

# Response Profile of the 2005 ACS

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*“Any views expressed on statistical, methodological, or technical issues are those of the author and not necessarily those of the U.S. Census Bureau.”*

## **ABSTRACT**

(ACS Response Profile Logistic Regression)

The objective of this paper is to use 2005 American Community Survey (ACS) data to compare and analyze the demographic, social, and economic characteristics of people who respond by mail, Computer Automated Telephone Interview (CATI), and Computer Automated Personal Interview (CAPI). There is a high cost involved with ensuring a high response rate for the ACS. Potential respondents are first contacted through a mail questionnaire. Those that don't respond to the mail questionnaire are followed up with by CATI. Finally, a portion of CATI nonrespondents is followed up by CAPI. We created a profile of who responds to what mode. Survey nonresponse is typically due to three reasons: noncontact, resistance, and inability to complete the survey. We tested mail questionnaire nonresponse due to resistance and those who were unable to respond. A logistic regression model for nonresponse due to resistance and inability to respond was created.

## **1. INTRODUCTION**

The American Community Survey (ACS) is a national survey conducted throughout the year by the U.S. Census Bureau. The ACS was designed to replace the decennial census long-form survey and allows the Census Bureau to produce small-area estimates annually. The ACS is a multi-mode survey that employs three sequential modes of data collection to achieve high levels of survey response. Initially in the ACS, a paper questionnaire is mailed to all sampled housing units with a mailable address. Mail nonrespondents are then followed up with a Computer Assisted Telephone Interview (CATI). Finally, a Computer Assisted Personal Interview (CAPI) is conducted on a subsample of the CATI nonrespondents and a subsample of unmailable addresses (U.S. Census Bureau 2006). Ultimately, the vast majority of mail nonrespondents complete the ACS by telephone or face-to-face interviews. This paper will look at the nonrespondents to the mail portion of the ACS. We hypothesize that certain sample units are more likely to be interviewed by the mail component than the CATI/CAPI component. We will try to determine what types of people choose to mail back the ACS mail questionnaire.

Two studies by McGovern and Griffin (2003) and Salvo and Lobo (2002), suggest reasons why people don't respond to the ACS mail questionnaires. In addition to those studies, Leslie, Raglin, and Braker (2002) studied overall ACS response. These papers stated that nonresponse was correlated with the respondent's race, language spoken, Hispanic origin, if they rent, and if they live in poverty. McGovern and Griffin (2003) examined data from the Census 2000 Supplementary Survey (C2SS) and 2001 Supplementary Survey (01SS), and reported an association between the use of different languages other than English at home and the mode of completion of the survey. The C2SS and 01SS were tests of the ACS's feasibility and used the same three modes of data collection as the ACS. They found that a higher percentage of those who speak English at home completed the mail questionnaire than households that spoke Spanish or other languages (McGovern and Griffin 2003). Salvo and Lobo (2002) looked at the quality of response to the 2000 ACS and also found differences in who completed which mode. They found that the Bronx in New York had a much lower mail return rate than the national average. Compared to national averages, the Bronx had higher levels of households in poverty, Hispanics, Black Nonhispanics, and renters (Salvo and Lobo 2002). Leslie, Raglin, and Braker (2002) studied differences between 2000 ACS respondents and nonrespondents, using Census 2000 data for the nonrespondents. The study showed that, overall, nonrespondents were more likely to be male, single, Black, renters, and living alone (Leslie, Raglin, and Braker 2002).

These three studies suggest that mail and overall nonresponse is mainly due to inability to respond and social or linguistic isolation. My hypothesis is that the various demographic groups that are likely not to respond by mail are those that are more likely to be isolated socially or by virtue of their language. We also hypothesize that people who have vision difficulties or other physical difficulties will be less likely to respond by mail. This account of ACS mail nonresponse is supported by Groves (2004), who states that survey nonresponse (other than noncontact) is typically due to two reasons: refusals and the

inability to complete the survey (Groves 2004). Social isolation can lead to a high refusal rate, and linguistic isolation is a major source of inability to complete the mail questionnaire.

