

THE 1986 RURAL POST-ENUMERATION SURVEY IN EAST CENTRAL MISSISSIPPI

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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).¹

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). Data from the P sample are used to estimate the number of persons missed in the census who should have been counted (gross undercount). Data from the E sample are used to estimate the number of persons incorrectly counted in the census such as duplicate enumerations and fictitious persons (gross overcount).

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 normal census conditions did not exist in those counties. 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 poststrata 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.

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

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.

3.1 Address Listing

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 were 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 1 shows the breakdown of the quality control operation.

Table 1: Address Listing Quality Control Results

	Advance Listing Comparison	Count Comparison	Total
Pass	20	123	143
Fail	77	51	128
Total	97	174	271

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 than can occur in the census (see Section 1).

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 2.

Table 2: Final Outcome of Interview

	Numbers	Percent	Percent of Occupied Housing Units
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	3252	100.0	100.0

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.

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 estimate.

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 case 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 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 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 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.

The overall computer match rate was 68.0%. This compares with a 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 enable 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 3 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 3. Extended Search Results

	Number	Percent of Non-mover Matches	Percent of Non-movers 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.

4.2.1 Review of Possible Matches

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 4 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 4: Match Results for Combined Automated and Clerical Operation^a

	Number	Percent of Final Matches
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 ^b on PES File	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 4, 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.

4.2.2 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 5.

Table 5: 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.

4.2.3 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 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 6 shows the results of matching these persons.

Table 6: Results of Matching with Separate Mailing Address

	Number	Percent
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 7 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 7: Results of Matching at Other Possible Census Day Address

	<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 Total Reporting Other Census Day Address	3	2.3
	132	100.0

As we see in table 7, most matched 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 8 shows the results of matching PES B in-movers. These results include information from the field follow-up (see Section 5).

Table 8. Results of Matching PES B In-movers

	<u>Number</u>	<u>Percent</u>
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 8 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 8 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 in the PES.

Table 8 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 9 shows the results of matching the P sample (nonmovers and PES B in-movers).

Table 9. Summary of P-Sample Matching

	<u>Number</u>	<u>Percent of In-Scope P Sample</u>	<u>Percent of Total</u>
Matched	6651	86.3	89.2
Nonmatched	791	10.3	10.6
Out-of-Scope	247	3.2	NA
Unresolved	14	0.2	0.2
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. Most of the out-of-scope cases are persons with Census Day addresses outside the test site. In 1990, there will be a search area for these out-of-scope persons in the census, 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 (CE) when (s)he is enumerated once and only once in the locations where the PES reported the person might have been enumerated. Thus E-sample matches are considered correctly enumerated. The E-sample person is erroneously enumerated (EE) 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.

A summary of E-sample matching shows 96.5% of the E sample to be CE in the census. Most of these CE cases (83.7%) were matched to the PES. More than half of the cases classified as 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. P-sample nonmatches were sent to follow-up in an attempt 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.

5.1 E-sample Follow-up Results

All E-sample nonmatches were sent to field follow-up to resolve their correct/erroneous enumeration status.

A summary of E-sample follow-up results shows 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 94.1% 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 10 shows results from follow-up for these cases.

Table 10: P-sample Follow-up Results for Nonmatches

	<u>Number</u>	<u>Percent</u>
Matched	48	5.4
Nonmatched	770	86.6
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 minimize the error introduced by the statistical treatment of missing data in the P-sample.

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 logistic regression models that included the following variables: tenure (owner or renter), sex, age (0-14, 15-29, 30-44, 45-64, or 65+), race (black or nonblack), and type of housing unit (single-unit or multiunit). A probability was 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 the following three poststrata within the original sampling strata:

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). 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.

The DSE 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.

The estimated percent net undercount can be written as

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

Table 11 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. Tables 11-14 also include standard error (S.E.) estimates in terms of percent undercount (% u.c.) for each Rural PES net undercount estimate presented.

Table 11: Estimates of Percent Net Undercount From the 1980 PEP and 1986 Rural PES

	<u>1980 PEP(#3-8)^a</u>	<u>1986 Rural PES</u>	<u>S.E.(% u.c.)</u>
Overall	1.0	5.5	1.4
Black	5.5	9.4	2.6
Nonblack	-1.7	4.0	1.4
Differential	7.2	5.4	3.0

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

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

Table 12 presents direct undercount estimates for the five age groups within each sex category.

Table 12: Estimates of Percent Net Undercount for Five Age Groups Within Each Sex Category

Age	Sex			
	<u>Male</u>	<u>S.E.(% u.c.)</u>	<u>Female</u>	<u>S.E.(% u.c.)</u>
0-14	8.4	2.5	8.6	2.5
15-29	11.8	2.0	7.7	2.2
30-44	4.9	2.2	4.9	2.2
45-64	2.2	1.5	3.2	1.3
65+	-0.1	1.4	-0.4	1.3
Overall	6.2	1.6	4.8	1.5

Table 12 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 estimated 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 13 presents undercount estimates for the three poststrata and the two delivery panels used in the Rural PES.

Table 13: Estimates of Percent Net Undercount for the Three Poststrata and Two Delivery Panels

Poststratum	Estimated Undercount (Percent)	S.E.(% u.c.)
Black Owners	10.8	3.4
Black Renters	9.0	2.6
Nonblacks	4.0	1.4
Delivery Panel		
Update List/Leave	6.6	2.3
Precanvass/Postal Delivery	4.3	1.6

Table 13 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 13 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 14.

Table 14: Outcome of Testing "PES Card" Approach (Newton County)

	Number	Percent of Total	Percent who Reported Receiving Card
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 Precanvass/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.

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Footnotes

¹Update 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.

²A work unit consists of one interviewer's work in one block on one day.

*This paper reports the general results of research undertaken by Census Bureau staff. The views expressed are attributable to the authors and do not necessarily reflect those of the Census Bureau.