WEIGHTING ADJUSTMENTS FOR PANEL NONRESPONSE IN THE SIPP

FINAL REPORT

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October 7, 1994

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1. INTRODUCTION

This report presents the findings of an investigation of alternative forms of weighting adjustment to compensate for panel nonresponse in the Survey of Income and Program Participation (SIPP), an ongoing household panel survey conducted by the U.S. Bureau of the Census. Panel surveys like the SIPP experience some level of total nonresponse at the initial wave of data collection. This nonresponse corresponds to the total nonresponse that occurs with cross-sectional surveys. In addition to the initial wave nonresponse, panel surveys also experience further nonresponse at each of the subsequent waves of the panel. It is this additional nonresponse that is classified as panel nonresponse in this report. Panel nonresponse is thus the failure to collect the survey data for initial wave respondents for all waves of the panel for which they were eligible. The weighting adjustments studied here aim to modify the weights of panel respondents (i.e., those who provide data for all waves for which they are eligible) to compensate for the panel nonrespondents.

Under the current SIPP design, a national probability sample of households is selected each year, and all the adults aged 15 and over living in those households become panel members who are followed for approximately 2f(2,3) years. Interviews are conducted with these panel members at four-month intervals to collect data about income amounts received, participation in income maintenance programs, and other factors that may affect their income and economic welfare. Interviews are also conducted with the adults with whom they are living at the time of interview, and data are collected about children. Interviews are not attempted with panel members who enter institutions, but those who then leave the institution during the panel's life return to the panel. See Nelson, *et al.* (1985) and Jabine, *et al.* (1990) for further information on the SIPP design.

The SIPP panel sample comprises all the adults living in the original sample of households at the time of first interview. Panel respondents are members of the panel sample for whom data are collected for every wave for which they reside in the noninstitutional U.S. population. Panel respondents thus include panel members for whom data are collected for every wave until they leave the survey universe (through death, entering an institution, entering an armed forces barracks, or leaving the country). Panel nonrespondents are panel members who respond at the initial wave

of data collection but fail to provide data for one or more of the subsequent waves for which they are eligible.

The investigation reported here was conducted with the 1987 SIPP panel. That panel started with a sample of about 12,300 households and followed panel members for seven waves of data collection. The household nonresponse rate at the initial wave was 6.7 percent (Jabine, *et al.*, 1990). Including children, 30,841 individuals were living in the responding households at the initial wave. Of these individuals, 20.8 percent failed to provide data for all waves for which they were eligible, i.e., they were panel nonrespondents.

Nonresponse is a source of potential bias in the estimates generated from sample surveys. Nonresponse bias arises when differences occur between respondents and nonrespondents in terms of the survey variables. The risk of sizable nonresponse bias is greater the larger the nonresponse rate. With the level of panel nonresponse experienced in the SIPP and the likelihood that panel respondents and nonrespondents will differ in terms of the survey variables, the issue of nonresponse bias is a serious concern. Moreover, a revised SIPP design is planned to be introduced in 1996 with a four-year panel duration. The level of panel nonresponse with that design can be expected to be higher than with the current design, thus increasing the concerns about nonresponse bias.

Weighting adjustments are commonly made in surveys to attempt to compensate for nonresponse, and thus to reduce the level of nonresponse bias. For the SIPP panel file, two separate nonresponse weighting adjustments are made. The first attempts to compensate for the nonresponding households at the initial wave, and the second attempts to compensate for panel nonrespondents in households responding at the initial wave. The procedures are described by Chapman, *et al.* (1986). Once these adjustments are made, a final poststratification adjustment is made to force the weighted sample distributions for certain demographic variables to conform to the distributions of postcensal estimates for these variables.

Since little is known about the nonresponding households at the initial wave, there is a limited choice of auxiliary variables to use in the first nonresponse weighting adjustment. The auxiliary variables used are census region, metropolitan versus nonmetropolitan residence, race of the

reference person, tenure (own, rent), and household size. Weighting adjustment cells are based on a cross-classification of these variables.

The situation for the second nonresponse weighting adjustment is different. Since panel nonrespondents have all responded to the initial wave of the survey, a great deal is known about them. Therefore, a wide choice of variables is available for use as auxiliary variables in the panel nonresponse weighting adjustment. The auxiliary variables being used are monthly household income, program participation status of the person's household, labor force status, race, years of school completed, and type of assets of the person's household. One of the aims of the present study is to investigate the use of alternative auxiliary variables in the nonresponse adjustment, selected from the wide range of variables available from the first wave responses.

The wealth of information about panel nonrespondents raises two issues for nonresponse weighting adjustments. First, there is the choice of auxiliary variables from the many variables available from the first wave responses. Second, there is the choice of a suitable weighting adjustment methodology to incorporate the chosen auxiliary variables. Both of these issues are treated in this research.

The use of a specific auxiliary variable in a weighting adjustment is effective for reducing bias in a particular estimate if two conditions hold. First, the auxiliary variable must be associated with response/nonresponse status, and second, it must be associated with the survey variables involved in the estimate. Since the SIPP is used to provide a wide range of different estimates, at least some of which will involve variables related to any specific auxiliary variable, the search for auxiliary variables in this investigation has focused on the first condition, that is on variables that are related to panel response/nonresponse status.

The first stage of the research is thus to identify variables from the first wave responses that are related to whether or not a panel member provides data for all the survey waves for which he or she was eligible. The process involved first identifying variables that had appreciable bivariate relationships with panel response status and then using these variables to develop models to predict panel response status. Logistic regression models were used for this purpose. This stage of the research is described in Chapter 2.

The second stage in the development of panel nonresponse weighting adjustments was to incorporate the chosen auxiliary variables into a weighting adjustment procedure. Several alternative weighting adjustment procedures were used, and different sets of auxiliary variables were used with each procedure. The procedures include: the inverse of the predicted response rate from a logistic regression model; weighting by the inverse of the response rate in a cell defined by the auxiliary variables; a combination of the two preceding approaches; and the use of a generalized raking algorithm. These procedures and properties of the resultant weights are described in Chapter 3.

Chapter 4 provides a comparative evaluation of the various weighting procedures developed and of the current procedure employed. The evaluation is performed by comparing a range of estimates produced with the alternative sets of weights with one another and with some benchmark estimates. Some of the benchmark estimates are obtained from alternative data sources. Others are obtained from the 1989 SIPP panel. Estimates for January 1989 from the 1987 SIPP panel computed with the alternative forms of weights are compared with the comparable estimates obtained from the first wave of the 1989 SIPP panel. Since the first wave of the 1989 panel is not subject to panel nonresponse, these comparisons can be used to evaluate the effectiveness of the panel nonresponse adjustments applied to the 1987 panel. The assumption is made here that panel conditioning effects are not sizable. This assumption is generally justified by the research on panel conditioning conducted by Pennell and Lepkowski (1992).

The final chapter of the report summarizes the results and draws conclusions about the effectiveness of the alternative weighting schemes investigated.

2. PREDICTORS OF RESPONSE PROPENSITY

In most cross-sectional surveys, the development of adjustments to reduce nonresponse bias in the estimates is limited by the lack of data for nonrespondents. Adjustments for panel nonresponse in longitudinal surveys like the SIPP do not suffer from this problem since the adjustments can be based on the responses from the initial wave of data collection. In fact, the first step in developing panel nonresponse adjustments is deciding which of the large number of items available from the first wave should be used in the adjustment procedures. The selection of items to use in the adjustment process is the focus of this chapter.

The choice of which items should be used in forming nonresponse adjustments depends on the analytic uses of the data. Since the SIPP is a multi-purpose survey and the panel nonresponse adjustment will be included as a component of the final panel weight, a method tailored to a particular variable or set of variables is not suitable because the method may perform poorly for a host of other important variables. A more general approach to adjusting the survey weights is to choose items with responses that discriminate persons by their likelihood to respond in later waves. Little (1986) calls this method a response propensity stratification method and shows that the large sample bias of estimates can be reduced by adjusting the sampling weights by the inverse of the response probabilities.

This adjustment method is applied to the SIPP by developing weighting adjustments based on responses to Wave 1 items. With a weighting cell adjustment procedure, the aim is to create cells so that persons within a cell have the same probability of responding in later waves. The cells are often formed by cross-classifying all the available items and then determining which cells in the cross-tabulation should be collapsed together because the response probabilities in the cells are approximately equal. Collapsing is needed because the number of cells in the cross-tabulation may be large and the sample sizes in cells small. Small sample sizes in cells lead to unstable nonresponse adjustments (the adjustment is usually the inverse of the response rate in a cell) that can increase the variances of the estimates. In particular, it is a common practice to collapse cells with low response rates with adjacent cells to reduce the variability in the resultant weights.

2.1 Screening Analysis

Cross-tabulating all the items in the Wave 1 SIPP file would have resulted in a extremely large number of cells because so many items are available. To make the task of finding variables predictive of panel nonresponse more manageable, we first screened those items we thought might be related to panel nonresponse by checking the marginal associations between an indicator of panel nonresponse and the responses to the items. The items that exhibited differential response rates across response categories in this screening process were retained for the more extensive evaluation discussed later in this chapter.

Since most of the items in the SIPP file are categorical, a simple tabulation of the panel nonresponse indicator by the response categories of the items provides the desired information. In essence, the tabulations show the response and nonresponse rates for subgroups of the population defined by the item response categories. Two continuous variables, age and income, were converted to categorical variable for the purpose of these tabulations.

The items screened included household and personal characteristics, as well as characteristics of the householder. In some cases the 1987 SIPP panel file identified two householders in the same household. This happened most often in households with married couples, where both adults were classified as householders. To uniquely define householder characteristics, we assigned the householder designation to the person with the higher personal income. While this assignment seems reasonable for economic variables, such as number of jobs, type of business, class of work, and unemployment status, it might not be as suitable for other types of variables.

Another type of household variable used in the screening analysis was based on whether anyone in the household had a specified characteristic. This type of variable was constructed primarily in relation to benefits from government programs. Thus, for this type of variable, if anyone in the household received the benefits, then all the household members were classified as receiving them.

One further constructed variable was included in the screening analysis. Other studies have found that individuals who are less cooperative at the initial wave of the panel survey

are more likely to be nonrespondents at later waves (see, for example, Kalton, *et al.*, 1990). We, therefore, constructed an index of the number of items imputed at Wave 1 as a measure of cooperation at Wave 1. As described below, this index turned out to be highly related to panel nonresponse.

In all, 58 potential explanatory items were examined. One item not included in the tabulations was metropolitan area status. This item is used in the U.S. Bureau of the Census' initial wave nonresponse adjustment, but it was not available for this research because of disclosure concerns. Since metropolitan status might be an important predictor of panel nonresponse, it should be considered for any subsequent research on this topic.

In examining the response associations between the panel rate and the items, we found that standard statistical tests of the significance of the differences in response rates across response categories were not useful. These tests almost always showed statistically significant differences, even when the differences in response rates were as small as 1 percent, because of the relatively large sample size in SIPP (30,841 persons in the first wave of the 1987 SIPP panel file). An alternative criterion to statistical significance was, therefore, used to help choose which items would be kept for further investigation.

We decided to retain an item for further analyses as a potential predictor of panel nonresponse only if the difference in response rates between any two response categories for the item was both statistically significant and four percentage points or more. This criterion was applied as a guideline rather than a strict rule. For a variety of reasons, some items were retained even if they did not meet these requirements. For example, the difference in the response rates for males and females was less than 2 percent, but gender was nevertheless used in some subsequent analysis.

The 31 specific items retained from the screening process are: tenure, public housing, household type, census region, household education, household size, household income, householder financial instruments (bonds), gender, race, Hispanic, relationship to reference person (RRP), age, marital status, family type, education, student status, Medicare benefits, laid off, personal income, multiple jobs, working class, Medicaid, Women, Infants, and Children (WIC),

Aid to Families with Dependent Children (AFDC), food stamps, general assistance, Social Security, other welfare, Veteran's status, and number of imputed items. Table 2-1 gives the panel nonresponse rates for each of the categories of these items. Appendix A gives the corresponding information for the remaining 27 items examined in the screening analysis but then dropped from the further analysis.

