	Percent of People Who Have Completed High School (including Equivalency)
R1402	Percent of People Who Have Completed a Bachelor's Degree
R1403	Percent of People Who Have Completed an Advanced Degree
R1601	Percent of People Who Speak a Language Other Than English At Home
R1602	Percent of People Who Speak Spanish at Home
R1603	Percent of People Who Speak English Less Than "Very Well"
R1701	Percent of People Below Poverty Level
R1702	Percent of Related Children Below Poverty Level
R1703	Percent of People 65 Years and Over Below Poverty Level

Table E.1. (Continued).

Ranking Table Number	Ranking Table Definition
R1704	Percent of Children Below Poverty Level
R1801	Percent of People 5 to 20 Years Old With a Disability
R1802	Percent of People 21 to 64 Years Old With a Disability
R1803	Percent of People 65 Years and Over With a Disability
R1901	Median Earnings for Male Full-Time, Year-Round Workers
R1902	Median Earnings for Female Full-Time, Year-Round Workers
R2001	Median Household Income
R2002	Median Family Income
R2003	Percent of Households With Retirement Income
R2004	Percent of Households With Cash Public Assistance Income
R2101	Percent of Civilian Population Who are Veterans
R2301	Percent of People Who are in the Labor Force (including Armed Forces)
R2302	Percent of Children With All Parents in the Labor Force
R2303	Employment Ratio
R2304	Percent of Married-Couple Families With Both Husband and Wife in the Labor Force
R2401	Percent of Civilian Employed People in Management, Business and Financial Occupations
R2402	Percent of Civilian Employed People in Professional and Related Occupations
R2403	Percent of Civilian Employed People in Service Occupations
R2404	Percent of Civilian Employed People in the Manufacturing Industry
R2405	Percent of Civilian Employed People in the Information Industry
R2406	Percent of Civilian Employed People Who are Private Wage and Salary Workers
R2501	Percent of Housing Units That are Mobile Homes
R2502	Percent of Housing Units That Were Built in 2000 or Later
R2503	Percent of Housing Units That Were Built in 1939 or Earlier
R2504	Percent of Occupied Housing Units That Were Moved into in 2000 or Later
R2505	Percent of Occupied Housing Units With Gas as Principal Heating Fuel
R2506	Percent of Occupied Housing Units With Electricity as Principal Heating Fuel
R2507	Percent of Occupied Housing Units With Fuel Oil, Kerosene, Etc as Principal Heating Fuel
R2509	Percent of Occupied Housing Units With 1 01 or More Occupants Per Room
R2510	Median Housing Value of Owner-occupied Housing Units
R2511	Median Monthly Housing Costs for Owner-occupied Housing Units With a Mortgage
R2512	Percent of Occupied Housing Units That are Owner-occupied
R2513	Percent of Mortgaged Owners Spending 30% or More of Household Income on Selected Monthly Owner Costs
R2514	Median Monthly Housing Costs for Renter-occupied Housing Units
R2515	Percent of Renter-occupied Units Spending 30% or More of Household Income on Rent and Utilities

Source: Census Bureau American Fact Finder Web Site, accessed January 2006.

R0801: Mean Travel Time to Work of Workers 16 Years and Over Who Did Not Work at Home (Minutes): 2004
Universe: Workers 16 years and over who did not work at home
Data Set: 2004 American Community Survey
Geographic Area: United States and States

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Rank	State	Average	Lower Bound	Upper Bound
1	New York	30.6	30.3	30.9
2	Maryland	29.7	29.2	30.2
3	New Jersey	29.4	28.9	29.9
4	District of Columbia	28.0	27.3	28.7
5	Illinois	27.7	27.2	28.2
6	California	27.1	26.7	27.5
7	Georgia	26.8	25.9	27.7
8	Virginia	26.5	26.0	27.0
9	Massachusetts	26.4	26.0	26.8
10	Hawaii	25.8	24.5	27.1
11	West Virginia	25.6	24.8	26.4
12	Florida	25.4	25.1	25.7
13	Pennsylvania	25.1	24.6	25.6
14	Washington	24.8	24.3	25.3
	United States	24.7	24.6	24.8
15	New Hampshire	24.6	24.0	25.2
16	Connecticut	24.0	23.4	24.6
17	Louisiana	23.9	23.3	24.5
17	North Carolina	23.9	23.4	24.4
19	Alabama	23.8	23.4	24.2
19	Texas	23.8	23.5	24.1
21	Colorado	23.5	22.9	24.1
22	Arizona	23.4	22.6	24.2
23	Missouri	23.3	22.3	24.3
24	Delaware	23.2	22.7	23.7
24	Tennessee	23.2	21.9	24.5
26	Rhode Island	23.1	22.5	23.7
27	Michigan	22.9	22.4	23.4

Figure E.1. Example of an ACS Ranking Table.

Rank	State	Average	Lower Bound	Upper Bound
28	Kentucky	22.7	21.9	23.5
29	Nevada	22.6	22.0	23.2
30	South Carolina	22.4	21.8	23.0
31	Minnesota	22.3	21.4	23.2
32	Maine	21.9	21.3	22.5
32	Ohio	21.9	21.6	22.2
34	Indiana	21.8	21.2	22.4
35	Mississippi	21.7	20.6	22.8
36	Oregon	21.4	20.6	22.2
36	Vermont	21.4	20.8	22.0
38	Arkansas	20.8	20.3	21.3
39	Utah	20.7	19.5	21.9
40	Wisconsin	20.6	20.1	21.1
41	New Mexico	20.1	19.3	20.9
42	Idaho	19.7	19.0	20.4
43	Oklahoma	19.5	18.9	20.1
44	Iowa	18.2	17.3	19.1
45	Alaska	18.0	17.1	18.9
45	Kansas	18.0	16.8	19.2
47	Wyoming	17.3	16.4	18.2
48	Nebraska	16.5	16.1	16.9
49	Montana	16.3	15.5	17.1
50	South Dakota	15.8	15.1	16.5
51	North Dakota	15.4	14.7	16.1

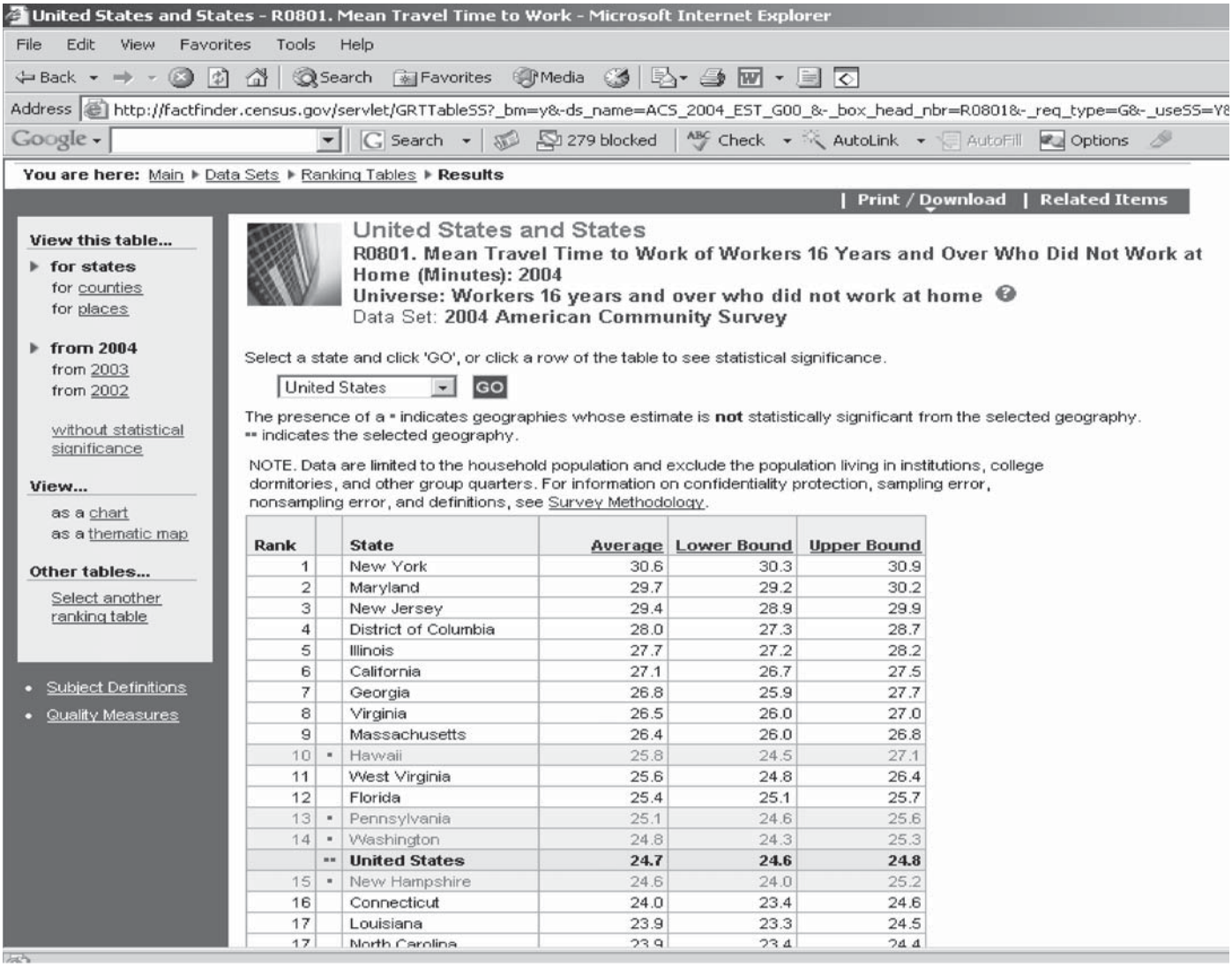
Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a confidence interval. The interval shown here is a 90 percent confidence interval. The stated range can be interpreted roughly as providing a 90 percent probability that the interval defined by the lower and upper bounds contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Explanation of Symbols:

1. An '*' entry in the lower and upper bound columns indicates that too few sample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
2. An '**' entry in the lower and upper bound columns indicates that no sample observations were available to compute a standard error and thus the lower and upper bounds. A statistical test is not appropriate.
3. An '-' entry in the estimate column indicates that no sample observations were available to compute an estimate.
4. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
5. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
6. An '***' entry in the lower and upper bound columns indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
7. An '*****' entry in the lower and upper bound columns indicates that the estimate is controlled. A statistical test is not appropriate.
8. An 'N' entry in the estimate, lower bound, and upper bound columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.

Figure E.1. (Continued).



Rank		State	Average	Lower Bound	Upper Bound
1		New York	30.6	30.3	30.9
2		Maryland	29.7	29.2	30.2
3		New Jersey	29.4	28.9	29.9
4		District of Columbia	28.0	27.3	28.7
5		Illinois	27.7	27.2	28.2
6		California	27.1	26.7	27.5
7		Georgia	26.8	25.9	27.7
8		Virginia	26.5	26.0	27.0
9		Massachusetts	26.4	26.0	26.8
10	*	Hawaii	25.8	24.5	27.1
11		West Virginia	25.6	24.8	26.4
12		Florida	25.4	25.1	25.7
13	*	Pennsylvania	25.1	24.6	25.6
14	*	Washington	24.8	24.3	25.3
	**	**United States**	**24.7**	**24.6**	**24.8**
15	*	New Hampshire	24.6	24.0	25.2
16		Connecticut	24.0	23.4	24.6
17		Louisiana	23.9	23.3	24.5
17		North Carolina	23.9	23.4	24.4

Figure E.2. Example of an ACS Ranking Table with statistical significance testing.

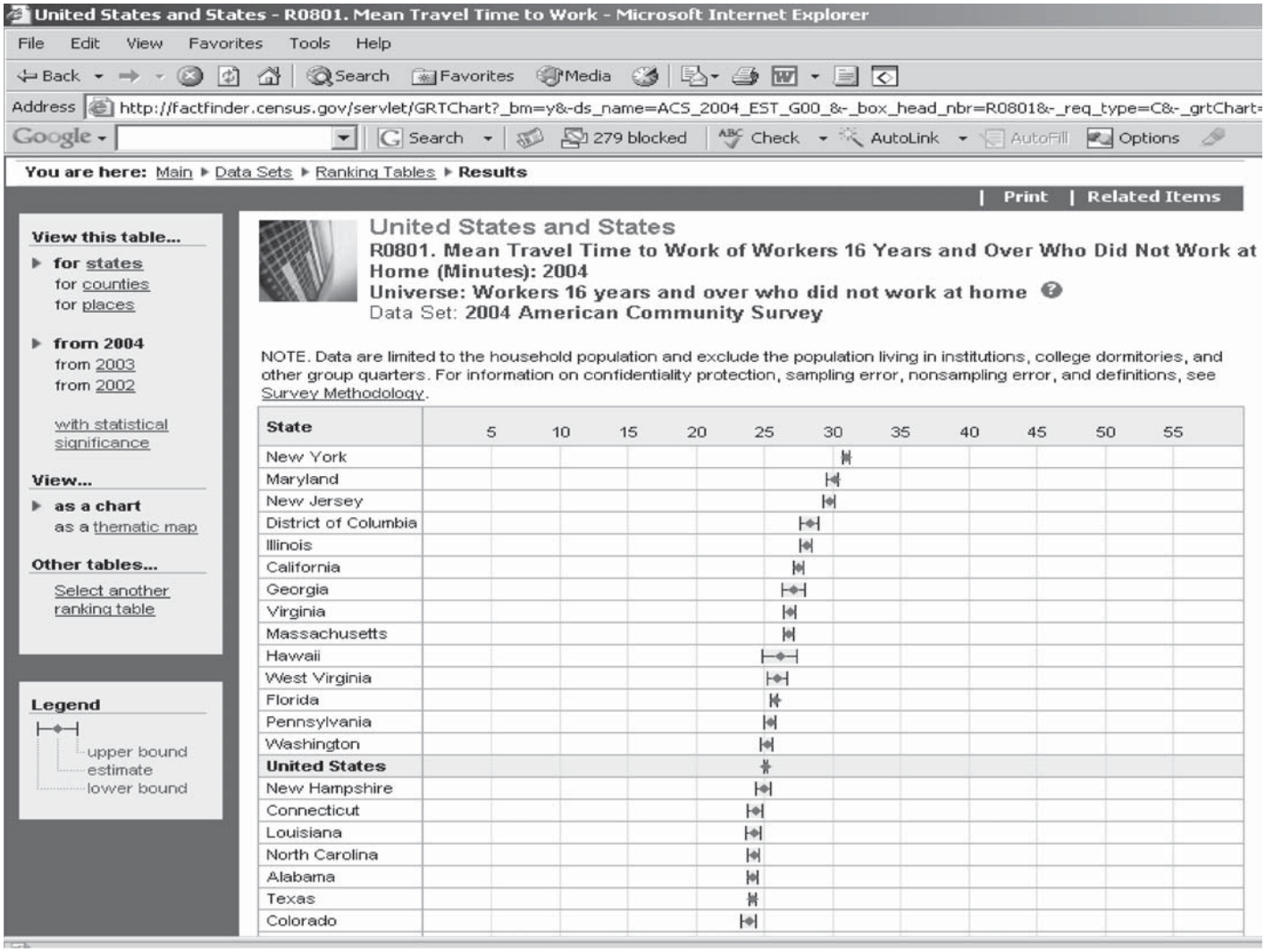


Figure E.3. Example of an ACS Ranking Table chart.

APPENDIX F

ACS Thematic Maps

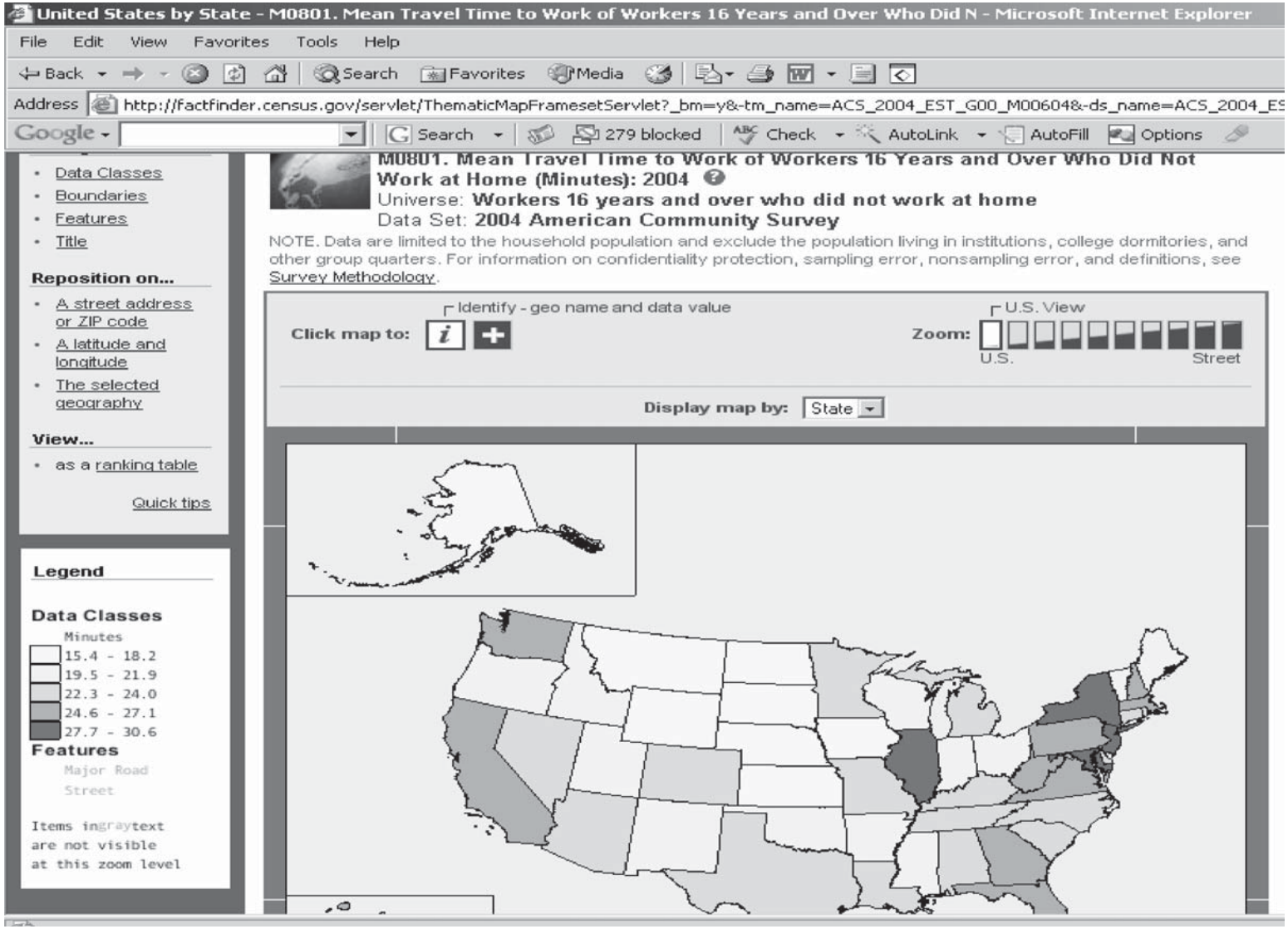


Figure F.1. Example of an ACS thematic map.

APPENDIX G

ACS Subject Tables

Table G.1. ACS subject tables available for 2004.