Social isolation describes the condition of people who do not consider themselves to be a part of a larger society or to be bound by its norms. Groups who have suffered historical inequities at the hands of major societal institutions and those identifying strongly with a specific subculture may consider themselves socially isolated (Groves and Couper 1998). The ACS is a government survey and the packet that includes the mail questionnaire features a cover letter that uses the phrase, "The U.S. Census Bureau is conducting a survey ..." The follow-up letter for nonrespondents includes the following wording: "You are required by U.S. law to respond to this survey" (U.S. Census Bureau 2006). Socially isolated groups may see themselves as alienated from central institutions such as the Federal Government and therefore they might be less likely to complete a government survey (Groves and Couper 1998).

Linguistic isolation describes people who speak a different language and have difficulty communicating with the majority of the population. If a mail nonrespondent does not speak English well, they could be described as linguistically isolated. The ACS does offer people who cannot read English the opportunity to call a toll-free number to receive a copy of the questionnaire in Spanish. However, a person who is linguistically isolated might not take the time to find the telephone number within the packet. The ACS collects information on English proficiency and language spoken at home.

The ACS also collects information on physical/mental difficulties and limitations in vision or hearing. (Hearing and vision difficulties are covered by a single question and so these two impairments cannot be differentiated.) Vision problems as well as other mental or physical difficulties could make a person unable to complete the mail questionnaire.

Noncontacts due to unmailable questionnaires and Undeliverable-As-Addressed (UAA) questionnaires could have a large effect on ACS mail nonresponse.<sup>1</sup> Therefore noncontacts will be excluded from the analysis of nonresponse. This is to distinguish mail refusals from noncontacts. Sosdian and Sharp (1980) state the inability to access mail respondents is a larger factor in mail nonresponse than resistance. Certain demographic groups may be more likely to not receive their ACS mail questionnaire due to living in areas with non-city-style addresses. A non-city-style address is a mailing address that does not use house number and street or road name (U.S. Census Bureau 2006).

## **2. ACS BACKGROUND**

The ACS is a monthly sampled national survey conducted by the U.S. Census Bureau. In 2005, the housing unit (HU) component of the ACS was fully implemented throughout the United States of America and Puerto Rico. The 2005 ACS sample consisted of housing units in all 3,141 counties and county equivalents, including the District of Columbia and all of Puerto Rico's 78 municipios (U.S. Census Bureau 2006). The ACS sample is taken from the Master Address File (MAF), which is the Census Bureau's official inventory of HUs and group quarters. The MAF is constructed from addresses that existed during Census 2000, post census adds and deletes from the United States Postal Service's (USPS) delivery sequence file, adds from the demographic area address listing, and count question resolution adds (U.S. Census Bureau 2006). There are 80 replicate weights for each sampled housing unit to reflect the population.

Data collection for HUs in the ACS is done in one of three modes. Sampled housing units with mailable addresses are first mailed a paper questionnaire. An unmailable address is a sample address that is inadequate for delivery by the USPS (U.S. Census Bureau 2006). The USPS does not deliver to some mailable addresses. They are identified as UAAs and occur for many reasons including bad addresses. Included with the paper questionnaire is a cover letter, a guide to the ACS, a frequently asked questions brochure, and a return envelope (U.S. Census Bureau 2006). If the Census Bureau does not receive a completed paper questionnaire within approximately three and a half weeks, a replacement questionnaire is sent out. If there is still no response after a month, a CATI interview is attempted if there is a telephone number for the address. The final phase of ACS data collection is CAPI. The CAPI sample is a subsample of the CATI nonrespondents plus a subsample of the unmailable addresses. The CAPI sampling rates depend on whether the HU has a mailable address. Addresses with an unmailable address are sampled at the rate of two-in-three (U.S. Census Bureau 2006). The sample rates for units with mailable addresses are based on their predicted levels of completed interviews prior to the CAPI stage. The sample rates are one-in-two, two-in-five, or one-in-three (U.S. Census Bureau 2006). Census Bureau Field Representatives conduct the CAPI component.

