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THE 1986 RURAL POST-ENUMERATION SURVEY
IN EAST CENTRAL MISSISSIPPI

by

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Final Report

Abstract

This paper discusses the methodology and results of conducting the 1986 Rural Post-Enumeration Survey (PES) in East Central Mississippi. The Rural PES was the first test during the 1980s of PES methodology in a rural site, where addresses pose some unique problems. It was also the first such test to evaluate person coverage in an area with a significant population of blacks, who traditionally have had the largest measured undercount of any group. The main objectives of the Rural PES were to test computer matching with rural addresses and to evaluate person coverage for characteristics such as race and method of questionnaire delivery in the census. Another objective was to test the so-called card approach to PES matching. How these objectives were met and recommendations for future PES methodology in rural areas are discussed in this paper.

1. INTRODUCTION

The 1986 Rural PES was a coverage measurement survey conducted after the 1986 Census of East Central Mississippi. It was designed to test the feasibility of computer matching in a rural area. Another objective of the Rural PES was to evaluate person coverage for characteristics such as race and method of census questionnaire delivery (Update List/Leave vs. Precanvass/Postal Delivery).*

* Update List/Leave involves an enumerator updating an existing geocoded address list. In conjunction with this listing activity, a questionnaire is delivered for the respondent to complete and mail back. Precanvass/Postal Delivery also involves updating an existing list of addresses but questionnaires are delivered through the mail.

In the Mississippi test site, many addresses consist of a rural route and box number with no house number or street name. Blocks are often irregularly shaped with "invisible" boundaries (e.g., an intermittent stream or a county line). An enumerator may list the wrong block or mistakenly include parts of neighboring blocks. This could lead to uncounted persons in missed housing units as well as duplicated persons in housing units counted more than once.

The Rural PES involved a two-way match between persons sampled in the Rural PES (P sample) and persons enumerated by the census in PES sample blocks (E sample). The P sample measures the number of persons missed in the census who should have been counted (gross undercount). The E sample measures persons incorrectly counted in the census such as duplicate enumerations and fictitious persons (gross overcount).

This paper is organized into eight sections, beginning with an introduction (Section 1) and seven additional sections. Section 2 discusses the Rural PES sample design including a brief description of the use of stratification and clustering. Section 3 discusses the Rural PES field activities of address listing and interviewing and includes the results of a quality control check of these activities. Section 4 discusses the rural matching including computer matching and the clerical review of the computer matching. Also included is a discussion of an extended search carried out both by computer and by clerical operation. Section 5 discusses the results after follow-up matching, for both the P sample and the E sample. Section 6 discusses imputation and dual-system estimation and includes estimates of percent undercount by age, race, sex and delivery method. Section 7 presents the results of testing the feasibility of a "PES card". The PES card is an identification card mailed to households with the census form. Residents were asked to retain this card for several months. If enough people were able to present this card to a PES interviewer, then it could be used successfully in matching the PES to the census. Section 8 summarizes the results of the rural PES and discusses the feasibility of conducting a PES in a rural area.

2. SAMPLE DESIGN

The Rural PES sample was chosen from the following five counties of the East Central Mississippi test site: Lauderdale, Leake, Neshoba, Newton, and Winston. Three other counties were excluded because reminder cards and some census questionnaires were prematurely mailed to respondents in those counties. Consequently, casing checks were not done and normal census conditions did not exist. Under such circumstances the delivery methods could not be compared with respect to coverage as they could be under "ordinary" census conditions.

The population in the five PES counties was stratified using demographic data from the 1980 Census. The following three characteristics, each with two levels, were used to form 8 strata: (1) Rurality (Urban vs. Rural), (2) Race (Non-Black vs. Black), and (3) Delivery Method (Update List/Leave (UL/L) vs. Precanvass/Postal Delivery (P/PD)). To determine rurality and race for the areas of the test site, 1980 data was mapped into 1986 geography. The equivalence of 1980 and 1986 data was defined at the census tract level which normally consists of several blocks. In order to evaluate person coverage in the 1986 Census of East Central Mississippi, dual-system estimates were produced for post strata within these 8 sampling strata (see Section 6).

Due to the primarily rural nature of East Central Mississippi, a number of blocks contained very few housing units. In an effort to reduce sampling variance, a ninth stratum was formed, consisting of blocks with 2 or fewer housing units.

The definitions of the nine strata are listed in table 1.

Table 1: Stratum Numbers and Definitions

<u>Stratum</u>	<u>Rurality</u>	<u>Race</u>	<u>Panel</u>
1	Urban	Non Black	UL/L
2	Urban	Non Black	P/PD
3	Urban	Black	UL/L
4	Urban	Black	P/PL
5	Rural	Non Black	UL/L
6	Rural	Non Black	P/PD
7	Rural	Black	UL/L
8	Rural	Black	P/PD
9	Small Blocks	NA	NA

NA- not applicable

Small blocks in the first 8 strata were grouped into block clusters with a preset minimum block cluster size of 6 housing units. This helps ensure a minimum sample size and reduces sampling variance.

The PES block sample consists of two overlapping samples referred to as the P sample and the E sample. The P sample is an independent interview of households in the census block. Persons included in the P sample are matched to the census to estimate the number of persons missed in the census. The E sample consists of persons enumerated by the census in the same census blocks. This sample is surveyed to estimate the number of persons erroneously enumerated in the census. Erroneous enumerations include duplications, fictitious persons, and geocoding errors.

A sample of 271 blocks was selected with about 3250 housing units. In order to reduce interviewing workloads and reduce costs, large blocks were subsampled after the address listing. A large block is any block containing 70 or more housing units. The Rural PES had 10 large blocks that were subsampled. The subsampling reduced the workload to approximately 45 housing units in each large block. To ensure the overlap of the P sample and the E sample, and to thus determine if a housing unit was counted in the census but missed in the PES, block faces or address ranges were used to form the subsample.

3. FIELD ACTIVITIES

3.1 **Address Listing**

The field activities were address listing and interviewing, including the quality control checks on these activities. A follow-up interview occurred after matching and is discussed in Section 5. The first phase of field activities for the Rural PES was address listing. This produced an independent listing of addresses in all sample blocks. The listing phase of a PES is very important, particularly in a rural area like East Central Mississippi. Addresses in such an area regularly consist of a rural route and box number with no house number or street name, and blocks are often bounded by unnamed roads. Thus the quality control (QC) check of the address listing takes on added importance.

As a quality control check in previous PES's conducted in urban areas, an administrative list of addresses was geocoded to specific blocks and compared to the address listings. For the Rural PES however, an administrative list of addresses that could be compared to the address listings was not available. (Addresses are not geocodable to specific blocks in much of the East Central Mississippi test site). Therefore, the QC operation involved advance listing a sample of blocks in the PES sample. The advance listing was done by crew leaders and experienced interviewers prior to the regular address listing. After the block was listed by the regular interviewer, the QC clerk determined if the right block was listed and if all addresses were reported correctly. For the blocks which were not advance listed, a comparison was made between the count of housing units in the PES interviewer's address listing book (ALB) and a count of housing units obtained from the census.