Subject Table Number	Subject Table Definition
S0101	Age and Sex
S0102	Population 60 Years and Over
S0103	Population 65 Years and Over
S0601	Selected Characteristics of the Total and Native Population
S0602	Selected Characteristics of the Native and Foreign-Born Populations
S0701	Geographic Mobility by Selected Characteristics
S0702	Movers Between Regions
S0801	Commuting Characteristics by Sex
S0802	Means of Transportation to Work by Selected Characteristics
S0803	Workers 16 Years and Over
S0901	Children Characteristics
S0902	Teenagers' Characteristics
S1001	Grandchildren Characteristics
S1002	Grandparents
S1101	Households and Families
S1201	Marital Status
S1301	Fertility
S1401	School Enrollment
S1501	Educational Attainment
S1601	Language Spoken at Home
S1602	Linguistic Isolation
S1603	Characteristics of People Who Speak a Language Other Than English at Home
S1701	Poverty Status in the Past 12 Months
S1702	Poverty Status in the Past 12 Months of Families
S1703	Selected Characteristics of People at Specified Levels of Poverty in the Past 12 Months
S1801	Disability Characteristics
S1901	Income in the Past 12 Months
S1902	Mean Income in the Past 12 Months
S1903	Median Income in the Past 12 Months
S2001	Earnings in the Past 12 Months
S2002	Median Earnings in the Past 12 Months of Workers by Sex and Women's Earnings as a Percentage of Men's Earnings
S2101	Veteran Status
S2201	Food Stamps
S2301	Employment Status
S2401	Occupation by Sex and Median Earnings in the Past 12 Months for the Civilian Employed Population
S2402	Occupation by Sex and Median Earnings in the Past 12 Months for Full-Time, Year-Round Civilian Employed Population
S2403	Industry by Sex and Median Earnings in the Past 12 Months for the Civilian Employed Population
S2404	Industry by Sex and Median Earnings in the Past 12 Months for Full-Time, Year-Round Civilian Employed Population
S2405	Industry by Occupation for the Civilian Employed Population
S2406	Occupation by Class of Worker for the Civilian Employed Population
S2407	Industry by Class of Worker for Civilian Employed Population

(*continued on next page*)

Table G.1. (Continued).

Subject Table Number	Subject Table Definition
S2408	Class of Worker by Sex and Median Earnings in the Past 12 Months for the Civilian Employed Population
S2501	Occupancy Characteristics
S2502	Demographic Characteristics for Occupied Housing Units
S2503	Financial Characteristics
S2504	Physical Housing Characteristics for Occupied Housing Units
S2505	Physical Housing Characteristics for Vacant Housing Units
S2506	Financial Characteristics for Housing Units With a Mortgage
S2507	Financial Characteristics for Housing Units Without a Mortgage

Source: Census Bureau American Fact Finder Web Site, accessed January 2006.

S0801: Commuting Characteristics by Sex
Data Set: 2004 American Community Survey
Geographic Area: St. Louis County, Missouri

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Percent of Total	MOE	Percent of Male	MOE	Percent of Female	MOE
Workers 16 years and over	481,852	+/-12570	248,620	+/-7501	233,232	+/-8633
MEANS OF TRANSPORTATION TO WORK						
Car, truck, or van	94.0	+/-0.9	92.4	+/-1.4	95.7	+/-1.0
Drove alone	87.4	+/-1.5	85.4	+/-2.0	89.5	+/-1.9
Carpooled	6.6	+/-1.2	7.0	+/-1.5	6.2	+/-1.6
In 2-person carpool	5.8	+/-1.1	5.9	+/-1.3	5.6	+/-1.4
In 3-person carpool	0.7	+/-0.4	0.9	+/-0.7	0.3	+/-0.3
In 4-or-more person carpool	0.1	+/-0.1	0.1	+/-0.1	0.2	+/-0.2
Workers per car, truck, or van	(X)	(X)	(X)	(X)	(X)	(X)
Public transportation (excluding taxicab)	1.1	+/-0.5	1.4	+/-0.9	0.8	+/-0.6
Walked	1.1	+/-0.4	1.5	+/-0.7	0.7	+/-0.6
Bicycled	0.0	+/-0.1	0.0	+/-0.3	0.0	+/-0.3
Taxicab, motorcycle or other means	0.6	+/-0.3	0.9	+/-0.5	0.4	+/-0.5
Worked at home	3.1	+/-0.6	3.8	+/-1.0	2.4	+/-0.7
PLACE OF WORK						
Worked in state of residence	97.8	+/-0.6	96.3	+/-1.2	99.4	+/-0.4
Worked in county of residence	70.0	+/-1.9	66.1	+/-2.9	74.2	+/-2.2
Worked outside county of residence	27.8	+/-1.9	30.2	+/-2.9	25.2	+/-2.3
Worked outside state of residence	2.2	+/-0.6	3.7	+/-1.2	0.6	+/-0.4
Living in a place	83.1	+/-1.7	83.6	+/-1.9	82.7	+/-2.0
Worked in place of residence	10.8	+/-1.3	11.2	+/-1.8	10.5	+/-1.7
Worked outside place of residence	72.3	+/-2.1	72.4	+/-2.6	72.2	+/-2.6
Not living in a place	16.9	+/-1.7	16.4	+/-1.9	17.3	+/-2.0
Living in 12 selected states	0.0	+/-0.1	0.0	+/-0.3	0.0	+/-0.3
Worked in minor civil division of residence	0.0	+/-0.1	0.0	+/-0.3	0.0	+/-0.3
Worked outside minor civil division of residence	0.0	+/-0.1	0.0	+/-0.3	0.0	+/-0.3
Not living in 12 selected states	100.0	+/-0.1	100.0	+/-0.3	100.0	+/-0.3
Workers 16 years and over who did not work at home	466,761	+/-12734	239,089	+/-7722	227,672	+/-8660
TIME LEAVING HOME TO GO TO WORK						
12:00 a.m. to 4:59 a.m.	2.5	+/-0.7	3.0	+/-1.0	1.9	+/-0.8
5:00 a.m. to 5:29 a.m.	1.8	+/-0.5	2.2	+/-0.7	1.3	+/-0.6

Figure G.1. Example of an ACS subject table, residence-based commuting characteristics by sex.

(*continued on next page*)

Subject	Percent of Total	MOE	Percent of Male	MOE	Percent of Female	MOE
5:30 a.m. to 5:59 a.m.	3.7	+/-0.7	4.9	+/-1.2	2.4	+/-0.8
6:00 a.m. to 6:29 a.m.	8.2	+/-1.2	10.8	+/-2.1	5.5	+/-1.4
6:30 a.m. to 6:59 a.m.	10.8	+/-1.3	12.2	+/-1.8	9.2	+/-1.9
7:00 a.m. to 7:29 a.m.	17.6	+/-1.6	16.9	+/-2.2	18.3	+/-2.5
7:30 a.m. to 7:59 a.m.	13.3	+/-1.4	11.3	+/-1.8	15.3	+/-2.0
8:00 a.m. to 8:29 a.m.	11.5	+/-1.4	11.4	+/-1.7	11.6	+/-1.9
8:30 a.m. to 8:59 a.m.	6.6	+/-1.0	6.1	+/-1.3	7.1	+/-1.6
9:00 a.m. to 11:59 p.m.	24.0	+/-1.6	21.0	+/-2.1	27.2	+/-2.5
TRAVEL TIME TO WORK						
Less than 10 minutes	11.2	+/-1.4	10.7	+/-2.1	11.7	+/-1.6
10 to 14 minutes	12.5	+/-1.3	10.2	+/-1.6	14.8	+/-2.2
15 to 19 minutes	15.2	+/-1.7	15.2	+/-2.3	15.3	+/-2.1
20 to 24 minutes	19.9	+/-1.6	19.2	+/-2.3	20.6	+/-2.4
25 to 29 minutes	8.2	+/-1.3	7.4	+ /-1.5	9.1	+/-2.1
30 to 34 minutes	18.3	+/-1.8	22.1	+/-2.5	14.2	+/-2.4
35 to 44 minutes	6.7	+/-1.1	7.7	+ /-1.5	5.7	+/-1.4
45 to 59 minutes	5.5	+/-1.0	4.5	+ /-1.3	6.5	+/-1.6
60 or more minutes	2.6	+/-0.9	3.1	+/-1.2	2.0	+/-1.0
Mean travel time to work (minutes)	23.2	+/-0.9	23.9	+/-1.0	22.4	+/-1.3
VEHICLES AVAILABLE						
Workers 16 years and over in households	481,852	+/-12570	248,620	+/-7501	233,232	+/-8633
No vehicle available	2.1	+/-0.9	2.7	+/-1.1	1.5	+/-1.1
1 vehicle available	20.4	+/-1.9	16.3	+/-2.4	24.8	+/-2.7
2 vehicles available	46.9	+/-2.6	48.7	+/-3.3	44.9	+/-3.0
3 or more vehicles available	30.6	+/-2.4	32.4	+/-2.6	28.8	+/-2.7
PERCENT IMPUTED						
Means of transportation to work	1.8	(X)	(X)	(X)	(X)	(X)
Private vehicle occupancy	3.3	(X)	(X)	(X)	(X)	(X)
Place of work	3.3	(X)	(X)	(X)	(X)	(X)
Time leaving home to go to work	9.0	(X)	(X)	(X)	(X)	(X)
Travel time to work	6.2	(X)	(X)	(X)	(X)	
Vehicles available	0.7	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:
· Workers include members of the Armed Forces and civilians who were at work last week.
· The 12 selected states are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin.

Explanation of Symbols:
1. An '*' entry in the margin of error column indicates that too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '**' entry in the margin of error column indicates that no sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
3. An '-' entry in the estimate column indicates that no sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
4. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
5. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
6. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
7. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
8. An 'N' entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
9. An '(X)' means that the estimate is not applicable or not available.

Figure G.1. (Continued).

S0802: Means of Transportation to Work by Selected Characteristics
Data Set: 2004 American Community Survey
Geographic Area: St. Louis County, Missouri

NOTE. Data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Percent of Total	MOE	Percent of Car, Truck, or Van – Drove Alone	MOE	Percent of Car, Truck, or Van – Carpooled	MOE	Percent of Public Transportation (Excluding Taxicab)	MOE	Mean Travel Time to Work (Minutes) for Workers who Did Not Work at Home	MOE
Workers 16 years and over	481,852	+/-12570	421,175	+/-13290	31,686	+/-5901	5,469	+/-2671	23.2	+/-0.9
AGE										
16 to 19 years	4.6	+/-0.6	4.3	+/-0.6	9.7	+/-4.9	3.0	+/-5.5	12.6	+/-1.6
20 to 24 years	8.0	+/-0.9	8.1	+/-0.9	6.3	+/-3.9	8.4	+/-10.0	24.0	+/-5.4
25 to 44 years	43.7	+/-1.3	43.5	+/-1.5	45.1	+/-8.4	44.0	+/-20.2	22.9	+/-1.0
45 to 54 years	25.8	+/-1.2	25.9	+/-1.3	22.5	+/-5.9	26.8	+/-17.8	25.1	+/-1.6
55 to 59 years	8.2	+/-0.9	8.4	+/-1.0	6.3	+/-4.3	13.5	+/-15.0	24.0	+/-3.1
60 to 61 years	3.0	+/-0.7	3.0	+/-0.7	3.0	+/-2.1	4.2	+/-7.2	21.3	+/-2.2
62 to 64 years	2.3	+/-0.6	2.3	+/-0.6	3.7	+/-2.3	0.0	+/-11.2	25.6	+/-5.2
65 years and over	4.3	+/-0.6	4.4	+/-0.7	3.4	+/-2.4	0.0	+/-11.2	22.7	+/-3.7
Median age (years)	42.8	+/-0.5	43.0	+/-0.5	39.2	+/-3.4	41.9	+/-6.2	(X)	(X)
SEX										
Male	51.6	+/-1.1	50.4	+/-1.3	54.5	+/-7.0	64.6	+/-19.9	23.9	+/-1.0
Female	48.4	+/-1.1	49.6	+/-1.3	45.5	+/-7.0	35.4	+/-19.9	22.4	+/-1.3
RACE AND HISPANIC OR LATINO ORIGIN										
One race	N	N	N	N	N	N	N	N	N	N
White	78.2	+/-1.3	78.9	+/-1.5	65.3	+/-9.2	46.8	+/-20.2	22.7	+/-1.1
Black or African American	18.3	+/-1.1	17.7	+/-1.4	26.7	+/-8.0	53.2	+/-20.2	25.0	+/-1.7
American Indian and Alaska Native	N	N	N	N	N	N	N	N	N	N
Asian	2.1	+/-0.5	1.8	+/-0.6	7.6	+/-6.0	0.0	+/-11.2	25.1	+/-3.7
Native Hawaiian and Other Pacific Islander	N	N	N	N	N	N	N	N	N	N
Some other race	N	N	N	N	N	N	N	N	N	N
Two or more races	0.7	+/-0.4	0.7	+/-0.4	0.3	+/-0.6	0.0	+/-11.2	23.0	+/-8.4
Hispanic or Latino origin (of any race)	1.5	+/-0.2	1.2	+/-0.5	6.5	+/-5.5	0.0	+/-11.2	21.9	+/-3.4
White alone, not Hispanic or Latino	77.0	+/-1.2	78.2	+/-1.5	58.8	+/-9.3	46.8	+/-20.2	21.9	+/-3.4

Figure G.2. Example of an ACS subject table, means of transportation to work by selected characteristics.

(*continued on next page*)

Subject	Percent of Total	MOE	Percent of Car, Truck, or Van – Drove Alone	MOE	Percent of Car, Truck, or Van – Carpooled	MOE	Percent of Public Transportation (Excluding Taxicab)	MOE	Mean Travel Time to Work (Minutes) for Workers who Did Not Work at Home	MOE
CITIZENSHIP STATUS										
Native	92.4	+/-1.5	93.1	+/-1.4	81.8	+/-8.9	96.0	+/-6.7	23.2	+/-1.0
Foreign born	7.6	+/-1.5	6.9	+/-1.4	18.2	+/-8.9	4.0	+/-6.7	22.7	+/-3.0
Naturalized U.S. citizen	2.8	+/-0.8	2.7	+/-0.9	4.3	+/-3.5	0.0	+/-11.2	24.2	+/-5.5
Not a U.S. citizen	4.8	+/-1.3	4.2	+/-1.3	13.8	+/-7.0	4.0	+/-6.7	21.8	+/-2.6
LANGUAGE SPOKEN AT HOME AND ABILITY TO SPEAK ENGLISH										
Speak language other than English	8.7	+/-1.4	7.7	+/-1.4	21.6	+/-8.3	16.1	+/-13.5	21.4	+/-1.7
Speak English "very well"	5.2	+/-1.1	4.7	+/-1.1	10.6	+/-5.6	12.4	+/-12.2	22.3	+/-2.1
Speak English less than "very well"	3.6	+/-1.1	3.0	+/-1.0	11.0	+/-7.4	3.7	+/-6.5	20.1	+/-2.8
MARITAL STATUS										
Never married	25.3	+/-2.0	25.0	+/-2.3	29.9	+/-7.7	34.8	+/-22.1	20.1	+/-1.1
Now married, except separated	58.8	+/-2.6	59.3	+/-2.8	54.5	+/-7.8	35.6	+/-18.4	24.0	+/-1.3
Divorced or separated	14.1	+/-1.7	14.1	+/-1.9	12.3	+/-6.4	29.6	+/-17.7	25.6	+/-2.4
Widowed	1.7	+/-0.5	1.7	+/-0.5	3.3	+/-3.5	0.0	+/-11.2	20.2	+/-2.6
EDUCATIONAL ATTAINMENT										
Workers 25 years and over	420,762	+/-11403	368,618	+/-11743	26,607	+/-5870	4,844	+/-2617	23.7	+/-0.9
Less than high school graduate	4.1	+/-1.1	4.2	+/-1.2	4.6	+/-4.0	0.0	+/-12.5	19.0	+/-2.2
High school graduate (includes equivalency)	22.0	+/-2.2	21.4	+/-2.1	24.0	+/-9.2	46.1	+/-21.1	22.8	+/-1.6
Some college or associate's degree	31.9	+/-2.7	32.3	+/-3.0	33.8	+/-9.6	24.2	+/-20.2	24.8	+/-1.6
Bachelor's degree	26.4	+/-1.6	26.4	+/-1.7	22.3	+/-8.2	21.4	+/-15.1	23.5	+/-1.5
Graduate or professional degree	15.7	+/-1.6	15.6	+/-1.6	15.3	+/-7.8	8.4	+/-9.6	23.9	+/-1.9
EARNINGS IN THE PAST 12 MONTHS (IN 2004 INFLATION-ADJUSTED DOLLARS) FOR WORKERS										
Workers 16 years and over with earnings	481,852	+/-12570	421,175	+/-13290	31,686	+/-5901	5,469	+/-2671	23.2	+/-0.9
$1 to $9,999 or loss	13.6	+/-1.1	12.4	+/-1.1	20.1	+/-6.7	19.1	+/-14.7	18.4	+/-3.4
$10,000 to $14,999	7.0	+/-1.1	6.7	+/-1.1	11.4	+/-5.5	8.3	+/-9.8	19.4	+/-1.6
$15,000 to $24,999	13.0	+/-1.6	12.5	+/-1.6	20.0	+/-6.2	11.9	+/-19.2	22.0	+/-2.2
$25,000 to $34,999	17.9	+/-1.5	18.6	+/-1.8	18.2	+/-6.4	12.7	+/-18.3	24.0	+/-1.7
$35,000 to $49,999	19.0	+/-1.7	19.9	+/-1.9	7.6	+/-3.6	29.7	+/-20.1	24.6	+/-1.9
$50,000 to $64,999	11.4	+/-1.1	11.2	+/-1.3	10.6	+/-5.6	15.3	+/-12.7	24.5	+/-1.6
$65,000 to $74,999	4.6	+/-0.9	4.9	+/-1.0	1.2	+/-1.8	0.0	+/-11.2	27.5	+/-4.7
$75,000 or more	13.4	+/-1.2	13.9	+/-1.4	10.9	+/-4.9	3.0	+/-4.9	25.2	+/-2.2
Median earnings (dollars)	33,332	+/-1796	34,842	+/-1738	24,524	+/-2701	34,613	+/-15949	(X)	(X)

Figure G.2. (Continued).