Table 2-1. Panel nonresponse rates by category for each of the 31 items retained for further analysis

	Nonresponse rate	Total
Tenure		
Own	17.6	21,135
Rent	28.3	8,863
Other	17.5	781
Missing	100.0	62
Public housing		
None	17.8	21,978
Subsidized rent	28.7	7,690
Public housing	20.6	413
Other	27.9	760
Household type		
Couple	18.7	22,039
Male-headed family	31.1	875
Female-headed family	26.8	3,979
Male-headed nonfamily	27.3	1,703
Female-headed nonfamily	18.8	2,125
Missing, Other	65.8	120
Census region		
New England	19.9	1,664
Mid Atlantic	24.3	4,580
South Atlantic	21.3	5,208
East South Central	17.1	1,776
East North Central	15.7	5,086
West South Central	26.6	3,406
West North Central	12.7	2,669
Mountain	29.8	1,161
Pacific	21.2	5,229
Missing	100.0	62
Household education[1]		
1 to 9	22.0	2,743
High school dropout	28.0	2,343
High school	22.2	10,851
College	19.6	10,749
Graduate	15.5	4,155
Household size		
1	16.9	2,766
2	21.0	7,398
3	20.6	6,270
4	20.0	7,428
5 or larger	23.2	6,979

[1] Education level of most well-educated person in household

Table 2-1. Panel nonresponse rates by category for each of the 31 items retained for further analysis (continued)

	Nonresponse rate	Total
Household income		
< 1,200	25.4	2,781
1,200 - 2,000	23.2	2,690
2,000 - 3,000	22.2	3,654
3,000 - 4,000	20.1	3,674
4,000 - 5,000	18.8	3,419
5,000 - 6,000	18.4	3,179
6,000 - 8,000	19.9	4,704
8,000 - 10,000	20.3	2,901
> 10,000	20.3	3,839
Householder financial instruments (bonds)		
Yes	18.0	16,054
No	23.8	14,787
Gender		
Male	21.6	14,774
Female	20.1	16,067
Race		
White	18.8	26,454
Black	33.4	3,337
Native	31.0	203
Asian	30.5	847
Hispanic origin		
Unknown	18.8	16,429
Yes	28.5	2,250
No	22.1	12,162
RRP		
HH in family	18.9	8,405
Living alone	19.1	3,221
Spouse	17.7	6,762
Child	21.4	10,277
Other relatives	31.4	1,342
Not relatives	43.1	772
Missing	100.0	62
Age		
< 15	18.4	7,452
16 - 24	30.7	4,238
25 - 50	21.4	11,465
51 - 71	17.0	5,604
> 71	13.9	2,020
Missing	100.0	62

Table 2-1. Panel nonresponse rates by category for each of the 31 items retained for further analysis (continued)

	Nonresponse rate	Total
Marital status		
Children	18.4	7,452
Married couple	18.2	13,756
Separated temporarily	23.9	163
Widow	15.7	1,741
Divorced/separated	24.9	2,261
Single adult	30.4	5,406
Missing	100.0	62
Family type		
In primary family	20.1	25,952
Not family member	43.1	772
Unrelated subfamily	32.9	167
Related subfamily	28.1	729
Primary individual	19.1	3,221
Education		
Children, missing	18.6	7,452
1 to 9	20.1	2,906
10 and 11	24.8	2,681
High school graduate	22.7	8,697
College	20.7	7,113
Post college	14.8	1,930
Missing	100.0	62
Student status		
Children, other	18.4	7,452
Full-time	26.6	2,288
Part-time	21.0	1,074
No	20.7	19,955
Missing	100.0	72
Medicare benefits		
Children, other	18.6	6,966
Yes	15.3	3,882
No	22.6	19,993
Laid off		
Children, other	18.4	7,452
On job, no layoff	21.5	13,876
Temporary layoff	24.9	245
Long-term layoff	33.3	1,106
No job, not looking	19.3	8,090
Missing	100.0	72

Table 2-1. Panel nonresponse rates by category for each of the 31 items retained for further analysis (continued)

	Nonresponse rate	Total
Personal income		
Children	18.4	7,452
< 1,200	22.5	15,361
1,200 - 2,000	20.9	3,678
2,000 - 3,000	18.3	2,494
3,000 - 4,000	16.6	914
4,000 - 5,000	13.1	419
> 5,000	21.7	461
Multiple jobs		
Children	18.4	7,452
Yes	22.5	574
No	21.3	22,753
Missing	100.0	72
Working class		
Children	18.4	7,452
Commercial	23.3	9,723
Nonprofit	18.1	585
Government	15.8	2,134
Unpaid	20.0	195
Missing, NA	21.4	10,752
Medicaid		
Yes	24.8	2,210
No	20.3	28,559
Missing	100.0	72
WIC		
Yes	24.0	242
No	20.6	30,527
Missing	100.0	72
AFDC		
Yes	24.3	1,140
No	20.5	29,629
Missing	100.0	72
Food stamps		
Yes	22.2	2,268
No	20.5	28,501
Missing	100.0	72
General assistance		
Yes	30.1	213
No	20.4	30,556
Missing	100.0	72

Table 2-1. Panel nonresponse rates by category for each of the 31 items retained for further analysis (continued)

	Nonresponse rate	Total
Social Security		
Yes	16.0	4,645
No	21.4	26,124
Missing	100.0	72
Other welfare		
Yes	28.1	57
No	20.6	30,712
Missing	100.0	72
Veteran's status		
Yes	15.8	475
No	20.7	30,294
Missing	100.0	72
Items imputed		
0	20.0	25,901
1	23.1	3,341
2	29.1	989
3 or 4	25.8	396
> 4	30.4	214

A few items were not included in this screening analysis but were included in the logistic regression analyses discussed later. These variables are: energy assistance status, free lunch status, and free breakfast status.

2.2 Logistic Regression Analysis

Since the 31 items identified in the screening analysis were correlated with panel nonresponse, their use in a panel nonresponse weighting adjustment holds promise for educing the nonresponse bias in some of the survey estimates. However, the screening analysis was limited because it did not consider the interrelationships between the items. For example, two items that are highly associated with response status might also be highly correlated with each other. In this case, one of the two might be sufficient for defining adjustment cells. To address this issue, the next step in selecting predictors of panel nonresponse was to investigate which combinations of the screened items could be used to form the best nonresponse adjustment categories.

A logistic regression approach to the examine the joint relationships of several items with response status. The logistic model is given by

$$\ln[p/(1-p)] = \mathbf{Xb},$$

where p is the probability of being a panel nonrespondent, $\mathbf{X}$ is the matrix of covariates (the 31 Wave 1 items identified in the screening process), and $\mathbf{b}$ is a vector of unknown parameters. Maximum likelihood estimation was

used to estimate b (see for example, Bishop, *et al*., 1975). The regressions were performed using the PROC CATMOD procedure in SAS.

The final regression models were fitted using the Wave 1 cross-sectional weights that account for unequal selection probabilities and initial wave nonresponse. The weights were incorporated by using a weighted count of the number of persons in each cross-classification of the covariates as the input for PROC CATMOD instead of the raw counts. The weights were first normalized so that their sum equaled the unweighted overall sample size to avoid grossly inflating the estimates of the standard errors from the procedure.

A comparison was made between models based on weighted and unweighted counts. The resultant models turned out to be generally similar. Since unweighted runs were simpler to perform, the initial model selection runs were, therefore, made using unweighted regressions. When models with reasonable fits were identified, the regressions were rerun using the weighted counts. The results presented in this report are from the weighted regressions.

An informal, forward, stepwise procedure was carried out to examine the relationships between the items systematically. We began by specifying models that contained the items that were most promising based on the screening analysis. Items were then added and items were deleted from the model based on the results of the model fits. In addition to adding and deleting items, response categories for some of the items were collapsed when differences in parameter estimates between similar categories were small.

After examining a number of possible models, two main effects models were selected. The first model includes seven predictor variables: age, relationship to reference person in the household (RRP), race of householder, tenure (home ownership status), census region, presence of imputation flags, and bond-holding status. The definitions of these variables are given below.

- Age (5 categories): less than 16 (children), 16 to 24 years, 25 to 50 years, 51 to 71 years, and greater than 71 years.

- RRP (2 categories): primary (nuclear) family member and nonfamily member.

- Race of householder (3 categories): White, Black, and other.

- Tenure (3 categories): home owner, renter, and other.

- Census region (7 categories): New England, Mid Atlantic, South Atlantic, East South Central, West/East North Central, Mountain/West South Central.

- Imputation flags (4 categories): no items imputed, one item imputed, 2 or 3 items imputed, and 4 or more items imputed.

- Bond-holding status (2 categories): no bonds or at least some bonds. For children, the householder's bond-holding status was used.

The Wald statistics for testing the null hypothesis that an item had no relationship to panel nonresponse ($b = 0$) for each of the seven covariates in the full main effects model are given in Table 2-2. The third column gives the degrees of freedom (DF) for the test, which is one less than the number of response categories for the item. Under the null hypothesis of no effect, the Wald statistics should be distributed approximately as a c^2 with degrees of freedom given in the table. All of the Wald statistics are highly significant.

Table 2-2. Wald statistics for the 7-variable main effects model

Predictors	Wald statistics	DF
Age	222.84	4
Race	195.20	2
RRP	139.34	1
Census region	330.26	6
Tenure	218.73	2
Imputation flags	452.93	3
Bond status	112.05	1

Table 2-3 gives the parameter estimates from the 7-variable main effects logistic regression fit, along with the predicted ratio between the category and the reference category from the model. The last response category for each item is a reference category with a parameter estimate of zero. Effects of the other response categories are measured relative to the reference category.

The predicted ratio in the last column in Table 2-3 represents the ratio of the predicted nonresponse rate for the category to the predicted nonresponse rate for the reference category of the covariate. For example, the ratio of the predicted nonresponse rate of those younger than 16 years old to those 71 years and older (the reference category) is 0.965. The predicted ratio for the intercept is the predicted nonresponse rate for persons classified in the reference group for each of the covariates (the subgroup of people who are age 71 and over, other race, etc.).

The other main effects model that was selected for further examination was an extended model that contained the same seven variables plus three additional ones. The definitions of the three additional variables in the 10 variable main effects model are:

- Layoff (2 categories): laid off during the Wave 1 time period or not laid off.

- Food stamps (2 categories): person received food stamps or not.

- Class of work (3 categories): business, government, and other.

For all of these items, children were assigned the status of the householder.

The Wald statistics for the full main effects model with 10 covariates are given Table 2-4. It is clear from the Wald statistics that the additional variables have less predictive power than the original seven variables, but still contribute significantly to the explanation of panel nonresponse. The parameter estimates and predicted ratios for this model are given in Table 2-5.

Models with interactions between the variables were also examined to determine if more extensive models would be useful in explaining panel nonresponse. Since there was speculation that there might be differences between model fits for children and adults, first-order interactions between the other six variables in the 7-variable main effects model and child status (an indicator variable set to unity for persons less than 16 years and zero otherwise) were examined. The summary results for this model are given in Appendix B. None of the interactions approached the level of predictive power of the main effects. The most important interaction was between RRP and child status.

Table 2-3. Parameter estimates for the 7-variable main effects model

Predictors	Parameter estimate	Predicted ratio
Intercept	-0.496	0.378
Age		
< 16	-0.096	0.965
16 - 24	0.452	1.216
25 to 50	0.140	1.057
51 to 71	-0.095	0.966
> 71	0.0	
Race		
White	-0.326	0.895
Black	0.222	1.094
Other	0.0	
RRP		
Family member	-0.298	0.902
Nonfamily member	0.0	
Census region		
New England	0.039	1.015
Mid Atlantic	0.165	1.068
South Atlantic	0.039	1.015
East South Central	-0.231	0.922
North Central	-0.401	0.875
Mountain/West South Central	0.397	1.185
Pacific	0.0	
Tenure		
Home owner	-0.166	0.941
Renter	0.321	1.144
Other	0.0	
Items imputed		
0	-0.630	0.823
1	-0.235	0.921
2 - 3	0.282	1.123
> 3	0.0	
Bond status		
No bonds	0.176	1.073
Some bonds	0.0	

Table 2-4. Wald statistics for the 10 variable main effects model

Predictors	Wald statistics	DF
Age	190.92	4
Race	202.75	2
RRP	139.57	1
Census region	308.89	6
Tenure	237.97	2
Imputation flags	440.29	3
Bond status	110.66	1
Layoff	46.95	1
Food stamps	26.69	1
Class of work	34.91	2

Three additional variables were identified as important predictors of panel nonresponse a categorical search algorithm analyses described later in the report: gender, household income, and level of education. The definitions for these variables are:

- Gender (2 categories): male or female.

- Household income (3 categories): less than $1,200 per month, $1,200 to $8,000 per month, and more than $8,000 per month.

- Education level (2 categories): highest grade completed was tenth or eleventh grade, or highest grade completed not tenth or eleventh grade (this categorization was used because it gave the greatest differences in response rates).