A block failed QC if there were any discrepancies between the PES interviewer listing and the advance listing or if the PES interviewer listed a smaller number of housing units than did the census. Any block which failed QC was sent back to the field for rectification. Table 2 shows the breakdown of the quality control operation.

Table 2: Address Listing Quality Control Results

	Advance Lising Comparison	Count Comparison	Total
Pass	20	123	143
Fail	77	51	128
Total	<u>97</u>	<u>174</u>	<u>271</u>

In addition, Table 3 gives a breakdown of the rectification results for those 128 address listing books which failed QC. (More than one correction could have been made to ALB's which failed QC).

Table 3: Summary of Corrections to Interviewers Listings which Failed QC

Type of Correction	Failed Advance Listing Comparison	Failed Count Comparison	Total
Different Blocks Listed	3	3	6
New Addresses Added	20	18	38
Addresses Deleted	11	13	24
Addresses Corrected	27	7	34
No Change	26	21	47
No Information on Rectification	7	1	8

During the QC operation, corrections were made to 81 (63%) of the 128 ALB's which failed QC. Especially important are 6 blocks which had to be relisted when the wrong block was originally listed. This indicates the kind of geocoding error that can occur in the census (see Section 1). We see that 47 (37%) of the ALB's did not require changes during rectification. For the advance listed blocks, 26 of 77 or 34% did not require changes during

rectification indicating that for those 26 blocks the advance listing done by the crew leaders and more experienced interviewers was incorrect. A likely explanation for this is that the regular interviewers more often lived nearer to their assigned blocks and were thus more familiar with the area. In any case, advance listing served as an effective means of providing actual listing practice for crew leaders and was a useful adjunct to the in-office crew leader training.

3.2 Interviewing

After completion of the Address Listing the next major field activity was interviewing. The Rural PES interview obtained demographic data on all current residents, where they lived on Census Day, any alternate addresses (such as a college address), mailing address, and other related information on persons who lived at the address on Census Day.

The final outcome of the interviewing for all PES questionnaires checked into the Collection Office is given in Table 4.

Table 4: Final Outcome of Interview

	<u>Numbers</u>	<u>Percent</u>	<u>Percent of Occupied Housing Units</u>
Complete Interview	2854	87.8	98.1
Vacant	342	10.5	NA
Noninterview-Refused	0	0.0	0.0
Noninterview-Not at Home	0	0.0	0.0
Noninterview-Other	0	0.0	0.0
Proxy	56	1.7	1.9
Last Resort	0	0.0	0.0
Total	<u>3252</u>	<u>100.0</u>	<u>100.0</u>

During the first three weeks of interviewing, only interviews with household members were accepted. During the fourth week of interviewing, proxy interviews with nonhousehold respondents, such as neighbors or landlords, were permitted. The final few days of interviewing allowed for last resort data with whatever information the interviewer could obtain on the household. Fortunately, the need to collect last resort data did not present itself for the Rural PES as we see in table 4. Table 4 also shows a zero noninterview

rate for the Rural PES. Assuming high quality data, a zero (or nearly zero) noninterview rate is a desirable outcome and aids in controlling the error component associated with missing data - one of the eight main components of error generic to coverage measurements produced by post-enumeration surveys as pointed out by Wolter (1987).

A quality control check of the interviewing involved either telephone calls or personal visits to a sample of households to determine if the right household was interviewed and whether all the correct household members were included on the PES roster of names. Of the 758 work units*, 752 (99.2%) passed QC. The interviewer errors uncovered were minor and there was no evidence from the QC clerk of any fabrication in the PES. Fabrication is another main component of error that the Rural PES was apparently able to successfully control.

3.2.1 Record of Visits

The number of visits required of interviewers was recorded for all Rural PES households. Also recorded was the date of each visit. Table 5 shows the number and percentage of households requiring a given number of visits.

*A work unit consists of one interviewer's work in one block on one day.

Table 5: Visits Required of Rural PES Interview

<u>Number of Visits</u>	<u>Number of Households^a</u>	<u>Percent of Total Households</u>	<u>Cumulative Percent of Total Households</u>
1	1794	62.2	62.2
2	587	20.4	82.6
3	225	7.8	90.4
4	100	3.5	93.9
5	56	1.9	95.8
6	55	1.9	97.7
7	31	1.1	98.8
8	14	0.5	99.3
9+	21	0.7	100.0
Total	2883	100.0	

^a Data regarding interviewer visits were unavailable for 27 households.

We see from Table 5 that most of the interviews were completed on the first visit to the household and about 90% were completed within 3 visits.

Table 6 shows the percentage of final visits falling within various time periods (i.e. weeks) from the start of interviewing.

Table 6: Time of Final Visit from Start of Interviewing

Time Period	Number of Final Visits Within Time Period	Percent of Total No. of Final Visits	Cumulative Percent of Total No. of Final Visits
Week 1	1030	35.7	35.7
Week 2	1098	38.1	73.8
Week 3	504	17.5	91.3
Week 4	195	6.8	98.1
Week 5	54	1.9	99.9
Week 6	2	0.1	100.0
Total	2883	100.0	100.0

Table 6 shows that over 98% of the final visits occurred within the first 4 weeks of interviewing. Also shown is that over 90% of the final visits occurred within the first 3 weeks when only interviews with household members were accepted. Weeks 5 and 6 allowed for completion of the QC operations and closing of the office.

4. MATCHING

Rural PES matching was affected by two design decisions. One decision was to use a "PES B" procedure to determine match/nonmatch status. In this procedure, the PES interviewer lists all the persons living (or staying) in the housing unit at the time of the PES. The PES information for nonmovers is matched with the census. In-movers (persons who moved into the sample block between Census Day and the PES interview) are asked where they lived on Census Day. Their Census Day address is searched in attempting to match PES B in-movers to the census. If their Census Day address is outside the test site, then the person is coded as being out-of-scope and not included in the dual-system estimates.

The major alternative to the PES B approach is called "PES A." The PES A procedure reconstructs the households as they existed at the time of the

census. It attempts to obtain names and basic characteristics of persons who moved out (out-movers) between Census Day and the time of the PES interview. In either cases the PES information is then matched with the census data. The difference between PES A and PES B involves people who move between Census Day and the time of the PES interview.

The PES B procedure was chosen for the Rural PES because it reduces the need to get information from neighbors or from other non-household members as to who was living in the housing unit at the time of the census. However, it requires that in-movers give complete and accurate information on where they were living at the time of the census. This information is used in searching for the persons in the census listings at these former locations.

The second design decision affecting Rural PES matching involved determining the extent of search. We decided to use an approach referred to as "any address matching" which searches the census files at all addresses obtained during the PES interview for P-sample persons. Such addresses represent places where the person might have been enumerated in the census, and include the sample address, mailing address, alternate addresses (such as college, etc.), and mover addresses. The P-sample person is coded as a match when (s)he is enumerated at any of the addresses in the census. A nonmatch is assigned only after all possible addresses are exhausted and no match is found. In addition, a search area is defined around each address. For the Rural PES, this area was the Block Numbering area (BNA) used in the census.