Subject	Percent of Total	MOE	Percent of Car, Truck, or Van – Drove Alone	MOE	Percent of Car, Truck, or Van – Carpooled	MOE	Percent of Public Transportation (Excluding Taxicab)	MOE	Mean Travel Time to Work (Minutes) for Workers who Did Not Work at Home	MOE
POVERTY STATUS IN THE PAST 12 MONTHS										
Workers 16 years and over for whom poverty status is determined	481,852	+/-12570	421,175	+/-13290	31,686	+/-5901	5,469	+/-2671	23.2	+/-0.9
Below 100 percent of the poverty level	3.1	+/-0.9	2.8	+/-1.0	2.1	+/-2.1	8.3	+/-9.9	18.1	+/-2.2
100 to 149 percent of the poverty level	3.3	+/-0.8	3.1	+/-0.8	6.7	+/-3.9	3.6	+/-6.0	21.3	+/-2.4
At or above 150 percent of the poverty level	93.7	+/-1.2	94.1	+/-1.3	91.2	+/-4.0	88.0	+/-11.9	23.4	+/-1.0
Workers 16 years and over	481,852	+/-12570	421,175	+/-13290	31,686	+/-5901	5,469	+/-2671	23.2	+/-0.9
OCCUPATION										
Management, professional, and related occupations	39.7	+/-2.2	39.6	+/-2.2	36.5	+/-8.4	34.7	+/-16.3	25.4	+/-1.6
Service occupations	13.7	+/-1.6	13.1	+/-1.6	16.8	+/-6.3	23.2	+/-20.7	18.6	+/-1.8
Sales and office occupations	30.5	+/-2.0	31.0	+/-2.3	25.5	+/-7.3	34.2	+/-21.1	21.9	+/-1.1
Farming, fishing, and forestry occupations	0.1	+/-0.1	0.1	+/-0.1	0.0	+/-2.0	0.0	+/-11.2	15.3	+/-6.2
Construction, extraction, and maintenance occupations	7.2	+/-1.0	7.1	+/-1.2	11.4	+/-6.2	0.0	+/-11.2	24.8	+/-2.6
Production, transportation, and material moving occupations	8.7	+/-1.3	9.0	+/-1.4	9.9	+/-5.3	7.8	+/-8.0	23.4	+/-2.2
Armed Forces	0.1	+/-0.1	0.1	+/-0.1	0.0	+/-2.0	0.0	+/-11.2	13.4	+/-9.5
INDUSTRY										
Agriculture, forestry, fishing and hunting, and mining	0.2	+/-0.1	0.1	+/-0.1	0.0	+/-2.0	0.0	+/-11.2	12.9	+/-3.1
Construction	6.0	+/-1.0	5.8	+/-1.1	10.1	+/-6.1	0.0	+/-11.2	26.0	+/-3.1
Manufacturing	11.1	+/-1.1	11.3	+/-1.3	15.1	+/-6.2	4.2	+/-7.0	25.4	+/-1.7
Wholesale trade	4.1	+/-0.8	4.1	+/-0.9	3.3	+/-3.2	0.0	+/-11.2	24.0	+/-2.4
Retail trade	11.6	+/-1.3	12.0	+/-1.6	7.5	+/-4.3	12.7	+/-18.3	20.3	+/-2.8
Transportation and warehousing, and utilities	4.6	+/-0.9	4.7	+/-1.0	3.6	+/-2.8	15.2	+/-12.2	26.1	+/-3.9
Information	3.8	+/-1.0	3.8	+/-1.1	4.3	+/-3.1	7.2	+/-8.1	24.7	+/-4.2
Finance, insurance, real estate, and rental and leasing	10.2	+/-1.4	10.8	+/-1.6	4.4	+/-3.1	8.2	+/-9.6	25.6	+/-2.7
Professional, scientific, management, and administrative and waste management services	9.8	+/-1.3	8.6	+/-1.3	9.8	+/-5.8	23.3	+/-17.4	29.3	+/-4.9
Educational services, health care and social assistance	22.5	+/-1.9	23.0	+/-2.0	22.6	+/-6.6	12.0	+/-12.1	20.9	+/-1.2
Arts, entertainment, recreation, accommodation and food services	7.9	+/-1.3	8.0	+/-1.4	6.8	+/-3.1	0.0	+/-11.2	16.9	+/-1.6
Other services (except public administration)	4.9	+/-0.9	4.7	+/-0.9	7.8	+/-5.1	3.0	+/-5.5	20.9	+/-3.2
Public administration	2.9	+/-0.7	2.9	+/-0.8	2.6	+/-2.0	14.1	+/-17.2	23.6	+/-3.4
Armed Forces	0.4	+/-0.3	0.3	+/-0.2	2.1	+/-3.5	0.0	+/-11.2	25.0	+/-6.7
CLASS OF WORKER										
Private for-profit wage and salary workers	74.1	+/-2.0	75.7	+/-2.1	68.4	+/-7.7	76.0	+/-18.3	23.4	+/-0.8
Private not-for-profit wage and salary workers	10.7	+/-1.3	10.7	+/-1.4	11.1	+/-5.1	9.9	+/-9.5	21.5	+/-1.9
Local government workers	4.8	+/-0.9	5.0	+/-0.9	5.2	+/-3.8	0.0	+/-11.2	16.6	+/-1.8

Figure G.2. (Continued).

(*continued on next page*)

Subject	Percent of Total	MOE	Percent of Car, Truck, or Van – Drove Alone	MOE	Percent of Car, Truck, or Van – Carpooled	MOE	Percent of Public Transportation (Excluding Taxicab)	MOE	Mean Travel Time to Work (Minutes) for Workers who Did Not Work at Home	MOE
State government workers	1.9	+/-0.5	1.9	+/-0.5	3.0	+/-2.5	0.0	+/-11.2	24.8	+/-4.2
Federal government workers	3.1	+/-0.8	2.8	+/-0.9	7.6	+/-5.0	14.1	+/-17.2	24.7	+/-2.9
Self-employed workers in own not incorporated business	5.2	+/-1.0	3.7	+/-0.8	4.7	+/-3.0	0.0	+/-11.2	27.8	+/-11.0
Unpaid family workers	0.2	+/-0.3	0.3	+/-0.3	0.0	+/-2.0	0.0	+/-11.2	52.7	+/-34.6
PLACE OF WORK										
Worked in state of residence	97.8	+/-0.6	98.0	+/-0.7	98.0	+/-1.9	92.4	+/-7.9	22.6	+/-0.9
Worked in county of residence	70.0	+/-1.9	70.0	+/-1.8	64.0	+/-8.2	30.5	+/-19.1	21.5	+/-1.2
Worked outside county of residence	27.8	+/-1.9	28.0	+/-2.0	34.0	+/-7.7	61.9	+/-19.1	25.3	+/-1.0
Worked outside state of residence	2.2	+/-0.6	2.0	+/-0.7	2.0	+/-1.9	7.6	+/-7.9	46.7	+/-10.5
Workers 16 years and over who did not work at home	466,761	+/-12734	421,175	+/-13290	31,686	+/-5901	5,469	+/-2671	23.2	+/-0.9
TIME LEAVING HOME TO GO TO WORK										
12:00 a.m. to 4:59 a.m.	2.5	+/-0.7	2.6	+/-0.7	1.3	+/-1.6	3.6	+/-5.3	19.7	+/-3.6
5:00 a.m. to 5:29 a.m.	1.8	+/-0.5	1.9	+/-0.5	1.7	+/-1.6	0.0	+/-11.2	24.6	+/-2.8
5:30 a.m. to 5:59 a.m.	3.7	+/-0.7	3.8	+/-0.8	4.3	+/-3.2	0.0	+/-11.2	25.1	+/-3.2
6:00 a.m. to 6:29 a.m.	8.2	+/-1.2	8.3	+/-1.2	5.9	+/-4.0	22.5	+/-21.7	28.9	+/-2.7
6:30 a.m. to 6:59 a.m.	10.8	+/-1.3	10.6	+/-1.4	12.4	+/-5.7	14.4	+/-12.1	25.5	+/-2.1
7:00 a.m. to 7:29 a.m.	17.6	+/-1.6	16.9	+/-1.6	24.2	+/-7.6	37.1	+/-21.5	26.8	+/-1.6
7:30 a.m. to 7:59 a.m.	13.3	+/-1.4	13.8	+/-1.5	7.7	+/-4.4	3.7	+/-6.3	22.2	+/-1.9
8:00 a.m. to 8:29 a.m.	11.5	+/-1.4	12.0	+/-1.5	8.2	+/-4.4	3.0	+/-5.5	21.2	+/-1.8
8:30 a.m. to 8:59 a.m.	6.6	+/-1.0	7.0	+/-1.1	2.9	+/-3.6	0.0	+/-11.2	18.5	+/-1.4
9:00 a.m. to 11:59 p.m.	24.0	+/-1.6	23.0	+/-1.6	31.3	+/-7.2	15.6	+/-20.3	20.2	+/-2.3
TRAVEL TIME TO WORK										
Less than 10 minutes	11.2	+/-1.4	10.6	+/-1.4	11.0	+/-5.2	0.0	+/-11.2	4.8	+/-0.2
10 to 14 minutes	12.5	+/-1.3	13.3	+/-1.5	3.8	+/-2.7	3.7	+/-6.5	10.3	+/-0.1
15 to 19 minutes	15.2	+/-1.7	15.1	+/-1.7	21.0	+/-8.3	3.6	+/-5.3	15.1	+/-0.1
20 to 24 minutes	19.9	+/-1.6	20.8	+/-1.7	13.4	+/-5.1	0.0	+/-11.2	20.0	+/-0.1
25 to 29 minutes	8.2	+/-1.3	8.5	+/-1.4	6.7	+/-5.0	6.7	+/-8.9	25.1	+/-0.1
30 to 34 minutes	18.3	+/-1.8	17.9	+/-1.8	25.4	+/-8.4	27.0	+/-17.5	30.0	+/-0.2
35 to 44 minutes	6.7	+/-1.1	6.5	+/-1.1	8.9	+/-4.6	19.3	+/-12.5	37.2	+/-0.4
45 to 59 minutes	5.5	+/-1.0	5.3	+/-1.0	4.5	+/-3.2	35.1	+/-20.6	45.6	+/-0.3
60 or more minutes	2.6	+/-0.9	2.0	+/-0.8	5.3	+/-4.0	4.6	+/-7.7	98.9	+/-16.4
Mean travel time to work (minutes)	23.2	+/-0.9	22.6	+/-0.7	25.2	+/-2.8	36.6	+/-4.2	(X)	(X)
Workers 16 years and over in households	481,852	+/-12570	421,175	+/-13290	31,686	+/-5901	5,469	+/-2671	23.2	+/-0.9
HOUSING TENURE										
Owner-occupied housing units	81.5	+/-2.3	82.0	+/-2.4	75.8	+/-7.5	58.7	+/-21.9	23.6	+/-1.1
Renter-occupied housing units	18.5	+/-2.3	18.0	+/-2.4	24.2	+/-7.5	70.4	+/-64.0	21.2	+/-1.4

Figure G.2. (Continued).

Subject	Percent of Total	MOE	Percent of Car, Truck, or Van – Drove Alone	MOE	Percent of Car, Truck, or Van – Carpooled	MOE	Percent of Public Transportation (Excluding Taxicab)	MOE	Mean Travel Time to Work (Minutes) for Workers who Did Not Work at Home	MOE
HOUSEHOLD TYPE										
In married-couple family households	65.1	+/-2.7	65.5	+/-2.7	62.8	+/-8.7	38.3	+/-19.9	23.1	+/-1.2
In other households	34.9	+/-2.7	34.5	+/-2.7	37.2	+/-8.7	61.7	+/-19.9	23.2	+/-1.3
VEHICLES AVAILABLE										
No vehicle available	2.1	+/-0.9	1.0	+/-0.5	8.4	+/-5.5	15.5	+/-21.8	20.9	+/-3.6
1 vehicle available	20.4	+/-1.9	20.4	+/-2.0	21.6	+/-8.9	44.4	+/-23.6	22.9	+/-1.7
2 vehicles available	46.9	+/-2.6	46.8	+/-2.7	48.4	+/-9.7	32.3	+/-22.7	23.8	+/-1.5
3 or more vehicles available	30.6	+/-2.4	31.9	+/-2.5	21.6	+/-6.4	7.8	+/-9.3	22.5	+/-1.3
PERCENT IMPUTED										
Means of transportation to work	1.8	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
Time leaving home to go to work	9.0	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
Travel time to work	6.2	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.7	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:

Workers include members of the Armed Forces and civilians who were at work last week.

Foreign born excludes people born outside the U.S. to parents who are U.S. citizens.

Occupation codes are four-digit codes, but are still based on Standard Occupational Classification 2000.

Industry codes are four-digit codes and are based on the North American Industry Classification System 2002. However, the Industry categories adhere to the guidelines issued in Clarification Memorandum No. 2,"NAICS Alternate Aggregation Structure for Use by U.S. Statistical Agencies," issued by the Office of Management and Budget.

Explanation of Symbols:

1. An '*' entry in the margin of error column indicates that too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '**' entry in the margin of error column indicates that no sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
3. An '-' entry in the estimate column indicates that no sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
4. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
5. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
6. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
7. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
8. An 'N' entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
9. An '(X)' means that the estimate is not applicable or not available.

Figure G.2. (Continued).

APPENDIX H

ACS Selected Population Profiles

Subject	Total Population	MOE	American Indian and Alaska Native Alone	MOE
Total population	5,633,997	*****	270,662	+/-23,339
SEX AND AGE				
Male	49.6%	+/-0.1	44.5%	+/-1.8
Female	50.4%	+/-0.1	55.5%	+/-1.8
Under 5 years	8.0%	+/-0.1	10.8%	+/-2.2
5 to 17 years	19.3%	+/-0.1	27.4%	+/-1.7
18 to 24 years	9.7%	+/-0.1	14.6%	+/-1.7
25 to 34 years	14.1%	+/-0.1	10.7%	+/-2.0
35 to 44 years	14.0%	+/-0.1	12.7%	+/-2.1
45 to 54 years	12.7%	+/-0.1	12.0%	+/-1.4
55 to 64 years	9.6%	+/-0.1	6.7%	+/-1.3
65 to 74 years	7.0%	+/-0.1	4.3%	+/-0.8
75 years and over	5.6%	+/-0.1	0.8%	+/-0.3
Median age (years)	34.1	+/-0.2	22.8	+/-1.2
18 years and over	72.6%	+/-0.1	61.8%	+/-1.1
21 years and over	68.6%	+/-0.2	53.6%	+/-1.8
62 years and over	15.2%	+/-0.2	6.3%	+/-1.3
65 years and over	12.6%	+/-0.1	5.1%	+/-1.1
18 years and over	4,092,291	+/-2,181	167,331	+/-14,171
Male	49.1%	+/-0.2	44.4%	+/-1.6
Female	50.9%	+/-0.2	55.6%	+/-1.6
65 years and over	709,031	+/-4,011	13,918	+/-3,700
Male	45.1%	+/-0.2	59.4%	+/-10.9
Female	54.9%	+/-0.2	40.6%	+/-10.9
RELATIONSHIP				
Householder or spouse	58.3%	+/-0.4	40.9%	+/-1.8
Child	29.9%	+/-0.4	36.2%	+/-4.2
Other relatives	6.4%	+/-0.5	17.5%	+/-2.5
Nonrelatives	5.4%	+/-0.4	5.3%	+/-1.3
Unmarried partner	2.5%	+/-0.2	2.4%	+/-0.7
HOUSEHOLDS BY TYPE				
Households	2,131,534	+/-32,767	77,767	+/-5,789
Family households	67.3%	+/-1.0	74.4%	+/-4.4
With own children under 18 years	31.8%	+/-0.9	38.8%	+/-6.7
Married-couple families	51.1%	+/-1.1	36.9%	+/-7.7
With own children under 18 years	21.9%	+/-1.0	17.0%	+/-5.6
Female householder, no husband present	12.1%	+/-0.8	29.6%	+/-6.3
With own children under 18 years	7.6%	+/-0.9	17.7%	+/-8.0
Nonfamily households	32.7%	+/-1.0	25.6%	+/-4.4

Figure H.1. Example of an ACS Selected Population Profile.

(*continued on next page*)

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Subject	Total Population	MOE	American Indian and Alaska Native Alone	MOE
Male householder	16.4%	+/-0.9	14.1%	+/-6.0
Living alone	12.8%	+/-1.0	12.4%	+/-6.0
Not living alone	3.5%	+/-0.4	1.7%	+/-1.7
Female householder	16.3%	+/-0.6	11.6%	+/-5.5
Living alone	13.5%	+/-0.6	7.7%	+/-4.1
Not living alone	2.8%	+/-0.3	3.9%	+/-2.4
Average household size	2.64	+/-0.04	3.49	+/-0.29
Average family size	3.22	+/-0.05	4.07	+/-0.24
MARITAL STATUS				
Population 15 years and over	4,331,652	+/-7,093	185,082	+/-14,671
Now married, except separated	54.4%	+/-0.8	39.6%	+/-3.5
Widowed	5.4%	+/-0.3	3.6%	+/-0.8
Divorced	11.3%	+/-0.4	7.6%	+/-1.0
Separated	1.9%	+/-0.2	2.4%	+/-1.2
Never married	27.0%	+/-0.5	46.7%	+/-3.2
SCHOOL ENROLLMENT				
Population 3 years and over enrolled in school	1,535,188	+/-37,120	101,227	+/-16,153
Nursery school, preschool	5.2%	+/-0.6	10.4%	+/-6.4
Kindergarten	5.4%	+/-0.6	4.1%	+/-1.9
Elementary school (grades 1-8)	44.0%	+/-1.0	42.8%	+/-4.2
High school (grades 9-12)	20.8%	+/-0.6	25.7%	+/-6.4
College or graduate school	24.7%	+/-0.9	17.0%	+/-4.1
EDUCATIONAL ATTAINMENT				
Population 25 years and over	3,548,365	+/-3,883	127,812	+/-12,175
Less than high school diploma	16.3%	+/-0.8	29.4%	+/-4.9
High school graduate (includes equivalency)	26.7%	+/-1.0	31.1%	+/-5.6
Some college or associate's degree	32.3%	+/-0.7	33.5%	+/-3.6
Bachelor's degree	15.5%	+/-0.7	2.4%	+/-1.0
Graduate or professional degree	9.2%	+/-0.7	3.7%	+/-0.9
High school graduate or higher	83.7%	+/-0.8	70.6%	+/-4.9
Male, high school graduate or higher	83.0%	+/-0.9	64.4%	+/-6.0
Female, high school graduate or higher	84.4%	+/-0.8	75.7%	+/-11.8
Bachelor's degree or higher	24.7%	+/-1.1	6.0%	+/-1.3
Male, bachelor's degree or higher	26.6%	+/-1.3	3.8%	+/-1.9
Female, bachelor's degree or higher	22.9%	+/-1.2	7.9%	+/-1.9
FERTILITY				
Women 15 to 50 years	1,391,938	+/-14,192	79,031	+/-7,842
Women 15 to 50 years who had a birth in the past 12 months	90,214	+/-7,757	3,111	+/-868
Unmarried women 15 to 50 years who had a birth in the past 12 months	23,732	+/-5,773	2,037	+/-686
As a percent of all women with a birth in the past 12 months	26.3%	+/-6.4	65.5%	+/-24.1
RESPONSIBILITY FOR GRANDCHILDREN UNDER 18 YEARS				
Population 30 years and over	3,152,337	+/-4,107	114,986	+/-12,624
Living with grandchild(ren) in the household	3.9%	+/-0.3	13.3%	+/-3.2
Responsible for grandchild(ren)	47.6%	+/-4.5	45.4%	+/-6.3
VETERAN STATUS				
Civilian population 18 years and over	4,083,706	+/-3,375	167,331	+/-14,171
Civilian veteran	13.4%	+/-0.4	9.4%	+/-3.1
DISABILITY STATUS				
Civilian population 5 years and over	5,173,508	+/-4,279	241,375	+/-21,659
With any disability	14.0%	+/-0.5	19.0%	+/-2.9
Civilian population 5 to 15 years	932,976	+/-12,506	61,931	+/-12,028

Figure H.1. (Continued).

