ESTIMATES ABOUT JOURNEY TO WORK FROM THE 2005 ACS, C2SS, AND CENSUS 2000

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INTRODUCTION

This report compares national distributions based on data from the 2005 American Community Survey (ACS) with those based on data from two other Census Bureau data sources for four items: means of transportation to work, departure time from home to work, travel time to work, and place of work (worked in area of residence or not). This report compares the 2005 ACS with estimates based on the Census 2000 and Census 2000 Supplementary Survey (C2SS). It then notes variations that are both statistically and substantially different, and for those found, offers possible explanations. For all analyses the universe is restricted to those 16 and over who worked at all during the reference week. All estimates are based on published data.

METHODOLOGY

The tables included in this report compare the most commonly tabulated data on means of transportation to work, departure time from home to work, travel time to work, and place of work from the 2005 ACS, C2SS, and Census 2000. Tabulations are restricted to the residence-based population as opposed to the workplace-based population. Comparisons consist of percentage-point differences between the ACS and all other comparison distributions as well as between Census 2000 and the C2SS. Tables display the survey estimates, the margins of error from which 90-percent confidence intervals of the estimates can be derived, and the difference between the estimates. In the case of relative frequency distributions, the difference is calculated as the percentage-point

difference between the two estimates. An asterisk (*) denotes statistically significant differences.

At the national level, survey variances were small, resulting in many statistically significant differences between the distributions. This report focuses on statistically significant differences of 0.5 percentage points or more. This yardstick can vary based on the relative size of the category. For example, for population groups constituting a relatively large percentage of the population (such as people who drove alone to work), a 0.5 percentage-point difference in the estimates might be relatively small, while for population groups constituting a smaller percentage of the population (such as people who bicycled to work), a 0.5 percentage-point difference could be relatively large. Users may choose statistically significant differences that are smaller or larger than 0.5 percentage points for their own analytical purposes. Those percentage point differences less than 0.5 percentage points but statistically significant could be due to differences between the surveys and not substantive differences. All the statements in this brief have undergone statistical testing and all comparisons are significant at the 90-percent confidence level.

The remainder of this section examines differences in methodology between these different data sets.

Sample Frame

The 2005 ACS surveyed a national sample of housing units, both occupied and vacant.

An initial sample of approximately 3 million addresses resulted in approximately 1,924,000 completed interviews. In 2005, data were collected in all 3,141 counties in the United States. The ACS sample is designed to provide single-year estimates of housing and socio-economic characteristics for the nation, all states, and areas with populations of 65,000 or more.

The long-form questionnaire used in Census 2000 was sent to a sample of approximately 1-in-6 households. This sample was designed to produce national, state, and substate estimates of many social, economic, and housing characteristics from questions that were not included on the Census 2000 short-form that was sent to the entire population.[1]

The C2SS was conducted as part of Census 2000 to demonstrate the operational feasibility of ACS methods. The C2SS distributions in this report come from information collected in the year 2000 from the 36 ACS test counties plus another sample of 1,203 counties selected and surveyed using ACS operational and data collection methods.[2]

One difference between the 2005 ACS, C2SS, and the Census 2000 universes is that the Census includes individuals enumerated at group quarters, while the 2005 ACS[3] and C2SS did not collect information on group quarters. The estimates in this report are

[1] For a detailed explanation of the Census 2000 sampling frame and data collection procedures, see U.S. Census Bureau, *Census 2000 Summary File 3: Technical Documentation.* U.S. Census Bureau: Washington, DC, 2002, chapter 8.
[2] For a detailed explanation of the C2SS survey and comparisons with Census 2000 sample items, see U.S. Census Bureau, *Meeting 21st Century Demographic Data Needs—Implementing the American Community Survey. Report 9: Comparing Social Characteristics with Census 2000.* Washington, DC, 2004.
[3] The ACS began collecting information on group quarters beginning in 2006. For a detailed explanation of the ACS 2006 group quarters data collection, see U.S. Census Bureau, *American Community Survey Design and Methodology: Technical Paper 67.* U.S. Census Bureau: Washington, DC, 2006, chapter 8.

based on published data and may be slightly different for some items in Census 2000 because of the inclusion of group quarters.