Logistic regression models were run for the model containing all the variables from the 10-variable main effects model along with these three new variables, plus the most important interaction noted from previous runs (the interaction between RRP and child status). The Wald statistics for this model are shown in Table 2-6. Since these findings showed the additional variables add little to the prediction of panel nonresponse, we decided to conduct the investigation of weighting adjustments based only on the main effects model with 10 variables.

.c4.Table 2-5. Parameter estimates for the 10 variable main effects model

Predictors	Parameter estimate	Predicted ratio
Intercept	-0.512	0.375
Age		
< 16	-0.067	0.958
16 - 24	0.422	1.274
25 - 50	0.145	1.092
51 - 71	-0.088	0.946
> 71	0.0	
Race		
White	-0.340	0.798
Black	0.242	1.155
Other	0.0	
RRP		
Family member	-0.297	0.822
Nonfamily member	0.0	
Census region		
New England	0.035	1.022
Mid Atlantic	0.167	1.107
South Atlantic	0.043	1.027
East South Central	-0.216	0.869
North Central	-0.403	0.763
Mountain/West South Central	0.389	1.252
Pacific	0.0	
Tenure		
Home owner	-0.169	0.897
Renter	0.334	1.216
Other	0.0	
Items imputed		
0	-0.623	0.649
1	-0.236	0.858
2 to 3	0.284	1.183
> 3	0.0	
Bond status		
No bonds	0.176	1.112
Some bonds	0.0	
Layoff		
Not laid off	-0.209	0.873
Laid off	0.0	
Food stamps		
Not recipient	-0.146	0.910
Recipient	0.0	
Class of work		
Business	0.109	1.069
Other	0.105	1.066
Government	0.0	

3. ALTERNATIVE PANEL NONRESPONSE WEIGHT ADJUSTMENTS

The methodology currently used in the SIPP to adjust the sampling weights for panel nonresponse is described in Chapman, Bailey, and Kasprzyk (1986). In this approach, nonresponse adjustment cells are formed based on the responses from a specified set of Wave 1 variables. The variables used to form the cells are monthly household income participation of the person's household, labor force status, race, years of school completed, and type of assets of person's household. The cells formed by the cross-classification of the variables are then collapsed so that the resulting sample sizes in each collapsed cell are 30 or more. The reciprocal of the observed response rate in each collapsed cell is the panel nonresponse adjustment for panel respondents in that cell. The panel nonresponse adjustment is multiplied by the panel respondent's Wave 1 weight to create a nonresponse adjusted weight.

This chapter examines alternative methods of forming the panel nonresponse adjustments. One class of adjustments we examine is based on the logistic regression models presented in the previous chapter. Within this class, we examine adjustments computed in three ways: as the inverse of the predicted response rate in a cell; as the inverse of the observed response rates in cells with large sample sizes and the inverse of the predicted response rates in cells with small sample sizes; and, as the inverse of the observed response rates in cells after cells are combined to avoid small sample sizes. The third method in this class is similar to the current SIPP procedures but uses different variables to define the cells and different strategies for collapsing cells.

A second alternative approach to forming nonresponse adjustments we examine is based on a categorical search algorithm, CHAID. This algorithm divides the data set into weighting cells by attempting to determine sequentially the response categories that have the greatest discrimination with respect to nonresponse rates. Criteria on the number of cells and the minimum sample sizes within each cell can be specified for this algorithm. The nonresponse adjustment is the inverse of the observed response rate in cells defined in this manner.

The third approach we study is the use of generalized raking methods to form nonresponse adjustments. This alternative method differs from the others because nonresponse

adjustments are based on the marginal nonresponse rates for the several variables rather than nonresponse rates within cells formed by cross-classifying the variables. As with most raking procedures, the solution is found by an iterative method. The adjustments are the factors that satisfy the condition that, when multiplied by the Wave 1 weights, the marginal sums of the adjusted weights for the respondents equal the marginal sums of the unadjusted weights for both respondents and nonrespondents for each variable.

Each of the three alternative approaches to nonresponse adjustment is discussed here. The procedures for developing the weighting adjustments are detailed along with important statistical properties of the adjustments.

3.1 Adjustments Based on Logistic Regression Models

As indicated above, three different methods of forming nonresponse adjustments based on the outcomes of the logistic regression models were investigated. Weighting adjustments for these methods were developed for both the 7-variable main effects model and the 10 variable main effects model described in Chapter 2. We begin by discussing methods for the 7-variable model.

Since the 7-variable logistic regression is a main effects model, the predicted nonresponse rate in any cell formed by cross-classifying the response categories of the variables is a function of the parameter estimates given in Table 2-3. By knowing a person's age, race, RRP, census region, tenure, imputation flag, and bond status, the predicted nonresponse rate can be computed from the parameter estimates in that table. The first alternative panel nonresponse weighting adjustment, called WA 1, was computed by taking the inverse of the predicted response rate based on each person's responses to the seven variables.

With a main effects model, the parameters for computing the predicted nonresponse rate are estimated from the marginal responses for the variables. Thus, the sample sizes in the cells of the cross-classification of all the variables are not a concern. However, this benefit is gained by ignoring possible interactions between the variables in the model. One approach to capture some of this information is to use the observed response rate in a cell, provided the sample size for the cell is large enough to ensure the stability of the observed

response rate. If the cell is not large enough, the predicted response rate is used.

The second member of this class of alternative adjustments we examined uses this mixed strategy. If 25 or more sample persons were in a cell, then the nonresponse adjustment (WA 2) was the inverse of the observed cell response rate. If the cell had less than 25 sample cases, the nonresponse adjustment was the inverse of the predicted response rate.

The next two adjustments were formed in the same way but were based on the 10 variable main effects model. The adjustment based on the inverse of the predicted response rate from the 10 variable is called WA 3. The other adjustment (WA 4) was the inverse of the observed response rate in large cells (sample size of 25 or more) and the inverse of the predicted response rate in the smaller cells.

A fifth nonresponse adjustment in this class that we studied is similar to the current SIPP procedures. The 10 variable main effects model was used to define initial cells. The cells were then combined until the sample size in each cell exceeded 30, and the inverse of the observed response rate within a cell was used as the nonresponse adjustment. This nonresponse adjustment is called WA 5.

The strategy for combining cells for WA 5 was to group together cells with similar predicted nonresponse rates. For example, the cells with persons 51 to 71 years and the 71 years and over have similar predicted nonresponse rates (see Table 2-5) and were combined if the sample size in any pair of cells with the same characteristics (other than age) was less than 30. If cells were still too small, the next collapsing of cells was based on census regions (1, 3, and 7) with similar predicted ratios. The priority list for cell collapsing is given in Appendix C. The process of collapsing continued until the minimum sample size criterion was satisfied for every cell.

For all five alternative weighting adjustments (WA 1 through WA 5), weighted counts were used to compute observed and predicted nonresponse rates. The observed nonresponse rates are the appropriate ratios of sums of the nonresponse adjusted Wave 1 weights. The predicted nonresponse rates are estimated using the weighted counts for the regression models. In practice, the weighted and unweighted adjustments were nearly the same.

In summary, the five alternative panel nonresponse adjustments based on the logistic regression models are:

- WA 1: 7-variable main effects model using predicted rates.

- WA 2: 7-variable main effects model using predicted rates for small cells and observed rates for large cells.

- WA 3: 10-variable main effects model using predicted rates.

- WA 4: 10-variable main effects model using predicted rates for small cells and observed rates for large cells.

- WA 5: 10-variable main effects model using observed rates collapsed so the sample size in every cell size is greater than 30.

The adjustments for each of these five schemes were computed for the 1987 SIPP file. Table 3-1 gives summary of the distribution of the resulting nonresponse adjustments. The summary is for the adjustments only, not the product of the adjustments and the Wave 1 weights. Table 3-1 is divided into three sections: the first section shows percentiles for each adjustment distribution; the second section shows the mean, standard deviation, and $(1+CV^2)$, where CV is the coefficient of the variation for each adjustment; and, the third section shows the correlations among the five adjustments.

Since the overall weighted nonresponse rate is 0.206, the mean overall nonresponse would be 1/(1 - 0.206) = 1.26 if the same adjustment were used for all persons. The mean weighting adjustment for all each of the five schemes is close to the overall mean, as expected. The standard deviations are slightly higher when the adjustments are based on the observed response rates for cells with more than 25 sample observations (WA 2 and WA 4), but these differences are small. The adjustments for 10-variable model (WA 3 and WA 4) are somewhat more variable than for the 7-variable model (WA 1 and WA 2), but again, the

differences are small. The standard deviation for WA 5 is similar to that for WA 1.

The percentiles and the correlations show that the distributions of the five adjustments are similar. The only appreciable differences in the percentiles occurs for the extreme order statistics (the maximum and minimum weight adjustments). The maximum adjustments for the 7-variable methods (WA 1 and WA 2) are smaller than those for 10-variable methods (WA 3 and WA 4). The maximum adjustment for the cell collapsing strategy for the 10-variable model (WA 5) is even lower than the maximum adjustment than either of the simpler adjustments from the 7-variable model.

Given the similarity between the first four weighting adjustments, it is not surprising that the correlations between them are uniformly high at 0.88 or more. The fifth weighting adjustment, based on the collapsing procedure, is somewhat different in nature. Nevertheless, it is based on the same set of explanatory variables, and hence, it is also fairly highly correlated (0.73 or better) with the other four.

The statistic $(1+CV^2)$ is included as an indicator of the increase in variance of the estimates introduced by having variable nonresponse adjustment factors (see Kish, 1992). All five of the adjustments result in small increases in the variance of the estimates of approximately 2.5 percent.

Table 3-1. Summary of logistic regression weight adjustments

Percentiles

	Minimum	1st Quartile	Median	3rd Quartile	Maximum
WA 1	1.055	1.137	1.209	1.315	3.801
WA 2	1.000	1.122	1.196	1.327	3.801
WA 3	1.040	1.138	1.204	1.315	4.282
WA 4	1.000	1.126	1.203	1.331	4.282
WA 5	1.000	1.129	1.202	1.339	3.431

Means, standard deviations, and $(1 + CV^2)$

	Mean	Standard deviation	$1+CV^2$
WA 1	1.260	0.191	1.023
WA 2	1.259	0.201	1.026
WA 3	1.260	0.196	1.024
WA 4	1.259	0.205	1.026
WA 5	1.261	0.190	1.023

Correlations

	WA 1	WA 2	WA 3	WA 4	WA 5
WA 1	1.000	0.919	0.957	0.915	0.751
WA 2		1.000	0.879	0.880	0.769
WA 3			1.000	0.955	0.734
WA 4				1.000	0.731
WA 5					1.000

Due to the similarity of the resulting adjustments and the need to restrict the number of weights and estimates generated in future steps of the process, the adjustments for the 7-variable main effects model (WA 1 and WA 2) were dropped at this point. The three panel nonresponse adjustments based on the 10-variable main effects model were retained (WA 3, WA 4, and WA 5).

3.2 Adjustments Based on CHAID Models

The second class of methods for adjusting for panel nonresponse that we examined is based on a different methodology for forming nonresponse adjustment cells. In this approach, a categorical search algorithm, called CHAID, is used to divide the data set into adjustment cells. The

general approach is to find cells defined in terms of combination of responses to the explanatory variables that have the greatest discrimination with respect to nonresponse rates while maintaining a minimum sample size in each cell. The panel nonresponse adjustment is the inverse of the observed response rate in a cell.

CHAID is the name given to one version of the Automatic Interaction Detector (AID) that has been developed for categorical variables. Kass (1980) presents the theory underlying the CHAID technique. Another version of the same methodology was used by Lepkowski, *et al*. (1989) and Kalton, *et al.* (1985) to model nonresponse in SIPP. The software used to conduct the analysis was SPSS/PC+ CHAID, published by Jay Magidson/SPSS, Inc.

An example helps explain the methods used in CHAID. All of the predictor variables in a CHAID model are tested and the variable with response categories having the largest discrimination with respect to the nonresponse rates is identified. In the first CHAID model shown in Appendix D, the response categories of renters (tenure = 2) and owned and others (tenure = 1 or 3) have the largest nonresponse rate difference. The data set is then split into two subgroups according to the two tenure categories. The process of dividing the data set is then repeated within each of the two categories, and so on. The process continues until no further splits are statistically significant at the 5 percent level using a c^2 test. In the present application, any splitting of the data set that would result in a cell with a sample size of less than 25 is rejected. When completed, the algorithm has generated a tree structure from the response categories of the predictor variables.

Many of the predictor response variables included in the analysis have multiple response categories. For example, tenure has three response categories (owned, rented, and other). The CHAID software handles this in two ways. It allows the data set to be split into multiple subgroups rather than only two at a time. However, before the data set is split into multiple subgroups, the following procedure is used to determine if any of the response categories for any predictor variable can be merged to form a new response categories:

1. Response categories of the predictor variable are cross-tabulated with the categories of the nonresponse indicators.

2. Pairs of response categories that are least significantly different are identified

and, if the difference in rates is not significant at the 5 percent level, the two categories are merged to form a new response category. This step is repeated until no new response categories are formed.

3. For each new response category, all possible binary splits are checked to ensure that each is not significant at the 5 percent level. If the split is significant, then new response categories are created corresponding to this split and step 2 is repeated. This process is iterated until no new response categories are formed.

The CHAID software allows the user some control over the collapsing of response categories. For the SIPP data, we classified three of the polychotomous variables (age, household income, and number of imputation flags) as monotonic variables. For monotonic variables, revised response categories are considered only if the collapsing retains the natural order of the categories (e.g., low income and high income cannot be combined because middle income disrupts the ordering). For the remaining polychotomous variables, all combinations of response category split were considered.

When the process of combining response categories is completed, the predictor variables may still have multiple response categories. The next step is to split the data set into two or more subgroups based on the revised response categories of the predictor variables. The choice of the predictor variable for defining the split of the data set is given by the following rule:

- Compute a Bonferroni adjusted c^2 test statistic for the null hypothesis that the nonresponse rates are homogeneous across each of the revised response categories of the predictor variables. The Bonferroni adjustment (see Kass, 1980) prevents predictors with large numbers of response categories from being favored due to the number of possible choices. The predictor with highest Bonferroni adjusted c^2 statistic is selected, and the subgroups of the data set are defined by the revised response categories for the variable.

For the SIPP analysis, two CHAID models were examined by including different predictor variables. The first CHAID model included the items in the 7-variable logistic regression model plus gender. Gender was included even though it was not significant in the logistic regression models. This model resulted in 99 nonresponse adjustment cells, each having at least 25 sampled persons. The cells are described in Appendix D, along with the sample size and the observed

nonresponse rate for each cell. The nonresponse adjustment, called WA 6, was computed by taking the inverse of the observed response rate in each of the 99 cells.

The second CHAID model included 13 predictor variables: the eight variables from the first model plus layoff status, household income, completion of tenth or eleventh grade, food stamp recipiency, and class of work. This model resulted in 142 nonresponse adjustment cells with 25 or more sampled persons per cell. The details of this model are also given in Appendix D. The nonresponse adjustment for this model is called WA 7 and is the inverse of the observed response rate in the cell.

The fact that gender was used in dividing the data set in the CHAID analyses is one indication of the difference between this method of analysis and the logistic regression models. The CHAID models examine the potential for variables to be introduced within different subgroups of the population, while the logistic regression models are somewhat more formally structured and determining which lower order interactions should be included is more difficult.

A summary of the distribution of the nonresponse adjustments for WA 6 and WA 7 is given in Table 3-2. This summary is similar to the one given in Table 3-1 for the adjustments from the logistic regression model approaches. The first two sections of the table give the percentiles of the adjustment distributions, the means, standard deviations, and the measures of the variance increases due to the adjustments. The WA 6 nonresponse adjustment distribution is similar to the distributions for the weights developed from the logistic regression models. The mean, standard deviation, and percentiles for WA 6 are close to the values observed for the adjustment distributions of WA 3, WA 4, and WA 5.

The distribution of WA 7 is somewhat different from the others. The adjustments for WA 7 are more extreme; the adjustments are smaller than the adjustments for the other distributions for persons below the median and higher for those above the median. Reflecting the greater variability in the WA 7 distribution, the expected increase in variance due to the WA 7 adjustment is about 4 percent, composed with only about 2 percent for the other adjustments. The maximum adjustment of WA 7 is approximately 14, which is about three to four times larger than for any other adjustment. While this adjustment is unique (the next largest adjustment is less than 3.5), this result

does point out the potential problems if any of these methods is applied mechanically.

The last section of the table gives the correlation matrix for the weighting adjustments, including some of the correlations for logistic regression models (WA 3 through WA 5) presented earlier. The correlations between the CHAID model adjustments and the logistic regression model adjustments are generally lower than the correlations within a single approach. The correlations of WA 6 with WA 3 through WA 5 are higher than those of WA 7 with WA 3 through WA 5, which is consistent with the other measures of the distribution. The adjustments from both CHAID models are retained in the analysis of the weights and estimates for later evaluation.

Table 3-2. Summary of CHAID weight adjustments

Percentiles

	Minimum	1st Quartile	Median	3rd Quartile	Maximum
WA 6	1.018	1.130	1.215	1.328	3.491
WA 7	1.006	1.112	1.192	1.346	13.931

Means, standard deviations, and $(1 + CV^2)$

	Mean	Standard deviation	$1+CV^2$
WA 6	1.261	0.216	1.029
WA 7	1.261	0.256	1.041

Correlations

	WA 3	WA 4	WA 5	WA 6	WA 7
WA 3	1.000	0.955	0.734	0.729	0.630
WA 4		1.000	0.731	0.721	0.629
WA 5			1.000	0.689	0.580
WA 6				1.000	0.814
WA 7					1.000

3.3 Adjustments Based on Generalized Raking Methods

The third class of methods for adjusting for panel nonresponse that we investigated

is generalized raking. Unlike the other approaches in the generalized raking approach, nonresponse adjustment cells are not first developed by cross-classifying the predictor variables. Rather, raking is directly applied to the panel respondents so that the marginal sum of the adjustments for the respondents across dimensions defined by the predictor variables is equal to the marginal sum of the number of respondents and nonrespondents. The approach is called generalized raking because the marginal sums can be equalized in a variety of ways, one of which is the standard raking algorithm (Deming and Stephan, 1942). The generalized raking approach is defined more technically later, after the variables used to define the marginal sums are described.

In many applications of raking, the respondent weighted sample marginal distributions for several variables are forced to equal the known population distributions for those variables derived from independent sources. To adjust for panel nonresponse, we use the sums of the sampling weights from the Wave 1 respondents as the marginal totals instead of independent totals from other sources. The raking algorithm is not affected by the source of the marginal totals.

The first step in the raking procedure is to select predictor variables used to define the marginal totals. We used the predictor variables from the 10 variable main effects logistic regression model (see Table 2-4 for these variables) for this purpose. The raking problem was 10 dimensional, with one dimension for each predictor variable. The marginal totals for each dimension were defined to be the sum of the Wave 1 weights for all persons (i.e., panel respondents and panel nonrespondents) in each response category of the predictor variable. The marginal totals are given in Table 3-3 along with the marginal nonresponse rates for each category of the predictor variables.

The objective of raking in the current application is to obtain panel nonresponse adjustments that when multiplied by the Wave 1 weight sum to the marginal totals for each of the 10 variables given in Table 3-3. Deville and Sarndal (1992) term these conditions on the weighted sums as calibration equations. They show that the calibration equations can be satisfied using a variety of different criteria, one of which is the traditional raking algorithm. Deville, *et al*. (1993) show that the traditional raking algorithm satisfies the calibration criteria according to the criterion that the distance between the adjusted weights and the original weights is minimized when the distance is measured multiplicatively. For this reason, the traditional raking algorithm is sometimes called a multiplicative

generalized raking procedure. Other generalized raking procedures use different metrics for the distance function.

Table 3-3. Marginal totals for the 10 variables used in raking adjustments

Raking dimension	Marginal total (in 1000s)	Nonresponse rate
Age		
< 16	51,902	0.185
16 - 24	29,725	0.308
25 - 50	79,050	0.217
51 - 71	41,821	0.170
> 71	14,656	0.140
Race		
White	184,644	0.188
Black	24,141	0.329
Other	8,370	0.294
RRP		
Family member	202,238	0.196
Nonfamily member	14,917	0.360
Census region		
New England	11,714	0.203
Mid Atlantic	32,691	0.244
South Atlantic	36,432	0.218
East South Central	12,300	0.175
North Central	53,627	0.147
Mountain/West South Central	32,807	0.271
Pacific	37,584	0.210
Tenure		
Home owner	147,732	0.176
Renter	63,855	0.284
Other	5,568	0.176

Items imputed		
0	154,839	0.188
1	41,556	0.233
2 to 3	17,801	0.299
> 3	2,960	0.315
Bond status		
No bonds	117,466	0.247
Some bonds	99,689	0.161
Layoff		
Not laid off	206,112	0.202
Laid off	11,043	0.323
Food stamps		
Not recipient	17,913	0.237
Recipient	199,242	0.205
Class of work		
Business	96,968	0.211
Other	98,386	0.216
Government	21,801	0.155

We examined generalized raking procedures with three different distance metrics for the SIPP problem: a linear distance function, a multiplicative distance function, and a bounded multiplicative function. The third method is a variation of the multiplicative method that bounds the size of adjustments to be within a user-defined interval (L,U). Since the average nonresponse adjustment for the SIPP data set is 1.26, we set the lower bound for the adjustment at L = 0.8 and the upper bound at U = 2.0.

The adjustments were obtained using the CALMAR software described by Deville, *et al*. (1993). This program uses an iterative method to arrive at a solution. CALMAR was run three times, corresponding to the three distance functions. We also ran the standard raking method (the multiplicative model) using Westat developed and tested software called WESWGT. The results of

the CALMAR runs for the multiplicative model were nearly identical to the WESWGT runs.

The adjustments for all three distance functions were nearly identical. The correlations between the adjustments were in excess of 0.998. This result is consistent with the comments of Deville, *et al*. (1993) that the choice of the distance function has minor or negligible impact on the point estimates and the variances. Because the three methods were nearly identical, the distribution for the adjustments for the multiplicative model, labeled WA 8, is the only one summarized in Table 3-4. The summary is similar to the ones given for the other approaches. The table shows the percentiles of the adjustment distribution, the mean, standard deviation, and a measure of the variance increase due to the adjustments.

The distribution for the raking adjustments is similar to the distributions for the other adjustments. One difference is that the minimum adjustment is less than unity, which is not possible when the adjustment is the inverse of the response rate in a cell (either the observed or predicted response rate). This type of occurrence is rare but typical of raking. The standard deviation of WA 8 and $(1+CV^2)$ are smaller than the corresponding values for any other adjustment, but the differences are minor.

The last section of Table 3-4 shows the correlations for all the adjustments that are included in further stages of the analysis. As noted before, the correlations are relatively high, as expected. The correlation between WA 8 and the observed and predicted methods from the logistic regression models (WA 3 and WA 4) are above 0.9, while the correlations with the other adjustments are somewhat lower.

.c4.Table 3-4. Summary of raking weight adjustments

Percentiles

	Minimum	1st Quartile	Median	3rd Quartile	Maximum
WA 8	0.906	1.131	1.227	1.361	2.506

Means, standard deviations, and $(1 + CV^2)$

	Mean	Standard deviation	$1+CV^2$
WA 8	1.260	0.181	1.020

Correlations

	WA 3	WA 4	WA 5	WA 6	WA 7	WA 8
WA 3	1.000	0.955	0.734	0.729	0.630	0.948
WA 4		1.000	0.731	0.721	0.629	0.902
WA 5			1.000	0.689	0.580	0.750
WA 6				1.000	0.814	0.728
WA 7					1.000	0.630
WA 8						1.000

.c2.3.4 Poststratification of Adjusted Weights

Six alternative nonresponse adjusted weights are computed by multiplying each of the alternative nonresponse adjustments by the Wave 1 weights. These alternative weights are not yet comparable to the standard SIPP panel weight because the panel weight is poststratified to control totals derived primarily from the Current Population Survey (CPS). To make estimates based on the SIPP panel weight and the alternative weights more comparable, the alternative nonresponse adjusted weights were poststratified to the same control totals. This is described in more detail later.

The poststratification procedure we used was equivalent to the current SIPP procedure, with only minor differences. The primary difference between our procedure and the standard SIPP one is that we poststratified the full sample, whereas rotation groups are separately

poststratified in the standard SIPP procedure.

The poststratification was conducted separately for each of the six alternative weights. The steps in the poststratification were:

- The first step was to poststratify children (persons under 15 years). Control totals from the March 1987 CPS were used for this step. The controls included ethnicity (Spanish or non-Spanish), age (two-year groups, primarily), race (Black and non-Black), and sex.

- The next step was to poststratify adults (persons 15 years and older). Control totals from the March 1987 Current Population Survey (CPS) and data supplied by the Population Analysis staff at the Census Bureau were used for this step. The CPS controls included age (five-year groups, primarily), type of family (combination of householder gender and relatives living in the household), race (Black and non-Black), and sex. The Population Analysis staff supplied Spanish controls. Some collapsing of groups was needed because of small numbers in the cells.

- To match the standard SIPP procedure the poststratification of adults was done iteratively. All adults were poststratified to the adult controls, generating a new set of weights for the adults. Using these weights, new weights for the Spanish adults were formed by adjusting the weights to Spanish control totals for adults by age category and gender. These new weights for the Spanish were combined with the weights for the non-Spanish, and the combined set of weights was poststratified to the overall control totals for adults. These weights were adjusted again to the Spanish adult controls. Estimates of the population of Spanish adults in specified subgroups were generated by summing their weights. Estimates for the population of non-Spanish adults in these margins were generated by subtracting the Spanish estimate from the overall CPS estimate. Non-Spanish adults were then poststratified to these non-Spanish control estimates.

The poststratified weights were used to compute the estimates from the SIPP panel file that are discussed in the next section. The seven poststratified weights are:

SIPP Panel This is the SIPP longitudinal weight for 1987 SIPP panel.

Predicted Logistic This is the poststratified nonresponse adjusted weight based on WA 3, the 10 variable main effects logistic regression model for which the adjustment is based on the predicted response rate in a cell.

Mixed Logistic This is the poststratified nonresponse adjusted weight based on WA 4, the 10 variable main effects logistic regression model for which the adjustment is the observed response rate if the cell has 25 or more

observations and the predicted response rate otherwise.

Collapsed Logistic This is the poststratified nonresponse adjusted weight based on WA 5, the 10 variable main effects logistic regression model for which the adjustment is the observed response rate, but cells were collapsed to ensure all had at least 30 sample persons.

CHAID I This is the poststratified nonresponse adjusted weight based on WA 6, the first CHAID model examined.

CHAID II This is the poststratified nonresponse adjusted weight based on WA 7, the second CHAID model examined.

Raking This is the poststratified nonresponse adjusted weight based on WA 8, the multiplicative raking adjustment computed using the CALMAR software.

The SIPP panel weight differs from the other weights in two respects. First, it employs a different panel nonresponse adjustment procedure as described earlier. Second, it employs a slightly different poststratification procedure, in that rotation groups are poststratified separately with the SIPP panel weight, whereas the poststratification is applied to the total sample with the other weighting procedures. By applying the poststratification adjustments to the total sample rather than to rotation groups separately, less collapsing of cells was needed. However, it seems unlikely that the difference in the poststratification procedures will have any appreciable effect on the weights. Thus, any differences between the results obtained with the SIPP panel weights and the other weights can be attributed fairly safely to differences in the panel nonresponse adjustments.

After poststratification, all seven weights summed to the same specified control totals. The distribution of the weights are slightly different, but the differences after poststratification are less pronounced. The measure of variability used previously ($1+CV^2$) is given below for each of the seven weights:

Poststratified Weight	$1+CV^2$
SIPP Panel	1.08
Predicted logistic	1.09
Mixed logistic	1.09
Collapsed logistic	1.08
CHAID I	1.09
CHAID II	1.10

Raking	1.08

As these measures show, a similar increase exists in variance of survey estimates associated with each of the weighting schemes.

To further examine the distribution of the weights after poststratification, the correlations between the weights were computed and are given in Table 3-5. The correlations shown here were weighted by the Wave 1 nonresponse adjusted weights. The correlations between the poststratified weights are all relatively high. The correlations between the SIPP Panel weight and the alternative weights are consistently lower than any others in the table. This result is probably due to the fact that the variables included in forming the nonresponse adjustments for this weight differ from those used for the alternative weights. The correlations between the alternative weights are all 0.85 or higher. When these correlations are compared to those in Table 3-4 for the adjustments prior to poststratification, we can see that poststratification increased the correlations between the alternative weights.

.c4.Table 3-5. Correlations between poststratified weights

	SIPP Panel	Predicted logistic	Mixed logistic	Collapsed logistic	CHAID I	CHAID II	Raking
SIPP Panel	1.00	0.75	0.74	0.75	0.71	0.68	0.77
Predicted logistic		1.00	0.99	0.91	0.90	0.86	0.98
Mixed logistic			1.00	0.91	0.90	0.86	0.97
Collapsed logistic				1.00	0.89	0.85	0.93
CHAID I					1.00	0.94	0.91
CHAID II						1.00	0.87
Raking							1.00

In the next chapter, we apply these alternative weights to the data from the 1987 SIPP panel file to develop estimates under the alternative schemes. These estimates are then compared with other data sources to estimate the potential of the alternative schemes for reducing the bias due to panel nonresponse.

.c.4. COMPARISON OF SURVEY ESTIMATES USING ALTERNATIVE WEIGHTING PROCEDURES

The previous chapter has described the development of six alternative weighting schemes for use in conducting analyses of panel respondents in a SIPP panel. The purpose of this chapter is to compare a set of estimates obtained with these weighting schemes with one another and with the corresponding estimates obtained using the current SIPP panel weighting scheme. All the weighting schemes incorporate adjustments for unequal selection probabilities, nonresponse at the initial wave, panel nonresponse, and poststratification adjustments to external control totals. In addition to internal comparisons between estimates obtained with the different weighting schemes with the 1987 SIPP longitudinal panel file, for some estimates comparisons are also made with benchmark estimates from external sources.

There are four sources of benchmark data that have been used to provide estimates comparable to those obtained from the 1987 SIPP panel:

- Administrative record data from the Social Security Administration on participation in the AFDC and SSI programs and from the USDA Food and Nutrition Service on participation in the food stamp program.

- Administrative record data on marriages and divorces.

- Data on changing address and annual wages from the CPS. The wages data are actually from the National Income Product Accounts administrative files but are reported with other estimates from the CPS.

- Survey data from the 1989 SIPP panel. Estimates for January 1989, computed from the 1987 SIPP longitudinal panel file, can be compared with estimates obtained from the cross-sectional file for the first wave of the 1989 SIPP panel. The latter estimates are free from panel nonresponse bias.

In making comparisons with estimates from these benchmark data, any differences

observed may be explained by a variety of different factors. Panel nonresponse is only one possible explanation and may often be less likely than others. For example, response errors and differences in definitions may explain differences between SIPP estimates and estimates obtained from administrative data. Response errors in both the SIPP and the CPS may explain differences between estimates from the two surveys, together with other design differences between the surveys. Differences between estimates obtained from the 1987 and 1989 SIPP panels are perhaps the most likely to be caused by a failure of the panel nonresponse. However, even in this case, there are possible alternative explanations such as panel conditioning (although the work of Pennell and Lepkowski, 1992, indicates that panel conditioning is not a major concern in the SIPP).

Table 4-1 presents a set of estimates from the 1987 SIPP panel file using the SIPP panel weight and using the six alternative weighting schemes. The table also includes benchmark estimates where available. Unless otherwise indicated, the figures in the table are percentages, given to two decimal places. Two decimal places are used because many of the percentages are small and because the differences between the estimates obtained with different weighting schemes are generally so small that rounding to one decimal place would mostly mask the differences. It should nevertheless be recognized that differences in the second decimal place and even differences in the first decimal place are generally of no practical importance and are small in comparison with the sampling errors of the estimates.

The estimates in Table 4-1 mostly relate to three different time periods: June 1987, January 1989, and the calendar year of 1987. Thus, the participation rate for a particular program is the percentage of individuals on that program in the specified month or the percentage who were on the program at any time during the calendar year. The estimates all relate to the total population with the following exceptions: employed, unemployed and out of the labor force, for which the percentages relate to the population over the age of 15; and annual wages, for which the percentages relate to the population over the age of 14.

The most notable finding from Table 4-1 is the close similarity of the estimates computed with all the weighting schemes. Rounded to one decimal place, the difference across all eight estimates is often less than 0.1 percent and only once exceeds 0.4 percent. The largest difference occurs for the percentage employed in January 1989. By way of comparison, the estimated standard error for this percentage with the current panel weight is 0.3.

In addition to the alternative estimates from the 1987 SIPP panel, the last two columns of Table 4-1 contain benchmark estimates from the 1989 SIPP panel and from other sources. Since the 1987 SIPP panel estimates with the alternative sets of weights are so similar to one another, no evidence exists that any one of the sets of weights produces estimates that are closer to the benchmark estimates. The differences between the benchmark estimates and the various 1987 SIPP panel estimates are generally much greater than the differences within the 1987 SIPP panel estimates. In making this observation, the 1987 SIPP panel estimates all employ the same sample, whereas the benchmark estimates are derived from different data sources.

.c4.Table 4-1. Estimates for the total population from the 1987 SIPP panel with alternative weighting schemes and estimates from other sources

	Current 1987 panel weight	Raking weight	Logistic regr. model weight	Logistic regr. mdl/obs weight	Collpsd cells weight	CHAID I weight	CHAID II weight	1989 SIPP panel	Bench-mark
AFDC - June 1987	3.73	3.69	3.70	3.70	3.72	3.71	3.60		4.28[2]
AFDC - January 1989	3.10	3.10	3.12	3.14	3.12	3.14	3.02	3.56	4.24[3]
AFDC - Annual 1987	4.85	4.78	4.78	4.82	4.81	4.80	4.69		
Food stamps - June 1987	7.43	7.21	7.26	7.30	7.34	7.38	7.20		7.35[4]
Food stamps - January 1989	6.71	6.58	6.63	6.67	6.64	6.70	6.59	6.30	7.29[4]
Food stamps - Annual 1987	10.30	10.06	10.11	10.16	10.18	10.24	10.05		
Medicaid - January 1989	6.77	6.76	6.78	6.81	6.75	6.81	6.68	6.97	
Medicaid - Annual 1987	9.21	9.21	9.21	9.24	9.21	9.25	9.09		
SSI - June 1987	1.68	1.69	1.70	1.69	1.67	1.69	1.65		1.68[5]
SSI - January 1989	1.65	1.66	1.67	1.66	1.64	1.66	1.61	1.65	1.74[6]
SSI - Annual 1987	1.80	1.82	1.82	1.82	1.80	1.82	1.78		
Social Security - January 1989	14.92	14.85	14.87	14.87	14.89	14.88	14.89	15.14	
Months without health insurance in 1987	1.66	1.69	1.69	1.70	1.67	1.67	1.69		
Poverty rate - June 1987	10.88	10.74	10.75	10.79	10.76	10.79	10.69		
Poverty rate - January 1989	12.91	12.93	12.98	13.02	12.97	12.99	12.91	14.46	
Entering poverty 1987/1988	2.25	2.31	2.31	2.32	2.30	2.29	2.32		
Leaving poverty 1987/1988	2.69	2.63	2.63	2.64	2.60	2.62	2.63		
Median household income - January 1989	2,601	2,602	2,600	2,597	2,607	2,607	2,607	2,550	

[2] Social Security Bulletin, Volume 52, No. 3.

[3] Social Security Bulletin, Volume 51, No. 7.

[4] USDA Food and Nutrition Service, National Data Bank, unpublished data.

[5] Social Security Bulletin, Volume 51, No. 7.

[6] Social Security Bulletin, Volume 51, No. 7.

Annual wages 1987 (in trillions)	1.93	1.94	1.94	1.93	1.94	1.94	1.94		2.22[7]
Employed - January 1989	62.74	62.42	62.36	62.34	62.43	62.42	62.52	61.60	
Unemployed - January 1989	3.57	3.63	3.64	3.63	3.60	3.58	3.60	4.52	
Out of labor force - January 1989	33.69	33.95	34.01	34.03	33.96	34.01	33.88	33.88	
Married in 1987	1.39	1.41	1.41	1.40	1.39	1.39	1.39		1.86[8]
Divorced in 1987	0.51	0.49	0.50	0.50	0.49	0.50	0.51		0.90[8]
Changed address in 1987	12.88	13.33	13.32	13.32	13.19	13.36	13.37		17.99[9]

To obtain a better insight into the magnitude of the differences between the 1987 SIPP panel estimates and the benchmark estimates, the sampling errors in the 1987 SIPP panel estimates and in the benchmark estimates need to be considered. For this purpose, approximate variances of the various estimates were computed as follows:

- For the 1987 SIPP panel estimates, generalized variance functions were used, as described in the SIPP Users' Guide (U.S. Bureau of the Census, 1991). These generalized functions strictly apply only to the estimates based on the 1987 SIPP panel weight. They should, however, also provide reasonable variance estimates for estimates based on the alternative weighting scheme. They are, therefore, used for all 1987 SIPP panel estimates.

- For cross-sectional estimates from the 1989 SIPP panel, the same generalized variance functions as used with the 1987 SIPP panel were employed but with slightly different parameter values.

- The benchmark estimate of the percentage of persons who changed address in 1987 was obtained from the CPS. An estimate of the variance of this

[7] U.S. Bureau of the Census, Current Population Reports, Consumer Income, P-60, No. 174.

[8] National Center for Health Statistics: Vital Statistics of the U.S., 1987, Volume III, Marriage and Divorce, DHHS Pub. No. (PHS) 91-1103.

[9] U.S. Bureau of the Census, Current Population Reports, Population Characteristics, P-20, No. 473.

estimate was obtained from a generalized variance function for the CPS (U.S. Bureau of the Census, 1993).

- Estimates obtained from administrative data were taken to be free of sampling error.

Given estimated variances determined in the manner described above, standard errors of differences between the various 1987 SIPP panel estimates and the benchmark estimates were computed under the assumption of independence between the two types of estimates. Then standardized differences between the 1987 SIPP estimates and the benchmark estimates were computed as

$$\frac{\text{1987 SIPP panel estimate - Benchmark estimate}}{\text{Standard error of the difference}}.$$

The results of these computations are displayed in Table 4-2.

.c4.Table 4-2. Standardized differences between 1987 SIPP panel estimates and benchmark estimates

	Bench-mark	Current 1987 panel weight	Raking weight	Logistic regr. model weight	Logistic regr. mdl/obs weight	Collpsd cells weight	CHAID I weight	CHAID II weight
1989 SIPP panel estimates								
AFDC	3.56	0.87	0.87	0.88	0.88	0.88	0.88	0.85
Medicaid	6.97	0.97	0.97	0.97	0.98	0.97	0.98	0.96
Food stamps	6.30	1.06	1.04	1.05	1.06	1.05	1.06	1.05
Poverty rate	14.46	0.89	0.89	0.90	0.90	0.90	0.90	0.89
SSI	1.65	1.01	1.01	1.01	1.01	1.00	1.01	0.98
Employed	61.60	1.02	1.01	1.01	1.01	1.01	1.01	1.01
Unemployed	4.52	0.79	0.80	0.81	0.80	0.80	0.79	0.80
Out of labor force	33.88	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Median Income	2,550	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Social Security	15.14	0.99	0.98	0.98	0.98	0.98	0.98	0.98
Other benchmark estimates								
AFDC - June 1987	4.28	-2.55	-2.71	-2.66	-2.49	-2.59	-2.65	-3.14
AFDC - January 1989	4.24	-5.71	-5.70	-5.62	-5.49	-5.63	-5.51	-6.10
Food stamps - June 1987	7.35	0.27	-0.48	-0.31	-0.16	-0.04	0.11	-0.50
Food stamps - January 1989	7.29	-2.04	-2.50	-2.32	-2.17	-2.26	-2.06	-2.44

SSI - June 1987	1.68	0.00	0.11	0.13	0.08	-0.03	0.08	-0.20
SSI - January 1989	1.74	-0.57	-0.50	-0.48	-0.53	-0.67	-0.54	-0.84
Married in 1987	1.86	-5.11	-4.95	-4.93	-4.98	-5.11	-5.10	-5.07
Divorced in 1987	0.90	-7.15	-7.40	-7.37	-7.36	-7.40	-7.32	-7.20
Changed address in 1987	17.99	-11.49	-10.49	-10.50	-10.51	-10.80	-10.42	-10.40
Annual wages 1987	2.22	-16.12	-15.78	-15.94	-16.38	-15.66	-15.61	-15.58

The upper part of Table 4-2 compares the 1987 SIPP panel estimates with the 1989 SIPP panel cross-sectional estimates. The standardized differences in this part of the table are small, indicating that the differences may be due to chance. The lower pare of the table compares the 1987 SIPP panel estimates with estimates from other benchmark sources. Here many of the standardized differences are sizable. Only the differences for the food stamp and SSI estimates appear to be reasonably attributable to chance. The differences for marriage, divorce, and changing address in 1987, and for annual wages in 1987 are large. If these differences are due to panel nonresponse bias, none of the weighting schemes has compensated adequately for that bias. However, as noted earlier, many alternative plausible explanations exist for these differences.

The analyses reported for the total population in Tables 4-1 and 4-2 were also conducted separately for the Black, Hispanic and non-Hispanic White subpopulations. The results of the subpopulation analyses are presented in corresponding tables, Tables E-1 and E-2 in Appendix E. The alternative 1987 SIPP panel estimates exhibit greater variability from one another for the Black and Hispanic subpopulations than for the non-Hispanic White population and for the total population as shown in Table 4-1. A review of the estimates in Table E-1 indicates that the CHAID II weighting scheme produces somewhat lower estimates of participation in the AFDC, food stamp, and Medicaid programs for Blacks, whereas the current 1987 SIPP panel weighting scheme produces somewhat lower estimates for these programs for Hispanics. In both cases the estimates for these two weighting schemes are on average lower by less than 1 percent, a minor decline in relation to the sampling errors of these subpopulation estimates.

Some appreciable differences occur between the various 1987 SIPP panel estimates for January 1989 and the corresponding estimates from the 1989 SIPP panel as can be seen from the final column of Table E-1. However, Table E-2 shows that the standardized differences between the 1987 SIPP panel estimates and the 1989 SIPP panel estimates are all small, indicating that the differences could readily have occurred simply as a result of sampling error.

.c.5. CONCLUSIONS

The analyses conducted in this study have identified a number of Wave 1 variables that are related to panel nonresponse and that are not employed in the current SIPP panel nonresponse adjustments. These include age, relationship to the household reference person, census region, tenure, and the number of imputed items.

These and other variables were included as auxiliary variables in developing panel weights for the 1987 SIPP panel using a number of alternative weighting schemes. The weights resulting from these alternative schemes were found to be highly correlated with one another, whereas their correlations with the current SIPP panel weights were somewhat lower. This finding suggests that the choice of auxiliary variables to use may be of greater significance than the choice of the weighting methodology. Nevertheless, after poststratification, the correlations of all the alternative sets of weights, including the current SIPP panel weights, were high.

A concern with several of the alternative weighting schemes was that the use of many auxiliary variables might lead to highly variable weights and, hence, a serious loss of precision in the survey estimates. This proved not to be the case. The variability of the weights with all the weighting schemes turned out to be similar. If the schemes are carefully developed, high variability in the weights can be avoided.

The examination of estimates from the 1987 SIPP panel using the alternative weighting schemes showed that all the schemes, including the current scheme, produced similar estimates. There is no real evidence that the alternative schemes are more effective in compensating for panel nonresponse, at least for the range of estimates included in this study. Greater differences were observed for estimates of subpopulation, but these differences were still small and not statistically significant.

Although the results do not show significantly better methods for reducing panel nonresponse bias, we recommend consideration of the use of some of the variables identified here as related to panel nonresponse in the SIPP panel nonresponse adjustment. While the use of these variables may not noticeably improve the quality of many of the survey estimates, they may do so for some estimates that were not examined in this study. Even if the additional variables do not

improve the predictions of panel nonresponse, they may still reduce the panel nonresponse bias due to their association with key SIPP estimates. Since the variables can be added without introducing substantial increases in the variances of the estimates, it is worthwhile to do so.

Before reaching a final conclusion on the choice of variables to include in the weighting adjustment, it would be useful to repeat the analysis to determine Wave 1 predictors of panel nonresponse with another SIPP panel to check the stability of the relationships of these variables to panel nonresponse across panels. If the same variables are found in another panel, it should be simple to develop a standard procedure for all future panels.

A range of different weighting methodologies has been examined in this study. None proved superior to the others. Therefore, ease of implementation is a factor that should be taken into account. The current procedure involves a relatively laborious process of collapsing cells until the cell sample sizes are large and the nonresponse adjustments are small. An alternative procedure, such as a raking procedure should be considered, that avoids the need for such collapsing.

.c.6. REFERENCES

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.c4.Table A-1. Panel nonresponse rates by category for items not retained for further analysis

	Nonresponse rate	Total
Living quarters		
House	20.6	28,746
Mobile home	20.7	1,895
Other	25.4	138
Missing	100.0	62
Householder Armed Forces		
Unknown	21.3	21,234
Yes	17.6	630
No	19.8	8,977
Householder Medicare		
N/A	21.7	26,555
Retired/disabled	15.1	3,238
Other	10.0	311
Missing	18.2	737
Householder disability		
Yes	22.7	6,670
No	20.3	24,171
Householder student		
Full-time	28.3	573
Part-time	17.4	1,404
No	20.8	28,854
Missing	100.0	10
Householder laid off		
On job	20.5	23,330
Layoff	28.6	1,161
No job, no time looking	20.5	6,340
Missing	100.0	10
Householder hours working		
< 24 hours	21.5	7,828
24-40 hours	21.5	13,777
41-45 hours	16.1	1,951
> 45 hours	20.0	7,285
Householder multiple jobs		
1	20.9	29,916
>1	18.4	925

Table A-1. Panel nonresponse rates by category for items not retained for further analysis (continued)

	Nonresponse rate	Total
Householder work class		
Commercial	21.4	15,589
Nonprofit	20.1	803
Government	17.0	3,784
Unpaid	19.1	530
NA, Missing	21.5	10,135
Householder business type		
Not business owner	20.9	27,215
Business owner	19.6	3,626
Household Medicaid		
Yes	24.7	2,010
No	20.5	28,821
Missing	100.0	10
Household WIC		
Yes	24.7	81
No	20.8	30,750
Missing	100.0	10
Household AFDC		
Yes	25.8	1,059
No	20.6	29,772
Missing	100.0	10
Household food stamps		
Yes	22.9	2,231
No	20.6	28,600
Missing	100.0	10
Household general assistance		
Yes	31.9	204
No	20.7	30,627
Missing	100.0	10
Household other welfare		
Yes	33.9	62
No	20.7	30,769
Missing	100.0	10
Household Social Security		
Yes	17.8	5,015

No	21.3	25,816
Missing	100.0	10

Table A-1. Panel nonresponse rates by category for items not retained for further analysis (continued)

	Nonresponse rate	Total
Householder railroad retired		
Yes	20.0	135
No	20.8	30,696
Missing	100.0	10
Householder veteran		
Yes	20.5	721
No	20.8	30,110
Missing	100.0	10
Householder Champus		
Yes	18.5	580
No	20.8	30,251
Missing	100.0	10
Householder Champva		
Yes	22.6	93
No	20.8	30,748
Armed Forces		
Children	18.4	7,452
Unknown	21.8	19,491
Yes	19.4	232
No	19.9	3,666
Working hours		
Children	18.4	7,452
0 hours	20.8	9,058
1 - 40 hours	22.0	9,945
> 40 hours	21.2	4,321
Missing	100.0	62
Business type		
Children	18.4	7,452
Other	21.1	21,541
Sole proprietorship	21.1	1,140
Partnership	19.7	290
Corporation	22.3	418
Railroad retired benefits		
Children	18.4	7,452
Yes	19.1	110
No	21.3	23,207
Missing	100.0	72

APPENDIX A

Table A-1. Panel nonresponse rates by category for items not retained for further analysis (continued)

	Nonresponse rate	Total
Champus		
Yes	16.1	845
No	20.7	29,924
Missing	100.0	72
Champva		
Yes	22.9	155
No	20.6	30,686

APPENDIX B

.c4.Table B-1. Wald statistics for the expanded model

Predictors	Wald statistics	DF
Age	184.93	4
Race	213.95	2
RRP	68.97	1
Census region	327.33	6
Tenure	207.24	2
Imputation flags	434.23	3
Bond status	97.14	1
Layoff	33.37	1
Food stamps	39.32	1
Class of work	31.37	2
Education level	12.79	1
Household income	14.93	2
Gender	10.28	1
RRP - Child interaction	10.08	1

APPENDIX C

Priority List for Cell Collapsing

Age 4,5

Census region 1,3,7 (three cells collapsed into 1)

Tenure 1,3

Class of work 1,2,3 (all categories)

Food stamps 1,2 (all categories)

Layoff 1,2 (all categories)

Race 1,3

RRP 1,2 (all categories)

Tenure 1,2,3 (all categories)

Imputation flags 2,3,4

Bond status 1,2 (all categories)

Race 1,2,3 (all categories)

Age 1,2,3,4,5 (all categories)

Census region 1,2,3,4,5,6,7 (all categories)

Imputation flags 1,2,3,4 (all categories)