Subject	Total Population	MOE	American Indian and Alaska Native Alone	MOE
With any disability	6.2%	+/-0.9	10.4%	+/-4.2
Civilian population 16 to 64 years	3,531,501	+/-12,578	165,526	+/-11,962
With any disability	11.3%	+/-0.7	19.1%	+/-4.3
No disability	88.7%	+/-0.7	80.9%	+/-4.3
Civilian population 65 years and over	709,031	+/-4,011	13,918	+/-3,700
With any disability	37.4%	+/-1.9	55.0%	+/-23.7
RESIDENCE 1 YEAR AGO				
Population 1 year and over	5,542,711	+/-7,589	263,048	+/-22,605
Same house	78.8%	+/-1.0	81.2%	+/-5.9
Different house in the U.S.	20.2%	+/-1.0	17.6%	+/-5.7
Same county	14.1%	+/-0.8	13.9%	+/-2.9
Different county	6.1%	+/-0.7	3.7%	+/-3.4
Same state	1.5%	+/-0.7	N	N
Different state	4.6%	+/-0.7	N	N
Abroad	0.9%	+/-0.2	1.2%	+/-1.4
PLACE OF BIRTH, CITIZENSHIP STATUS AND YEAR OF ENTRY				
Total population	5,633,997	*****	270,662	+/-23,339
Native	4,823,670	+/-52,769	266,244	+/-22,884
Foreign born	810,327	+/-52,769	4,418	+/-3,121
Entered U.S. 2000 or later	24.9%	+/-3.1	53.0%	+/-33.8
Entered U.S. 1990 to 1999	34.8%	+/-3.1	24.3%	+/-22.2
Entered U.S. before 1990	40.3%	+/-3.1	22.7%	+/-18.5
Naturalized U.S. citizen	27.9%	+/-2.0	18.4%	+/-23.0
Not a U.S. citizen	72.1%	+/-2.0	81.6%	+/-23.0
WORLD REGION OF BIRTH OF FOREIGN BORN				
Foreign-born population excluding population born at sea	810,327	+/-52,769	4,418	+/-3,121
Europe	9.6%	+/-1.3	N	N
Asia	12.0%	+/-1.2	N	N
Africa	2.3%	+/-0.9	N	N
Oceania	0.4%	+/-0.3	N	N
Latin America	71.3%	+/-1.9	N	N
Northern America	4.4%	+/-1.1	N	N
LANGUAGE SPOKEN AT HOME AND ABILITY TO SPEAK ENGLISH				
Population 5 years and over	5,182,093	+/-5,624	241,375	+/-21,659
English only	74.6%	+/-1.0	52.2%	+/-5.0
Language other than English	25.4%	+/-1.0	47.8%	+/-5.0
Speak English less than “very well”	10.5%	+/-0.8	8.7%	+/-2.0
EMPLOYMENT STATUS				
Population 16 years and over	4,249,117	+/-8,582	179,444	+/-14,160
In labor force	63.2%	+/-0.6	60.7%	+/-2.2
Civilian labor force	63.0%	+/-0.6	60.7%	+/-2.2
Employed	58.8%	+/-0.7	49.2%	+/-3.0
Unemployed as a percent of civilian labor force	6.7%	+/-0.5	18.9%	+/-4.1
Armed Forces	0.2%	+/-0.1	0.0%	+/-0.3
Not in labor force	36.8%	+/-0.6	39.3%	+/-2.2
Females 16 years and over	2,161,167	+/-11,984	98,448	+/-8,017
In labor force	55.2%	+/-0.9	60.8%	+/-7.3
Civilian labor force	55.2%	+/-0.9	60.8%	+/-7.3
Employed	51.2%	+/-1.0	49.1%	+/-4.5
Unemployed as a percent of civilian labor force	7.3%	+/-0.7	19.3%	+/-6.6
COMMUTING TO WORK				
Workers 16 years and over	2,427,059	+/-29,693	85,232	+/-9,022
Car, truck, or van – drove alone	76.0%	+/-1.1	65.7%	+/-3.6

Figure H.1. (Continued).

(*continued on next page*)

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Subject	Total Population	MOE	American Indian and Alaska Native Alone	MOE
Car, truck, or van – carpooled	14.4%	+/-0.9	23.5%	+/-4.1
Public transportation (excluding taxicab)	1.8%	+/-0.3	2.9%	+/-2.2
Walked	2.0%	+/-0.3	5.6%	+/-2.0
Other means	2.2%	+/-0.3	1.5%	+/-1.4
Worked at home	3.6%	+/-0.4	0.8%	+/-0.5
Mean travel time to work (minutes)	23.4	+/-0.8	24.6	+/-2.2
Employed civilian population 16 years and over	2,497,460	+/-31,724	88,349	+/-9,678
OCCUPATION				
Management, professional, and related occupations	32.2%	+/-1.4	23.6%	+/-5.6
Service occupations	17.4%	+/-0.6	31.0%	+/-7.8
Sales and office occupations	28.1%	+/-1.5	23.5%	+/-3.3
Farming, fishing, and forestry occupations	0.5%	+/-0.2	0.2%	+/-1.0
Construction, extraction, and maintenance occupations	11.2%	+/-0.8	12.4%	+/-3.8
Production, transportation, and material moving occupations	10.6%	+/-0.6	9.3%	+/-3.7
INDUSTRY				
Agriculture, forestry, fishing and hunting, and mining	1.0%	+/-0.2	1.4%	+/-0.2
Construction	10.0%	+/-0.8	9.7%	+/-4.2
Manufacturing	8.6%	+/-0.6	4.7%	+/-2.7
Wholesale trade	3.6%	+/-0.4	0.6%	+/-0.6
Retail trade	12.2%	+/-0.7	10.7%	+/-2.6
Transportation and warehousing, and utilities	5.8%	+/-0.5	3.1%	+/-2.3
Information	1.9%	+/-0.3	2.6%	+/-2.8
Finance, insurance, real estate and rental and leasing	8.2%	+/-0.6	1.1%	+/-0.7
Professional, scientific, management, administrative and waste management services	10.0%	+/-0.6	4.3%	+/-2.3
Educational services, health care and social assistance	18.8%	+/-1.5	32.0%	+/-4.7
Arts, entertainment, recreation, accommodation and food services	9.8%	+/-0.6	13.2%	+/-4.1
Other services (except public administration)	4.7%	+/-0.4	3.1%	+/-2.0
Public administration	5.4%	+/-0.4	13.4%	+/-2.1
CLASS OF WORKER				
Private wage and salary workers	78.1%	+/-1.5	53.5%	+/-4.2
Government workers	15.2%	+/-1.7	44.8%	+/-4.4
Self-employed workers in own not incorporated business	6.5%	+/-0.5	1.4%	+/-0.7
Unpaid family workers	0.2%	+/-0.1	0.4%	+/-0.4
INCOME IN THE PAST 12 MONTHS (IN 2004 INFLATION-ADJUSTED DOLLARS)				
Households	2,131,534	+/-32,767	77,767	+/-5,789
Median household income (dollars)	41,995	+/-747	26,224	+/-2,609
With earnings	79.0%	+/-0.7	85.0%	+/-3.6
Mean earnings (dollars)	57,283	+/-1,123	35,238	+/-5,200
With Social Security income	27.7%	+/-0.6	14.8%	+/-4.5
Mean Social Security income (dollars)	13,689	+/-257	9,241	+/-927
With Supplemental Security Income	3.0%	+/-0.6	8.0%	+/-3.4
Mean Supplemental Security Income (dollars)	7,472	+/-399	6,952	+/-2,350
With cash public assistance income	2.5%	+/-0.3	11.2%	+/-3.0
Mean cash public assistance income (dollars)	2,484	+/-279	2,632	+/-559
With retirement income	18.5%	+/-0.6	11.2%	+/-6.7
Mean retirement income (dollars)	18,892	+/-708	9,855	+/-1,774
With Food Stamp benefits	7.8%	+/-0.7	28.1%	+/-10.0
Families	1,434,980	+/-21,518	57,840	+/-5,195
Median family income (dollars)	48,995	+/-1,036	28,176	+/-3,898
Individuals	5,633,997	*****	270,662	+/-23,339
Per capita income (dollars)	22,105	+/-385	10,218	+/-570

Figure H.1. (Continued).

Subject	Total Population	MOE	American Indian and Alaska Native Alone	MOE
With earnings for full-time, year-round workers:				
Male	1,037,494	+/-18,914	23,736	+/-4,118
Female	653,472	+/-22,348	33,507	+/-5,118
Mean earnings (dollars) for full-time, year-round workers:				
Male	50,679	+/-1,579	34,956	+/-3,562
Female	36,596	+/-984	28,618	+/-2,695
Median earnings (dollars) full-time, year-round workers:				
Male	37,516	+/-1,552	26,892	+/-3,482
Female	30,196	+/-552	25,851	+/-1,380
POVERTY RATES FOR FAMILIES AND PEOPLE FOR WHOM POVERTY STATUS IS DETERMINED				
All families	10.9%	+/-1.6	30.6%	+/-14.8
With related children under 18 years	16.8%	+/-2.5	36.8%	+/-13.8
With related children under 5 years only	21.5%	+/-4.7	57.1%	+/-15.1
Married couple families	6.7%	+/-0.9	19.4%	+/-12.8
With related children under 18 years	10.5%	+/-1.6	21.5%	+/-13.1
With related children under 5 years only	10.5%	+/-2.6	20.8%	+/-15.1
Families with female householder, no husband present	26.8%	+/-4.8	41.6%	+/-14.2
With related children under 18 years	32.9%	+/-5.5	51.2%	+/-10.6
With related children under 5 years only	52.9%	+/-10.2	79.2%	+/-10.4
All people	14.2%	+/-1.1	34.8%	+/-4.1
Under 18 years	20.3%	+/-2.0	42.6%	+/-5.4
Related children under 18 years	19.6%	+/-1.9	40.3%	+/-5.2
Related children under 5 years	24.0%	+/-3.2	45.6%	+/-9.9
Related children 5 to 17 years	17.7%	+/-1.9	38.2%	+/-5.8
18 years and over	12.0%	+/-0.8	30.0%	+/-3.9
18 to 64 years	12.9%	+/-0.8	30.3%	+/-3.7
65 years and over	7.5%	+/-1.3	27.3%	+/-13.7
People in families	13.3%	+/-1.3	33.7%	+/-5.5
Unrelated individuals 15 years and over	22.2%	+/-1.2	53.2%	+/-14.5
Occupied housing units	2,131,534	+/-32,767	77,767	+/-5,789
HOUSING TENURE				
Owner-occupied housing units	68.7%	+/-1.0	42.4%	+/-3.4
Renter-occupied housing units	31.3%	+/-1.0	57.6%	+/-3.4
Average household size of owner-occupied unit	2.69	+/-0.05	4.17	+/-0.25
Average household size of renter-occupied unit	2.53	+/-0.07	2.99	+/-0.49
UNITS IN STRUCTURE				
1-unit, detached or attached	66.9%	+/-1.8	60.7%	+/-12.7
2 to 4 units	4.7%	+/-0.8	7.9%	+/-8.7
5 or more units	16.4%	+/-0.6	17.0%	+/-5.2
Mobile home, boat, RV, van, etc.	11.9%	+/-1.2	14.4%	+/-7.1
YEAR STRUCTURE BUILT				
2000 or later	12.9%	+/-0.9	4.5%	+/-2.4
1990 to 1999	26.0%	+/-1.1	31.4%	+/-8.1
1980 to 1989	21.0%	+/-1.1	17.9%	+/-4.4
1960 to 1979	29.1%	+/-1.3	32.3%	+/-5.5
1940 to 1959	9.4%	+/-0.8	11.7%	+/-7.1
1939 or earlier	1.6%	+/-0.4	2.2%	+/-0.7
VEHICLES AVAILABLE				
None	6.3%	+/-0.4	15.5%	+/-2.8
1 or more	93.7%	+/-0.4	84.5%	+/-2.8

Figure H.1. (Continued).

(*continued on next page*)

Subject	Total Population	MOE	American Indian and Alaska Native Alone	MOE
HOUSE HEATING FUEL				
Gas	39.9%	+/-2.6	32.6%	+/-13.2
Electricity	57.5%	+/-3.1	44.4%	+/-10.8
All other fuels	2.2%	+/-0.7	22.3%	+/-4.0
No fuel used	0.5%	+/-0.1	0.7%	+/-0.7
SELECTED CHARACTERISTICS				
No telephone service available	4.8%	+/-0.5	20.0%	+/-5.9
1.01 or more occupants per room	4.4%	+/-0.5	13.4%	+/-2.1
Owner-occupied housing units	1,463,860	+/-22,489	32,968	+/-3,832
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN THE PAST 12 MONTHS				
Less than 30 percent	73.1%	+/-1.8	76.2%	+/-16.0
30 percent or more	26.9%	+/-1.8	23.8%	+/-16.0
OWNER CHARACTERISTICS				
Median value (dollars)	145,741	+/-2,513	87,053	+/-7,117
Median selected monthly owner costs with a mortgage (dollars)	1,130	+/-13	896	+/-73
Median selected monthly owner costs without a mortgage (dollars)	284	+/-13	146	+/-28
Renter-occupied housing units	667,674	+/-28,708	44,799	+/-3,975
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN THE PAST 12 MONTHS				
Less than 30 percent	52.7%	+/-2.1	59.5%	+/-8.4
30 percent or more	47.3%	+/-2.1	40.5%	+/-8.4
GROSS RENT				
Median gross rent (dollars)	691	+/-11	614	+/-53

Source: U.S. Census Bureau, 2004 American Community Survey.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see http://www.census.gov/acs/www/Downloads/ACS/accuracy2004.pdf). The effect of nonsampling error is not represented in these tables.

Notes:

Data for the households, families, occupied housing units, owner-occupied housing units, and renter-occupied housing units lines refer to the specified race, Hispanic or Latino, American Indian or Alaska Native, or ancestry of the householder shown in the table. Data in the "Total population" column is shown regardless of the race, Hispanic or Latino, American Indian or Alaska Native, or ancestry of the person.

See the Glossary for more information on the definition of the following population groups: Arab, Arab/Arabic, European, Sub-Saharan African, African, United States or American, and All Other Hispanic or Latino.

Explanation of Symbols:

1. An '*' entry in the margin of error column indicates that too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '**' entry in the margin of error column indicates that no sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
3. An '-' entry in the estimate column indicates that no sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
4. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
5. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
6. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
7. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
8. An 'N' entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
9. An '(X)' means that the estimate is not applicable or not available.

Figure H.1. (Continued).

APPENDIX I

Comparison of ACS and Decennial Census Transportation Planning Estimates

We evaluated the general quality and validity of three-year accumulations (1999–2001) of ACS residence-, workplace-, and flow-based transportation-related data for nine test counties by comparing them to Census 2000 data that correspond to CTPP Part 1, Part 2, and Part 3 data. The ACS and Census data tables were provided to the project team by FHWA, who had received them for evaluation from the Census Bureau. This appendix summarizes the analyses that were conducted.

The database included tract-level tabulations for nine counties and transportation analysis zone (TAZ)-level tabulations for the five counties for which TAZ data had been specified. Table I.1 shows the geographic areas covered.

The comparison tables that were provided included those CTPP-type tables that are listed in Tables I.2, I.3, and I.4 for the residence-, workplace-, and flow-based estimates.

Residence-Based Evaluation

For the residence-based estimates, we computed the differences in estimates between the ACS and CTPP, tried to identify statistically significant differences, and looked for factors that might contribute to those differences through regression analysis.

The estimates available in the Part 1 datasets are counts (e.g., number of people/households/housing units with a certain characteristic). To compare the estimates, we converted the individual table cell estimates to percentages of the table totals. This means that differences due to slightly different weighted populations were accounted for. We then graphically examined the differences in the percentages between the CTPP data and ACS data at the tract and TAZ levels.

For the most part, the two datasets appear to show the same patterns for the transportation-related tables. Only a small number of tracts and TAZs show significant variance between the two datasets. However, it should be noted that for some tracts and for many TAZs, ACS sample sizes were too small to show values.

Next, we tested the significance of the observed differences. The standard errors of the ACS estimates were calculated by the Census Bureau and provided in the datasets used for this analysis. Since the CTPP standard errors were unavailable, we computed them using the methods described in the SF3 documentation, Section 8, "Accuracy of the Data." For the purpose of statistical significance testing, the difference in estimates is defined as the ACS count minus the CTPP count (note that for several of the tables provided, the ACS and CTPP estimates are means and medians).

It is difficult to find any statistically significant differences at the 95 percent level of confidence, especially for smaller geographies. Examining those standard errors further, we note that

Table I.1. Geographic areas represented in evaluation dataset.

County	Census Tract-Level Data	Census TAZ-Level Data
Pima County, Arizona	✓	✓
San Francisco County, California	✓	✓
Broward County, Florida	✓	✓
Lake County, Illinois	✓	✓
Hampden County, Massachusetts	✓	
Douglas County, Nebraska	✓	✓
Franklin County, Ohio	✓	
Multnomah County, Oregon	✓	
Bronx County, New York	✓	

Source: Federal Highway Administration, 2004.

in most cases the ACS standard errors are much higher than the CTPP standard errors, rendering the t-statistic of the difference small enough as to be statistically insignificant. Figures I.1 through I.9 show the ACS and CTPP 95 percent confidence intervals for randomly selected tracts within each test county for an example variable. Note that the ACS confidence intervals are in general much wider than the CTPP confidence intervals because of the larger ACS standard errors.

The estimates for the variables appear to be largely in line with one another, but the sampling error for the three-year ACS data is too large to allow us to statistically confirm that this is the case or to determine if certain variables are more prone to be different.

Although it was difficult to draw any meaningful conclusions about the statistical significance of the differences in estimates, we could examine the data to see whether the estimate differences were correlated with other tract characteristics. If this were the case, future comparisons between ACS and year 2000 CTPP data would be biased.

We modeled these differences as a function of various population and household characteristics to check whether any particular variable is likely to bias the ACS estimates. We tested for the presence of systematic biases through regression analysis. For population estimates, we regressed the difference between the ACS and CTPP percentages as a function of the following population characteristics:

- Total tract population,
- Percent of population that are non-Hispanic white,
- Percent of population that are Hispanic,
- Percent of population that are 75 years or older,
- Percent of population without a high school diploma,
- Percent of population with an income below poverty line, and
- Percent of workers in households with a disability.

For household estimates, we regressed the difference between the ACS and CTPP percentages as a function of the following household characteristics:

- Total households,
- Percent of householders that are non-Hispanic,
- Percent of householders that are Hispanic,
- Percent of householders that are 75 years or older,
- Percent of households with six or more people,
- Percent of households with income below poverty line, and
- Percent of households with single female head and kids.

Table I.2. Residence-based evaluation dataset tables.

Table	Universe	Content
1	All persons	Total Population
2		Number of People Sampled
3		Sex by Age
4		Hispanic Origin by Race
5	Persons 16 and over	Employment Status
6	Workers in households	Total Workers
7		Mode to Work
8		Travel Time to Work
9		Time Leaving Home for Work
11		Household Income
12		Disability Status
13		Poverty Status
14		Disability Status by Mode to Work
15		Industry
16		Mode to Work by Time Leaving Home for Work
17		Mode to work by Travel Time to Work
18		Hispanic Origin
19		Hispanic Origin by Race
20		Hispanic Origin by Race by Mode to Work
21		Number of Workers in Household
22		Means of Transportation
23		Median Travel Time by Mode to Work
24		Mean travel Time by Mode to Work
26		Average Number of Workers per Vehicles
28	Households	Vehicles Available
29		Tenure
30		Number of Persons in Household
31		Number of Persons in Household by Number of Workers in Household
32		Number of Persons in Household by Vehicles Available
33		Number of Persons in Household by Household Income
34		Number of Workers in Household by Vehicles Available
35		Number of Workers in Household by Household Income
36		Telephone Availability
37		Number of Workers in Household by Vehicles Available by Household Income
38		Mean Household Income
39		Median Household Income
40	Housing units	Aggregate Number of Vehicles
41		Total Housing Units
42		Number of Housing Units Sampled
43		Percent of Housing Units Sampled
44		Quarter
45		Occupancy Status

Source: Federal Highway Administration, 2004.

Table I.3. Workplace-based evaluation dataset tables.

Table	Universe	Content
1	Workers in Households	Time of arrival at work
2		Worker earnings by Mode to work
3		Mode to work by Time of arrival at work
4		Mode to work by Travel time to work
5		Hispanic origin by Race by mode to work
6		Household income
7		Household income by Mode to work
8		Vehicles available by Mode to work
9		Median earnings by Mode to work
10		Mean earnings by Mode to work
12		Aggregate number of vehicles by Time Leaving Home for Work
13		Average Number of workers per vehicles by Time Leaving Home for Work
14		Number of workers per carpool by Time Leaving Home for Work
15		Median travel time by Mode to work
16		Mean travel time by Mode to work
17		Mean travel time by Mode to work
18		Mode to Work
19		Median travel time by Mode to work by Time arriving at work
20		Mean travel time by Mode to work by Time arriving at work
22		Aggregate number of carpools by Time Leaving Home for Work

Source: Federal Highway Administration, 2004.

The results of this analysis would answer questions such as: does the presence of minorities, low-income populations, or hard-to-reach communities in a certain area systematically bias the ACS estimates for that area? Would the ACS estimates be systematically larger or smaller than the CTPP estimates in seasonal areas? The regressions are ordinary least squares regressions that were estimated for most of the population and household variables listed in Table I.2. The analysis was done at the tract level.

Systematic biases were measured to varying degrees in each of the Part 1 tables. For certain tables, the bias is structural and is likely to be related to the differences in the survey instruments. For other tables, the measured differences seem to be related to sample size and would decrease as sample size increases. The residence-based tables with relatively large biases were

- Disability status,
- Disability status by mode to work,

Table I.4. Flow-based evaluation dataset tables.