4.1 Computer Matching

Rural PES interview questionnaires were keyed and the data were sent to headquarters where the PES files were prepared for computer matching. Similarly, census files were created for the same purpose. The census files included names, addresses, census processing data and demographic information.

The computer matching was done in a single pass in which the matcher "blocked" (i.e., sorted) on the following 3 variables:
(1) Block Numbering Area (BNA), (2) SOUNDEX of last name, and (3) Sex.

The SOUNDEX procedure enables a variable such as surname to be phonetically encoded and allows matching despite minor spelling differences.

The number of records in the PES and Census files is too large to consider all possible record pairs. The files are therefore partitioned into "logical blocks" so that comparisons are restricted to record pairs within each logical block. This blocking is implemented by sorting the two files on one or more variables. Such blocking variables ideally should have a large number of uniformly distributed value states and a low probability of reporting error. Blocking is a tradeoff between computation cost (examining too many record pairs) and false nonmatch rates (classifying record pairs as nonmatches because the records are not members of the same logical block).

The important variables used for the computer match are given name, year of birth, race, and telephone number. In previous PES matching studies, address was also an important variable used in computer matching. However, the Rural PES included rural type addresses that could not be standardized in time for computer matching. Standardizing an address involves partitioning the address into separate fields. Any one of these fields could then be used as a matching variable. Currently, work is being done to finish a rural address standardizer which should be available for use in 1988 and 1990.

Given the nature of rural addresses and the fact that these addresses were not standardized for PES or census, the effectiveness of using addresses as a matching variable was severely limited. Despite this, the results of computer matching were encouraging, largely due to the availability on both the PES and Census files of telephone number which proved to be the most important matching variable for the Rural PES.

Table 7 below shows the results of the computer matching for each sampling stratum. The match rate is the total number of computer matches divided by the number of persons comprising the PES file within each stratum. The PES file includes nonmovers, PES B in-movers and PES A out-movers.

Table 7: Computer Match Results

Sampling Strata	Total Persons	Computer Matched ^a	Match Rate (%)
1	888	619	69.7
2	759	511	67.3
3	860	539	62.7
4	556	365	65.6
5	1409	916	65.0
6	1151	826	71.8
7	850	590	69.4
8	1360	947	69.6
9	120	69	57.5
TOTAL	7953	5382	67.7

^a Matched refers to persons matched by computer that remained matched.

The overall match rate of 67.7% compares favorably with the 74.2% computer match rate obtained during the 1986 Test of Adjustment Related Operations (TARO) conducted in Central Los Angeles County. Unlike the Rural PES, the 1986 TARO contained urban type street addresses that were standardized (Diffendal, 1987).

4.1.1 Extended Search Results

Census questionnaire information, including names, was keyed for the entire rural test site. Therefore, it was possible to detect geographic coding errors by computer as well as clerically. Such an automated extended search was, in effect, incorporated into the computer matcher by the use of BNA as a blocking variable (as discussed earlier). This enabled P-sample persons to be automatically matched to persons enumerated in non-PES blocks within the same BNA. A total of 466 nonmovers were matched outside the PES

sample block. Of these, 365 (78.3%) were matched by computer and 101 (21.7%) were matched clerically. Table 8 shows nonmover matches broken down by the number of surrounding rings of blocks that required searching in order to match. These results suggest that the search area for PES blocks in a rural area like East Central Mississippi should include at least one ring of surrounding blocks.

Table 8: Extended Search Results

	Number	Percent of Nonmover Matches	Percent of Nonmovers Total (in scope)
Matched Within Block	5976	92.8	83.5
Matched Outside Block (1 ring)	369	5.7	5.2
Matched Outside Block (2 rings)	45	0.7	0.6
Matched Outside Block (> 2 rings)	52	0.8	0.7
Nonmover Matches	6442	100.0	90.0
Total Nonmovers	7156	NA	100.0

Geographic errors in a rural site such as East Central Mississippi may be attributed to rural addresses and geography as discussed earlier. Postal delivery in such an area may also play a role. For instance people may have a mailbox across the street from where they live (i.e., in another block). The geography of the mailbox may often be recorded on the address control file of the census instead of the location of the housing unit. Anecdotal evidence provided by the PES field supervisor suggests that most differences between census and PES are due to census geocoding errors.

4.2 Clerical Review

The Clerical Review for the Rural PES was completed by a clerical staff in Jeffersonville, Indiana. This was followed by a review by a more experienced staff, called the Special Matching Group (SMG), that ensures consistent and accurate matching results. All computer match forms were reviewed. Many of the nonmatches and possible matches were easily and quickly converted to matches by reviewing the persons in the household together. For instance, children from a previous marriage not matched because of inconsistent

reporting of surnames can be matched when the parents are matched. Also since sex was used as a blocking variable, any miscoding of sex by the PES or Census would typically result in an unmatched pair that could easily be converted to a match. About 50 such cases were reported causing no appreciable delay or difficulty since almost all of the unmatched pairs resulting from miscoding of sex appeared on the same match form and could be quickly verified as a match.

All possible matches were reviewed clerically and many were matched by examining PES and Census questionnaires. Any cases which remained possible matches after clerical review were sent to field follow-up (see Section 5).

Table 9 shows the total number of matched persons on the PES file broken down by computer matches and computer possible matches that were later clerically matched.

Table 9: Match Results For Combined Automated and Clerical Operation^a

	<u>Number</u>	<u>Percent of Final Matches</u>
Computer Matched- Remained Matched	5382	79.2
Computer Possible Match- Clerically Matched	610	9.0
Computer Matched or Computer Possible Match-Clerically Matched	5992	88.2
Total Matched on PES File ^b	6796	100.0

^a The results include information from field follow-up.

^b The PES file includes nonmovers, PES B in-movers and PES A out-movers.

As we see from table 9, 79.2% of the persons ultimately matched on the PES file were initially matched by computer. An additional 9% were computer possible matches that were matched clerically. Computer matching thus linked together 88.2% of the cases that were ultimately matched.

4.2.1 Review of Nonmatches

All PES persons on the PES file not matched by computer were reviewed by the clerical staff and the Special Matching Group. The results of this clerical review are shown in table 10.

Table 10: Results of Clerical Review

	Number	Percent
Total Computer Nonmatched	2571	100.0
Matched Clerically	1031	43.2
Matched by the SMG	334	13.6
Remaining Nonmatched	1207	43.2

This table shows that 56.8% of the cases that were nonmatched to the census by the computer were matched during prefollow-up clerical operations.

4.2.2 Review of Computer Matches

All matches assigned by the computer were reviewed. Of 5407 computer matches, 47 (0.9%) were found to be matched erroneously. This error rate is reasonably low and may be further reduced with the use of standardized addresses for computer matching. Refinements to the computer matcher and a more limited search area should also play a role in reducing this error rate in the 1988 and 1990 PES's.

4.3 Results of Matching at Alternate Addresses

To assist in matching to the census, any addresses at which a person may have been counted were recorded during the PES interview. Examples of such addresses include colleges, military bases, and second homes. Also, a mailing

address was recorded if it was different from the address obtained during address listing. For persons not living at the sample address on Census Day, their Census Day address was recorded. Results of matching at these alternate addresses will now be examined.

4.3.1 Results of Matching Persons Who Report Separate Mailing Addresses

In rural areas a mailing address is often different from a street address. The census may record either of these addresses in its files. The PES interview recorded 261 persons who reported a mailing address different from their street address. Table 11 shows the results of matching these persons.

Table 11: Results of Matching with Separate Mailing Address

	<u>Number</u>	<u>Percent</u>
Matched at Sample Address	220	84.3
Matched at Mailing Address	4	1.5
Nonmatched	35	13.4
Other ^a	2	0.8
Total Reporting Separate Mailing Address	261	100.0

^a "Other" persons included one out-of-scope and one matched at another alternate address.

The above table suggests that these separate mailing addresses played a very minor role in matching persons in a rural area such as East Central Mississippi. Apparently, the census recorded the sample address and not the mailing address.

4.3.2 Results of Matching Persons Who Report Other Possible Census Day Addresses

There were 132 persons who reported other possible Census Day addresses on the PES interview questionnaire. Such addresses included colleges, military bases, places of work, and second homes. This information is used to determine other addresses where a person may have been counted and to

assist in a duplicate search. Table 12 shows the results of matching at other possible Census Day addresses. Addresses outside the test site could not be searched as they would be in 1990.

Table 12: Results of Matching at Other Possible Census Day Addresses

	<u>Number</u>	<u>Percent</u>
Matched at PES Sample Address	84	63.6
Matched at Other Possible Census Day Address	4	3.0
Out-of-Scope at Other Possible Census Day Address	37	28.0
Unresolved (sent to follow-up)	4	3.0
Nonmatched	3	2.3
Total Reporting Other Census Day Address	132	100.0

As we see in table 12, most people reporting other possible Census Day addresses were matched at the PES sample address. Since all such persons were included in the computer match many of the cases that matched at the sample address represent computer matches. This introduces a bias arising from the erroneous inclusion of out-of-scope persons in the PES, because determination of whether or not these cases were out-of-scope was not made before matching. Thus some persons may be included (matched) in the PES who should not have been enumerated in the census. Plans for the 1988 Dress Rehearsal and 1990 Decennial Census have already been made to avoid introducing this type of "out-of-scope" bias. See U.S. Bureau of the Census (1979) for a discussion of this type of bias.

4.3.3 Results of Matching PES Movers

Persons reporting to have moved into a PES sample address between Census Day and the PES are called PES B in-movers. PES B in-movers are more difficult to match to the census because reported Census Day addresses can be incomplete or difficult to geocode to the census. Studies of other censuses have confirmed that persons moving at a time close to Census Day are at greater risk of being omitted from the census or of being enumerated at a subsequent address rather than at their correct Census Day address (Fay et.al., 1988). Table 13 shows the results of matching PES B in-movers.

These results include information from the field follow-up (see Section 5).

Table 13: Results of Matching PES B In-movers

	Number	Percent
Matched at Reported Census Day Address	157	33.1
Matched at PES Sample Address	49	10.3
Out-of-Scope	174	36.7
Nonmatched (mover status unchanged)	57	12.0
Nonmatched to Census (changed to nonmover)	31	6.5
Unresolved	6	1.3
Total Movers	474	100.0

As one might expect many of these movers were out-of-scope or outside the test site at their Census Day address. Hence, they should not have been counted in the census. Table 13 shows however that about half of those cases reported as "in scope" were matched at their Census Day address. For these movers, both their sample address and their Census Day address were within the test site. Table 13 also shows that over 10 percent of PES B in-movers were matched at their PES sample address. These cases were either enumerated incorrectly at their PES sample address rather than at their correct Census Day address or they incorrectly reported their Census Day address.

Table 13 also shows 31 cases whose mover status was changed to nonmover as a result of follow-up. These results reflect another major problem that faces any PES - namely, inaccurate reporting of mover status. The 1988 Dress Rehearsal PES is attempting to minimize this problem by redesigning the section of the PES questionnaire which obtains information for PES B in-movers.

4.4 P-Sample Matching

Sections 4.4 and 4.5 summarize the results of matching the P and E samples respectively. These results include final matching which uses information from the field follow-up (see Section 5).

Table 14 shows the results of matching the P sample (nonmovers and PES B in-movers).

Table 14: Summary of P-Sample Matching

	<u>Number</u>	<u>Percent of Total</u>	<u>Percent of In-Scope P sample</u>
Matched	6651	86.3	89.2
Nonmatched	791	10.3	10.6
Out-of-Scope	247	3.2	NA
Unresolved	<u>14</u>	<u>0.2</u>	<u>0.2</u>
Total	7703	100.0	100.0

We see from this table that 99.8% of the P-sample cases had their match/nonmatch status resolved. This is due in large part to the fact that nonmatches and unresolved cases in the P sample were included in the field follow-up (see section 5). Most of the out-of-scope cases are persons with Census Day addresses outside the test site. In 1990, these out-of-scope persons will be searched except for those who lived outside the country on Census Day.

4.5 E-Sample Matching

The purpose of E-sample matching is to determine correct/erroneous enumeration status in the census. With the "any address" matching approach used in the Rural PES, the E-sample person is correctly enumerated when (s)he is enumerated once and only once in the census. The E-sample person is erroneously enumerated when (s)he is enumerated more than once or should not

have been included in the census. Examples of erroneous enumerations are persons enumerated in more than one location, persons fabricated by the census enumerator, or persons who died before Census Day.

E-sample matching is summarized in table 15 which categorizes each case as either correctly enumerated or erroneously enumerated. Each of these two categories is then further broken down by type to better describe the results of E-sample matching.

Table 15 shows 96.5% of the E sample to be correctly enumerated (CE) in the census. Most of these CE cases (83.7%) were matched to the PES. More than half of the cases classified as erroneously enumerated (EE) represent Census duplicates. Almost 20% of the EE's have their address outside the test site and should not have been counted in the census. For 36 cases (13.4% of the EE's) matching was not attempted due to insufficient information. Since these cases can never be resolved with certainty, they are considered as nonmatches if captured in the P-sample and are subtracted from the census count to prevent multiple inclusion in the dual-system estimator (see section 6).

5. RESULTS OF FIELD FOLLOW-UP

All persons remaining nonmatched or possible matched after clerical review were sent to field follow-up. This includes E-sample persons not matched to the PES (E-sample nonmatches), P-sample persons not matched to the census (P-sample nonmatches), and possible matches. For E-sample nonmatches, the follow-up interview attempted to determine correct or erroneous enumeration in the census. Due to a smaller than expected E-sample follow-up workload it was decided to follow-up all P-sample nonmatches and unresolved cases. This was done for research purposes and to verify correct match/nonmatch status. Possible matches confirmed to be the same person during follow-up were recoded as matched. When the possible matches were not the same person the P-sample person was coded as nonmatched. (For the corresponding E-sample nonmatch, the follow-up had to determine correct or erroneous enumeration). The results of field follow-up are discussed below.

Table 15: Summary of E-Sample Matching

	<u>Number</u>	<u>Percent of E-sample</u>	
Total E-sample cases	7647		100.0
		<u>Percent of CE's</u>	
Correctly Enumerated (CE)			
Total	7378	100.0	96.5
Matched to PES	6179	83.7	80.8
Nonmatched to PES	1129	15.3	14.8
Unresolved (imputed as CE)	70	0.9	0.9
		<u>Percent of EE's</u>	
Erroneously Enumerated (EE)			
Total	269	100.0	3.5
Census Duplicate (not sent to follow-up)	110	40.0	1.4
Census Duplicate Address Outside Test Site	39	14.5	0.5
Died Before Census Day	50	18.6	0.7
Fictitious Person	7	2.6	0.1
Incorrectly Geocoded in Census	8	3.0	0.1
Match not Attempted (insufficient information)	11	4.1	0.1
Unresolved (imputed as EE)	36	13.4	0.5
	8	3.0	0.1

5.1 E-sample Follow-up Results

All E-sample nonmatches were sent to field follow-up to resolve their correct/erroneous enumeration status. Table 16 shows results from follow-up for these cases.

Table 16: E-sample Follow-up Results

	<u>Number</u>	<u>Percent</u>
Correctly Enumerated-Matched	21	1.6
Correctly Enumerated-Nonmatched	1129	84.1
Erroneously Enumerated	115	8.6
Noninterviews or Unresolved After Follow-up	78	5.8
Total E-sample Follow-up Workload	1343	100.0

We see from this table that 21 (1.6%) of the E-sample follow-up cases were matched to P-sample cases as a result of follow-up and thus were considered as correctly enumerated. The majority (84.1%) of E-sample follow-up cases were found to be correctly enumerated but remained nonmatched. In other words, these persons were counted in the census but are considered missed by the PES. Of the 115 persons determined to be erroneously enumerated, 39 were counted in more than one location, 48 had Census Day addresses outside the test area, 7 died before Census Day and 9 were coded as fictitious persons. The remaining 12 cases were EE due to geocoding error (incorrectly geocoded in the census). The 78 unresolved cases had their correct/erroneous enumeration status imputed for use in the dual-system estimation. The correct/erroneous enumeration status was resolved for 94.2% of the E-sample cases sent to follow-up.

5.2 P-sample Follow-up Results

All P-sample nonmatches were sent to field follow-up. Table 17 shows results from follow-up for these cases.

Table 17: P-sample Follow-up Results for Nonmatches

	<u>Number</u>	<u>Percent</u>
Matched	48	5.4
Nonmatched	770	86.7
Out-of-Scope	55	6.3
Noninterviews or Unresolved	14	1.6
Total P-sample Follow-up Workload	888	100.0

Note that 5.4% of the P-sample cases sent to follow-up were matched and another 6.3% were determined to be out-of-scope. Without a P-sample follow-up, many of these cases would have been considered as nonmatched, resulting in a higher overall estimate of percent undercount (see Section 6, equations 1 and 2).

We see that the P-sample follow-up was able to resolve match status for all but 14 cases. These cases had their match status imputed. By having so few P-sample cases with missing match/nonmatch status, the P-sample follow-up was able to reduce the error introduced by the statistical treatment of missing data in the P-sample.

5.3 Follow-up Results for Possible Matches

Persons coded as possible matches after clerical review were followed up to determine if the pair referred to the same person. Table 18 shows the results from follow-up for possible matches.

Table 18: Follow-up Results for PES Possible Matches

	<u>Number</u>	<u>Percent</u>
Matched	17	65.4
Nonmatched	5	19.2
Unresolved	3	11.5
Out-of-Scope	1	3.8
Total PES Possible Matches Sent to Follow-up	26	100.0

As we see from this table, almost two-thirds of the possible matches were matched after field follow-up. For those cases that were nonmatched (i.e. the possible match pair did not refer to the same person) the P-sample person was coded as a nonmatch and the E-sample person was questioned during follow-up to determine correct or erroneous enumeration status. The three cases that remained possible matches, and hence unresolved, had their final match status determined by imputation.

6. MISSING DATA AND DUAL-SYSTEM ESTIMATION

6.1 **Missing Data**

Values for missing data were imputed (filled in) for certain characteristics and for match status (P sample) and enumeration status (E sample). The missing characteristics were imputed using a "hot-deck" procedure which used the previous processed record to complete the missing data. This procedure is similar to that described in Schenker (1987).

The match statuses and enumeration statuses were imputed using the following variables: tenure (owner or renter), sex, age (0-14, 15-24, 30-44, 45-64, or 65+), race (black or nonblack), and type of housing unit (single-unit or multiunit). A probability is imputed for each unknown status remaining from field follow-up. The weighted sum of the imputed probabilities served as the contribution of the unresolved cases to the dual-system estimates. The match

statuses for P-sample cases and enumeration statuses for E-sample cases that remained unresolved after follow-up were imputed using resolved follow-up cases.

6.2 Dual-system Estimation

In order to evaluate person coverage of the 1986 Census of East Central Mississippi, dual-system estimates (DSEs) were produced for poststrata within the original sampling strata.

The tables in the attachment contain the results of the production of DSEs and subsequent estimates of percent undercount for each of the following poststrata:

1. Black owners in all blocks
2. Black renters in all blocks
3. Nonblacks in all blocks

These poststrata are cross tabulated by sex and age (0-14, 15-29, 30-44, 45-64, 65 +).

In addition, the original sampling strata were used to produce DSEs for the above poststrata in each of the two delivery panels (Update List/ Leave and Precanvass/ Postal Delivery). Overall estimates for blacks and all persons are also included in the tables. Since there was only one black person in the P sample for stratum 9 (small blocks), this stratum was not used in producing the DSEs given in the attachment.

The DSEs used in the tables can be written as:

$$DSE = N_p (CEN - SUB - EE)/M \quad (1)$$

where:

N_p = weighted number of people in the P-sample

CEN = census count

SUB = number of census whole person imputations

EE = weighted estimate of the number of erroneous enumerations and unmatchable persons in the census

M = weighted estimate of the number of matches between the PES and the census.

In addition to the DSE and each of its components the tables contain the standard deviation of the DSE, the coefficient of variation (percent) and the estimated undercount where:

$$\text{Estimated undercount (\%)} = 100 (1 - \text{CEN/DSE}) \quad (2)$$

Table 19 summarizes the results of undercount estimation by race group and compares the 1986 Rural PES estimates with 1980 Post-Enumeration Program (PEP) estimates from Mississippi.

Table 19: Percent Undercount Estimates for 1980 PEP and 1986 Rural PES

	1980 PEP (#3-8) ^a	1986 Rural PES
Overall	1.0	5.5
Black	5.5	9.4
Nonblack	-1.7	4.0
Differential	7.2	5.4

^a This set of dual-system estimates is one of several presented in Fay et. al. (1988).

While the undercount estimates from the Rural PES are higher than the 1980 PEP, the nature and extent of the differential undercount between blacks and nonblacks are similar.

Table 20 presents direct undercount estimates for the five age groups within each sex category.

Table 20: Estimated Undercount (Percent) for the Five Age Groups Within Each Sex Category

Age	Sex	
	Male	Female
0-14	8.4	8.6
15-29	11.8	7.7
30-44	4.9	4.9
45-64	2.2	3.2
65+	-0.1	-0.4
Overall	6.2	4.8

Table 20 shows a slightly higher undercount estimate for males than females. Also, the younger age groups for both sexes showed higher undercount estimates than the older age groups. The age group 15-29 showed the highest estimate of undercount for males and the highest differential undercount between males and females within an age group. These results seem consistent with those of other coverage measurement studies (Fay et. al., 1988).

Table 21 presents undercount estimates for the three poststrata and the two delivery panels used in the Rural PES.

Table 21: Estimated Undercount (Percent) for the Three Poststrata and Two Delivery Panels

<u>Poststratum</u>	Estimated Undercount (Percent)
Black Owners	10.8
Black Renters	9.0
Nonblacks	4.0
<u>Delivery Panel</u>	
Update List/Leave	6.6
Precanvass/Postal Delivery	4.3

Table 21 shows the higher undercount estimates for blacks than nonblacks discussed earlier. Also, shown is a slightly higher undercount estimate for black owners than for black renters. This suggests that tenure may not be a reasonable stratification variable in rural areas. With regard to delivery panel, table 21 shows a slightly higher undercount estimate for Update List/Leave than for Precanvass/Postal Delivery. Thus, insofar as the Rural PES shows, no coverage improvement was realized through the Update List/Leave method of delivery.

7. PES CARD

The Rural PES involved the testing of a "PES card" -an approach suggested by Preston (1982). The purpose of the PES card was to assist matching addresses from the PES to the census. The immediate goal was to see how many people were able to provide the card to a PES interviewer. The PES card was mailed along with each census questionnaire to all addresses in Newton County, MS and contained census geocoding information about the housing units at those addresses. This would facilitate address matching. Residents were requested to hold onto the card until October 1, 1986 or until an interviewer visited them. The interviewer would then record information from the card onto the interview form. Results of testing the PES card are shown in table 22.

Table 22: Outcome of Testing "PES Card" Approach (Newton County)

	<u>Number</u>	<u>Percent of Total</u>	<u>Percent who Reported Receiving Card</u>
Reported Receiving Card	120	38.5	100.0
Could Show Card	41	13.1	34.2
Could not Show Card	79	25.3	65.8
Unable to Recall Receiving Card	192	61.5	NA
Total Households Interviewed	312	100.0	NA

Of the 312 households interviewed in Newton County, only 120 (38.5%) respondents remembered receiving the card and 41 (13.1%) respondents showed it to the PES interviewer.

In order to show potential feasibility for the PES card, it was hoped that at least 50% of the PES households interviewed would be able to present the card. Assuming that the PES card was indeed mailed along with each census questionnaire to addresses in Newton County, the results shown above are disappointing. Even if one only considers those respondents who remember receiving the card, we see that only one third were able to present the card. Given these results, the "PES card" will not be used in either the 1988 Dress Rehearsal or the 1990 Decennial Census.

8. CONCLUSIONS

The Rural PES was the first test during the 1980s of PES methodology in a rural site. It was also the first such test to evaluate person coverage in an area with a significant population of blacks, traditionally the group with the largest undercount. One of the objectives of the Rural PES was to test computer matching on rural addresses. The results were encouraging, despite the limited effectiveness of using rural addresses in the computer matching. The evaluation of person coverage for the two census delivery methods - Update List/Leave and Percanvass/Postal Delivery - suggests that no coverage improvement was realized through the Update List/Leave method of delivery. Also tested was the card approach to PES matching. The results of this test showed that most people were unable to present the "PES card" to the PES interviewer. Thus, the PES card will not be used in 1990.

Other results from the Rural PES were encouraging. Improved quality control procedures for listing addresses in a rural area helped detect errors attributable to rural addresses and geography. Geographic coding errors detected during matching operations suggest that the search area for PES blocks in a rural area should include at least one ring of surrounding blocks. Interviewing yielded a zero noninterview rate which led to a small number of unresolved cases after clerical matching and field follow-up. This minimized the need for imputation and helped to control the amount of error introduced by the statistical treatment of missing data.

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Attachment

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

AGE IN YEARS:	ALL PERSONS					ALL PERSONS					TOTAL
	0-14	15-29	MALE 30-44	45-64	65+	0-14	15-29	FEMALE 30-44	45-64	65+	
Census counts:											
Non-imputed persons	17509	15242	13441	12527	8069	16737	16220	14079	14819	12209	140852
Imputed persons	371	355	234	235	117	388	380	269	259	149	2757
Total persons	17880	15597	13675	12762	8186	17125	16600	14348	15078	12358	143609

P-sample counts:											
Unweighted totals	882	793	670	684	454	846	819	709	823	663	7343
Unweighted matches	765	660	604	628	432	729	708	645	759	630	6560
Weighted totals	16258	15140	13098	12693	8042	15679	15709	13572	15088	11627	136905
Weighted matches	14199	12577	11812	11639	7651	13579	13552	12344	13882	11078	122314

E-sample counts:											
Unweighted totals	879	838	720	686	487	843	836	757	835	707	7588
Unweighted EEs	20	34	26	25	15	30	35	22	27	25	265
Weighted totals	17183	16099	14674	12733	8988	16347	16547	15186	15502	12913	146172
Weighted EEs	405	604	547	535	308	608	695	475	472	495	5144

Dual system estimates:											
D. S. E.	19524.58	17692.84	14379.56	13052.63	8176.11	18729.62	17980.12	15081.91	15583.08	12306.73	151888.00
std. dev. (D. S. E.)	522.61	405.35	331.25	194.20	110.96	508.90	419.65	348.71	209.87	164.82	2252.59
c. v. (percent)	2.68	2.29	2.30	1.49	1.36	2.72	2.33	2.31	1.35	1.34	1.48
D. S. E. /tot. census (%)	109.20	113.44	105.15	102.28	99.88	109.37	108.31	105.12	103.35	99.59	105.76
D. S. E. /wgt. E-tot. (%)	113.63	109.90	97.99	102.51	90.97	114.57	108.66	99.31	100.53	95.31	103.91
Est. undercount (%): 100*(i-c.tot./D. S. E.)	8.42	11.85	4.90	2.23	-0.12	8.57	7.68	4.87	3.24	-0.42	5.45

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

NONBLACKS

AGE IN YEARS:	MALE					FEMALE					TOTAL
	0-14	15-29	30-44	45-64	65+	0-14	15-29	30-44	45-64	65+	
Census counts:											
Non-imputed persons	10128	9886	9929	9937	5934	9655	9826	9812	11062	9097	95266
Imputed persons	185	197	167	168	87	200	195	175	191	93	1658
Total persons	10313	10083	10096	10105	6021	9855	10021	9987	11253	9190	96924