APPENDIX D

CHAID I

		Group	Sample size	Nonresponse rate
Home owners and nonpaying				
No items imputed				
New England, South Atlantic, East South Central				
White				
Age < 16				
Parent does not hold bonds		1	450	12.00
Parent holds bonds		2	408	7.60
Age 16 to 24	3	421	21.62	
Age > 24				
Does not hold bonds				
New England, South Atlantic		4	838	17.66
East South Central				
Age 25 to 39		5	193	15.54
Age 50 and older		6	147	6.80
Holds bonds	7	1,360	11.91	
Black				
Age < 50		8	410	29.02
Age > 49		9	123	7.32
Asian, Native American	10	50	2.00	
Mid Atlantic				
Does not hold bonds				
Non-Black				
Home owners		11	823	19.44
Nonpaying, other	12	30	43.33	
Black		13	93	34.41
Holds bonds				
Related to reference person				
Non-Black	14	906	11.48	
Black		15	44	25.00
Not related to reference person		16	34	38.24
North Central (East and West)				
Age < 16		17	1,037	7.23
Age 16 to 24				
White		18	382	14.14
Non-White	19	28	39.29	
Age 25 to 71				
White		20	1,995	10.08
Non-White	21	142	22.54	
Age 50 to 71				
Male		22	109	1.83
Female	23	150	8.67	
West South Central and Mountain				
Related to reference person				
Does not hold Bonds				
Age < 16		24	340	23.53
Age 16 to 24	25	231	32.47	
Age 25 to 71	26	649	24.96	
Age > 71		27	54	3.70

	Group	Sample size	Nonresponse rate
Holds bonds 28	979	18.79	
Not related to reference person	29	137	40.15
Pacific (including Idaho, Wyoming, Montana)			
White			
Does not hold bonds			
Related to reference person	30	814	13.39
Not related to reference person	31	76	23.68
Holds bonds 32	1,074	9.31	
Non-White 33	264	23.11	
Home owners and nonpaying			
One item imputed			
Does not hold bonds			
White			
All except North Central			
Male	34	462	29.87
Female			
Age < 50	35	355	27.04
Age > 49	36	134	15.67
North Central (East and West)			
Age < 16	37	56	8.93
Age 16 to 24 38	220	20.91	
Age > 49	39	80	6.25
Black			
Age < 16	40	55	10.91
Age 16 to 24 41	67	53.73	
Age > 24	42	194	29.38
Asian, Native American 43	104	46.15	
Holds bonds			
White			
N. England, M. Atlantic, E. S. Central, Pacific			
Related to reference person			
Age < 16	44	232	10.78
Age 16 to 24 45	64	29.69	
Age > 24	46	789	13.31
Not related to reference person	47	34	32.35
S. Atlantic, W. S. Central and Mountain	48	819	19.17
North Central (East and West)	49	748	9.89
Non-White 50	199	26.63	
Two or more items imputed			
White			
New England, South Atlantic			
Two or three items imputed			
New England	51	147	27.21
South Atlantic	52	295	18.98
More than three items imputed	53	95	37.89
M. Atlantic, W. S. Central and Mountain, Pacific			
Does not hold bonds			
Mid Atlantic	54	134	41.79
W. S. Central and Mountain, Pacific	55	110	59.09
Holds bonds 56	689	29.61	

	Group	Sample size	Nonresponse rate
East South Central	57	112	9.82
North Central (East and West)			
Does not hold bonds	58	209	28.71
Holds bonds 59	515	16.31	
Non-White			
N. Eng., S. Atl. E. S. Cen., W. S. Cen. & Mtn.	60	74	33.78
M. Atlantic, N. Central, Pacific			
Age < 50	61	86	72.09
Age > 49	62	40	47.50
Renters			
Related to reference persons			
White			
New England, East South Central, Pacific			
Does not hold bonds			
No items imputed			
Age < 50	63	1,002	24.55
Age > 49	64	135	11.85
One item imputed	65	141	39.01
Two or more items imputed	66	33	18.18
Holds bonds 67	635	17.64	
Mid Atlantic, South Atlantic			
No items imputed			
Age < 16	68	425	24.24
Age 16 to 24	69	227	34.80
Age 25 to 49			
Does not hold bonds	70	470	30.00
Holds bonds	71	163	17.18
Age > 49	72	282	14.54
One item imputed			
Age < 50	73	206	35.44
Age > 49	74	68	19.12
Two or more items imputed	75	116	47.41
North Central (East and West)			
No or one items imputed			
Does not hold bonds			
Age < 16	76	250	15.20
Age 16 to 24	77	178	24.72
Age > 24			
Male	78	182	19.23
Female	79	237	10.55
Holds bonds	80	437	11.67
Two or more items imputed	81	53	32.08
West South Central and Mountain			
Does not hold bonds	82	587	36.12
Holds bonds 83	272	24.63	

	Group	Sample size	Nonresponse rate
Black			
No items imputed			
Age < 16	84	416	29.81
Age 16 to 24 85	192	44.79	
Age 25 to 49 86	421	33.02	
Age > 49	87	153	22.22
One or more items imputed			
Age < 50	88	216	57.87
Age > 49	89	43	34.88
Asian, Native American			
No items imputed 90	378	26.46	
One or more items imputed	91	59	44.07
Renters			
Not related to reference person			
Age < 16	92	168	34.52
Age 16 to 49			
Non-Black			
Male			
Does not hold bonds	93	242	53.72
Holds bonds	94	56	37.50
Female			
Age 16 to 24			
No items imputed	95	73	41.10
One or more items imputed	96	27	70.37
Age 25 to 49	97	123	33.33
Black	98	96	67.71
Age > 49	99	98	29.59

CHAID II

	Group	Sample size	Nonresponse rate
Home owners and nonpaying, other			
No items imputed			
New England, South Atlantic, East South Central			
White			
Age < 16			
Does not hold bonds	1	450	12.00
Holds bonds			
Monthly income $8,000 or less	2	305	5.57
Monthly income over $8,000	3	103	13.59
Age 16 to 24			
Monthly income $8,000 or less	4	310	18.71
Monthly income over $8,000	5	111	29.73
Age 25 and older			
Does not hold bonds			
Monthly income under $1,200	6	136	6.62
$1,200 and greater			
New England, South Atlantic	7	761	18.92
East South Central			
Class of work-government, other	8	160	7.50
Class of work-business	9	121	19.01
Holds bonds 10	1,360	11.91	
Black			
Age < 50			
Not food stamp beneficiary			
Home owners			
No layoff during month	11	62	19.35
Layoff during ref. month	12	25	40.00
Nonpaying, other	13	28	7.14
Food stamp beneficiary	14	295	32.20
Age over 50 15	123	7.32	
Asian, Native American 16	50	2.00	
Mid Atlantic			
Does not hold bonds			
High school graduate/no high school			
White	17	698	18.34
Non-White 18	71	30.99	
Last grade completed tenth or eleventh	19	177	31.07
Holds bonds			
Related to reference persons			
Non-Black 20	906	11.48	
Black	21	44	25.00
Not related to reference person	22	34	38.24
North Central (East and West)			
Age < 16			
Monthly income < $1,200	23	41	26.83
Monthly income $1,200 and greater			
Class of work-business, other	24	849	7.42
Class of work-government	25	147	0.68

		Group	Sample size	Nonresponse rate
Age 16 to 24				
White		26	382	14.14
Non-White	27	28	39.29	
Age 25 to 71				
White		28	1,995	10.08
Non-White	29	142	22.54	
Age over 71				
Male		30	109	1.83
Female	31	150	8.67	
Home owners and nonpaying				
No items imputed				
West South Central and Mountain				
Related to reference person				
Does not hold bonds				
Not food stamp beneficiary				
No layoff during month		32	112	6.25
Layoff during ref. month		33	32	34.38
Food stamp beneficiary				
Age < 72				
Monthly income < $1,200		34	65	44.62
Monthly income $1,200 and greater		35	1,019	26.50
Age over 71	36	46	4.35	
Holds bonds				
Class of work-business, other		37	806	20.47
Class of work-government		38	173	10.98
Not related to reference person		39	137	40.15
Pacific (including Idaho, Wyoming, Montana)				
White				
Does not hold bonds				
Related to reference person		40	814	13.39
Not related to reference person		41	76	23.68
Holds bonds	42	1,074	9.31	
Non-White	43	264	23.11	
One item imputed				
Does not hold bonds				
White				
All except North Central (East and West)				
Male		44	462	29.87
Female				
Class of work-government, other		45	290	19.66
Class of work-business		46	199	30.15
North Central (East and West)				
Age < 16		47	56	8.93
Age 16 to 49				
High school graduate/no high school				
Age 16 to 24				
Male		48	35	40.00
Female		49	39	10.26

	Group	Sample size	Nonresponse rate
Age 25 to 49			
Male	50	45	4.44
Female	51	56	19.64
Last grade completed tenth or eleventh	52	45	33.33
Age over 49 53	80	6.25	
Black			
Age < 16	54	55	10.91
Age 16 to 24 55	67	53.73	
Age over 24 56	194	29.38	
Asian, Native American 57	104	46.15	
Holds bonds			
White			
No layoff during month			
N. England, M. Atl., E. S. Central, Pacific			
Related to reference person			
Age < 16	58	229	10.04
Age 16 to 24	59	63	30.16
Age over 24	60	780	13.08
Not related to reference person	61	34	32.35
S. Atlantic, W. S. Central and Mountain	62	808	18.69
North Central (East and West)	63	746	9.79
Layoff during ref. month	64	26	46.15
Non-White 65	199	26.63	
Home owners and nonpaying			
Two or more items imputed			
White			
New England, South Atlantic			
Two or three items imputed			
New England	66	147	27.21
South Atlantic 67	295	18.98	
More than three items imputed			
Class of work-other	68	52	26.92
Class of work-business, government	69	43	51.16
M. Atlantic, W. S. Central and Mountain, Pacific			
Does not hold bonds			
Mid Atlantic 70	134	41.79	
W. S. Central and Mountain, Pacific	71	110	59.09
Holds bonds 72	689	29.61	
East South Central 73	112	9.82	
North Central (East and West)			
Does not hold bonds 74	209	28.71	
Holds bonds 75	515	16.31	
Non-White			
All except Middle Atl., N. Central, and Pacific	76	74	33.78
Mid Atlantic., N. Central and Pacific			
Monthly income $8,000 or less			
Age < 25	77	29	93.10
Age over 24 78	59	61.02	
Monthly income over $8,000	79	38	47.37

	Group	Sample size	Nonresponse rate
Renters			
Related to reference person			
White			
N. England, East South Central, Pacific			
No layoff during month			
Class of work-business, other			
Does not hold bonds			
No items imputed			
Age < 50	80	816	23.53
Age over 49	81	129	12.40
One item imputed	82	122	38.52
Two or more items imputed	83	30	16.67
Holds bonds			
Class of work-other			
Monthly income $8,000 or less	84	185	19.57
Monthly income over $8,000	85	34	44.12
Class of work-business	86	326	15.34
Class of work-government	87	153	9.80
Layoff during reference month			
Not food stamp beneficiary	88	51	25.49
Food stamp beneficiary	89	101	42.54
Mid Atlantic, South Atlantic			
No items imputed			
Age < 16			
Parent no layoff during month			
Monthly income < $1,200			
Mid Atlantic	90	63	31.75
South Atlantic	91	26	57.69
Monthly income $1,200 and greater	92	299	21.74
Parent laid off during reference month	93	37	8.11
Age 16 to 24 94	227	34.80	
Age 25 to 49			
Does not hold bonds	95	470	30.00
Holds bonds 96	163	17.18	
Age over 49			
Class of work-other	97	217	11.06
Class of work-business, government	98	65	26.15
One item imputed			
Age < 50			
High school graduate/no high school	99	179	37.99
Last grade completed tenth or eleventh	100	27	18.52
Age over 49 101	68	19.12	
Two or more items imputed	102	116	47.41
North Central			
No layoff during month			
Monthly income $8,000 or less			
High school graduate/no high school			
None or one item imputed			
Monthly income < $1,200			
Age < 50	103	105	23.81
Age over 49	104	56	3.57

	Group	Sample size	Nonresponse rate
Monthly income $1,200 to $8,000	105	774	10.08
Two or more items imputed	106	39	28.21
Last grade completed tenth or eleventh			
Age < 50	107	128	25.78
Age over 49	108	57	3.51
Monthly income over $8,000			
No items imputed	109	50	16.00
One or more items imputed	110	44	40.91
Renter			
Related to reference person			
White			
North Central			
Age < 25	111	55	50.91
Age over 24 112	29	17.24	
West South Central and Mountain			
Does not hold bonds			
Class of work-business, other	113	539	37.85
Class of work-government	114	48	16.67
Holds bonds 115	272	24.63	
Black			
No items imputed			
Not food stamp beneficiary			
Monthly income < $1,200	116	309	30.10
Monthly income $1,200 and greater			
Class of work-government, other	117	99	8.08
Class of work-business	118	51	37.25
Food stamp beneficiary			
Age < 16			
Parent does not hold bonds	119	154	39.61
Parent holds bonds	120	33	21.21
Age 16 to 24			
High school graduate/no high school	121	85	42.35
Last grade completed tenth or eleventh	122	30	63.33
Age 25 to 49 123	302	37.09	
Age over 49 124	119	23.53	
One or more items imputed			
Age < 49	125	216	57.87
Age over 49 126	43	34.88	
Asian, Native American			
Class of work -business, other			
No items imputed			
Does not hold bonds			
Monthly income < $1,200	127	43	44.19
Monthly income $8,000 or more			
Not food stamp beneficiary	128	72	11.11
Food stamp beneficiary	129	159	27.04
Holds bonds 130	74	13.51	
One or more items imputed	131	53	41.51
Class of work government 132	36	66.67	

	Group	Sample size	Nonresponse rate
Renter			
Not related to reference person			
Age < 16			
Parent high school graduate/no high school			
Not food stamp beneficiary	133	51	17.65
Food stamp beneficiary	134	73	34.25
Parent last grade completed tenth or eleventh	135	44	54.55
Age 16 to 49			
Non-Black			
Male			
Does not hold bonds	136	242	53.72
Holds bonds 137	56	37.50	
Female			
Age 16 to 24			
No items imputed	138	73	41.10
One or more items imputed	139	27	70.37
Age 25 to 49 140	123	33.33	
Black	141	96	67.71
Age over 49 142	98	29.59	

APPENDIX E

.c4.Table E-1. Estimates for Blacks, Hispanics, and non-Hispanic Whites from the 1987 SIPP panel with alternative weighting schemes and from the 1989 SIPP panel

	Race/ ethnic group	Current 1987 panel weight	Raking weight	Logistic regr. model weight	Logistic regr. mdl/obs weight	Collapsd cells weight	CHAID I weight	CHAID II weight	1989 panel weight
AFDC June 1987	Black	12.61	12.56	12.61	12.66	12.34	12.41	11.66	
	Hispanic	8.67	9.12	9.20	9.36	9.44	9.34	9.07	
	White	2.28	2.24	2.25	2.28	2.31	2.29	2.31	
AFDC January 1989	Black	11.24	11.40	11.51	11.56	11.16	11.40	10.57	12.08
	Hispanic	7.26	7.61	7.68	7.74	7.88	7.81	7.51	7.75
	White	1.82	1.79	1.79	1.81	1.85	1.84	1.85	2.14
AFDC Annual 1987	Black	16.46	16.23	16.24	16.29	16.04	16.03	15.06	
	Hispanic	10.38	10.92	11.02	11.18	11.37	11.26	10.89	
	White	3.04	2.97	2.98	3.01	3.05	3.04	3.10	
Food stamps June 1987	Black	23.70	23.19	23.24	23.28	23.10	23.42	22.24	
	Hispanic	16.53	17.18	17.32	17.52	17.66	17.87	16.99	
	White	4.87	4.68	4.72	4.77	4.86	4.87	4.86	
Food stamps January 1989	Black	23.71	23.39	23.62	23.66	23.08	23.59	22.64	19.45
	Hispanic	14.61	15.24	15.38	15.56	15.54	15.68	15.47	13.16
	White	4.22	4.11	4.14	4.18	4.23	4.23	4.26	4.20
Food stamps Annual 1987	Black	30.74	30.11	30.17	30.22	30.05	30.26	28.86	
	Hispanic	21.08	22.08	22.23	22.42	22.62	22.93	22.03	
	White	7.05	6.84	6.88	6.93	7.01	7.06	7.07	
Medicaid January 1989	Black	20.55	20.94	21.07	21.11	20.53	21.17	20.08	19.95
	Hispanic	14.33	14.85	14.97	15.12	15.29	15.02	14.93	13.05
	White	4.57	4.49	4.50	4.53	4.56	4.53	4.58	4.90
Medicaid Annual 1987	Black	25.63	25.91	25.91	25.95	25.76	26.11	24.77	
	Hispanic	19.62	20.70	20.84	21.00	21.24	21.10	20.62	
	White	6.60	6.54	6.54	6.57	6.60	6.59	6.64	
Supplemental Security Income June 1987	Black	4.59	4.88	4.91	4.91	4.81	5.02	4.83	
	Hispanic	1.84	2.02	2.02	2.02	2.06	2.00	1.93	
	White	1.23	1.20	1.20	1.20	1.20	1.18	1.16	
Supplemental Security Income January 1989	Black	4.41	4.62	4.65	4.66	4.55	4.76	4.60	3.92
	Hispanic	1.99	2.11	2.12	2.12	2.16	2.06	2.00	2.25
	White	1.19	1.16	1.16	1.16	1.16	1.15	1.12	1.31
Supplemental Security Income Annual 1987	Black	4.94	5.25	5.28	5.28	5.19	5.35	5.19	
	Hispanic	2.05	2.29	2.30	2.30	2.32	2.31	2.25	
	White	1.32	1.30	1.30	1.29	1.29	1.29	1.26	
Months w/o Health insurance coverage Annual 1987	Black	2.49	2.53	2.55	2.55	2.47	2.45	2.52	
	Hispanic	3.41	3.47	3.48	3.48	3.43	3.46	3.50	
	White	1.50	1.53	1.53	1.54	1.52	1.53	1.53	
Poverty rate Annual 1987	Black	30.04	29.70	29.70	29.75	29.28	29.81	28.59	
	Hispanic	22.95	23.99	24.10	24.29	24.46	24.52	24.20	
	White	7.97	7.85	7.87	7.91	7.94	7.91	7.98	
Poverty rate January 1989	Black	32.31	32.52	32.83	32.85	32.11	32.46	31.57	31.08
	Hispanic	23.66	24.95	25.06	25.19	25.30	25.33	24.95	29.84
	White	10.05	10.04	10.05	10.09	10.15	10.12	10.17	11.72

Table E-1. Estimates for Blacks, Hispanics, and non-Hispanic Whites from the 1987 SIPP panel with alternative weighting schemes and from the 1989 SIPP panel (continued)

	Race/ ethnic group	Current 1987 panel weight	Raking weight	Logistic regr. model weight	Logistic regr. mdl/obs weight	Collapsd cells weight	CHAID I weight	CHAID II weight	1989 panel weight
Percent entering poverty 1987/1988	Black	4.17	4.22	4.29	4.28	4.11	4.06	4.25	
	Hispanic	3.27	3.48	3.53	3.53	3.57	3.57	3.47	
	White	1.99	2.04	2.04	2.05	2.05	2.04	2.04	
Percent employed January 1989	Black	57.13	56.80	56.54	56.55	56.78	56.55	57.21	
	Hispanic	60.54	59.32	59.15	59.13	58.93	59.14	59.37	
	White	63.48	63.18	63.15	63.12	63.18	63.20	63.23	62.39
Percent unemployed January 1989	Black	6.64	6.82	6.86	6.86	6.72	6.70	6.68	7.92
	Hispanic	5.86	5.79	5.78	5.81	5.98	5.77	5.80	7.32
	White	3.19	3.24	3.23	3.23	3.22	3.18	3.22	4.05
Percent out of labor force January 1989	Black	36.23	36.38	36.60	36.59	36.50	36.75	36.11	36.25
	Hispanic	33.60	34.89	35.07	35.07	35.10	35.10	34.83	33.75
	White	33.32	33.58	33.62	33.64	33.60	33.62	33.56	33.56
Social Security January 1989	Black	11.76	11.56	11.58	11.58	11.65	11.63	11.62	12.57
	Hispanic	7.95	8.00	8.03	8.01	8.01	8.05	8.06	7.99
	White	15.78	15.72	15.75	15.76	15.72	15.74	15.74	15.91
Percent married in 1987	Black	1.14	1.16	1.13	1.12	1.17	1.09	1.12	
	Hispanic	1.23	1.30	1.30	1.30	1.31	1.28	1.29	
	White	1.43	1.46	1.46	1.46	1.43	1.45	1.45	
Percent divorced in 1987	Black	0.52	0.48	0.48	0.48	0.50	0.50	0.51	
	Hispanic	0.54	0.50	0.49	0.49	0.49	0.50	0.51	
	White	0.51	0.50	0.50	0.50	0.50	0.50	0.51	
Percent leaving poverty 1987/1988	Black	4.88	4.75	4.76	4.77	4.56	4.80	4.68	
	Hispanic	3.99	3.97	3.97	3.97	3.95	3.98	3.87	
	White	2.31	2.25	2.26	2.26	2.25	2.24	2.28	
Median household income 1987	Black	1,532	1,562	1,538	1,540	1,594	1,640	1,644	1,681
	Hispanic	1,822	1,808	1,808	1,804	1,781	1,800	1,802	1,720
	White	2,728	2,725	2,725	2,720	2,723	2,723	2,723	2,650
Annual wages 1987 (in trillions)	Black	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
	Hispanic	0.11	0.10	0.10	0.10	0.10	0.10	0.10	
	White	1.71	1.72	1.71	1.71	1.72	1.71	1.71	
Percent changing address Annual 1987	Black	13.68	14.16	14.37	14.38	14.00	14.48	14.35	
	Hispanic	11.53	11.99	12.02	11.95	11.87	11.84	11.92	
	White	12.69	13.14	13.10	13.09	13.02	13.14	13.18	

.c4.Table E-2. Standardized differences between 1987 SIPP panel estimates for January 1989 and the 1989 SIPP panel estimates

Variable	Group	1989 Final	1987 Panel current weight	Raking weight	Logistic regr. model weight	Logistic regr. mdl/obs weight	Collpsd cell weight	CHAID I weight	CHAID II weight
AFDC	Black	12.08	0.93	0.94	0.95	0.96	0.92	0.94	0.87
	Hispanic	7.75	0.94	0.98	0.99	1.00	1.02	1.01	0.97
	White	2.14	0.85	0.84	0.84	0.85	0.86	0.86	0.86
Medicaid	Black	19.95	1.03	1.05	1.06	1.06	1.03	1.06	1.01
	Hispanic	13.05	1.10	1.14	1.15	1.16	1.17	1.15	1.14
	White	4.90	0.93	0.92	0.92	0.92	0.93	0.92	0.93
Food stamps	Black	19.45	1.22	1.20	1.21	1.22	1.19	1.21	1.16
	Hispanic	13.16	1.11	1.16	1.17	1.18	1.18	1.19	1.18
	White	4.20	1.01	0.98	0.98	1.00	1.01	1.01	1.01
Poverty rate	Black	31.08	1.04	1.05	1.06	1.06	1.03	1.04	1.02
	Hispanic	29.84	0.79	0.84	0.84	0.84	0.85	0.85	0.84
	White	11.72	0.86	0.86	0.86	0.86	0.87	0.86	0.87
Supplemental Security Income	Black	3.92	1.13	1.18	1.19	1.19	1.16	1.21	1.18
	Hispanic	2.25	0.88	0.94	0.94	0.94	0.96	0.92	0.89
	White	1.31	0.91	0.89	0.89	0.88	0.88	0.88	0.85
Employed	Black	55.83	1.02	1.02	1.01	1.01	1.02	1.01	1.02
	Hispanic	58.93	1.03	1.01	1.00	1.00	1.00	1.00	1.01
	White	62.39	1.02	1.01	1.01	1.01	1.01	1.01	1.01
Unemployed	Black	7.92	0.84	0.86	0.87	0.87	0.85	0.85	0.84
	Hispanic	7.32	0.80	0.79	0.79	0.79	0.82	0.79	0.79
	White	4.05	0.79	0.80	0.80	0.80	0.79	0.78	0.79
Out of labor force	Black	36.25	1.00	1.00	1.01	1.01	1.01	1.01	1.00
	Hispanic	33.75	1.00	1.03	1.04	1.04	1.04	1.04	1.03
	White	33.56	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Median income	Black	1,681.	0.91	0.93	0.91	0.92	0.95	0.98	0.98
	Hispanic	1,720.	1.06	1.05	1.05	1.05	1.04	1.05	1.05
	White	2,650.	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Social Security	Black	12.57	0.94	0.92	0.92	0.92	0.93	0.92	0.92
	Hispanic	7.99	0.99	1.00	1.00	1.00	1.00	1.01	1.01
	White	15.91	0.99	0.99	0.99	0.99	0.99	0.99	0.99