Table	Universe	Content
1	Workers in Households	Total Workers
2		Vehicles Available per Household by Mode to work
3		Means of Transportation
4		Household Income by Means of Transportation
5		Mean Travel Time by mode to work by Time Leaving Home
6		Median Travel Time by mode to work and Time Leaving Home
7		Aggregate Number of Vehicles by Time Leaving Home for Work
8		Average Number of Workers per Vehicle by Time Leaving Home
9		Aggregate Number of Carpools by Time Leaving Home for Work
10		Number of Workers per Carpool by Time Leaving Home for Work
11		Aggregate travel time by mode to work and Time Leaving Home

Source: Federal Highway Administration, 2004.

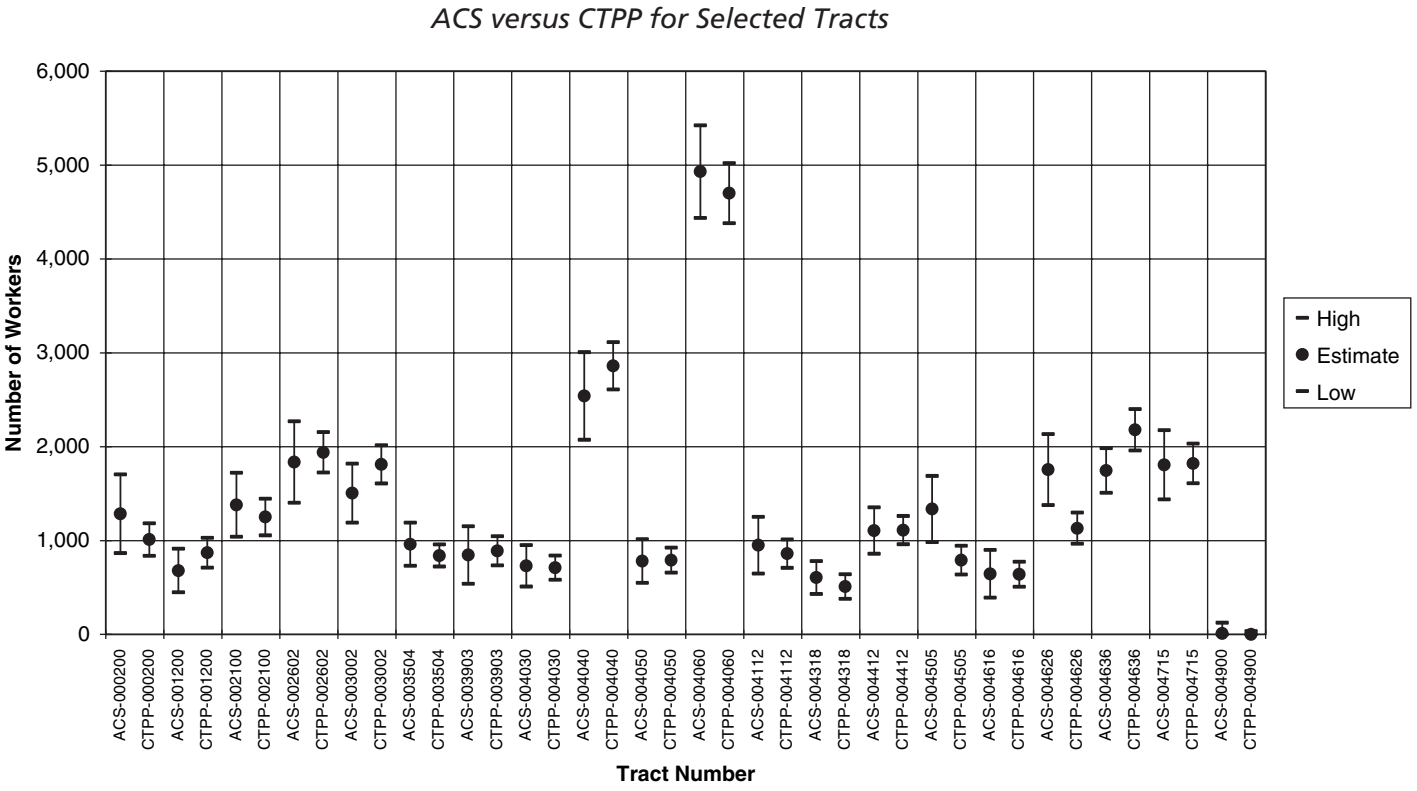

Figure I.1. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Pima County, Arizona).

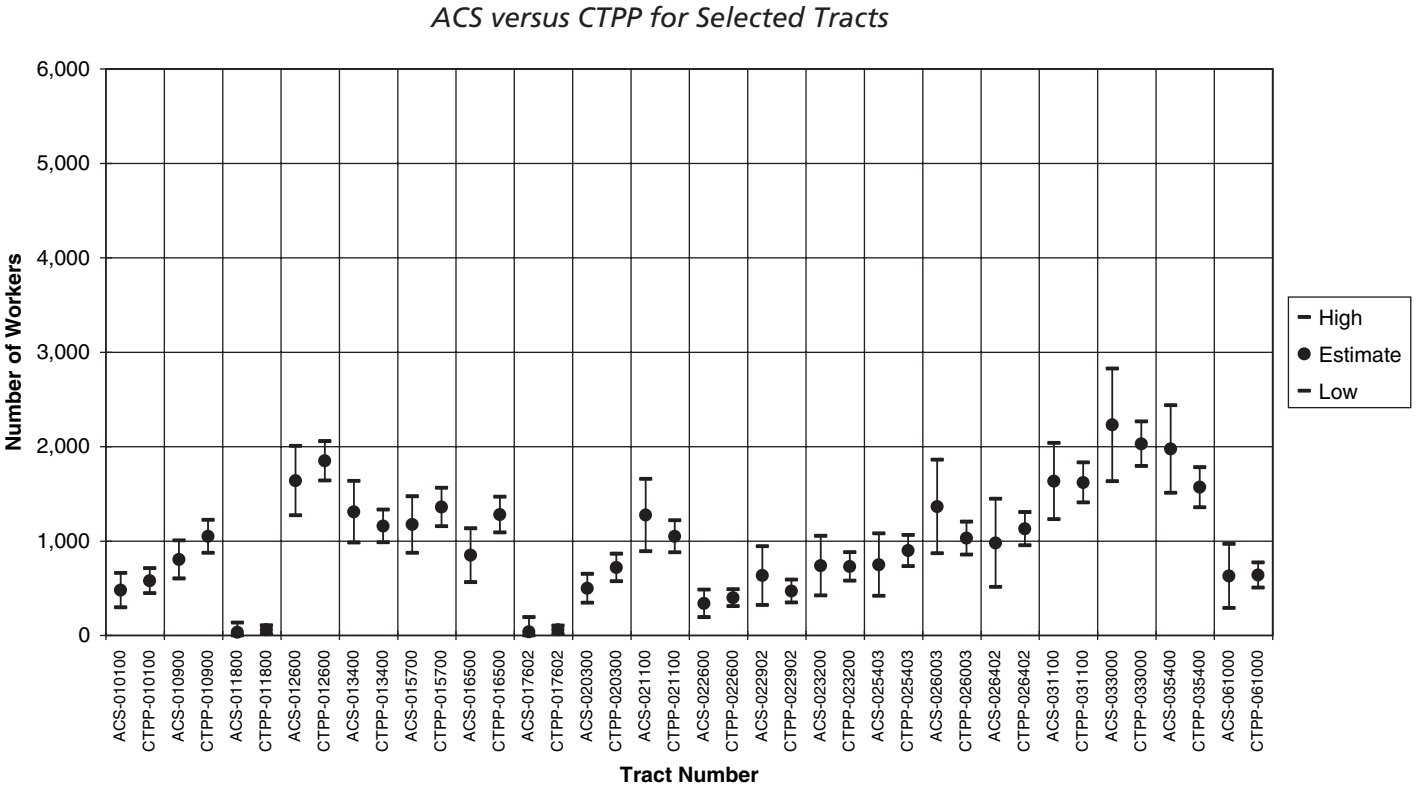

Figure I.2. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (San Francisco County, California).

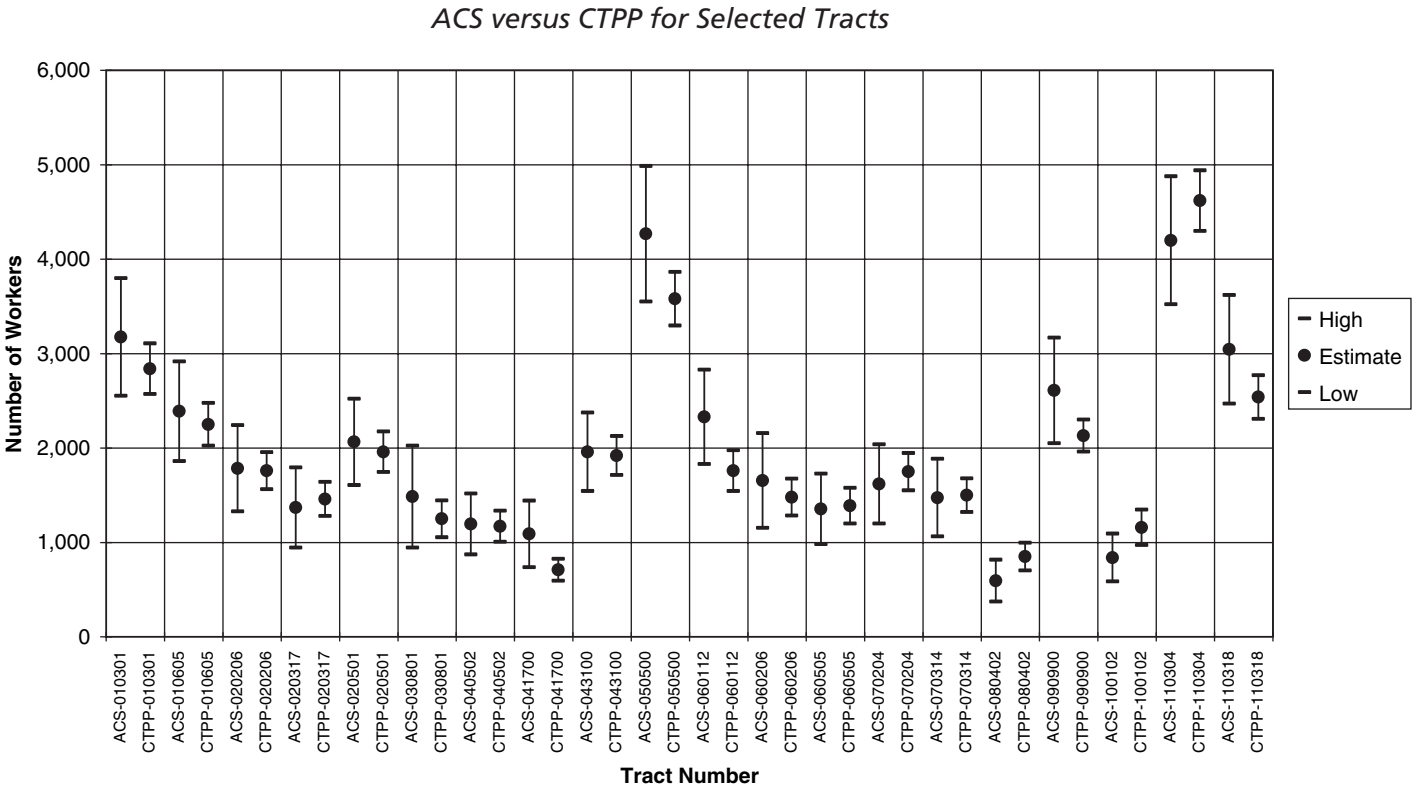

Figure I.3. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Broward County, Florida).

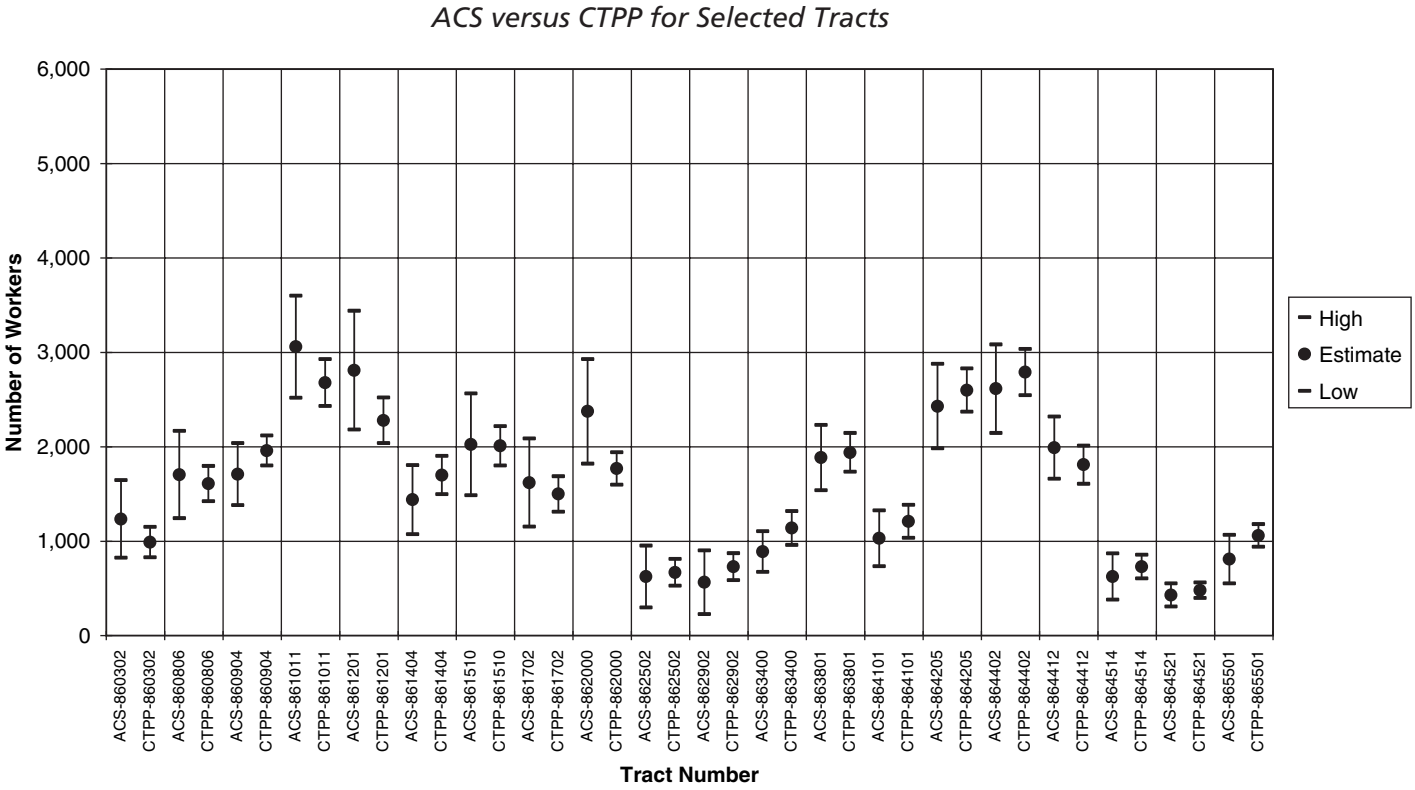

Figure I.4. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Lake County, Illinois).

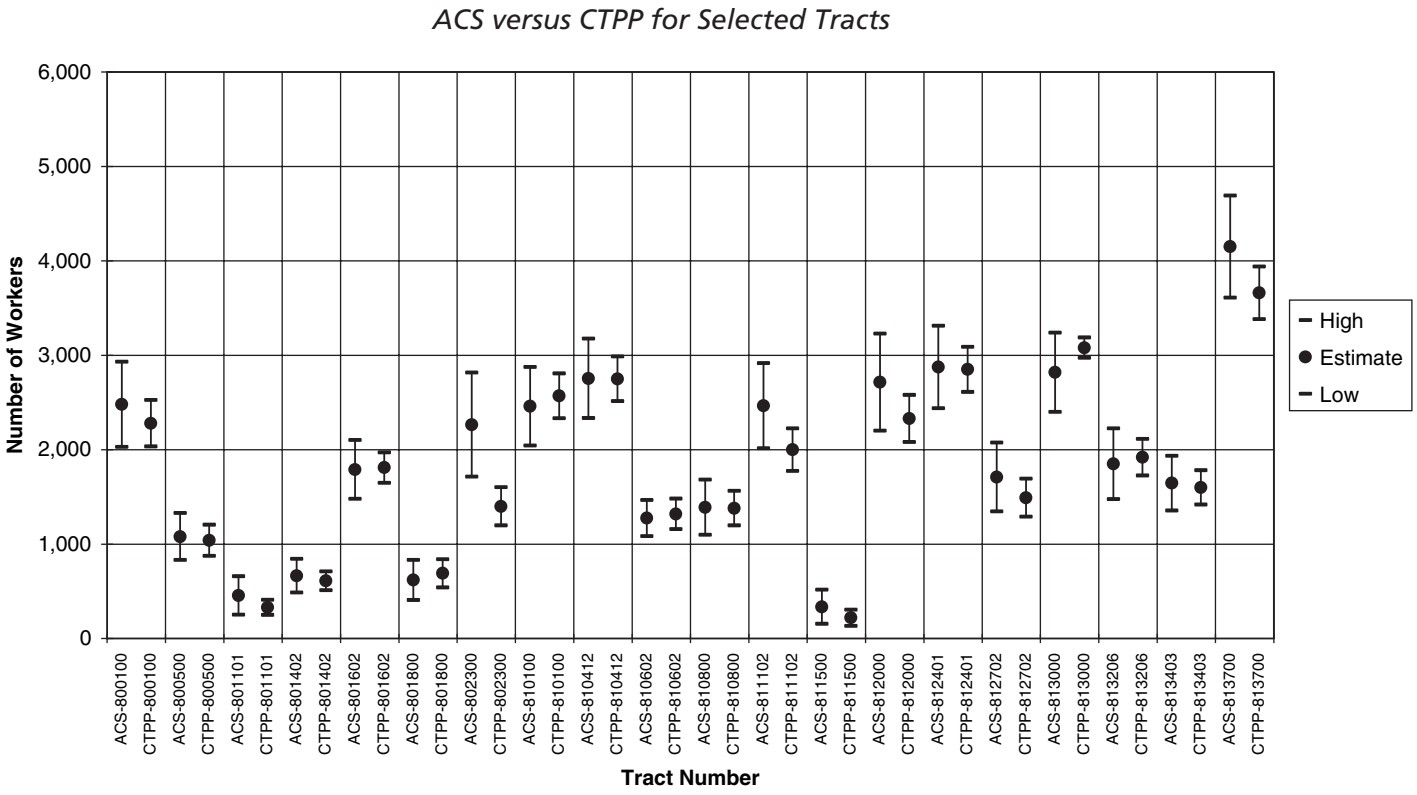

Figure I.5. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Hampden County, Massachusetts).