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<sup>1</sup> Unmailable questionnaires correspond to sample addresses that were too incomplete to meet the requirements for mailing. UAA questionnaires have mailable addresses identified by the USPS as addresses that they could not deliver to.

### 3. METHODS

#### 3.1. Datasets

This analysis is based on information about the person who completed the ACS questionnaire (the respondents) and information about the respondent's household. There were seven 2005 ACS datasets used to create this dataset that included edited and unedited person and household data. The edited and unedited person and household files were used because some variables of interest were only available within one of those files. Since this analysis is interested in respondent characteristics the final dataset contains only those households with identifiable respondents. All vacant housing units, housing units where a respondent name was not given, and housing units where a respondent could not be identified were considered out of scope. This resulted in a loss of 627,725 households (33% of the 2005 sample). Respondents' demographic information and their household characteristics were analyzed in creating the response profile. To distinguish between the effects of mail nonresponse and mail noncontacts, any CATI or CAPI case that had either one of the two mail-outs flagged as an UAA by the USPS or an address considered unmailable were not included in the analysis. A CATI/CAPI case with a UAA mail questionnaire or unmailable address was considered a mail noncontact instead of a mail refusal.

Of the 1,280,989 households in the initial in-scope universe, there were 81,730 CATI/CAPI households classified as UAAs and 44,104 CAPI respondents classified as unmailable excluded from the final dataset. For more information on the UAA and unmailable cases excluded, see table 4.1. The final dataset contains 1,228,712 respondents.

#### 3.2. Weights

The replicate weights used in the variance estimation reflect the ACS sample design and the CAPI subsample of mail and CATI nonrespondents. There are 80 replicate weights for each respondent. Weights to correct for coverage errors and noninterviews are not available for this analysis because of the use of respondent identifying information. Noninterview correction weights are only available for datasets where any respondent identifiers have been removed (U.S. Census Bureau 2006). The successive differences variance estimation method was used with the replicate weights for variance estimation. The successive difference method is the Census Bureau's required variance estimation method for ACS (U.S. Census Bureau 2006). The formula for the successive differences method is below.

$$Var(X_0) = \frac{4}{80} \sum_{r=1}^{80} (X_r - X_0)^2$$

Where  $X_0$  = the final sample estimate and  $X_r$  = the replicate weights.

#### 3.3. Analysis

Demographic information collected in either CATI or CAPI was used to examine the characteristics of ACS respondents and their households that were either mail questionnaire nonresponse or mail noncontacts.

To calculate the weighted percentage of a given respondent or household characteristic that were UAAs and Unmailable, the following formulas were used with the final sample weights:

$$\text{Percentage of Characteristic that were UAAs} = \frac{\text{UAAs}}{\text{Initial In-Scope Universe}} \times 100$$

$$\text{Percentage of Characteristic that were Unmailable} = \frac{\text{Unmailable}}{\text{Initial In-Scope Universe}} \times 100$$

These rates were calculated for each characteristic and are displayed in Table 4.1.

To calculate the weighted distribution of responses by mode across respondent and respondent household characteristics, the following formula was used with the final sample weight. All UAA, unmailable, deleted, unidentified vacant, and nonresponding households were excluded from this completion rate.

$$\text{Percentage Mail} = \frac{\text{Mail Total}}{\text{Mail Total} + \text{CATI Total} + \text{CAPI Total}} \times 100$$

$$\text{Percentage CATI} = \frac{\text{CATI Total}}{\text{Mail Total} + \text{CATI Total} + \text{CAPI Total}} \times 100$$

$$\text{Percentage CAPI} = \frac{\text{CAPI Total}}{\text{Mail Total} + \text{CATI Total} + \text{CAPI Total}} \times 100$$

In analyzing race, we used a six-category race variable created by the Census Bureau (White, Black, American Indian, Asian, Native Hawaiian and Other Pacific Islander, and some other race). In the six-category race variable, the races are mutually exclusive and respondents are only coded as having one race. However, in the ACS questionnaire, respondents can select more than one race. Respondents who selected more than one race category are randomly assigned a race category from one of their selections.