Sample Size and Mode of Data Collection

The 2005 ACS interviewed a total of 1,787,986 households. There were 133,091,043 workers 16 and older in the 2005 ACS. Data were collected continuously throughout the year using a combination of mail-out/mail-back questionnaires, Computer-Assisted Telephone Interviewing (CATI), and Computer-Assisted Personal Interviewing (CAPI). Each month a unique national sample of addresses received an ACS questionnaire. Addresses that did not respond were telephoned during the second month of collection if a phone number for the address was available, and personal visits were conducted during the third, and final, month of data collection for a subsample of the remaining nonresponding units. The 2005 ACS achieved an overall survey response rate of 97.3 percent, calculated as the initially weighted estimate of interviews divided by the initially weighted estimate of cases eligible to be interviewed[4]. Both ACS and C2SS employed experienced, permanent interviewers for CATI and CAPI data collection.

The Census 2000 Supplementary Survey (C2SS) had an initial sample of 890,698 addresses and used similar methods to the 2005 ACS[5]. Census 2000 used a one-in-six sample. Census 2000 and C2SS had smaller worker populations than the 2005 ACS with 128,279,228 and 127,731,766, respectively. The survey-response rate for the C2SS was

[4] For a description of the accuracy of the 2005 ACS data, please refer to *American Community Survey, Accuracy of the Data (2005)* <www.census.gov/acs/www/Downloads/ACS/accuracy2005.pdf>
[5] For a description of the accuracy of the 2000 C2SS data, please refer to *Census 2000 Supplementary Survey, Accuracy of the Data* <www.census.gov/acs/www/Downloads/ACS/Accuracy00_C2SS.pdf>

95.1 percent. In Census 2000, the sample had a housing-unit survey-response rate of 91.2 percent.[6]

Reference Period and Question Wording

The 2005 ACS, C2SS, and Census 2000 had the same question wording for the journey to work items and used the same reference question to determine eligibility in responding to these items. The 2005 ACS and the C2SS collected data for 12 months while Census 2000 collected data for approximately four months. This difference in length of data collection may contribute to differences in the estimates.

The employment question (LAST WEEK, did this person do ANY work for either pay or profit?) preceding the journey to work questions on the 2005 ACS, C2SS, and Census 2000 directs respondents to the journey to work questions. Using the skip pattern, a response of 'No' takes a respondent to the set of questions following the journey to work section. Respondents on vacation or not working during the week prior to completing the survey should respond 'No' to the employment question. Respondents were to report their usual transportation method, departure time, travel time, and place of work for the previous week, whether or not the information was consistent with their commuting activities for the majority of the year.

All three surveys use the same reference period of "last week" however, "last week" varies through the year depending on the survey. The 2005 ACS and the C2SS were

[6] Deborah Griffin, Susan Love, and Sally Obenski, "Can the American Community Survey Replace the Census Long Form?" Paper presented at the Annual Meeting of the American Association for Public Opinion Research, Nashville, TN, May 14-18, 2003.

conducted over 12 calendar months and respondents had three months to complete and return the mailed questionnaire. The CATI and CAPI components overlapped the mail return timeframe with the CATI operation beginning in the second month and CAPI in the third month for non-responses. The January 2005 data collection month for ACS could refer to the last week of December 2004 and households selected for the December 2005 data collection month could be referencing a week in February 2006 if they were part of the CAPI operation. The C2SS had a corresponding collection period in 2000. Census 2000 was conducted during a much shorter timeframe (mailings began in mid-March and non-response follow-up lasted through June) and collected journey to work information on those people who were working in the single week prior to when they completed the survey. This variation in when the reference period is applied by the respondent could account for differences between the survey estimates.

Means of Transportation:

> How did this person usually get to work LAST WEEK? *If this person usually used more than one method of transportation during the trip, mark (X) the box of the one used for most of the distance.*
>
> [ ] 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

If a respondent worked in the week prior to the survey completion date they were

directed to provide their method of transportation to their workplace.

Departure Time:

What time did this person usually leave home to go to work LAST WEEK?

Hour Minute
[ ][ ]:[ ][ ]

[] a.m.
[] p.m.

Time of departure informs public and transportation planners of the times when commuters are on the roadways or using public transportation and potential times of high congestion. Respondents who worked at home were directed to not answer the departure time question.

Travel Time to Work:

How many minutes did it usually take this person to get from home to work LAST WEEK?

Minutes
[ ]

Commute time to work is a measure of vehicular volume on roadways and public transportation. Respondents who worked at home were directed to not answer the travel time question.

Place of Work:

At what location did this person work LAST WEEK? *If this person worked at more than one location, print where he or she worked most last week.*

a. Address (Number and street name)

b. Name of city, town, or post office

c. Is the work location inside the limits of that city or town?

[ ] Yes

[ ] No, outside the city/town limits

d. Name of county

e. Name of U.S. state or foreign country

f. ZIP Code

[ ][ ][ ][ ][ ]

Place of residence is compared to place of work and gives insights into inter-and intra-state and county commuting patterns. Place of work is based on the location worked during the previous week.

The 2005 ACS and the C2SS data collection periods span the entire year while Census 2000 was over a smaller portion of the year, comparatively. We would expect some difference in the estimates due to methodology between ACS/C2SS and Census 2000. We would also expect the length of time between the two data collection points (2005 and 2000) to contribute to changes in the estimates.

Item Nonresponse

Item nonresponse occurs when an individual does not provide complete and usable information for a data item. Item allocation rates are often used as a measure of the level

of item nonresponse. Allocation rates are computed as the ratio of the number of eligible people for which a value was allocated during the editing process for a specific item to the number of people eligible to have responded to that item. Table 1 lists the allocation rates for each of the journey to work items by survey.

Table 1. Journey to Work Item Allocation Rates for 2005 ACS, C2SS, and Census 2000

Item	2005 ACS	C2SS	Census 2000
Means of Transportation	2.3	4.6	7.6
Departure Time	7.7	11.3	15.0
Travel Time	5.7	8.7	11.8
Place of Work[7]	4.5	9.9	10.7

Differences in data collection procedures could account for some of the differences in allocation rates. The 2005 ACS and C2SS had lower allocation rates for each of the journey to work items compared with Census 2000. The use of experienced interviewers and data collection through the year for ACS and C2SS may have had a positive effect on the quality of the data. The 2005 ACS and C2SS also had an operation to conduct telephone follow-up on returned mail questionnaires with missing or inconsistent responses. This could also account for the lower allocation rates for ACS and C2SS. Census 2000 had no content follow-up, which could increase the allocation rate. A subset of the ACS and C2SS data were collected using a CATI/CAPI instrument that had internal consistency checking routines, possibly reducing errors from being recorded in the field collection of the data. No CATI/CAPI instruments were used to collect Census 2000 data.

[7] Place of work data are calculated in this report as allocated if any one piece of geography down to the place level is missing. Place of work is allocated at least to the place level for the 2005 ACS, the C2SS, and Census 2000 but the goal is to code down to the block level.

In all three surveys, allocation rates for departure time, travel time, and place of work were higher than for means of transportation. Whenever a person's means of transportation in any of these surveys was allocated or altered, it opened the possibility that their other journey to work information would be created or changed to another category, thus creating the potential for inconsistencies in reporting patterns. The journey to work items – departure time, travel time, and place of work – use means of transportation in their editing procedures. If means of transportation to work was missing then the subsequent journey to work items were also set as missing.