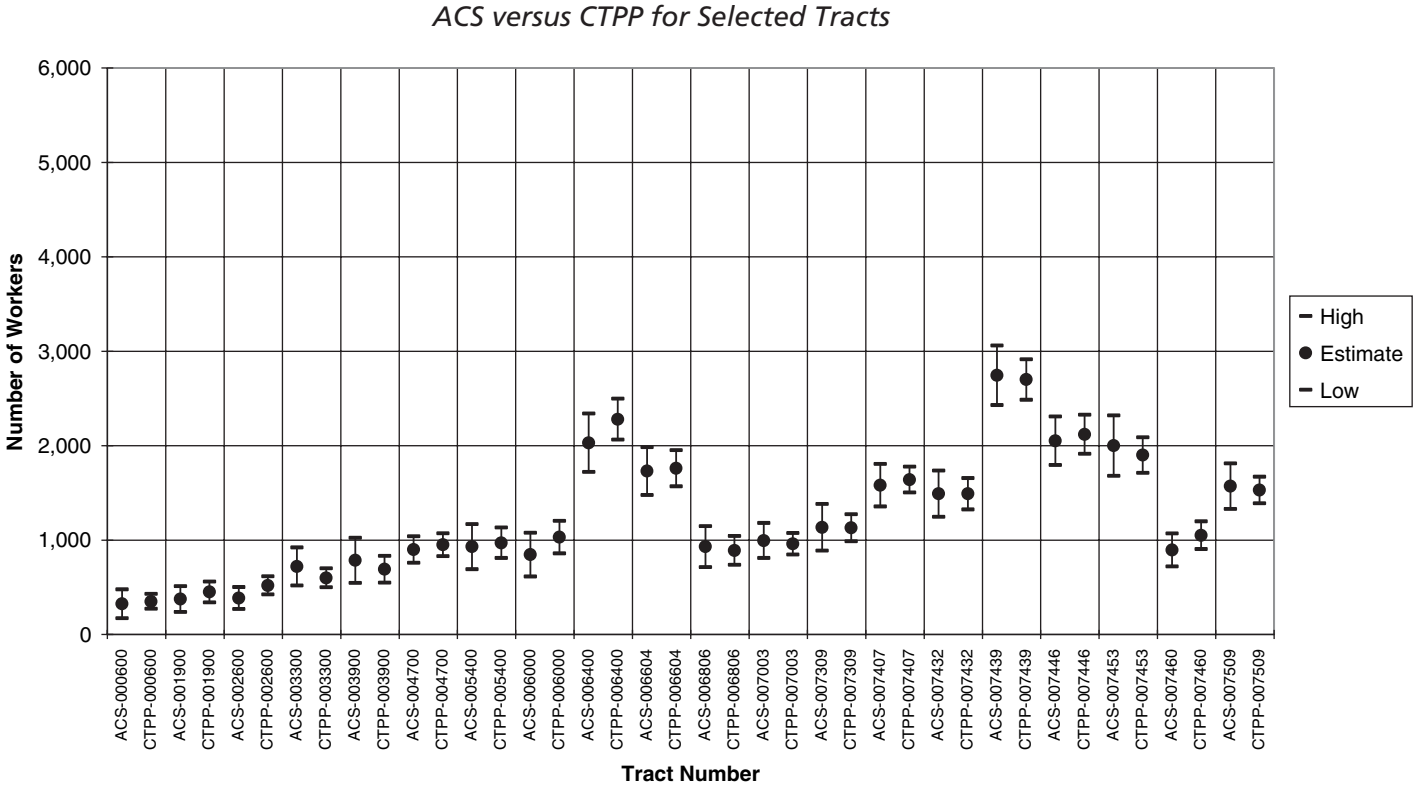

Figure I.6. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Douglas County, Nebraska).

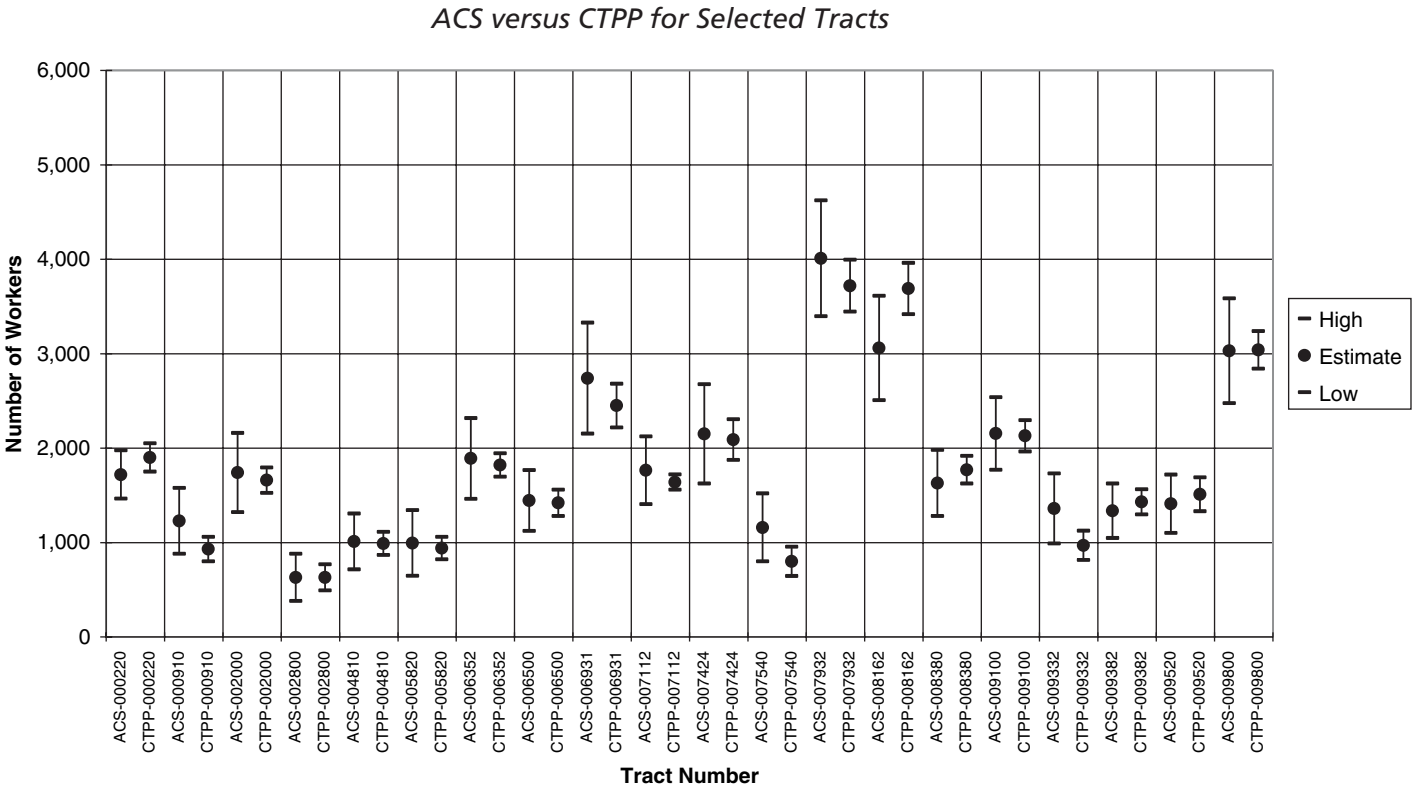

Figure I.7. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Franklin County, Ohio).

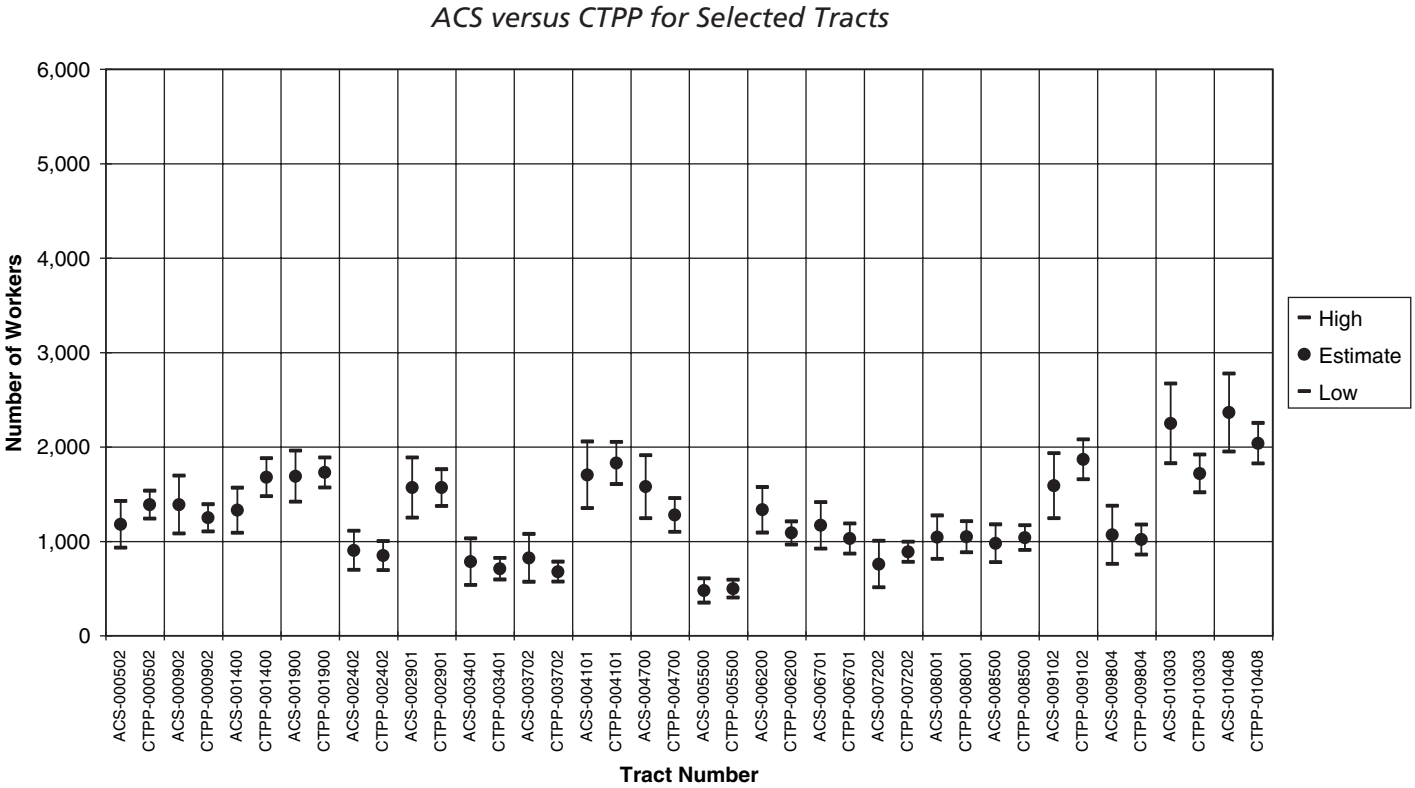

Figure I.8. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Multnomah County, Oregon).

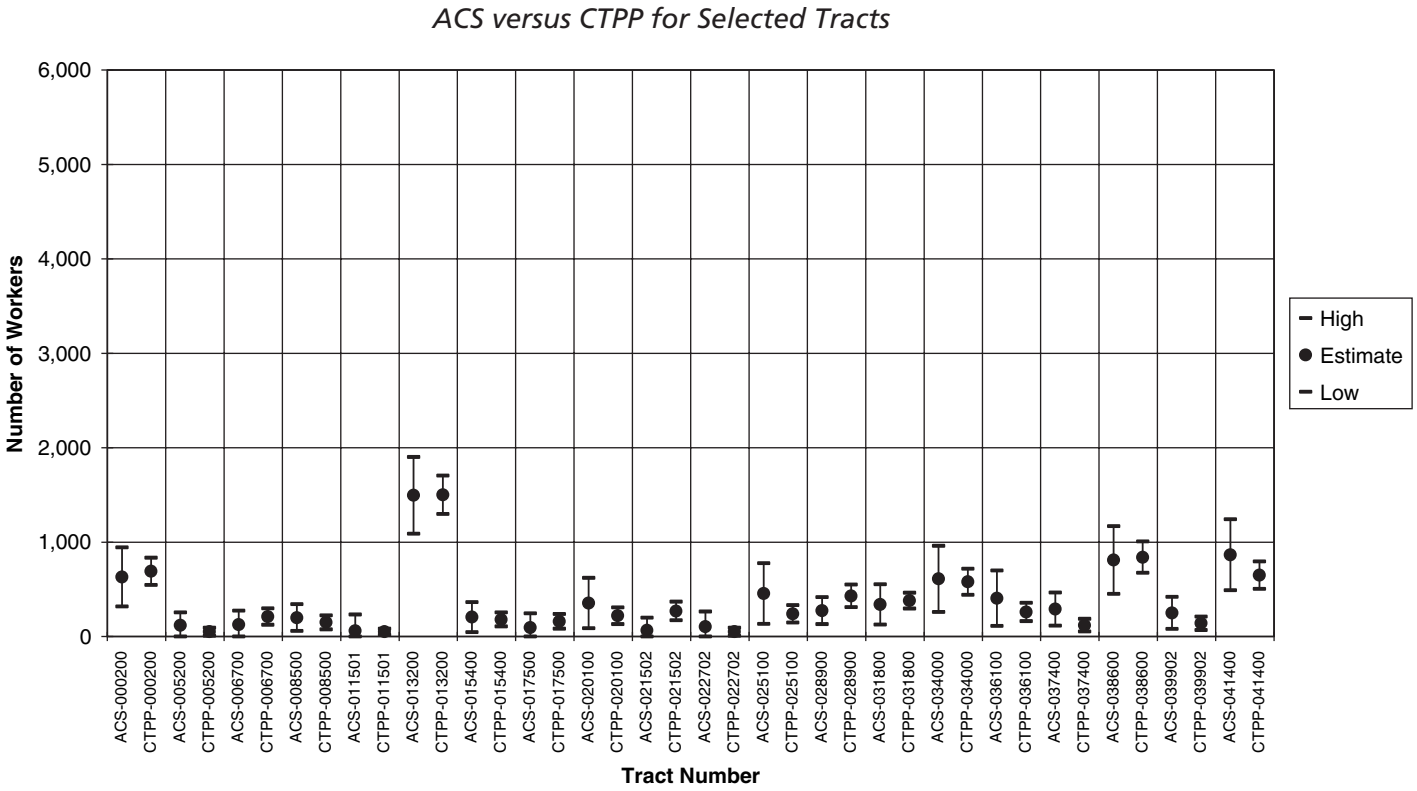

Figure I.9. Estimate of Workers Driving Alone-95 Percent Confidence Intervals (Bronx County, New York).

- Tenure (owned with mortgage category),
- Number of workers in household by vehicles available by household income,
- Poverty status (category for incomes between 100 and less than 150 percent of poverty), and
- Telephone availability.

Workplace-Based Evaluation

For the workplace-based estimates, the evaluation of the differences between ACS and Census place of work tables was complicated by:

- The absence of the extended place of work allocation system for ACS, and
- The difficulty of calculation of standard errors of place of work for Census 2000.

Therefore, the evaluation of the workplace-based estimates was based on descriptive analysis of the difference between the ACS and Census estimates. We evaluated the following variables at the county and tract levels: mode to work, vehicles available by mode to work, mean travel time by mode to work, worker earnings, and mean earnings by mode to work.

The general conclusions from the workplace-based evaluation are:

- The differences in the estimates between ACS and Census tend to be larger as the geographic level becomes smaller due to the larger variances in the ACS estimates; and
- Overall, the ACS estimates do not seem to be biased; the distributions of the differences between ACS and Census estimates are not skewed in a certain direction. However, the ACS estimates of the percentage of workers who carpooled to work and the ACS estimates of travel time to work seem to be consistently lower than the corresponding Census estimates on average.

Worker Flow-Based Evaluation

The worker flow evaluation datasets did not allow for a meaningful comparison of the differences between ACS and CTPP, because:

- The test site data were only for isolated counties, so only the worker flows with both trip ends in the counties were available; and
- The disclosure limitations placed on the ACS test data were probably different than will be employed for actual future releases of the data, so conclusions about the test data are not likely to be valid.

Figure I.10 is representative of the comparisons that were conducted on the worker flow-based tables. In general, the pattern of differences for travel times by mode among the comparable origin-destination flows did not reveal systematic bias in one direction or the other.

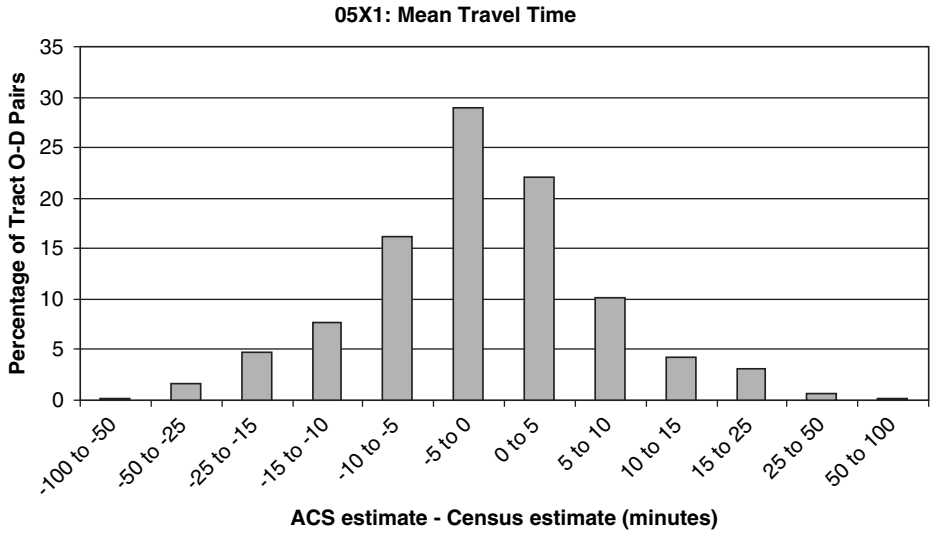

Figure I.10. Comparison of ACS and Census 2000 worker flow data for tracts in San Francisco County.

APPENDIX J

Seasonality Analyses Using ACS

The datasets provided by the Census Bureau contained four universe tables designed to investigate the availability of seasonal data from ACS. These data tables are listed in Table J.1.

MPOs in both these areas were sent shape files with data on occupancy status from ACS, and were asked to provide inputs on seasonal units by TAZ.

Variable Sampling Rates Over Three Years

The ACS test sites were originally sampled at a high rate that allowed three-year averages to be compared to the Census 2000 at the tract and county level. However, many of the counties used for creating the ACS and Census 2000 data were not sampled at 15 percent. The final sampling rates per county are listed in Table J.2.

Using Broward County as an example, the cumulative sampling rate was only 9.5 percent. With such a low-sampling rate, analysis at the TAZ level was not possible. Figure J.1 shows the sampling rate in Broward County TAZs with the ACS compared to the Census 2000. The sampling ratio of ACS to Census 2000 is lower than 75 percent in almost all TAZs and lower than 50 percent for over half the TAZs.

Input from the Broward County MPO helped develop a process to identify Broward County TAZs with seasonal variation.[1] Broward County has a population of 1.6 million people, and is divided into 898 TAZs. The average "seasonal" vacancy of housing units (741,000) is 6.3 percent for the county. TAZs with more than 10 percent "seasonal" vacancy status were defined as seasonal areas/TAZs. Data for several Census tables were then accumulated for seasonal TAZs, and compared to the rest of the county. Of the 898 TAZs in the county, 116 are classified as "seasonal." By using this definition, most of coastal Broward County is classified as seasonal—areas where seasonal variation in vacancy would be expected. Figure J.2 shows the spatial distribution of the seasonal TAZs.

Occupancy of Housing Units—Broward County, Florida

Figure J.3 shows Broward County occupancy rates summarized by both seasonal TAZs and the rest of county (non-seasonal) TAZs. The occupancy rates for the rest of the county (non-seasonal) are consistent at about 92 percent, while the seasonal areas, as expected, fluctuate dur-

[1] Personal correspondence with Ted Leonard, and Christine Heshmati, Broward MPO on April 29, 2004. Ted Leonard provided an MS Excel file with percentage of seasonal units by TAZ.

Table J.1. Seasonal tables included in the ACS dataset.

Table	Universe	Content
5	Persons 16+	Calendar Quarter (5) by Employment Status (7)
22	Workers	Means of Transportation (11) by Calendar Quarter (5)
38	Households	Mean Household Income by Calendar Quarter (5)
39		Median Household Income by Calendar Quarter (5)
44	Housing Units	Number of housing units sampled by Calendar Quarter (5)
45		Calendar Quarter(5) by Occupancy Status (3)

ing the year. The average occupancy for the ACS three-year average, and Census 2000 were nearly the same for both areas. In the seasonal areas, the average occupancy rate indicated by the ACS and CTPP data is similar at 71.3 percent and 72.1 percent, respectively. In the rest of the county (non-seasonal), the rates also are similar with 91.9 percent with the ACS and 92.5 percent with the CTPP.