I used logistic regression to model mail nonresponse. The dependent variable is whether a respondent responded by mail or by CATI or CAPI. The independent variables for the prediction model will consist of variables identified in the previous literature as having an effect on mail response such as race, Hispanic origin, tenure (i.e., owners vs. renters), poverty, living alone, receives public assistance, and households where a language other than English is spoken at home. Other variables that may be related to mail nonresponse were also included, such as the presence of someone under 18 years old in the house, the respondent being between 18 and 24 years old, the respondent having difficulty with seeing or hearing, and other physical and mental difficulties (includes difficulty remembering, dressing themselves, going outside, and physical difficulty).

#### 4. RESULTS

Table 4.1 is a summary of the characteristics of the population of mail questionnaires classified as noncontacts (unmailable and UAA) as a percentage of the in-scope universe. Poverty and Renters, two characteristics Salvo and Lobo (2002) associated with high mail nonresponse also have a higher level of noncontacts than the in-scope universe percentage of noncontacts. Other demographic characteristics found to have a high level of noncontacts are American Indians, people receiving public assistance, respondents between 18 and 24 years old, and people with difficulty seeing or hearing. The initial in-scope universe percentage of UAAs is much larger than the percentage of unmailables. American Indians are the only group with both an unmailable rate and UAA rate above 10 percent. If the UAAs and unmailable responses were included with CATI/CAPI responses due to refusals, the percentage of mail nonresponse would be inflated due to the noncontacts.

**Table 4.1. Distribution of Noncontact Mail Questionnaires by Respondent and Respondent Household Characteristics, with Standard Errors.**

	Percentage Unmailable	Percentage Unmailable Standard Error	Percentage UAAs	Percentage UAA Standard Error
In-Scope Universe	2.3	0.015	7.0	0.029
<b>Respondent's Characteristics</b>				
Race				
White	2.2	0.015	6.9	0.033
Black	1.4	0.027	7.4	0.095
American Indian	11.0	0.23	12.7	0.42
Asian	0.37	0.027	4.0	0.14
Native Hawaiian and Other Pacific Islander	2.3	0.31	7.2	0.78
Some Other Race	1.0	0.046	6.7	0.16
Hispanic Origin				
Yes	2.2	0.014	7.1	0.11
No	1.3	0.031	7.0	0.031
Between 18 and 24 years Old				
Yes	1.9	0.039	12.2	0.17
No	2.4	0.016	6.7	0.027
Speaks a Language Other than English at Home				
Yes	3.1	0.031	6.3	0.076
No	2.2	0.015	7.2	0.033
Difficulty Hearing or Seeing				
Yes	4.6	0.083	10.3	0.14
No	2.2	0.014	6.8	0.030
Other Difficulties				
Yes	3.8	0.044	9.1	0.070
No	2.1	0.015	6.6	0.032
<b>Respondent's Household Characteristics</b>				
Living in Poverty				
Yes	3.0	0.045	10.3	0.10
No	1.9	0.013	6.4	0.029
Receiving Public Assistance				
Yes	2.3	0.081	9.7	0.25
No	2.2	0.015	7.3	0.032
Presence of Someone Under 18 years old in the Household				
Yes	2.1	0.022	6.5	0.054
No	2.1	0.017	7.2	0.037
Home Ownership				
Own	1.8	0.021	5.8	0.033
Rent	2.7	0.018	9.5	0.065
Living Alone				
Yes	1.9	0.021	7.6	0.068
No	2.1	0.016	6.7	0.035

Tables 4.2 and 4.3 show the distribution across modes of respondent and respondent household characteristics and their associated standard errors. This indicates how households or people with specific characteristics tend to be interviewed in the ACS. All UAAs, unmailables, vacants, deletes, unidentifiable respondents, and nonrespondents are excluded from tables 4.2 and 4.3

The 2005 ACS results support the past findings of McGovern and Griffin (2003) and Salvo and Lobo (2002). Non-whites (except Asians), Hispanics, those receiving public assistance, respondents with someone under the age of 18 present in their household, renters, and those living in poverty are less likely to respond via mail.