P-sample counts:											
Unweighted totals	472	506	491	527	318	486	481	487	601	484	4853
Unweighted matches	424	429	453	497	306	423	420	450	568	464	4434
Weighted totals	9019	10247	9802	9949	5714	9303	9923	9593	11192	8469	93210
Weighted matches	8065	8643	9001	9356	5510	8084	8558	8820	10527	8142	84705

E-sample counts:											
Unweighted totals	506	537	539	530	340	493	514	531	620	524	5134
Unweighted EEs	16	21	19	17	11	18	22	19	18	16	181
Weighted totals	10044	10871	11076	9952	6407	9644	10681	10842	11495	9517	100527
Weighted EEs	336	376	404	377	237	345	461	413	297	280	3527

Dual system estimates:											
D. S. E.	10901.14	11398.24	10491.85	10161.19	5925.54	10815.37	10785.72	10418.69	11448.56	9189.13	100980.22
std. dev. (D. S. E.)	336.28	288.78	271.54	141.68	93.64	362.34	275.67	296.21	172.89	115.13	1453.29
c. v. (percent)	3.08	2.53	2.59	1.39	1.58	3.35	2.56	2.84	1.51	1.25	1.44
D. S. E. /tot. census (%)	105.70	113.04	103.92	100.56	98.41	109.75	107.63	104.32	101.74	99.99	104.18
D. S. E. /wgt. E-tot. (%)	108.53	104.85	94.73	102.10	92.49	112.15	100.98	96.10	99.60	96.56	100.45
Est. undercount (%): 100*(1-c. tot. /D. S. E.)	5.40	11.54	3.77	0.55	-1.61	8.88	7.09	4.14	1.71	-0.01	4.02

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

BLACKS

AGE IN YEARS:	MALE					FEMALE					TOTAL
	0-14	15-29	30-44	45-64	65+	0-14	15-29	30-44	45-64	65+	
Census counts:											
Non-imputed persons	7381	5356	3512	2590	2135	7082	6394	4267	3757	3112	45586
Imputed persons	186	158	67	67	30	188	185	94	68	56	1099
Total persons	7567	5514	3579	2657	2165	7270	6579	4361	3825	3168	46685

P-sample counts:											
Unweighted totals	410	287	179	157	136	360	338	222	222	179	2490
Unweighted matches	341	231	151	131	126	306	288	195	191	166	2126
Weighted totals	7238	4893	3296	2745	2328	6376	5786	3978	3896	3158	43695
Weighted matches	6134	3934	2811	2283	2141	5495	4995	3524	3355	2936	37609

E-sample counts:											
Unweighted totals	373	301	181	156	147	350	322	226	215	183	2454
Unweighted EEs	4	13	7	8	4	12	13	3	9	9	83
Weighted totals	7139	5228	3599	2781	2581	6703	5867	4345	4007	3396	45645
Weighted EEs	69	228	143	158	71	263	234	62	174	215	1618

Dual system estimates:											
D.S.E.	8668.94	6441.30	3978.48	2903.36	2285.98	8040.28	7153.27	4759.07	4172.18	3116.77	51524.27
std. dev. (D.S.E.)	262.76	231.44	170.77	111.87	73.76	283.83	203.91	162.19	114.62	108.03	1495.46
c.v. (percent)	3.03	3.59	4.29	3.85	3.23	3.53	2.85	3.41	2.75	3.47	2.90
D.S.E./tot. census(%)	114.56	116.82	111.16	109.27	105.59	110.60	108.73	109.13	109.08	98.38	110.37
D.S.E./wgt.E-tot. (%)	121.43	123.21	110.56	104.41	88.56	119.94	121.93	109.54	104.13	91.77	112.88
Est. undercount(%) 100*(1-c.tot./D.S.E.)	12.71	14.40	10.04	8.49	5.29	9.58	8.03	8.36	8.32	-1.64	9.39

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

BLACK OWNERS

AGE IN YEARS:	MALE					FEMALE					TOTAL
	0-14	15-29	30-44	45-64	65+	0-14	15-29	30-44	45-64	65+	
Census counts:											
Non-imputed persons	4126	3366	2440	1949	1690	3886	3549	2709	2751	2390	28856
Imputed persons	101	82	39	38	24	106	94	50	45	38	617
Total persons	4227	3448	2479	1987	1714	3992	3643	2759	2796	2428	29473

P-sample counts:											
Unweighted totals	243	191	132	112	107	235	211	152	158	131	1672
Unweighted matches	198	157	114	98	101	205	180	137	138	124	1452
Weighted totals	4181	3204	2337	1870	1797	4053	3549	2650	2654	2236	28531
Weighted matches	3438	2583	2035	1624	1675	3607	3041	2407	2296	2116	24823

E-sample counts:											
Unweighted totals	222	199	127	106	118	214	184	149	151	138	1608
Unweighted EEs	1	9	3	7	3	4	4	0	8	7	47
Weighted totals	4235	3377	2377	1803	2018	3973	3265	2746	2672	2425	28891
Weighted EEs	22	159	53	121	54	94	59	0	137	159	859

Dual system estimates:											
D. S. E.	4920.02	4005.75	2784.07	2143.94	1794.51	4369.36	4037.04	2986.68	3049.27	2352.69	33039.28
std. dev. (D. S. E.)	214.41	170.10	121.62	75.16	64.92	145.61	136.00	87.95	104.16	83.32	1261.59
c. v. (percent)	4.36	4.25	4.37	3.51	3.62	3.33	3.37	2.94	3.42	3.54	3.82
D. S. E. / tot. census (%)	116.40	116.18	112.31	107.90	104.70	109.45	110.82	108.25	109.06	96.90	112.10
D. S. E. / wgt. E-tot. (%)	116.18	118.63	117.11	118.93	88.93	109.98	123.63	108.75	114.13	97.02	114.36
Est. undercount (%): 100*(1-c. tot. / D. S. E.)	14.09	13.92	10.96	7.32	4.49	8.64	9.76	7.62	8.31	-3.20	10.79

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

BLACK RENTERS

AGE IN YEARS:	MALE					FEMALE					TOTAL
	0-14	15-29	30-44	45-64	65+	0-14	15-29	30-44	45-64	65+	
Census counts:											
Non-imputed persons	3255	1990	1072	641	445	3196	2845	1558	1006	722	16730
Imputed persons	85	76	28	29	6	82	91	44	23	18	482
Total persons	3340	2066	1100	670	451	3278	2936	1602	1029	740	17212

P-sample counts:											
Unweighted totals	167	96	47	45	29	125	127	70	64	48	818
Unweighted matches	143	74	37	33	25	101	108	58	53	42	674
Weighted totals	3057	1690	959	875	531	2323	2237	1329	1242	922	15164
Weighted matches	2696	1351	776	658	466	1888	1954	1117	1059	819	12786

E-sample counts:											
Unweighted totals	151	102	54	50	29	136	138	77	64	45	846
Unweighted EEs	3	4	4	1	1	8	9	3	1	2	36
Weighted totals	2904	1851	1221	978	563	2730	2601	1598	1335	971	16754
Weighted EEs	47	69	90	37	16	169	175	62	37	55	758

Dual system estimates:											
D. S. E.	3869.61	2400.47	1260.64	739.28	524.88	3814.90	3147.03	1771.78	1134.31	785.63	18908.01
std. dev. (D. S. E.)	122.25	99.11	45.12	35.97	25.67	201.98	100.36	85.22	44.53	72.45	530.25
c. v. (percent)	3.16	4.13	3.58	4.87	4.89	5.29	3.19	4.81	3.93	9.22	2.80
D. S. E. /tot. census (%)	115.86	116.19	114.60	110.34	116.38	116.38	107.19	110.60	110.23	106.17	109.85
D. S. E. /wgt. E-tot. (%)	133.25	129.67	103.22	75.58	93.16	139.72	120.98	110.86	84.98	80.89	112.86
Est. undercount (%): 100*(1-c. tot. /D. S. E.)	13.69	13.93	12.74	9.37	14.08	14.07	6.71	9.58	9.28	5.81	8.97

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

PRECANVASS/POSTAL DELIVERY STRATA

ALL PERSONS

AGE IN YEARS:	MALE					FEMALE					TOTAL
	0-14	15-29	30-44	45-64	65+	0-14	15-29	30-44	45-64	65+	
Census counts:											
Non-imputed persons	8804	7534	6838	6387	4000	8334	7946	7229	7365	6088	70525
Imputed persons	166	182	128	129	59	202	189	150	127	74	1406
Total persons	8970	7716	6966	6516	4059	8536	8135	7379	7492	6162	71931

P-sample counts:											
Unweighted totals	418	380	323	356	239	415	395	348	407	347	3628
Unweighted matches	370	315	293	331	227	371	348	317	382	328	3282
Weighted totals	7123	6878	5748	6105	4008	7278	7260	6149	6958	5817	63324
Weighted matches	6425	5676	5171	5678	3817	6585	6473	5593	6504	5534	57456

E-sample counts:											
Unweighted totals	459	409	355	364	259	439	419	383	430	382	3899
Unweighted EEs	5	16	13	13	7	15	17	9	14	15	127
Weighted totals	8704	7406	6773	6266	4524	8361	7960	7215	7492	6810	71511
Weighted EEs	84	281	244	286	157	295	289	174	220	294	2324

Dual system estimates:											
D. S. E.	9677.96	8779.36	7366.29	6535.79	4042.06	8944.44	8581.66	7842.63	7637.62	6103.07	75145.34
std. dev. (D. S. E.)	229.40	232.88	265.09	115.31	93.16	287.32	184.10	293.85	135.55	127.18	1236.86
c. v. (percent)	2.37	2.65	3.60	1.76	2.30	3.21	2.15	3.75	1.77	2.08	1.65
D. S. E. /tot. census (%)	107.89	113.78	105.75	100.30	99.58	104.78	105.49	106.28	101.94	99.04	104.47
D. S. E. /wgt. E-tot. (%)	111.19	118.54	108.76	104.31	89.35	106.98	107.81	108.71	101.94	89.62	105.08
Est. undercount (%): 100*(1-c. tot. /D. S. E.)	7.32	12.11	5.43	0.30	-0.42	4.57	5.20	5.91	1.91	-0.97	4.28

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

UPDATE LIST/LEAVE STRATA

ALL PERSONS

AGE IN YEARS:	MALE					FEMALE					TOTAL
	0-14	15-29	30-44	45-64	65+	0-14	15-29	30-44	45-64	65+	
Census counts:											
Non-imputed persons	8705	7708	6603	6140	4069	8403	8274	6850	7454	6121	70327
Imputed persons	205	173	106	106	58	186	191	119	132	75	1351
Total persons	8910	7881	6709	6246	4127	8589	8465	6969	7586	6196	71678

P-sample counts:											
Unweighted totals	464	413	347	328	215	431	424	361	416	316	3715
Unweighted matches	395	345	311	297	205	358	360	328	377	302	3278
Weighted totals	9135	8262	7351	6589	4034	8401	8449	7423	8130	5810	73581
Weighted matches	7774	6901	6641	5961	3833	6994	7079	6751	7379	5544	64858

E-sample counts:											
Unweighted totals	420	429	365	322	228	404	417	374	405	325	3689
Unweighted EEs	15	18	13	12	8	15	18	13	13	10	138
Weighted totals	8479	8692	7901	6467	4464	7987	8587	7972	8009	6103	74661
Weighted EEs	321	323	303	249	151	313	406	301	252	201	2820

Dual system estimates:											
D.S.E.	9846.62	8913.48	7013.27	6516.84	4134.05	9785.18	9398.46	7239.28	7945.46	6203.66	76742.65
std. dev. (D.S.E.)	469.57	331.78	198.62	156.26	60.27	420.03	377.11	187.75	160.22	104.83	1882.64
c. v. (percent)	4.77	3.72	2.83	2.40	1.46	4.29	4.01	2.59	2.02	1.69	2.45
D.S.E./tot. census (%)	110.51	113.10	104.54	104.34	100.17	113.93	111.03	103.88	104.74	100.12	107.07
D.S.E./wgt. E-tot. (%)	116.13	102.54	88.76	100.77	92.61	122.52	109.45	90.81	99.20	101.65	102.79
Est. undercount (%): 100*(1-c. tot./D.S.E.)	9.51	11.58	4.34	4.16	0.17	12.22	9.93	3.73	4.52	0.12	6.60

RESULTS OF THE 1986 RURAL TEST CENSUS POST-ENUMERATION SURVEY

	BLACK MALES	BLACK FEMALES	NONBLACK MALES	NONBLACK FEMALES	ALL MALES	ALL FEMALES
Census counts:						
Non-imputed persons	20974	24612	45814	49452	66788	74064
Imputed persons	508	591	804	854	1312	1445
Total persons	21482	25203	46618	50306	68100	75509

P-sample counts:						
Unweighted totals	1169	1321	2314	2539	3483	3860
Unweighted matches	980	1146	2109	2325	3089	3471
Weighted totals	20500	23194	44730	48480	65231	71674
Weighted matches	17304	20305	40574	44131	57878	64435

E-sample counts:						
Unweighted totals	1158	1296	2452	2682	3610	3978
Unweighted EEs	36	46	84	93	120	139
Weighted totals	21327	24318	48349	52178	69676	76496
Weighted EEs	669	948	1730	1797	2399	2745

Dual system estimates:						
D.S.E.	24384.67	27166.42	48663.60	52326.81	72580.86	79335.85
std. dev. (D.S.E.)	818.01	763.98	729.52	764.75	1157.45	1172.34
c.v. (percent)	3.35	2.81	1.50	1.46	1.59	1.48
D.S.E./tot. census(%)	113.51	107.79	104.39	104.02	106.58	105.07
D.S.E./wgt. E-tot. (%)	114.33	111.71	100.65	100.29	104.17	103.71
Est. undercount (%): 100*(1-c.tot./D.S.E.)	11.90	7.23	4.20	3.86	6.17	4.82