Civilian Employed Population—Broward County, Florida

A review of employment data offers another way to confirm the seasonal nature of some areas of Broward County. Figures J.4 and J.5 show labor data aggregated for TAZs in seasonal areas, and the rest of the county (non-seasonal), respectively. Data on the Civilian Population (over 16 years of age), employment and population not in labor force are summarized.

As reflected in the occupancy data, the ACS data show a decrease in the civilian population during Quarters 2 and 3 for the seasonal TAZs (Figure J.4), while the rest of the county does not show much variation (Figure J.5).

A comparison of civilian employment data for the seasonal TAZs from the ACS and Census 2000 (shown in Figure J.6) shows that Quarters 2 and 3 of ACS data is closer to Census-derived

Table J.2. Sampling rates in ACS compared to census 2000.

	Census 2000 100 Percent Counts			1999-2001 ACS Sampling Rates			Census 2000 Sampling Rates		
	Housing Units			Housing Units			Housing Units		
Geography	Total	Occupied	Population	Total	Occupied	Population	Total	Occupied	Population
Pima County, Arizona	366,737	332,330	821,712	13.4%	9.4%	8.6%	12.5%	12.5%	13.7%
San Francisco County, California	346,527	329,700	756,976	9.6%	6.1%	5.5%	11.7%	11.7%	11.8%
Broward County, Florida	741,043	654,445	1,603,094	9.5%	6.7%	5.9%	11.7%	11.4%	11.5%
Lake County, Illinois	225,919	216,297	623,378	10.3%	7.1%	6.6%	14.3%	14.3%	14.4%
Hampden County, Massachusetts	185,876	175,288	441,799	14.6%	10.0%	9.4%	13.4%	13.5%	13.5%
Douglas County, Nebraska	192,672	182,194	451,878	15.2%	11.0%	10.5%	13.9%	13.9%	13.9%
Bronx County, New York	490,659	463,212	1,285415	10.2%	5.1%	4.4%	11.3%	11.5%	11.6%
Franklin County, Ohio	471,016	438,778	1,046,872	9.4%	6.6%	6.2%	14.1%	14.1%	14.1%
Multnomah County, Oregon	288,561	272,098	643,798	15.0%	10.7%	10.0%	14.1%	14.1%	14.0%
Total for Nine Counties	**3,309,010**	**3,064,362**	**7,674,922**	**11.2%**	**7.5%**	**6.8%**	**12.7%**	**12.7%**	**12.7%**

[A] Rates presented here are based on Decennial Census Totals.

ACS to Census 2000

Figure J.1. Sampling ratio.

values. As shown in Figure J.7, for the rest of the county (non-seasonal) TAZs, the ACS data, Census 2000, and quarterly ACS data area similar.

Means of Transportation to Work—Broward County, Florida

Table J.3 shows a comparison of mode shares for ACS and Census 2000 by calendar quarter and area type for Broward County. In the seasonal TAZs, the ACS three-year average shows 3.6 percent fewer workers carpooling to work than in the rest of the county (non-seasonal). As shown in Figure J.8, there were fluctuations in carpool rates in Quarter 2 and Quarter 4. ACS also showed lower transit percentages in the seasonal TAZs.

In the rest of the county (non-seasonal), the ACS data shows a gradual increase in carpooling rates throughout the four quarters from 12.1 percent to 13.6 percent.

One of the issues with seasonality measurements from ACS is the use of intercensal estimates for weighting that are not seasonally adjusted. If possible, data for the four quarters must be weighted by intercensal estimates that are seasonally adjusted. The Short Form of the decennial census usually included a question on seasonal occupancy and estimates could be developed for housing unit counts by calendar quarter.

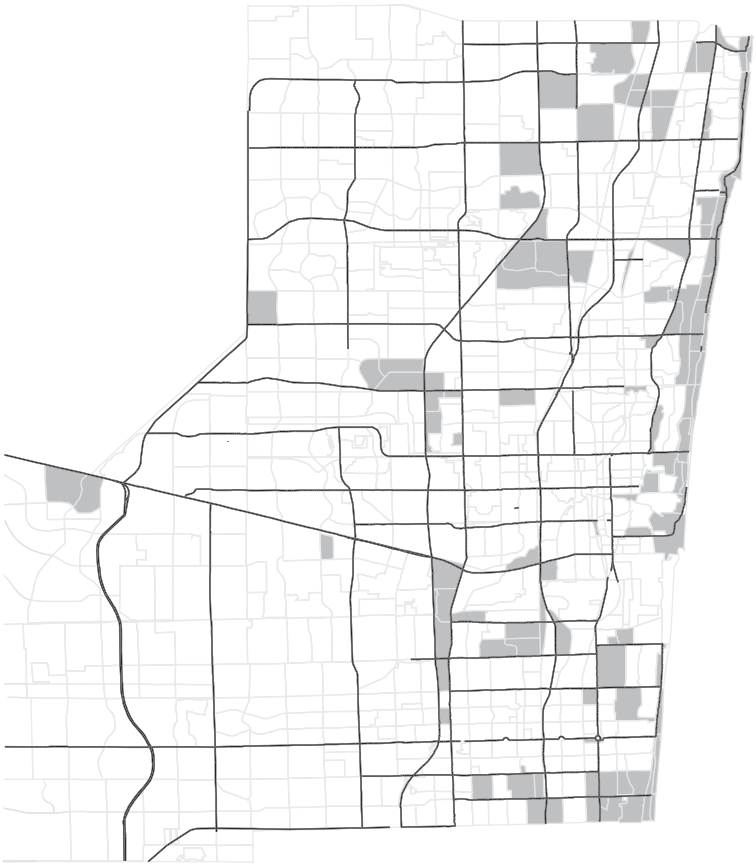

Figure J.2. Seasonal TAZs in Broward County, Florida.

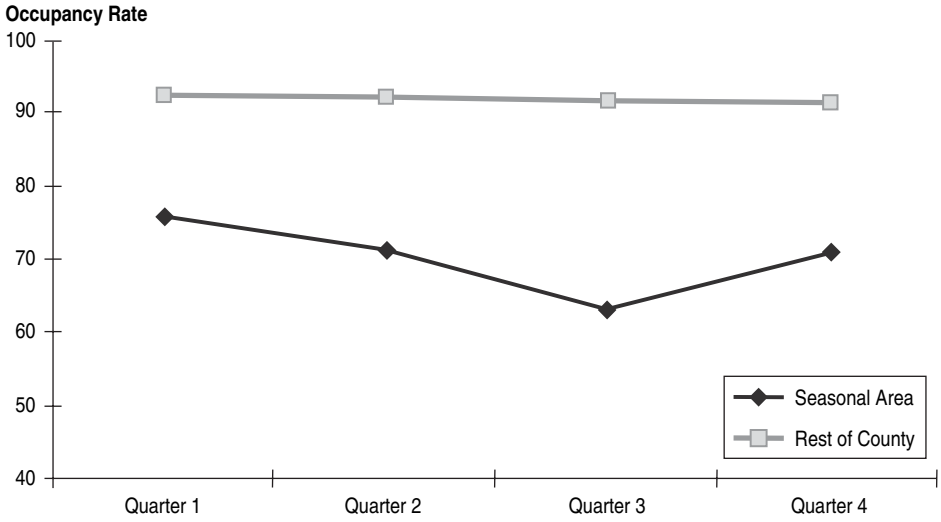

Figure J.3. Occupancy rates of housing units by calendar quarter.

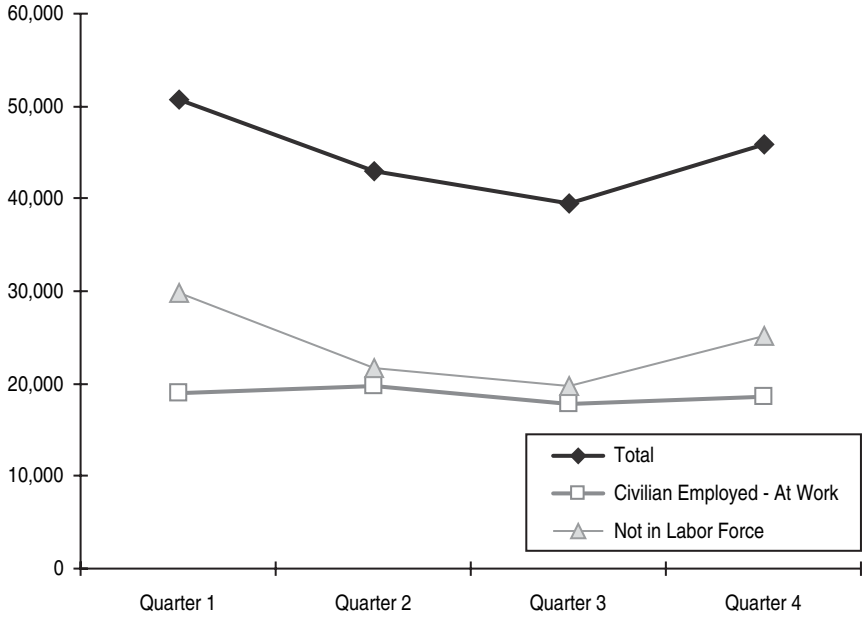

Figure J.4. Civilian employment (seasonal TAZs in Broward County, Florida).

Defining Seasonal TAZs—Pima County, Arizona

Based on MPO input, we accumulated TAZs into those considered seasonal based on percentage of housing units per TAZ that were seasonally occupied.[2] Pima County has a population of 821,000 people, and is divided into 545 TAZs. The average vacancy of housing units (366,735) is 9.4 percent for the county. Of the 545 TAZs in Pima County, 42 were classified as "seasonal"

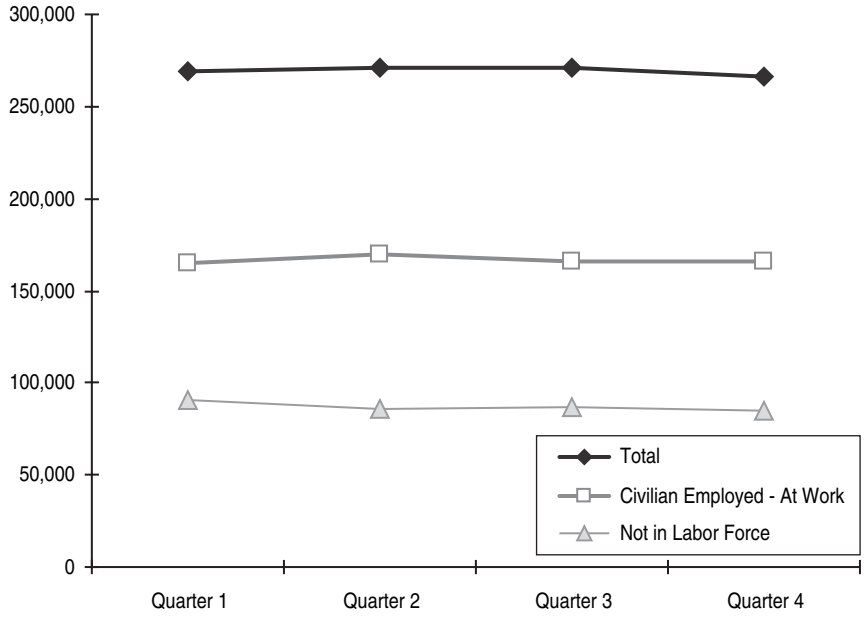

Figure J.5. Civilian employment (rest of Broward County TAZs, non-seasonal).

[2] Personal correspondence with Sandra White, and Karen Lamberton, Pima COG on August 25, 2004. Sandra White provided an MS Excel file defining seasonal TAZs by type of seasonality.

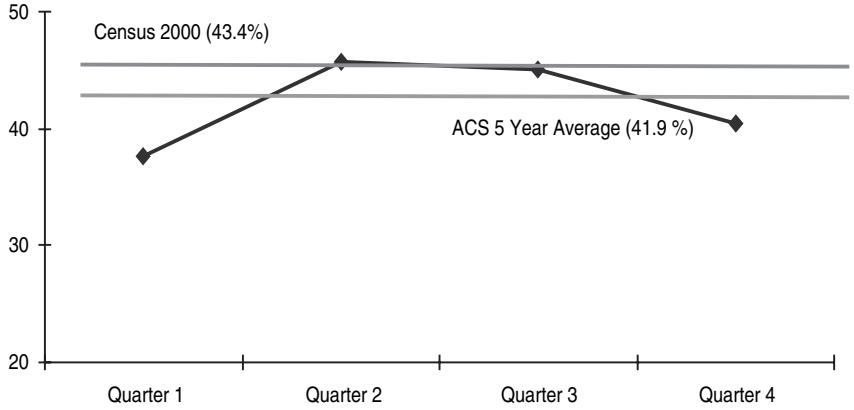

Figure J.6. Percent Civilian Employment-ACS versus Census 2000 (seasonal TAZs in Broward County, Florida).

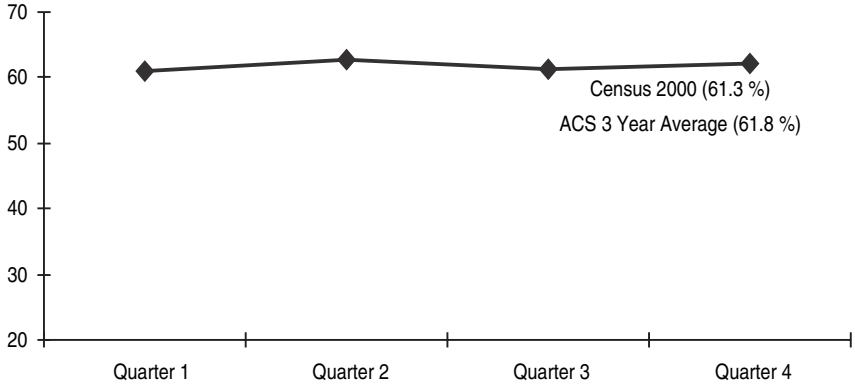

Figure J.7. Percent civilian employment-ACS versus Census 2000 (rest of Broward County, Florida TAZs, non-seasonal).

Table J.3. Means of transportation to work in Broward County, florida.

Seasonal Area – Percent of Workers					
	Drive Alone	**Carpool**	**Transit**	**Bike/Walk**	**Others**
Quarter 1	80.2%	10.6%	1.4%	3.4%	4.4%
Quarter 2	82.9%	7.1%	1.0%	2.8%	6.4%
Quarter 3	79.7%	11.3%	1.7%	1.6%	5.6%
Quarter 4	81.2%	7.9%	2.4%	2.3%	6.3%
ACS Total	81.0%	9.2%	1.6%	2.5%	5.7%
Census 2000	79.3%	10.8%	1.9%	2.5%	6.0%
Rest of County (Non-Seasonal) – Percent of Workers					
Quarter 1	79.5%	12.1%	2.6%	1.7%	4.0%
Quarter 2	78.9%	12.6%	2.6%	2.0%	4.0%
Quarter 3	79.0%	12.9%	2.3%	1.5%	4.3%
Quarter 4	78.4%	13.6%	2.2%	1.9%	3.9%
ACS Total	79.0%	12.8%	2.4%	1.8%	4.0%
Census 2000	80.2%	12.3%	2.2%	1.7%	3.9%

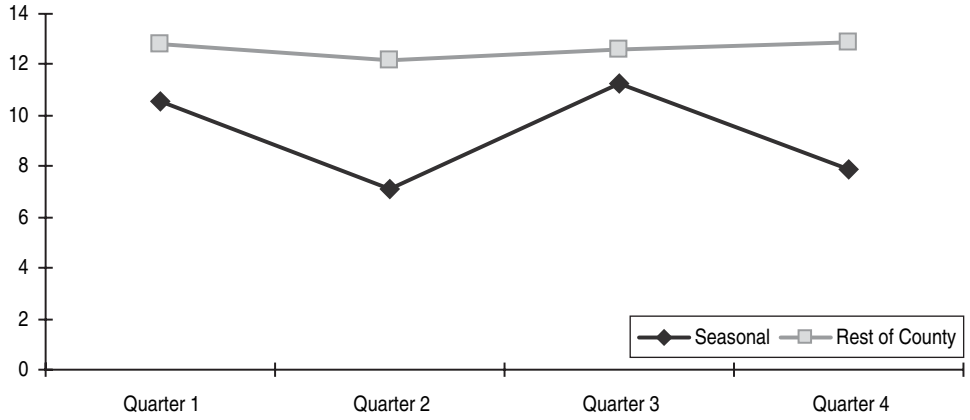

Figure J.8. Carpool to work percentage in Broward County, Florida.

and further categorized as retirement, university or vacation areas. Figure J.9 shows the spatial distribution of the TAZs with seasonal variation.

Although Pima County was sampled at a rate of 13.4 percent of occupied housing units, most of the tracts in ACS were sampled at a rate less than three quarters that of the Census (see Figure J.10). Even when these tracts are aggregated, there are very few housing units classified as "vacation" units. Table J.4 shows Census 2000 totals for housing units in the vacation, university and retirement seasonal areas and the rest of the county.

Occupancy of Housing Units—Pima County, Arizona

Figure J.11 shows occupancy status by seasonal area and rest of Pima County. The occupancy rates for the rest of the county are fairly consistent across the calendar quarters at 90.5 to 92.5 per-

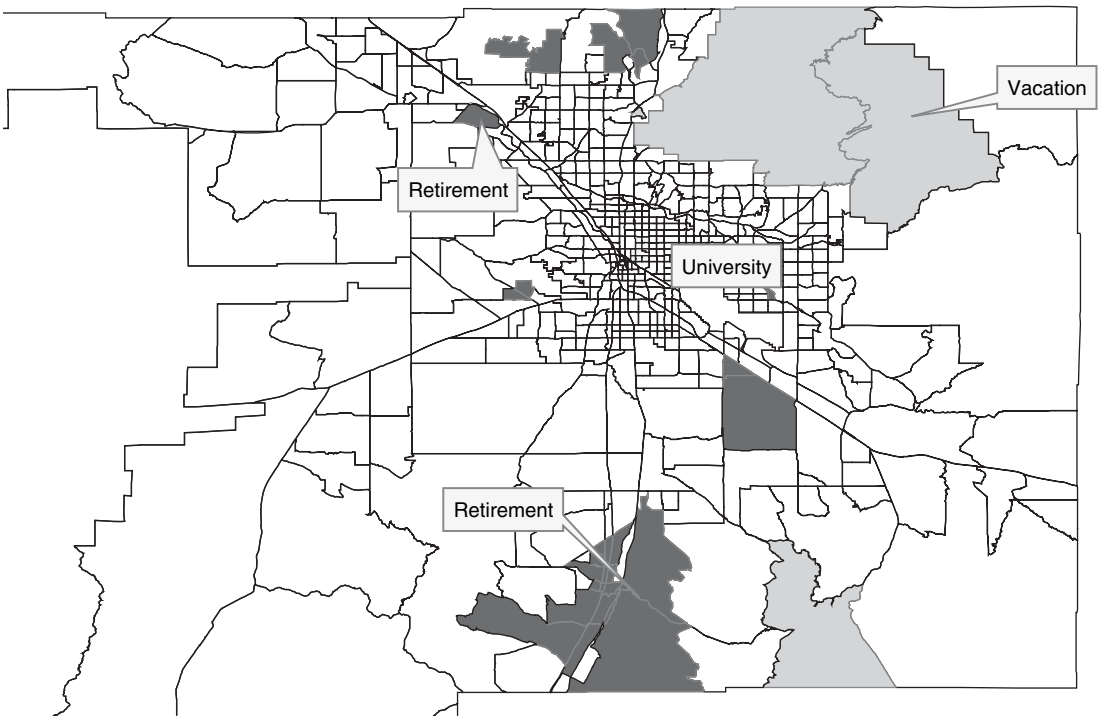

Figure J.9. Seasonal TAZs in Pima County, Arizona.