The distribution for linguistically isolated ACS respondents also replicated earlier findings. Respondents who spoke a language other than English at home had a far lower percentage of interviews completed by mail than the respondents that spoke only English.

Respondents who reported difficulty seeing or hearing showed that they were less likely to complete the mail questionnaire than those who do not have these difficulties.

**Table 4.2. Distribution Across Modes for Respondent's Demographic Characteristics, with Standard Errors**

	Percentage Mail	Percentage CATI	Percentage CAPI	Total
In-Scope Universe	56.1 (0.059)	12.4 (0.029)	31.5 (0.061)	100.0
<b>Race</b>				
White	62.5 (0.073)	11.9 (0.033)	25.6 (0.070)	100.0
Black	29.7 (0.11)	15.1 (0.10)	55.2 (0.15)	100.0
American Indian	40.1 (0.56)	18.0 (0.36)	41.9 (0.69)	100.0
Asian	52.7 (0.27)	9.7 (0.13)	37.6 (0.32)	100.0
Native Hawaiian and Other Pacific Islander	30.0 (1.3)	14.2 (0.88)	55.8 (1.6)	100.0
Some Other Race	22.9 (0.16)	16.7 (0.16)	60.3 (0.22)	100.0
<b>Hispanic Origin</b>				
Yes	25.9 (0.14)	15.1 (0.097)	58.8 (0.16)	100.0
No	59.6 (0.068)	12.2 (0.033)	28.2 (0.071)	100.0
<b>Speaks a Language Other than English at Home</b>				
Yes	36.1 (0.12)	14.0 (0.085)	49.9 (0.14)	100.0
No	60.3 (0.071)	12.1 (0.031)	27.6 (0.074)	100.0
<b>Difficulty Hearing or Seeing</b>				
Yes	47.9 (0.24)	19.2 (0.15)	32.9 (0.29)	100.0
No	56.5 (0.059)	12.0 (0.029)	31.4 (0.062)	100.0
<b>Other Difficulties</b>				
Yes	51.8 (0.14)	17.2 (0.088)	31.0 (0.17)	100.0
No	56.9 (0.065)	11.5 (0.031)	31.6 (0.065)	100.0
<b>Respondent Between 18 and 24 Years Old</b>				
Yes	36.9 (0.24)	6.8 (0.082)	56.2 (0.25)	100.0
No	57.3 (0.062)	12.7 (0.030)	29.9 (0.065)	100.0

**Table 4.3. Distribution Across Modes for Respondent’s Household Demographic Characteristics, with Standard Errors**

	Percentage Mail	Percentage CATI	Percentage CAPI	Total
In-Scope Universe	56.1 (0.059)	12.4 (0.029)	31.5 (0.061)	100.0
Living in Poverty				
Yes	38.7 (0.14)	11.4 (0.085)	49.8 (0.15)	100.0
No	58.8 (0.065)	12.6 (0.032)	28.6 (0.066)	100.0
Receiving Public Assistance				
Yes	35.7 (0.36)	11.1 (0.25)	53.1 (0.042)	100.0
No	54.4 (0.063)	13.2 (0.033)	32.4 (0.066)	100.0
Presence of Someone Under 18 Years Old in the Household				
Yes	44.5 (0.097)	15.9 (0.056)	39.6 (0.12)	100.0
No	62.4 (0.083)	10.6 (0.032)	26.9 (0.080)	100.0
Home Ownership				
Own	63.8 (0.074)	14.2 (0.037)	22.0 (0.08)	100.0
Rent	40.2 (0.098)	8.7 (0.041)	51.1 (0.11)	100.0
Living Alone				
Yes	61.7 (0.011)	9.1 (0.041)	29.2 (0.11)	100.0
No	54.1 (0.065)	13.7 (0.038)	32.1 (0.071)	100.0

In the prediction model, the dependent variable was mail response (versus response via another mode) and the independent variables were the demographic, social, and housing variables. The dataset used for the prediction model did not include UAAs, unmailables, vacants, unidentifiable respondents, deletes, and nonrespondents. Table 4.4 shows the estimated model parameters.

In the logistic regression model, all of the parameter estimates were significant. The normalized r-square value of the model is 0.1512. We expected negative parameter estimates for all of the variables except Living Alone. According to Table 4.3 the proportion of people living alone had a higher proportion of responses returned by mail than was true overall, therefore as expected, has a positive coefficient. The coefficients with negative parameter estimates as expected due to having a lower proportion of responses returned by mail than the overall proportion of mail returns were Black, American Indian, Asian, Native Hawaiian, some other race, presence of someone under 18, renter, in poverty, ages 18 to 24, speaks a language other than English at home, difficulty seeing or hearing, and other physical or mental difficulties. However, the public assistance parameter did not have a negative value as expected. The proportion of persons receiving public assistance who were interviewed by mail was 35.7 percent. There is a significant difference in the number of persons that respond by mail between all of the parameter estimates and their control variable. For example, there is a significant difference in the percentage of respondents that complete the mail questionnaire for White respondents when compared to Black, American Indian, Asian, Native Hawaiian and Pacific Islander, and some other race. All demographic, social, and housing variables of interest are significantly different from their counterpart.

**Table 4.4. Coefficients for logistic regression prediction model for mail response, with Standard Errors and P-values**

Predictors	Coefficient	Standard Error*	P-value
Intercept	1.0233	0.005048	<0.0001
Black	-1.3424	0.007134	<0.0001
American Indian	-0.7212	0.02849	<0.0001
Asian	-0.0824	0.01375	<0.0001
Native Hawaiian and Pacific Islander	-1.0383	0.06481	<0.0001
Some Other Race	-0.3135	0.01497	<0.0001
Hispanic Origin	-0.9683	0.01160	<0.0001
Receives Public Assistance	0.2400	0.01859	<0.0001
Lives Alone	0.1312	0.006020	<0.0001
Presence of Someone Under 18	-0.5735	0.006894	<0.0001
Renter	-0.7450	0.007170	<0.0001
Poverty	-0.3002	0.008259	<0.0001
Age 18 to 24	-0.4090	0.01279	<0.0001
Speaks a Language Other than English	-0.4169	0.009103	<0.0001
Difficulty Hearing or Seeing	-0.2303	0.007987	<0.0001
Other Difficulties	-0.4553	0.01166	<0.0001

\*Using the successive differences variance estimation method, see section 3.2 for formula

## 5. DISCUSSION

The variables associated with inability to respond, and social (except living alone) and linguistic isolation seemed to have an effect on whether a person is likely to respond to the ACS by mail. As expected, respondents with these characteristics have lower proportions of mail interviews. These mail nonresponders will then respond to either CATI or CAPI. The high overall ACS response rate<sup>2</sup> dispels any notion of people who are socially or linguistic isolated of never responding.

A continuum of resistance model could help explain the effects of mail response rates and overall nonresponse. The model assumes nonrespondents are similar to each other. In addition, it assumes overall nonrespondents are similar to respondents that required more than one contact to complete the survey (Lin and Schaeffer 1995). In a continuum of resistance model one could assume that CAPI respondents are similar to overall nonrespondents because of the difficulty involved in obtaining CAPI responses. An area of future research would be analyzing ACS data with a continuum of resistance model.

When we did the analysis, we had no data on urbanicity or geographic information. We predict that the rate of mail response would be lower for people in urban environments than those in suburban and rural areas. People living in urban areas would be home less often and therefore less likely to complete a mail survey. Geographic information would also be helpful in the prediction model for mail response.

Future research should look into CATI nonresponse. A similar analysis to this study could be done on CATI nonrespondents. Using CAPI response data one could test if different types of people are refusing the CATI portion of ACS. The effects of inability to respond and social and linguistic isolation on CATI could be different than their effects on mail nonresponse. Linguistic isolation should have less of an effect on CATI response, because CATI interviewers who speak different languages are used.

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<sup>2</sup> The 2005 ACS response rate was 97.3% (U.S. Census Bureau 2007)

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