Data Editing and Imputation Procedures

The 2005 ACS, C2SS, and Census 2000 edit and imputation rules are designed to ensure that the final edited data are as consistent and complete as possible. These rules are used to identify and account for missing, incomplete, and contradictory responses. In each case where a problem is detected, pre-established edit rules govern its resolution.

The three surveys employ two principal imputation methods: relational imputation and hot deck allocation. Relational imputation assigns values for blank or inconsistent responses on the basis of other characteristics on the person's record or within the household. Hot deck allocation supplies responses for missing or inconsistent data from similar responding housing units or people in the sample.

The editing procedures for all of these surveys employ logical checking routines to produce consistency among household members and other responses. For example, no

person reported as not employed in the previous week can have a means of transportation to work. When answers cannot be logically assigned or when inconsistencies or missing data are encountered, allocation routines using hot decks generally stratify the donors and recipients of the hot deck by their sex, race, and other characteristics of commuting behavior. Because of differences in the sample size of these surveys, hot decks will vary in the level of detail and the frequency of updating the individual cells in the hot deck.

Controls and Weighting

There are notable differences among these three surveys in the selection of controls and the calculation of weights that may lead to differences in estimates. The 2005 ACS, C2SS, and Census 2000 samples are weighted to account for both the probability of selection and housing unit nonresponse.

After the initial weighting, data from the 2005 ACS and the C2SS were controlled to be consistent with independent population estimates of the population of individuals and housing units using July 2005 estimates and the April 2000 census count, respectively. Both the 2005 ACS and the C2SS used county level controls, but grouped smaller counties into weighting areas before applying population and housing unit controls. The C2SS grouped counties into weighting areas with a minimum population of 250,000. The smallest weighting area for the 2005 ACS had a population of 30,000. Because the 2005 ACS and C2SS control to both the total population and the total number of housing units, both files contain both person weights and housing-unit weights.

Estimates from the Census 2000 sample were obtained from an iterative ratio-estimation procedure that assigned a weight to each sample person. The estimation procedure used to assign the weights was performed in geographically defined weighting areas that were usually formed of contiguous geographic units within counties. Within a weighting area, the long-form sample was ratio-adjusted to equal the 100-percent total for certain categories such as family households or nonfamily households, age, sex, race, and Hispanic origin. This procedure resulted in weights for each person that could vary from person to person within the same housing unit.

RESULTS

There were many statistically significant differences between the surveys and across the journey to work items but few were substantively significant. Overall, the distributions were similar between the surveys and most differences can be attributed to the differences in data collection procedures and reference periods rather than substantive changes.

Means of Transportation

A majority of the percentage-point differences shown in Table 2 are statistically significant but few are significant at 0.5 percentage points or more. In the 2005 ACS, 77.0 percent of workers 16 and over drove alone, while for the C2SS 76.3 percent drove alone, and 75.7 percent drove alone for Census 2000. The 2005 ACS data records a larger percentage driving alone than does the C2SS (0.7 percentage-point difference) or Census 2000 data (1.3 percentage-point difference). The percent carpooling was significantly lower in the 2005 ACS than in the C2SS or Census 2000. In 2005 the ACS

had 10.7 percent of people carpooling, while C2SS had 11.2 percent and Census 2000 12.2 percent carpooling. The 2005 ACS compared to Census 2000 had the largest difference in percent carpooling with 1.5 percentage points. This difference might be due to the 2005 ACS data collection occurring five years after Census 2000 and C2SS. The trend has been towards higher levels of driving alone and lower levels of carpooling so the differences between the surveys are understandable[8]. The 2005 ACS also differed from Census 2000 for those walking to work. Census 2000 has 2.9 percent of the population walking to work while the 2005 ACS has 2.5 percent walking. Dispersions of work places and urban sprawl could account for the decrease in walking as a main mode of transportation to work. Those who worked at home ranged from 3.2 (C2SS) to 3.6 percent (2005 ACS).

This report compares not only the 2005 ACS to the C2SS and Census 2000, but also Census 2000 to the C2SS. This way we can assess the impact of ACS data collection methods by comparing C2SS data to Census 2000. Census 2000 had a smaller percent of people driving alone and a larger percent carpooling compared to C2SS. There were also fewer people taking public transportation according to Census 2000 (4.6 percent) than C2SS (5.0 percent). While there are statistically significant differences between the two surveys, the C2SS collected comparable data to the Census 2000 long form.

Departure Time

Table 3 compares data on departure time from the three surveys: the 2005 ACS, the

[8] See U.S. Census Bureau, *Journey to Work: 2000, Census 2000 Brief.* U.S. Census Bureau: Washington, DC, 2004

C2SS, and Census 2000. Results from the 2005 ACS are expected to differ from those in the C2SS and the Census 2000 sample because the data were collected 5 years apart. Despite this difference in years, the data are fairly consistent. Significant differences of 0.5 percent largely occurred for total lines that summed up finer categories of departure times. For all three surveys the most popular time of departure category was 6:30 am to 8:29 am, but the 2005 ACS had a lower percentage of people leaving home at that time than either the C2SS or Census 2000. There was an increase for the 2005 ACS in the percent of people leaving for work between 12:00 am and 6:29 am (ACS: 21.4; C2SS: 20.3; and Census: 19.7) and between 8:30 am and 11:59 am compared to C2SS and Census 2000 (ACS: 15.2; C2SS: 14.4; and Census: 14.2).

A smaller percentage of people left for work from 12:00 am to 6:29 am in Census 2000 than C2SS. A larger percent left for work from 6:30 am to 8:29 am for Census 2000 than C2SS. The difference in reference period could explain this variation. Departure time can vary through the year, especially seasonally. C2SS would reflect these variations in the overall estimate while Census would not.

Travel Time

Table 4 presents data on travel time to work. While the overall results from the 2005 ACS, C2SS and the 2000 Census compare favorably--given the difference in years--a few statistically significant differences of 0.5 percentage points or more are noted. A smaller percentage of people commuted 5 to 9 minutes in the 2005 ACS (10.9 percent) than C2SS (11.5 percent). Fewer people were commuting 10 to 14 minutes in the 2005 ACS

(14.3 percent) than Census 2000 (15.0 percent). The other commuting times were fairly consistent between the 2005 ACS and Census 2000, and the 2005 ACS and the C2SS. The C2SS had a higher percentage of people commuting less than 20 minutes compared to the 2005 ACS and a smaller percent of people commuting 25 minutes or more. Therefore, it is not surprising that ACS has a higher mean travel time than the C2SS – 25.1 minutes compared to 24.4 minutes. Shorter travel times – less than 20 minutes – all decreased from 2000 to 2005 in C2SS/ACS, while longer travel times – 25 minutes or greater – all increased, a clear representation of overall increasing travel time for workers.

The C2SS and Census 2000 had two interesting differences. The extreme commute time categories, less than 5 minutes and more than 90 minutes, were both significantly different by 0.5 percentage points or more. Census 2000 had a lower percentage of people commuting less than 5 minutes compared to C2SS (3.4 percent and 3.9 percent, respectively) and a higher percent commuting 90 minutes or more (2.8 percent and 2.1 percent). The difference in percent that commuted 90 minutes or more caused most of the increase in mean commute time between Census 2000 and C2SS. The increase was 1.1 minutes from 24.4 minutes for C2SS to 25.5 minutes for Census 2000. One possibility is that the C2SS captured greater variation in job locations through the year than Census 2000, and the adjustment in commute time is distributed through the commute time categories.

Place of Work

Table 5 presents data on place of work. Results from the 2005 ACS and Census 2000 are again fairly consistent. Statistically significant differences of 0.5 percentage points or more are noted for the 2005 ACS, with a smaller percent of people in the 2005 ACS working in their county of residence than either Census 2000 or the C2SS. Conversely, a higher percentage of people worked outside their county of residence in the 2005 ACS than in Census 2000 or the C2SS. No statistical differences were found between Census 2000 and C2SS percentage distributions by place of work. Increases in commute time and the dispersion of the population and work centers in the past five years could account for workers' place of residence coinciding less with their place of work.

SUMMARY

Data from the 2005 American Community Survey (ACS) on journey to work are reasonably consistent with those from the Census 2000 Supplementary Survey (C2SS), and Census 2000. The differences in length of data collection and the length of time between data collection points contribute to variations in the estimates between the 2005 ACS, the C2SS, and Census 2000. Different conclusions can be drawn on the direction and magnitude of change for the journey to work measures depending on which surveys are being compared. While many statistical differences are present, few are substantively large. The principal findings in this paper concern means of transportation and departure time. An increasing percentage of people are driving alone when comparing the 2005 ACS to either Census 2000 or C2SS. The percentage of people leaving for work between 6:30 am and 8:29 am is lower for the 2005 ACS compared with either Census 2000 or

C2SS. Some differences between the ACS and Census 2000 estimates may be influenced by the different collection periods of the two data systems. Overall, patterns of change between 2005 and either of the 2000 data points are fairly similar. None of the differences between the comparison points are large enough to raise concern.

ACCURACY OF THE ESTIMATES

The data contained in this report are based on the sample of households who responded to the 2005 ACS, Census 2000 long form, and C2SS. As a result, the sample estimates may differ somewhat from the 100-percent figures that would have been obtained if all housing units, people within those housing units, and people living in group quarters had been enumerated using the same questionnaires, instructions, enumerators, and so forth. The sample estimates also differ from the values that would have been obtained from different samples of housing units, and hence of people living in those housing units, and people living in group quarters. The deviation of a sample estimate from the average of all possible samples is called the sampling error. The initial sample for the 2005 ACS was approximately 3 million households; C2SS had an initial sample of 890,000 addresses in 1,239 counties; and nationally, approximately one out of every six housing units was included in the Census 2000 sample.

In addition to the variability that arises from the sampling procedures, both sample data and 100-percent data are subject to nonsampling error. Nonsampling error may be introduced during any of the various complex operations used to collect and process data. Such errors may include: not enumerating every household or every person in the

population, failing to obtain all required information from the respondents, obtaining incorrect or inconsistent information, and recording information incorrectly. In addition, errors can occur during the field review of the enumerators' work, during clerical handling of the questionnaires, or during the electronic processing of the questionnaires.

While it is impossible to completely eliminate error from an operation as large and complex as the ACS and decennial census, the Census Bureau attempts to control the sources of such error during the data collection and processing operations. The primary sources of error and the programs instituted to control error are described in detail for the ACS in *Design and Methodology Technical Paper 67* located at www.census.gov/acs/www/Downloads/tp67.pdf. Census 2000 documentation on sources of error and controlling for it can be found at www.census.gov/prod/cen2000/doc/sf3.pdf and C2SS documentation on this topic is at www.census.gov/acs/www/Downloads/ACS/Accuracy00_C2SS.pdf.

Nonsampling error may affect the data in two ways: (1) errors that are introduced randomly will increase the variability of the data and, therefore, should be reflected in the standard errors; and (2) errors that tend to be consistent in one direction will bias both sample and 100-percent data in that direction. For example, if respondents consistently tend to underreport their incomes, then the resulting estimates of household or families by income category will tend to be understated for the higher income categories and overstated for the lower income categories. Such biases are not reflected in the standard errors.

All statements in this report have undergone statistical testing and all comparisons are

significant at the 90-percent confidence level, unless otherwise noted. The estimates in the tables may vary from actual values due to sampling and nonsampling errors. As a result, estimates in one category used to summarize statistics in the tables may not be significantly different from estimates assigned to a different category.

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