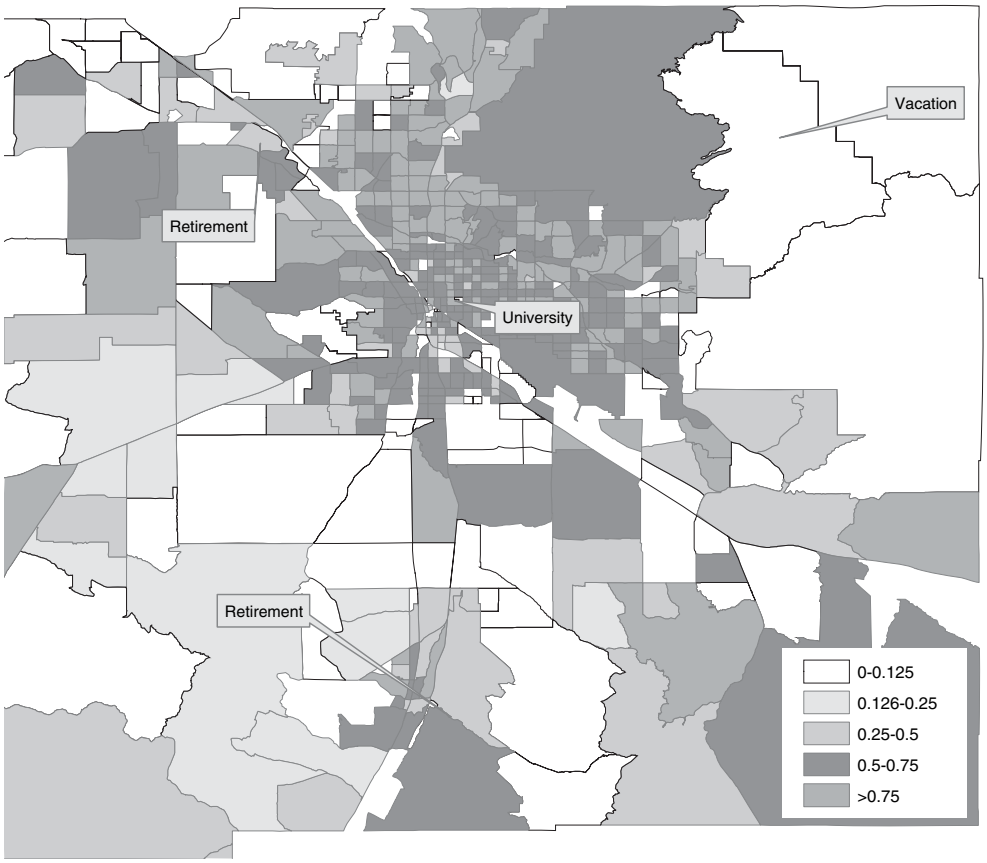

Figure J.10. Sampling ratio-ACS versus Census 2000 (Pima County, Arizona).

cent, while the seasonal areas show fluctuations as expected. The occupancy is high for the first, third, and fourth calendar quarters and drops for the second quarter in the university area. Occupancy in vacation homes decreases in the fourth quarter but the number of vacation units are very small. Retirement areas show higher occupancy in the first and fourth quarters. Table J.5 shows the overall comparison of ACS and Census 2000 for the different types of areas.

Civilian Employed Population—Pima County, Arizona

Figures J.12 and J.13 show the civilian population over 16, workers at work, and population not in labor force for both the seasonal areas and the rest of the county (non-seasonal).

Just like occupied housing units, the ACS data in seasonal areas show a decrease in the civilian employment during Quarter 2 and Quarter 3. The rest of the county does not show much

Table J.4. Total housing units in seasonal and non-seasonal areas of Pima County, Arizona.

Type of Seasonality	Total	Occupied	Vacant
Vacation	800	350	440
University	5,650	5,350	310
Retirement	25,960	19,460	6,540
Total Seasonal	32,410	25,160	7,290
Rest of County (Non-Seasonal)	334,390	307,440	27,370

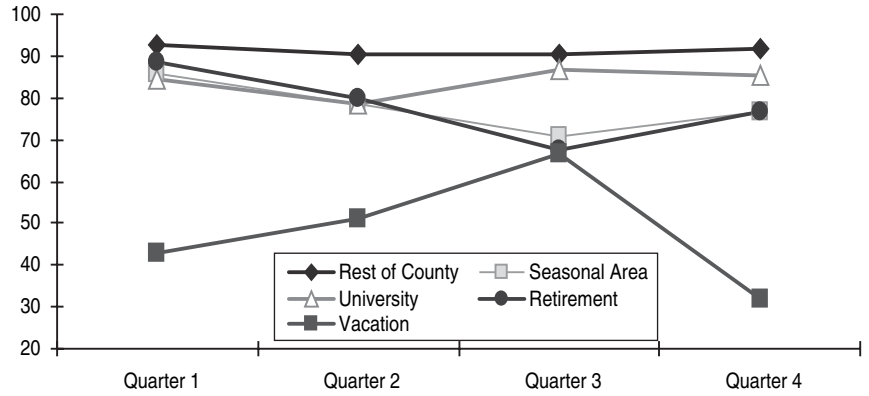

Figure J.11. Occupancy rates of housing units by calendar quarter.

Table J.5. Occupancy rates-acs versus Census 2000.

	ACS	Census 2000
Seasonal	78.0	77.6
University	83.9	94.7
Retirement	78.1	75.0
Vacation	45.1	43.8
Rest of the County	91.2	91.9

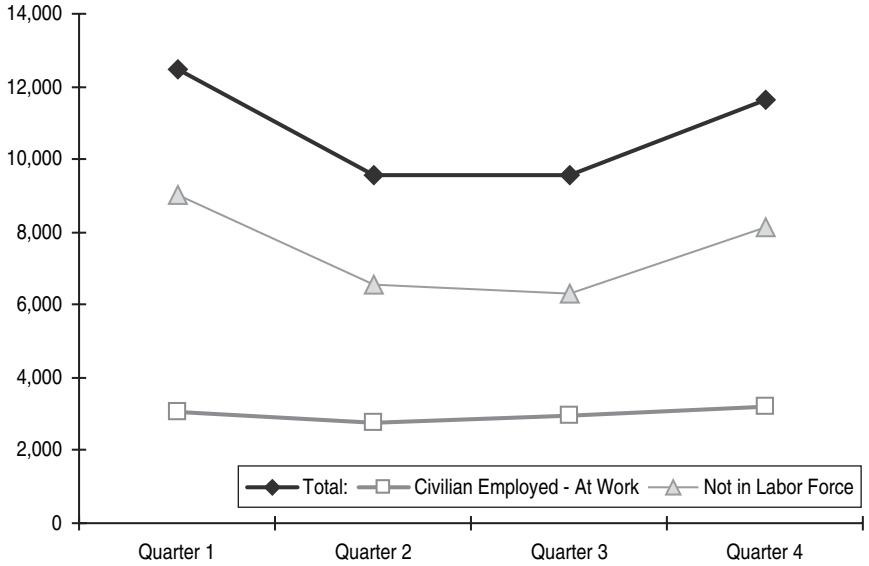

Figure J.12. Civilian employment (seasonal TAZs in Pima County, Arizona).

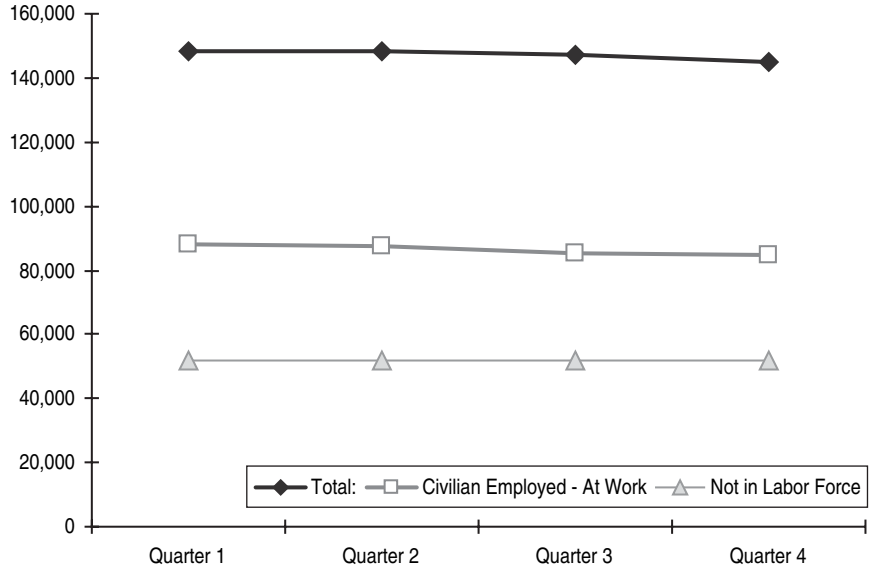

Figure J.13. Civilian employment (rest of Pima County, Arizona TAZs, non-seasonal).

variation. A comparison of percent of civilian employed population for ACS quarterly data versus Census 2000 data (Figures J.14 and J.15) show that Quarter 2 of ACS data is closer to Census-derived values. The graphs are similar to those presented for Broward County showing that ACS data do measure seasonal variation.

Means of Transportation to Work—Pima County, Arizona

The most significant modes to work for Pima County are drove alone, carpool and bike/walk. Table J.6 shows mode shares for the chief modes by calendar quarter and area type. Figures J.16, J.17, and J.18 show the variability in modes for the four quarters. Vacation areas are not shown here because the numbers of workers are very small.

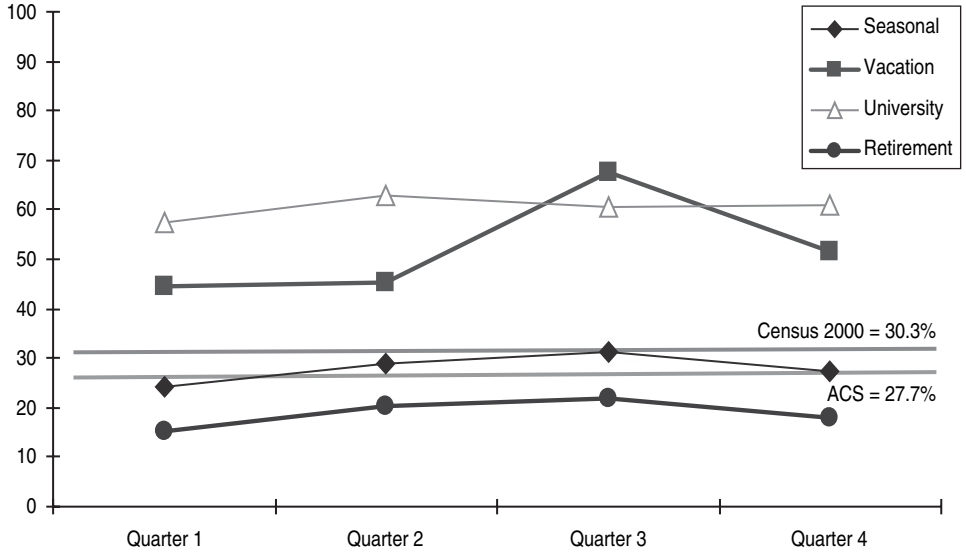

Figure J.14. Civilian employment percentage-ACS versus Census 2000 (seasonal in Pima County, Arizona TAZs).

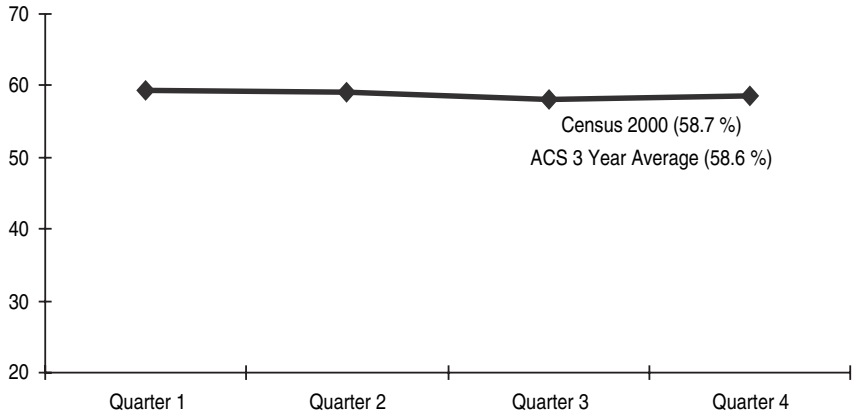

Figure J.15. Percentage civilian employment-ACS versus Census 2000 (rest of Pima County, Arizona TAZs, non-seasonal).

Table J.6. Means of transportation to work in Pima County, Arizona.

		Drove Alone	Carpool	Bike/Walk
Quarter 1	University	47.0%	9.0%	33.9%
	Retirement	79.7%	10.5%	2.0%
	Seasonal	64.8%	10.0%	16.5%
	Rest of County	74.4%	14.7%	3.3%
	Total	**74.1%**	**14.6%**	**3.8%**
Quarter 2	University	53.8%	3.0%	31.7%
	Retirement	81.1%	10.0%	1.7%
	Seasonal	69.4%	8.5%	13.7%
	Rest of County	75.9%	13.1%	3.6%
	Total	**75.7%**	**12.9%**	**3.9%**
Quarter 3	University	51.9%	7.2%	30.4%
	Retirement	85.0%	4.0%	1.3%
	Seasonal	70.6%	5.5%	13.8%
	Rest of County	75.6%	13.4%	3.8%
	Total	**75.5%**	**13.1%**	**4.1%**
Quarter 4	University	60.3%	9.7%	23.0%
	Retirement	70.2%	14.6%	4.6%
	Seasonal	65.9%	11.8%	13.7%
	Rest of County	76.5%	12.7%	3.2%
	Total	**76.1%**	**12.6%**	**3.6%**
ACS-3 Year Average	University	53.3%	7.9%	29.2%
	Retirement	78.5%	9.7%	2.4%
	Seasonal	67.4%	9.1%	14.3%
	Rest of County	75.6%	13.4%	3.5%
	Total	**75.3%**	**13.3%**	**3.8%**
Census 2000	University	49.0%	8.5%	32.1%
	Retirement	76.0%	11.8%	4.1%
	Seasonal	63.8%	10.2%	16.7%
	Rest of County	74.8%	15.0%	3.1%
	Total	**74.4%**	**14.8%**	**3.6%**

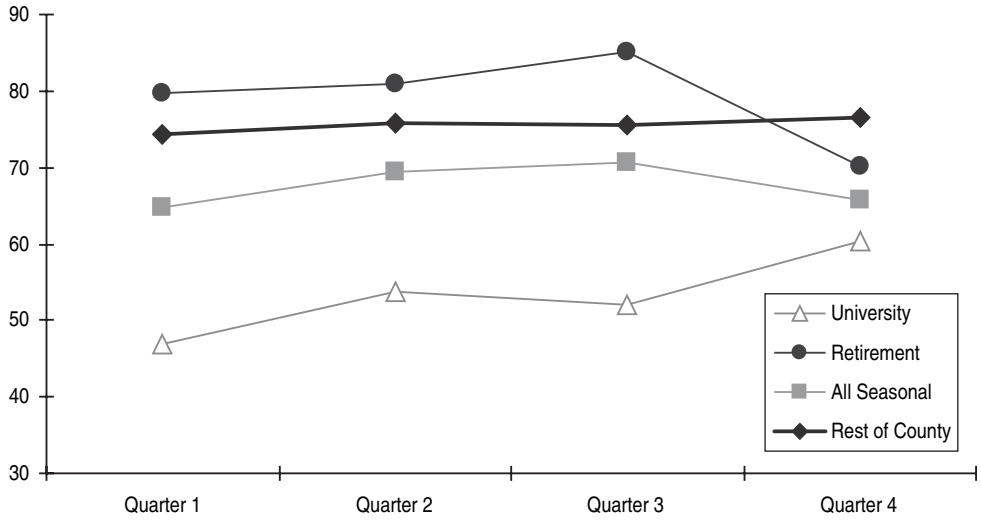

Figure J.16. Drove alone to work percentage in Pima County, Arizona.

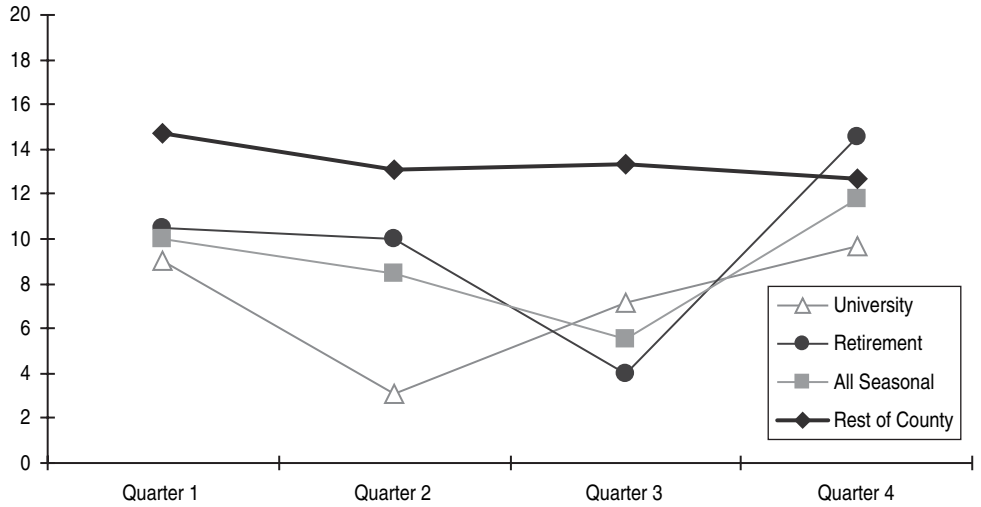

Figure J.17. Carpool to work percentage in Pima County, Arizona.

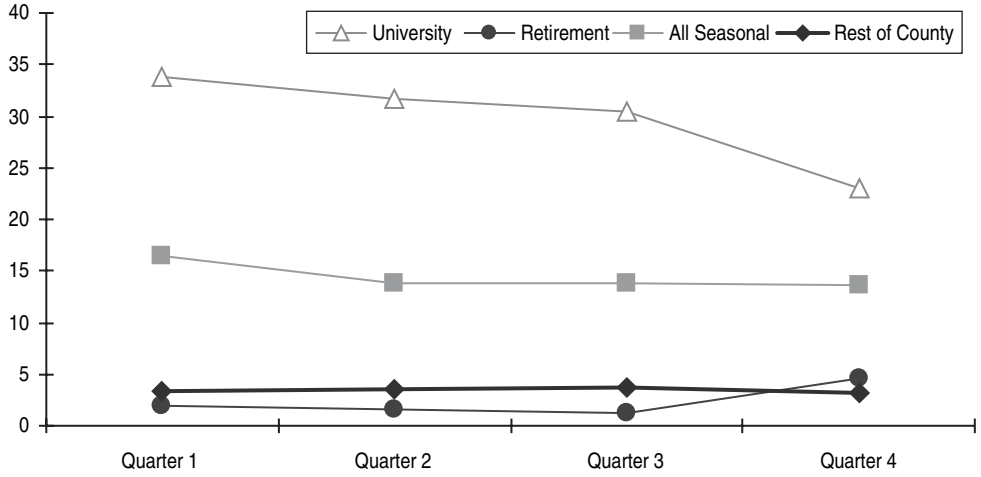

Figure J.18. Bike/walk to work percentage in Pima County, Arizona.

There is a lot of variability across the seasonal areas and across calendar quarters. The ACS data show that many workers in the university area walk/bike to work in the first three quarters but drive alone or carpool in the last quarter. Similarly, workers in the retirement community are shown to have significant increase in carpool rates in the winter. The rest of the county does not show much variability in these modes to work.

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation